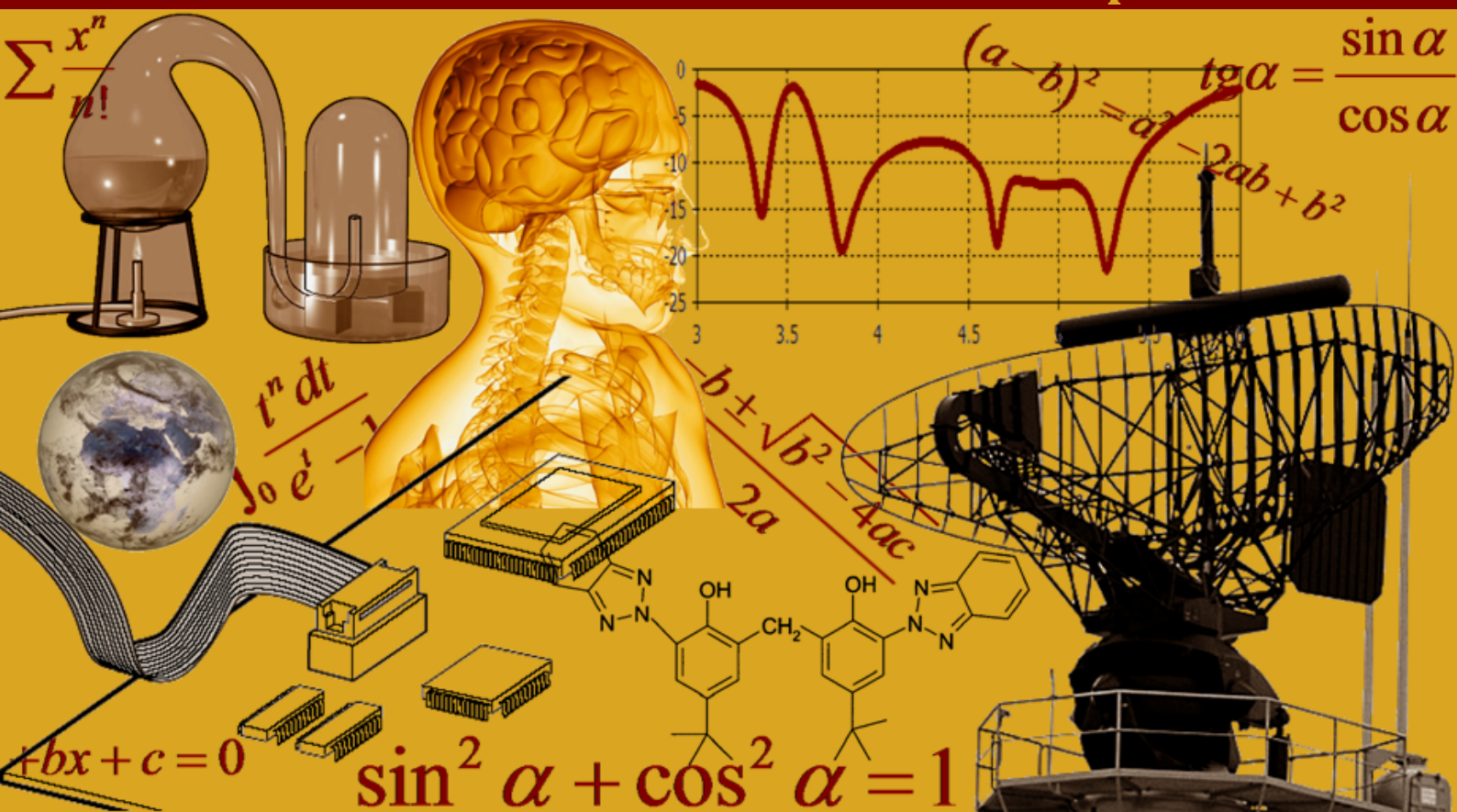


INTERNATIONAL JOURNAL OF INNOVATION AND SCIENTIFIC RESEARCH

Vol. 9 N. 2 September 2014



International Peer Reviewed Monthly Journal



International Journal of Innovation and Scientific Research

International Journal of Innovation and Scientific Research (ISSN: 2351-8014) is an open access, specialized, peer-reviewed, and interdisciplinary journal that focuses on research, development and application within the fields of innovation, engineering, science and technology. Published four times per year in English, French, Spanish and Arabic, it tries to give its contribution for enhancement of research studies.

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Dioxin and PCB contamination around a heavy industrial area: A case history

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ABSTRACT: An extended investigation carried out after the discovery of excess occurrence of dioxins and PCB in sheep and goat freely grazing around Europe's largest integrated iron and steel (I&S) factory in Taranto industrial area revealed an ubiquitous *recent* (by dioxins) and *historic* (by PCB) contamination. Experimental results, including fingerprint and PCA comparison, excluded *single-point* emission by the I&S factory as well as by other nearby industrial chimneys, pointing out to *fugitive diffuse* emission escaping from the I&S sinter plant as the contamination source. The occurrence of two routes of environment contamination and their overlapping toxicity effects through the food chain were demonstrated, due primarily to such diffuse emission and secondarily to PCB present in top soil around the industrial area.

KEYWORDS: dioxins, PCB, sinter plant, foodstuff, risk analysis.

1 INTRODUCTION

In a previous paper [1] excess gaseous and particulate emission of benzo(a)pyrene (BaP) and other polycyclic aromatic hydrocarbons (PAH) from the coke-oven batteries of ILVA, Europe's largest integrated iron and steel (I&S) factory in Taranto (South Italy) industrial area, was demonstrated, yielding to shut-down and thorough revamping of the coke-oven batteries. More recently, the occurrence of dioxins and polychlorinated biphenyls (PCB) in some edible products from livestock freely grazing around the I&S factory was discovered. A 3-years long investigation on dioxins and PCB contamination of the surrounding environment, cattle and their feed products as well as on contamination source(s) apportionment was carried out as described herein.

2 CONTAMINATION BY DIOXINS AND PCB_{DL}

Polychlorinated dibenzo-*p*-dioxins (PCDD) and polychlorinated dibenzo-furans (PCDF) (in short *dioxins* PCDD/F) with some PCB who mimic their toxicological properties (PCB "*dioxin like*", PCB_{DL}) belong to the so called "*Persistent Organic Pollutants*" (POPs), toxic to humans and animals [2]. The production of POPs, characterized by strong persistency, bioaccumulation through the food chain (particularly in fatty tissue of living organisms) and long-range transport impacting the wildlife even at extreme latitudes [3], has been prohibited and their diffusion regulated after the 2001 Stockholm Convention, ratified by the European Community in 2004 [4].

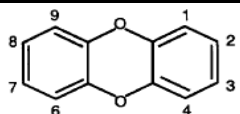
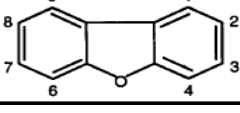
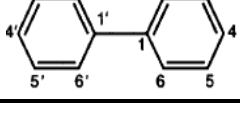
Differently from PCB, used mainly as dielectric insulator and produced industrially in millions of tons until their ban in the late 1980s, PCDD/F form unintentionally as by-product of numberless combustion processes, both industrial (waste incineration and sintering plants in particular) and anthropogenic (forest fire, grass combustion, scrap tire burning, bonfires, backyard barrel burning, open burning of wood and waste, smoking, fireplaces etc.) and are massively present in pesticides and chemicals [5] [6] [7] [8]. Accordingly, the occurrence of PCB_{DL} is considered today the heritage of *historic* contamination, while that of dioxins proves *recent* contamination, often in progress. As a consequence, dioxin and PCB_{DL} source apportionment in the frequent cases of food-chain contamination is often questionable.

As shown in Table 1, however, only 29 out of their 419 congeners are toxic, depending on their chlorination degree and substitution pattern, with TEF (toxicity equivalent factor) ranging from 1 to 0.00001 for 2,3,7,8 TCDD and 2,3',4,4',5,5'-HxCB respectively [9] [10].

Following the enforcement of the stringent emission limit of $0.1 \text{ ng}_{\text{TEQ}}/\text{Nm}^3$ for waste incineration plants by Directive 2000/76/EC, adopted in Italy with Leg. Decree No. 133/05, approx. 90% reduction of dioxin emission to the environment has been achieved in the EU, where the sintering process of I&S industry is rated the #1 dioxin industrial emission source [11]. In Italy the Leg. Decree No.152/06 limits to $10,000 \text{ ng}/\text{Nm}^3$ all the 210 PCDD/F congeners in the I&S emission.

After the IPPC Directive 1996/61/EC, dioxin regulation among other EU member countries relies on Best Available Techniques that, due to process optimization (mainly by input control) and emission abatement by electrostatic precipitators and fabric filters, usually allow a concentration in the $0.5\text{-}5 \text{ ng}_{\text{I-TE}}/\text{Nm}^3$ range, i.e., a dioxin output of $1\text{-}10 \text{ } \mu\text{g}_{\text{I-TE}}/\text{t}_{\text{sinter}}$ based on an average production of $2,100 \text{ Nm}^3/\text{t}_{\text{sinter}}$ [12].

Table 1. PCDD, PCDF, PCB and their congeners

Compound	Chemical formula	Total congeners	Toxic congeners
PCDD		75	7
PCDF		135	10
PCB		209	12
Total		419	29

3 TARANTO CASE

The 220,000 Taranto (Apulia region, South Italy) inhabitants closely neighbour their heavy industrial area which, in addition to ILVA since the 1970s, hosts several potential dioxin-emitting plants, i.e., a large oil refinery and a big cement kiln, one ongoing and two exhausted MSW sanitary landfills (where waste often used to undergo uncontrolled burning in the past), three sanitary landfills for (non) hazardous waste, the MSW and the hospital waste incinerators, one RDF modern waste-to-energy plant plus several mechanic SMEs, including in particular a plant for dismantling PCB-based appliances (MATRA), now dismissed. The city also hosts relevant infrastructures like Italy's 2nd busiest industrial harbour, NATO's largest European Navy basis, a military arsenal etc., prompting its inclusion among Italian "areas at high risk of environmental crisis" (Laws No. 349/86 and No. 305/89).

Among over one hundred chimneys in the industrial area, the E312 main stack from ILVA sinter plant, Europe's tallest (220 m) and most powerful ($\approx 3 \text{ MNm}^3/\text{h}$) of its kind, is blamed on emitting 92% of industrial dioxins to air in Italy [13], with $\approx 7.5 \text{ kg}$ of dioxins emitted in its half-century life, i.e., almost the triple than escaped in the well known Seveso accident [14]. Although not formed in the I&S industrial cycle, PCBs were largely used until the last decade.

Following a Framework Agreement signed in 2006 by Apulian Regional Government and Local Authorities, in 2007 the Regional Environment Protection Agency (Arpa) started to carry out regular monitoring campaigns on the emission of the E312 stack of ILVA sinter plant AGL2.

In such scenario, uncultivated land in the industrial area was utilised for unrestricted livestock grazing by local shepherds. In 27 February 2008 the discovery of excess dioxins and PCB_{DL} in cheese produced by said livestock prompted Arpa to carry on an extensive survey on the environmental matrices (dust, air, groundwater, soil etc.) and Taranto' Sanitary Surveillance Authority (Asl-Ta1) to increase the veterinary controls on cattle and food derivatives in local farms in a 20 km radius area around ILVA E312 sinter stack. In addition to prohibiting grazing activities within the industrial area, the Regional Government issued the regional law 44/08 that, first and still unique in Italy, limits to $0.4 \text{ ng}_{\text{I-TE}}/\text{Nm}^3$ the emission of toxic dioxin congeners from point sources of industrial plants.

The evaluation of the results of controls carried out by Arpa and Asl-Ta1 – that led to abate 2,170 contaminated sheep - and the attempts of apportioning the contamination source(s) of dioxin and PCB_{DL} in Taranto area are now presented.

4 MATERIALS AND METHODS

4.1 PCDD/F AND PCB_{DL} CONTROLS IN ENVIRONMENTAL MATRICES AND IN CATTLE AND THEIR EDIBLE DERIVATIVES

Within the period of this investigation Arpa carried out 3 monitoring campaigns on the emission of E312 sinter stack, in 12-16 June 2007, 26-28 February and 23-26 June 2008 (this latter occurring after ILVA had started *urea* addition test in the sinter process) [15] [16] [17]. Emission samples were collected at a suitable height (53 m) of the stack in steady operating conditions (gas temperature 150°C, flow rate 3 MNm³/h, i.e., 17 m/h, 17% O₂ and 7% humidity, with sinter plant producing 1,158÷1,200 t/h, i.e., 2,134÷2,440 Nm³/t_{sinter}) and analysed according to UNI-EN 1948 1-2-3:2006. Similar controls occurred at the main stack of other major suspected plants in the industrial area.

Following the results of the above *point source* controls, Arpa looked also for *diffuse fugitive sources* of dioxin emission inside ILVA sinter plant, wherein the suspended dust (reportedly made by ore minerals) intolerably floating in the working environment, subjected to indoor/outdoor wind transportation, and the toxic fines filtered by electrostatic precipitators (ESP) ahead of the E312 stack were analysed.

Furthermore, Arpa controlled PCDD/F and PCB_{DL} in 106 representative samples of environmental matrices within/beyond the no-grazing area, upwind/downwind the E312 stack: air (36 samples), atmospheric deposition (21), industrial (26) and agricultural (17) top soils, aquifer (3 samples), marine sediments (2) and sludge from the municipal wastewater treatment plant (1) used as soil amendment.

Asl-Ta1 carried out veterinary controls in livestock breeding in 86 farms in the 20-km radius area investigated, measuring PCDD/F and PCB_{DL} concentration in 276 representative samples (mainly from sheep and goats and their edible products).

All the environmental and veterinary analyses were carried out in duplicate/triplicate according to the acknowledged standard analytical methods at Arpa and Asl-Ta1 laboratories.

4.2 SOURCE APPORTIONMENT

Not all the 419 PCDD/F and PCB_{DL} congeners occur simultaneously, nor in the same amount, in dioxin-forming processes, each usually having its own characteristic molecular emission spectrum (i.e., congeners profile or *fingerprint*). By comparing the fingerprint of the contaminated matrices and the suspected process(es) one may be able to apportion the contamination source(s) more or less affordably. To that aim, the following occurrences are usually considered in each matrix:

- 1) PCDD vs. PCDF (% on 17 congeners total concentration);
- 2) PCDD/F vs. PCB_{DL} (% on 17+12 congeners total concentration);
- 3) single congeners (% on 17+12 congeners total concentration).

Among the various procedures for deriving congeners profile Erreur ! Source du renvoi introuvable. [18] the “Falcon” method by the U.S. EPA, relating the toxic contribution of each congener to the overall toxicity of the given matrix in order to better account for the large differences among concentration and TEF of each PCDD/F and PCB_{DL} congener, was used [19].

When different sources emitting from different time overlap their spectra, like in the present situation, not even the Falcon method allows to apportion the contamination source affordably and the use of more rigorous statistical procedures like the well-known *Principal Component Analysis* (PCA) [20], becomes mandatory. The PCA submits all the analytical results achieved in a complex investigation to serial statistic evaluations ending up with clusters in a dimensionless pseudo-Cartesian diagram: less overlapping/more homogeneous are the clusters, more reliable is the contamination source apportioned.

4.3 HEALTH RISK ASSESSMENT

Health risk assessment for people consuming contaminated cattle and their food derivatives was carried out following the European Food Safety Agency methodology [21] accounting for local uses. To that aim, by reference to the average body weight (bw) of male and female adult consumers (60 kg), the following conservative assumptions were made [22] [23]:

- average overall consumption of animal fat: 80 g/person•d (1.33 g/kg_{bw}•d)
- local percentage of sheep in overall meat consumption: 10% (more than triple than 3% Italian average).

Once the percentage of contaminated sheep in the area and the concentration of toxic PCDD/F and PCB_{DL} in contaminated sheep (mean v_m , highest v_{max} , 95th percentile v_{95}) are known, the exposure scenarios may be calculated by reference to 3 types of consumers (% of meat eaten coming from sheep):

- ordinary (10%)
- super (50%)
- farmer (90%)

to obtain the **TWI** (*Tolerable Weekly Intake* of toxic dioxins) and the **BB** (*Body Burden* of toxic dioxins build-up in a 70 years half-life), calculated as $BB = f \cdot \text{intake} \cdot \text{half-life} / \ln 2$, where f is the fraction of dose absorbed (assumed to be 50% for absorption from food for humans), *intake* is the daily consumption of contaminated animal fat (ng_{WHO-TE}/kg_{bw}*day) and *half-life* refers to the human metabolism of the most toxic dioxin 2,3,7,8-TCDD (2740 days).

The results are compared with the limits stated by WHO [24]: TWI ≤ 14 pg_{WHO-TEQ}/kg_{bw}*week and BB ≤ 4,000 pg_{WHO-TE}/kg_{bw}.

5 RESULTS AND DISCUSSION

As anticipated [25], Arpa controls on chimney from other investigated plants excluded appreciable emission of PCDD/F and PCB compared with E312 main stack of ILVA AGL sinter plant. Accordingly, ILVA emissions only will be discussed.

5.1 PCDD/F AND PCB_{DL} IN THE EMISSION OF E312 STACK AT ILVA AGL SINTER PLANT

Table 2. PCDD/F and PCB_{DL} emissions from the E312 stack of ILVA AGL sinter plant

Monitoring campaigns	$\Sigma \text{PCDD}_{\text{DL}}$ [ng _{WHO-TE} /Nm ³]	$\Sigma \text{PCDD/Fs}$ [ng/Nm ³]	$\Sigma \text{PCDD/Fs}$ [ng _{I-TE} /Nm ³]	Absolute Emission Factor [g _{I-TEQ} /yr]	Specific Emission Factor [μg _{I-TEQ} /t _{sinter}]
I) 12-06 June 2007	0.13÷0.28	89÷188	2.39÷4.94	58÷130	5.5÷12.4
II) 26-28 February 2008	0.29÷0.52	118÷212	4.44÷8.34	117÷219	11.1÷20.9
III) 23-26 June 2008 ^(*)	0.16÷0.29	66÷110	1.94÷3.37	50÷89	4.8÷8.5

^(*) with *urea* addition

Table 2 shows the results of controls carried out by Arpa during the period covered by the present investigation. As predicted, the occurrence of PCB_{DL} was almost negligible. From these data the following considerations may be drawn:

1. *total* PCDD/F concentration was ≈3 orders of magnitude lower than the Italian limit (10,000 ng/Nm³), but their *toxic* congeners exceeded the regional limit to be in force by 2011 (0.4 ng_{I-TEQ}/Nm³);
2. addition of *urea* decreased by ≈30% PCDD/F concentration in stack emission, but it is not sufficient to that aim;
3. due to stack huge flow rate (3 MNm³/h), the Specific Emission Factor largely exceeds the 1 g/yr recommended Italian limit [13] and the performance of best-performing European sinter plants using Sector BREF/BAT [26].

5.2 PCDD/F AND PCB_{DL} OCCURRENCE IN ENVIRONMENTAL MATRICES

Table 3 summarizes the results of the extensive survey carried out by Arpa (bold numbers for values exceeding the limit).

Table 3. PCDD/F and PCB_{DL} concentration in environmental samples in Taranto area

	$\Sigma \text{PCDD/F (WHO-TE)}$	$\Sigma \text{PCB}_{\text{DL (WHO-TE)}}$	PCB
A) Air [fg/Nm³]			
Min	9.3	0.6	0.03*10 ⁶
Max	252.5	12.3	44.34*10 ⁶
Guide Value by WHO [27]: PCDD/F = 300 fg _{TE} /Nm ³ ; PCB = 300.000.000 fg/Nm ³			
B) Atmospheric deposition [pg/m² d]			
Min	2.8	0.1	5
Max	42.0	5.8	210

German Guide value [28]: PCDD/F = 15pg_{TE}/m²d; proposed Belgian Guide value [29]: (PCDD/F+PCB_{DL}) = 8 pg_{TE}/m²d

Min	0.5	1.2	2,359
Max	5.6	1.5	4,087

Limit value by Ital. Legs. Decree No.152/2006: PCDD/F = 4 pg_{TE}/L; PCB = 10.000 pg/L

D) Soil (agricultural) [ng/kg dry matter]

Min	0.8	0.7	2,8
Max	10.3	6.1	90,280

Limit value by Ital. Legs. Decree No.152/2006 for residential site: PCDD/F = 10 ng_{TE}/kg; PCB = 60.000 ng/kg

E) Soil (industrial) [ng/kg dry matter]

Min	0.78	0.46	4,669
Max PCDD/F	351,6	25,6	111,148
Max PCB _{DL}	55.8	2.575	39,427,011

Limit value by Ital. Legs. Decree No.152/2006 for industrial site: PCDD/F = 100 ng_{TE}/kg; PCB = 5.000.000 ng/kg

F) Marine sediments [ng/kg dry matter]

Min	2.3	2.1	85,635
Max	8.3	12.9	476,041

Guide value proposed by Ital. Env. Ministry [30]: (PCDD/F+PCB_{DL}) = 30 ng_{TE}/kg; PCB = 190.000 ng/kg as Σ of 24 given congeners

G) Sludge [ng/kg dry matter]

Unique	8.8	0.5	16,739
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Guide value proposed by the EC [31]: PCDD/F 100 ng_{TE}/kg; PCB 800.000 ng/kg

As shown by the data in Table 3, the contamination by PCDD/F and PCB_{DL} was ubiquitous. However, only 4 out of 106 samples exceeded the environmental limits in force. The occurrence of dioxins, symptomatic of *recent* contamination, seems to be reasonably blamed on ILVA sinter plant, as confirmed by a recent study [32]. The source(s) of PCB_{DL}, not produced in the I&S cycle (*historic* contamination), should be looked at in mismanagement of electric insulators and other PCB-containing devices in previous years, when ILVA utilized over 1,000 electric transformers and the MATRA plant for dismantling such devices was active in the area.

Overall PCDD/F and PCB_{DL} concentration in the air (36 samples), increasing when winds come from the industrial area, was below the WHO guide-value and the 100 fg_{WHO-TE}/m³ typical value for urban ambient [33] [34] [35]. In spite of their low concentration and the negligible contribution to direct human exposure, however, PCDD/F and PCB_{DL} in the air may contaminate the food chain through soil deposition (particularly relevant near the industrial area investigated).

Atmospheric deposition (21 samples) showed $\approx$ 30% of PCDD/F+PCB_{DL} measurements beyond the German Guideline. Re-suspension of crustal soil dust (coarse particles) has much higher deposition rate than fresh emission (ultra/fine particles) and may potentially account for $\leq$ 90% of total dioxin deposition in urban/industrial areas and $\leq$ 40% in rural regions [36] [37].

Industrial top soil showed abnormal concentration of PCDD/F and PCB_{DL} in 2 out of 26 samples, taken at the electrostatic filters discharge of ILVA sinter plant.

Agricultural top soil exceeded the limits for PCDD/F and PCB_{DL} in 1 out of 17 sample, taken near *Fornaro Stazionamento*, where part of the 2,170 infected sheep had to be abated later on.

Aquifer, often used by local farmers for animal beverage and domestic uses, exceeded the limit in 1 out of 3 samples, taken near *Masseria Carmine* (where other infected sheep were found), but 2 weeks later the outcome was not confirmed.

Neither the marine sediments or the WWTP sludge samples showed appreciable contamination by PCDD/F and PCB_{DL}.

According to these results, the overall level of dioxins and PCB_{DL} contamination of the various environmental matrices in the area investigated appears comparable with other intensively urbanized/industrial sites in the world [38]. This is not in contrast with the impressive dioxins emission from ILVA E312 stack as its fallout, thanks to the height, the high rise plume and local prevailing meteorological conditions, occurs at $\geq$ 100 km distance, as shown by fluid-dynamic models [39].

5.3 PCDD/F AND PCB_{DL} OCCURRENCE IN LIVESTOCK AND THEIR FOOD DERIVATIVES

Table 4 reports the results of controls carried out by Asl Ta/1 on 276 animals and their edible parts (86 farms controlled), where 60 samples in 11 farms, all from sheep and goat, except 1 chicken egg, did not comply with EC Regulation no.1881/06.

Table 4. PCDD/F + PCB_{DL} concentration in non-compliant animals in Taranto area

No. of samples	foodstuff	Limit of EC Regulation no.1881/2006 (pg _{WHO-TE} /g _{fat})		PCDD/F + PCB _{DL} (pg _{WHO-TE} /g _{fat})		PCB _{DL} (%)	
		(PCDD/F)	(PCDD/F + PCB _{DL})	Range	Mean	Range	Mean
24	liver	6.00	12.00	9.5÷279.2	87.6	31÷80	48
12	muscle	3.00	4.50	4.9÷26.5	14.5	47÷92	72
11	fat	3.00	4.50	4.5÷37.1	14.1	66÷93	76
11	milk	3.00	6.00	6.45÷31.2	13.7	21÷92	69
1	cheese	3.00	6.00	6.0		58	
1	egg	3.00	6.00	11.3		60	
Σ60							

Differently from the environmental survey, sheep contamination percentage was remarkable (22%) and prevalently due to PCB_{DL} (≤76%). As already shown, PCB_{DL} was largely present in pastured top soil, probably as deposition after re-suspension from the industrial area and nearby hotspots contaminated during previous improper dismantling of PCB-containing devices. It must be pointed out that farm contamination (13% in the area investigated) was not continuous, with some conforming farms very close to non-compliant ones in the so called “leopard” scenario. Although top soil is a typical accumulation sink of POPs, that once adsorbed tend to remain relatively immobile therein with poor transfer to plant and groundwater, direct deposition, vaporization, re-suspension and re-deposition on grass and leaves contribute to PCDD/F and PCB_{DL} entry into the food-cycle as livestock pasture [40] [41]. Sheep in particular play a well-known “sentinel role” towards POP contamination, due to the large amount of soil ingested with grazing [42]. Accordingly, almost uniquely their edible organs (mainly liver) and food derivatives (milk, cheese), i.e., 59 out of the 60 samples, were found contaminated in all non-compliant animals.

As for the health risk assessment for humans consuming contaminated cattle and their food derivatives, dioxins and PCB_{DL} are ranked as being of high potential concern, owing to their bioaccumulation in the food chain and their frequent occurrence particularly in sheep liver [43]. From a scientific point of view, however, comprehensive studies on dioxin and PCB_{DL} transfer mechanism to livestock are very difficult, depending on congener molecule, type of animal (sheep, cow, pig), pasture (leaves, grass, soil), metabolic specificity (usually reaching steady state in 100 to 200 days), organ (muscle or fat tissues) etc. so that even laboratory studies quite often yield contradictory results, not to mention the few studies on non-laboratory and farmed animals [44] [45].

As stated in Paragraph 4.3, calculation for a 60 kg_{bw} consumer eating 80 g_{fat}/day was referred to the 3 values of toxics concentration experimentally found in sheep (mean v_m , 95th percentile v_{95} and maximum v_{max}) and 3 consumer profiles (ordinary, super and farmer, eating 10-50-90% sheep with their meat diet respectively), considering that 13% of sheep-farms was found contaminated in the area. Table 5 shows the resulting calculation for TWI and BB.

Table 5. Tolerable weekly (TWI) and life-long (BB) human exposure to toxic dioxins and PCB_{DL} in the area investigated

Consumer profile		Ordinary		Super		Sheep Farmer	
Toxic concentration in contaminated sheep (pg _{WHO-TE} /g _{fat})		TWI*	BB**	TWI*	BB**	TWI*	BB**
v_m	43,4	4.2	1,142	20.2	4,269	36.4	7,358
v_{95}	162,0	15.1	5,712	75.6	21,346	136.1	36,788
v_{max}	279,2	26.1	10,281	130.3	38,422	234.5	66,218

*Tolerable Weekly Intake: WHO limit ≤14.0 pg_{WHO-TE}/kg_{bw}×week;

**Body Burden: WHO limit ≤4,000 pg_{WHO-TE}/kg_{bw}

It can be seen that for the ordinary consumer the calculated health risk of exposure is largely below the WHO limits. However, accounting for the super consumers and the sheep-farmers, the precautionary principle made the abatement of the 2,170 infected sheep mandatory.

5.4 SOURCE APPORTIONMENT OF THE CONTAMINATION

Fig.1 shows the % occurrence of PCDD vs. PCDF and PCDD/F vs. PCB_{DL} TEQ concentration in the various samples of the different matrices examined (for sake of simplicity, results of air samples, agreeing quite well with those from atmospheric deposition, are omitted). From these data it clearly appears that dioxins occurrence in E312 stack emission (top row) is due

almost exclusively to furans (PCDF:PCDD $\approx$ 90:10%, left) with negligible PCB_{DL} presence as expected (PCDF+PCDD:PCB_{DL} $\approx$ 95:5%, right).

A completely different, yet reasonably homogeneous, situation is shown by the other 3 environmental matrices examined (industrial top soil, atmospheric deposition and agricultural top soil, 2nd, 3rd and 4th row), where the presence of furans and dioxin is almost comparable (PCDF:PCDD $\approx$ 50:50%, left) and the occurrence of PCB_{DL} is appreciable (PCDF+PCDD:PCB_{DL} $\approx$ 65:35%, right).

These results exclude ILVA E312 stack point-emission from potential source(s) contaminating the environmental matrices that closely surround it.

A still different scenario is shown by sheep and their edible part (bottom row), with a minor contribution of dioxin vs. furans (PCDF: PCDD $\approx$ 20:80%, left) and the contamination due prevalingly to PCB_{DL} (PCDF+PCDD:PCB_{DL} $\approx$ 35:65%, right).

The results of sheep seem contradictory as their contamination should originate almost exclusively from ingestion of top agricultural soil (none of the infected sheep was bred with feedstuff) wherein, on the contrary, PCB_{DL} is minority and the occurrence of dioxins and furans is comparable.

This conclusion was matched with fingerprint comparison. Fig.2 shows that the fingerprints of industrial top soil, air deposition and agricultural top soil (2nd, 3rd and 4th row) are almost perfectly comparable, with OCDD and 1,2,3,4,6,7,8-HpCDD predominating among dioxins and 1,2,3,4,6,7,8-HpCDF (and, to a lower extent, OCDF) among furans and 126 and 114 among PCB_{DL}, thus calling for a common contaminating source. This source, however, cannot be ILVA E312 stack emission (top row in Fig.2), whose fingerprints are remarkably different.

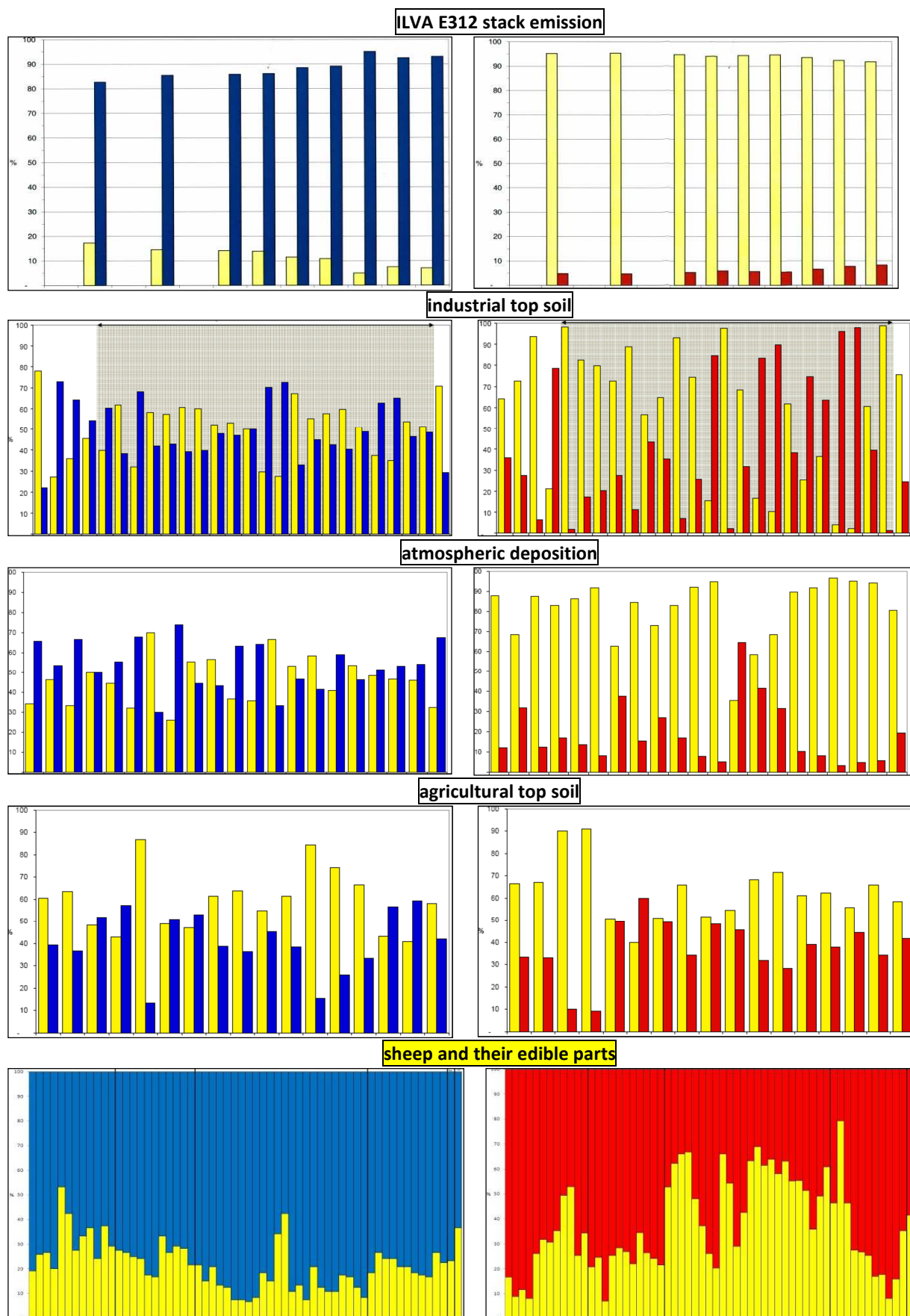


Fig.1. TEQ occurrence of PCDD (□) vs. PCDF (■) (left) and PCDD/PCDF (□) vs. PCB_{DL} (■) (right) in various matrix samples

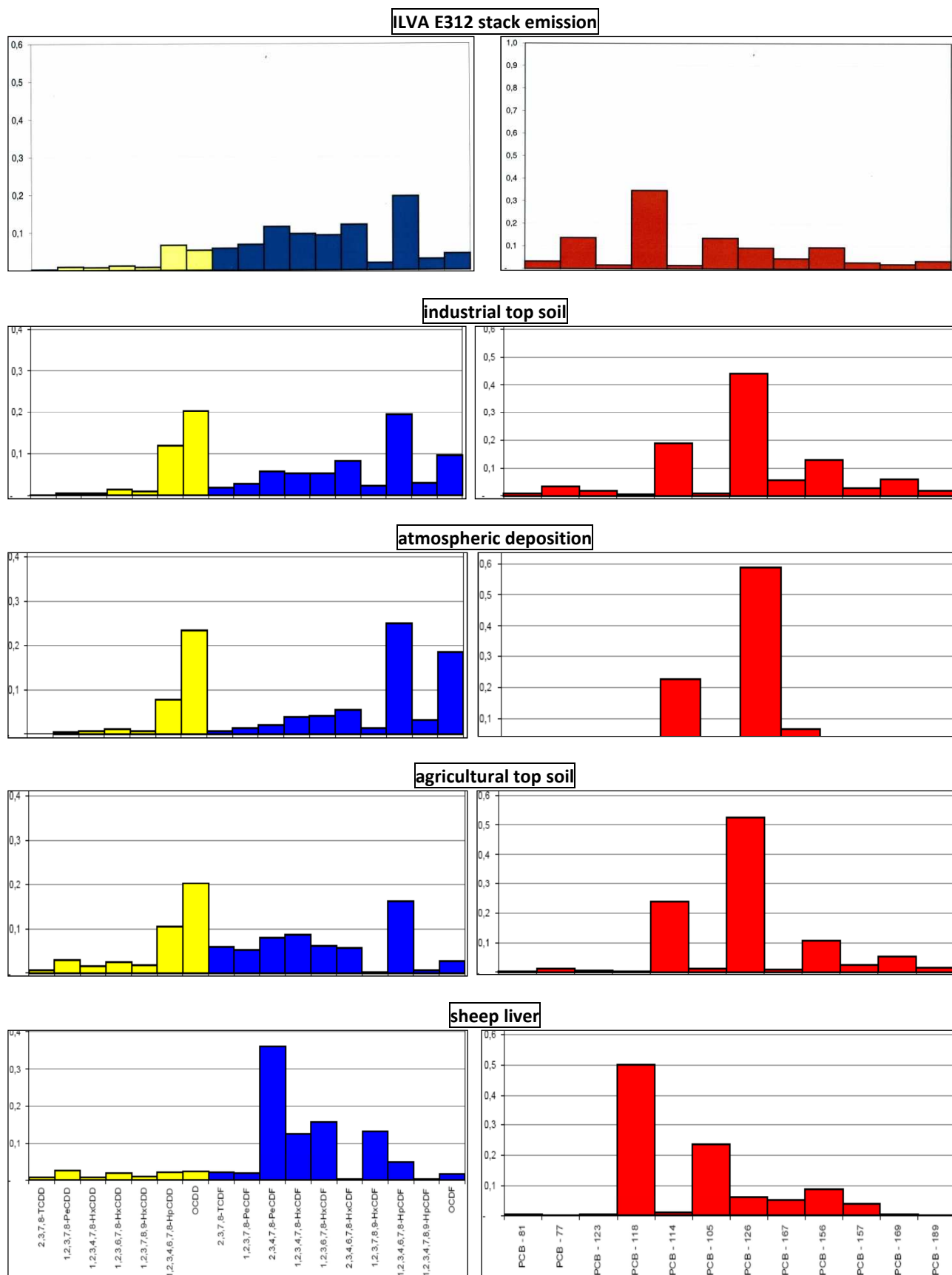


Fig.2. Comparison of toxic congeners profile (*fingerprint*) in investigated matrices (PCDD and PCDF left, PCB_{DL} right)

Still different fingerprints are exhibited by sheep liver and other foodstuffs examined (bottom row in Fig.2), where not only animal contamination is due prevalently to PCB_{DL} (as already seen in Fig.1), but their PCB_{DL} fingerprint is predominated by other congeners than in environmental matrices, namely by PCB 118 and 105.

Fingerprint comparison confirmed that point-emission from ILVA E312 sinter stack cannot be the source of dioxins and PCB_{DL} contaminating the surrounding environment nor the sheep and their food derivatives examined.

Finally, the multivariate PCA statistical analysis of all the experimental data collected was carried out (Fig.3).

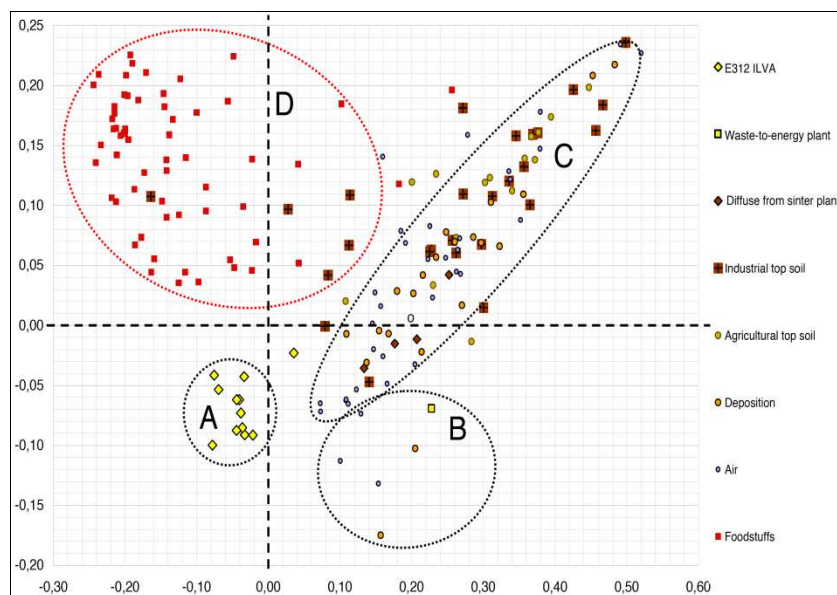


Fig.3 Results of PCA evaluation

As shown in Fig.3, PCA gave origin to 4 clusters, satisfactorily homogeneous and with poor overlapping, aggregating:

- ILVA E312 sinter stack emission only (cluster A);
- waste-to-energy plant stack emission and some samples of air and atmospheric deposition (cluster B);
- almost all the environmental matrices (cluster C);
- almost all animals and their food derivatives, including part of industrial top soil (cluster D).

From these data the following considerations may be drawn:

- PCDD/Fs emitted by ILVA E312 sinter stack lie in a definitely different cluster (A) from those contaminating the environmental (cluster C) and animal/food matrices (cluster D);
- some affinity exists among some samples of air/atmospheric deposition and the single available sample of the RDF waste-to-energy plant (cluster B);
- the vast majority of the environmental matrices examined, including agricultural top soil, lies in cluster C, well separated from cluster D that aggregates animal and food matrices, apparently indicating that these latter were contaminated by different source(s);
- animal and food matrices are closely and homogeneously clustered (D), where the appreciable occurrence of some industrial top soil samples is also registered.

The evidence achieved at this point of the investigation converged on the following conclusions:

- 1) point-emission from E312 main flue gas stack serving ILVA sintering plant is not the source of the *recent* (probably on-going) dioxins and *historic* PCB_{DL} contamination;
- 2) intoxication of the 2,170 infected sheep and their food products apparently did not originate from the agricultural top soil where they grazed freely.

Although hard to believe, the latter conclusion may be easily explained. PCDD/F and PCB are a family of lipophilic hydrophobic congeners, highly recalcitrant to biodegradation by the natural micro-organisms present in environmental matrices. This is so in particular in agricultural soil, where they tend to remain at the top for ≈ 100 years, with poor ability to migrate to crops and groundwater, while persisting ≈ 10 years in humans and only ≈ 1 month in rat [40]. Since the pioneering studies of Bjerke [46] and Flesh-Janys [47], still little is known on PCDD/F and PCB metabolic degradation in living bodies,

wherein the fingerprints may soon be completely altered [48] [49] [50] [51] [52]. Accordingly, the remarkable difference between fingerprints soil and in sheep grazing thereupon should not be a surprise nor should PCDD/F and PCB_{DL} in agricultural top soil be denied as the main vehicle of sheep contamination.

Excluding the *point-source* emissions examined (ILVA E312 stack and other chimneys), the occurrence of *diffuse fugitive* emissions close to ground level was looked at in search of the source(s) of environmental and animal contamination. To that aim, an inspection was authorized in 23rd February 2010 to ILVA sinter plant. Samples of the dust continuously deposited on the pavement and floating inside the plant, reportedly made by ore minerals, were collected and analysed, together with toxic fines filtered by the electrostatic precipitators (ESP) ahead of the E312 stack and collected in big bags for transportation to a sanitary landfill. Fig.4 shows the results of the analysis carried out.

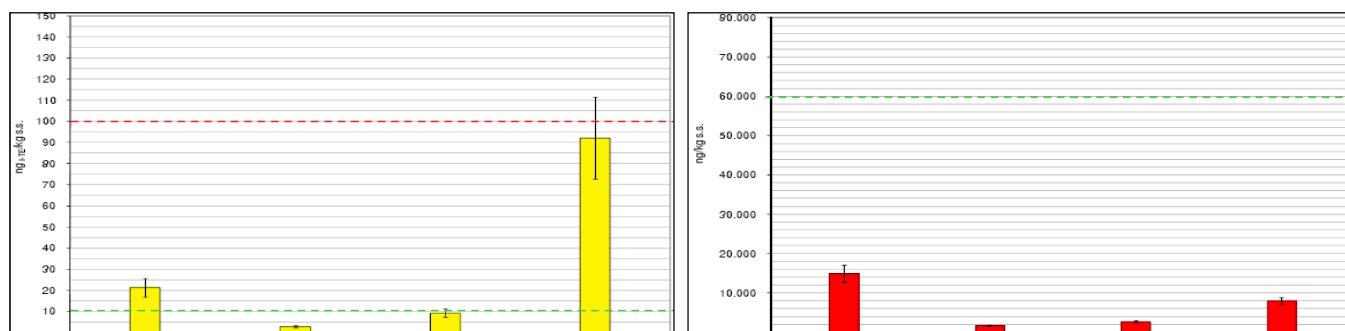


Fig.4. PCDD/F (left) and PCB_{TOT} (right) in 4 dust samples collected inside ILVA AGL sinter plant (Maximum Allowable Concentration in industrial [---] and public [---] sites ex Legs. Decree n.152/2006)

Fig.4 indicates a finite presence of dioxins (although below the limits in force) and almost negligible of PCB in the dust.

More important, Fig.5 shows a strict similarity of PCDD vs. PCDF and PCDD/F vs. PCB_{DL} occurrence between that dust and the fines filtered by ESP as well as between their PCDD/F fingerprints (PCB were negligible), thus indicating a common origin.

Finally, Fig.6 confirms that both fingerprints match perfectly with those of samples taken from ILVA industrial top soil surrounding the sinter plant, already shown in Fig.1 (2nd row).

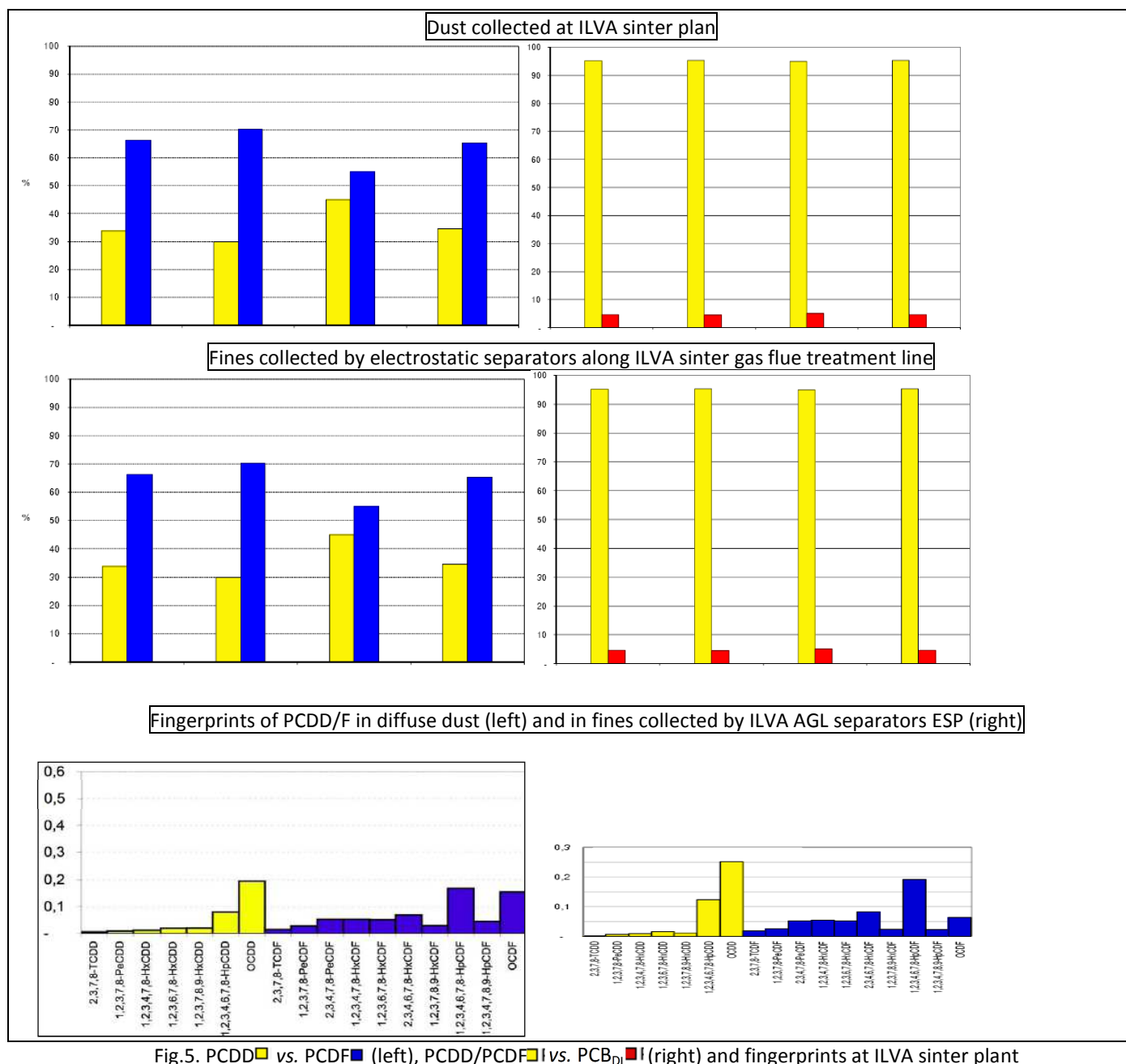


Fig.5. PCDD vs. PCDF (left), PCDD/PCDF vs. PCB_{DL} (right) and fingerprints at ILVA sinter plant

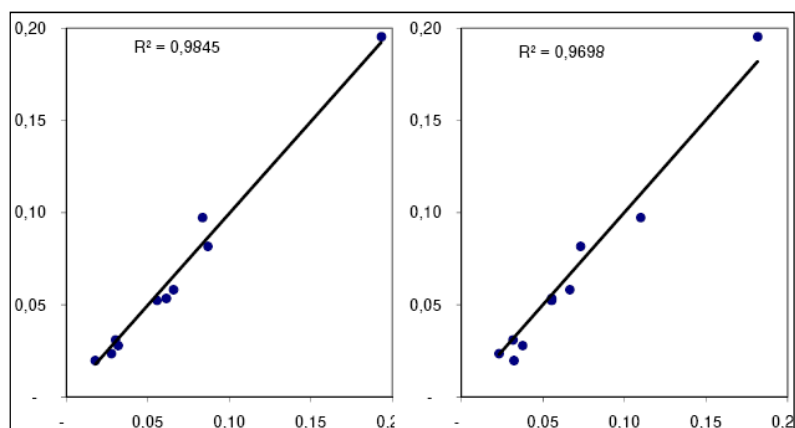


Fig.6. Fingerprint correlation of dust (left) and toxic fines (right) at ILVA sinter plant with outdoor top industrial soil

6 CONCLUSIONS

The results of this extensive investigation showed a remarkable ubiquitous contamination by dioxins (*recent*) and PCB_{DL} (*antique*) of environmental and cattle matrices in an area with 20km radius surrounding Taranto industrial zone. On the basis of the various evidences achieved, it may be reasonably concluded that *fugitive diffuse* emissions escaping from ILVA sinter plant, not the largely suspected *point source* emission from its E312 main stack, are the main source of dioxin contamination.

On the other hand, the contaminating source of PCB_{DL} (not produced during the I&S cycle) should be found in previous mismanagement of PCB-containing devices largely used in the past in the area.

As for animal contamination, the difference of dioxin and PCB fingerprints between the intoxicated sheep (2,170 were abated) and the uncultivated top soil around ILVA where they used to graze is due most probably to the relatively fast, although still largely unexplained, biodegradation rate of those contaminants in living organisms.

Following these results, a regional law reduced dramatically the threshold of *point-source* emission of toxic dioxins from industries (chimneys and stacks) in Apulia region. Major attention, however, should be dedicated to regulating and eliminating the shift *fugitive diffuse* toxic industrial emissions in order to ensure better working conditions and safer living situation for the surrounding population.

Furthermore, given the differences in source, toxicity and diffusion route into the environment and living organisms of dioxins and PCB, it is appropriate that separate actions for their control could be considered by the responsible authorities.

ACKNOWLEDGEMENT

The author would like to express its greatest appreciation to Dr. Roberto Primerano, senior researcher at Apulian Arpa, and Dr. Filippo Cassano, professor of Occupational Health at Bari University, for sharing its efforts in this extensive investigation with passion and competence. He would also like to tribute its deepest gratitude to Prof. Giorgio Assennato, scientific director of Apulian Arpa, and to Dr. Michele Conversano, head of Asl-Ta1, for coordinating the massive analytical surveys carried out by their laboratories.

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Landslide risk: study of soil instability of an area in the region of Tetouan, Occidental Rif (Morocco)

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ABSTRACT: The study area is located in the North of Morocco on the Mediterranean coastline. The purpose of this article is to know the principles of a study of soil stability using geological study and geotechnical test, in order to characterize and to undertake the stability of the areas subject of movement and particularly for landslides by a numerical method (SLIDE 5.0). It will also enable to define the nature of soil at the site using mechanical test and the pressumeter tests supplemented by laboratory tests to understand and deduce the risk of instability affecting this area. The studies and tests have allowed us to highlight a schistose soil. This schist are quite permeable, therefore the flow of water into soil, particularly clays and schist, and when it is saturated in water, its internal cohesion decreases very significantly, which causes the landslides. It is important to understand these instabilities in order to better characterize and define the kind of preventions for this area, where the subject of this study.

KEYWORDS: geology, geotechnical, Slide5.0, test, landslide...

1 INTRODUCTION

The stability of the entire slope is threatened by gravity; between imperceptible distortion on certain aspects and incessant falling blocks in the hallways of the high mountains, landslides cover a broad category of movements along the slopes [1]. They are frequent and constitute a permanent risk in almost all regions of the world. Their study and monitoring, which should allow the prediction of their release, have become a priority for natural disasters.

Geological complexity, morphology steep relief and relatively abundant rainfall make the Rif region where slope movement; commonly referred landslides are most common in Morocco. If damage in human life in relation to these phenomena are rare, they nevertheless have a significant impact on land they directly threaten the infrastructure of the region.

The slope instability is rarely attributed to a single factor, but it is the combination of several, difficult to dissociate because of mutual interactions [2]. Landslides are characterized by the appearance of shear surfaces relatively well defined within the environment.

The damage does not save more buildings because the geological risk associated with these processes does not worsen with the expansion of urban centers, sometimes too fast and without prior planning [3].

The objective of this study is to define the nature of the soil means of geological and geotechnical studies, supplemented with a stability study of the ground by a numerical method (Slide 5.0). These combined methods will allow us to characterize the type of ground movement affecting this area.

1.1 PRESENTATION OF THE STUDY AREA

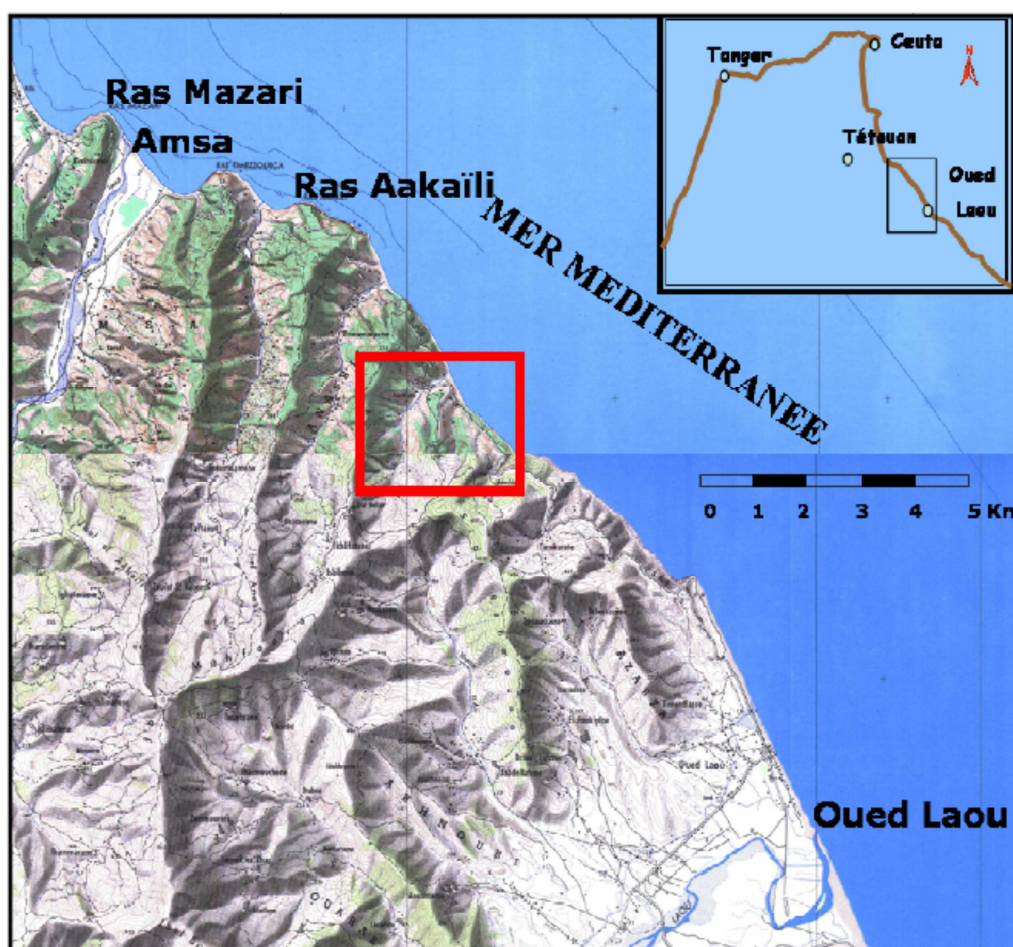


Fig. 1. Geographical location of the study area at 1:50,000 topographic maps of Ras Mazari and Talembote

The study area is located in northern Morocco on the Mediterranean coastline. It is bordered to the northwest by the Ras Mazari, and south-east region of Oued Laou.

1.2 GEOMORPHOLOGY

In general, it is a ridge with a maximum altitude of about 350 NGM, pyramidal with three sides: a larger eastern side directly overlooking the coast; a North East side; and a slope south-southwest.

1.3 CLIMATE

As the majority of Moroccan territory, the study area is characterized by high climatic irregularity. This occurs mainly in the rainfall which varies greatly from one year to another, and also within one year. This climate can be classified in the sub-humid, wet periods with features and semi-arid.

1.4 HYDROLOGY AND HYDROGRAPHY

Hydrological and hydrographic point of view, the watershed including the study area is bounded by two rivers, the river Laou and its tributaries in the southeast and the river Amsa at Northwest.

The analysis of the sector shows that drainage system is a small area to poor drainage system concentrated in the north-east of the site, and composed of some troughs more or less branched, including runoff s' performs generally towards the sea (east direction).

1.5 GEOLOGY

Geologically, the site belongs in its entirety to the Akaili unit (Silurian) belonging to the field of Ghomarides whose abundant geological formations are flyschoides composed of limestones, sandstones, conglomerates and schists.

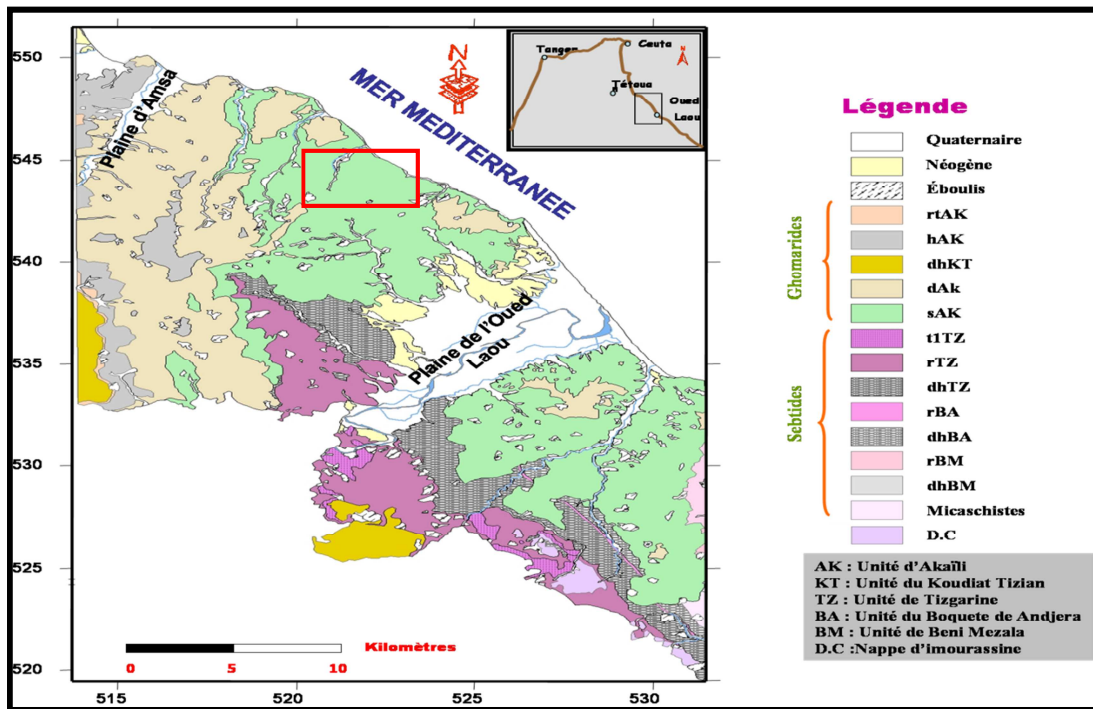


Fig. 2. Geological map of the study area (Saarig Zaakia, 2007) [4]

Thus, the facies representatives are glistening sandstone schist and conglomerates with pebbles quartz stretched of the Silurian, and limestone. In addition, recent deposits covering the entire study area, with the exception of some small areas denuded by the sliding planes or along of slopes. Red clays are confined arched terraces from the sliding phenomenon while colluviums are in the southeastern part of the area.

2 MATERIALS AND METHODS

2.1 GEOLOGICAL AND GEOTECHNICAL STUDIES OF THE SITE

The recognition of soil allows us to understand the problems that can arise during the study of a construction project or during the sinister expertise.

2.1.1 GEOLOGICAL STUDY

Geological reconnaissance is the first step; it identifies the soil by visual observation of the different layers, confirmed by examining the geological maps.

Examination careers or trenches located near the area, gives immediate information on the sub-layers. Recognition was thus performed using coring [5], from what we could establish summary geological sections of our area.

2.1.2 GEOTECHNICAL STUDY

The geotechnical study allowed us to identify the site using the soil tests [6] (Atterberg limits), the pressuremeter test which gives information on the strength and deformability. This study is also complemented by tests on the granulometry of soil, the degree of fragmentability or degradability of material (schists). These analyzes were conducted on soil materials taken from the site and transported to the laboratory for testing.

The campaign in situ of recognition consisted of the execution of ten (10) cores drilling from 10 meters in 2008, then fifteen (15) cores drilling from 15 to 20 meters deep in 2011.

2.2 NUMERICAL METHOD TO STUDY STABILITY: SLIDE (VERSION 5.0)

2.2.1 PRINCIPLE AND CHARACTERISTICS OF THE MODEL

The principle of calculating slope stability is to determine the safety factor SF by which is dividing the resistance of the sliding surface so that the potentially permanent mass is at the limit of equilibrium.

This factor can be written as follows:

$$FS = \frac{Q_{\max}}{Q}$$

Where Q: value that defines the vector or tensor applied to mass (horizontal force H, V vertical force, moment M). Qmax: maximal value of Q.

The SLIDE software is a tool of stability analysis in geotechnical with or without reinforcements. It allows to study projects, and not just sections, that is to say that the management of phasing of implementation is integrated in the software: from an initial cut (which must include all the elements will be used in phasing: geometric lines, characteristic of the slope overload reinforcements, the water parameters etc...).

Some features of the model:

- Homogenization of the slope of a single material;
- No pressure water (dry);
- Circular research of slip surface (Grid Search)).

It is this last feature that gives us all probable sliding surfaces with a coefficient of security value.

This automatic search of rupture surfaces can be made by three (3) methods for circular sliding surfaces; Grid Search ; Slope Search; Auto Refine Search. It is much more recommended to use the method « Grid Search», because it is the default method, but also it is that which requires a rack in the middle of sliding.

The definition of the grid can be made by the user (Adding the Grid option) or automatically created by Slide (Automatic Grid option).

Thereafter, it is necessary to define the type of material order to choose the appropriate method for the simulation.

First methods that are applicable to the sliding is examined; by default the methods chosen in Slide are those Bishop simplified and Janbu simplified. It is also possible to perform the calculation according to any method of user request.

After analysis and simulation, it is noted that the sliding surfaces are color-coded depending on the safety factor; and the safety factors that varies depending on the analysis method chosen. The overall minimum sliding surface thus defined, is the surface with the lowest coefficient of all security sliding surfaces analyzed. The global minimum safety factor is displayed next to the center sliding surface.

3 RESULTS AND DISCUSSION

3.1 GEOLOGICAL ANALYSIS

The exploitation of geological data and sections realized, shows that, generally, the soil is predominately schistose, and with the exception of some core drilling that are predominately clayey.

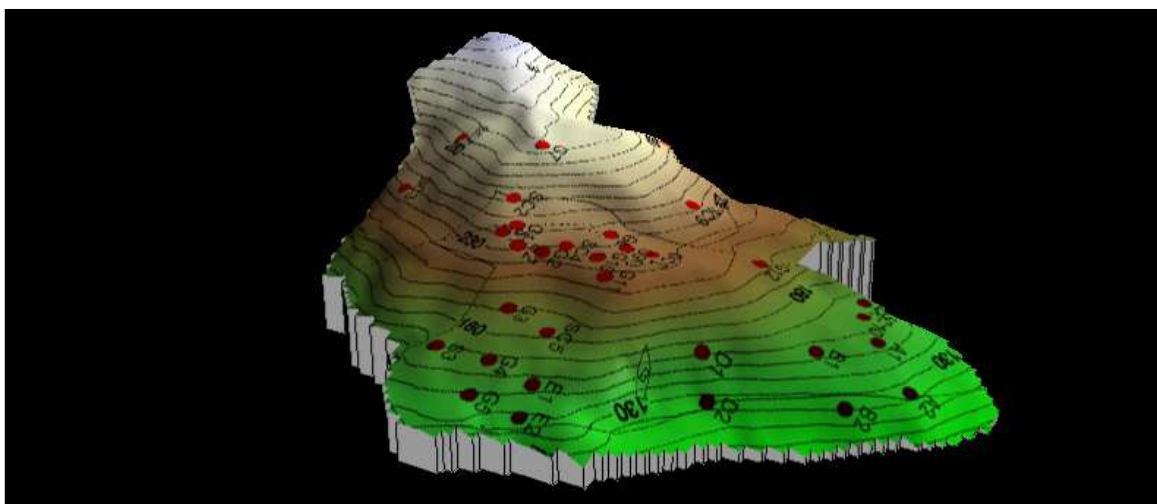


Fig. 3. Map of distribution of core drilling

Locally, fronts set up along the road show schist facies (smoke color) overlain by schists interbedded calcareous. The front of the schists to the south of the site shows slope deposits (scree and colluvium, etc.) of different types and sizes. The upstream part of the site shows generally greenish schist.

3.2 GEOTECHNICAL ANALYSIS

According to the cuts realized and the statements of natural fronts, we can define three lithological groups distinct:

- Group 1 (wholesome schist): located by our polls in the upper part of the site. This is an area generally stable, which skinning of his vices can only be done after weeding of the site.
- Group 2 (clay-schist): according core drilling realized (SC2, SC8, SC9, S2, S3, G1, G4, G5, G8), a vertical alternating of the gravelly clay with schists is observed. This testifies that there had been a reorganization of the material probably an old sliding. This alternation was observed even in the horizontal direction.
- Group 3 (gravelly clay and screes) : these facies encountered in the core drilling SC4, SC5, G3, located in the downstream part of the site are clearly visible on the fronts to the south of the site. It is loose soil without cohesion, from a filling (terrace deposits, witnesses of an ancient sliding). The areas in which these facies have been encountered are susceptible to movement when changing their characteristics geometric and intrinsic.

The pressuremeter tests were carried out in several drill holes such as S2-S3-G3-G4-G5-G6-G8-G9-G10-G11-G12-SC4 and SC5. The results obtained on the first meters of some polls have been exploited. We note that the clay soils are characterized by low pressure limits as the case of polls G4- G5- G8.

The identification tests on soil samples have given the following results:

- Gravelly red clay

This material has the following characteristics:

- o A percentage of fines (elements of diameter <0.08 mm) 60% to 70%;
- o Between 8 and 18% elements higher than 2 mm;
- o A liquid limit WL between 41 to 51% ;
- o An index of plasticity Ip between 19 to 30.2%;
- o This is a fine soil (according to the classification LCPC), this is "Clays little plastic to plastics" named Ap.

- Schist crumbled

The tests performed on the fine portion of this material have the following characteristics:

- o A percentage of fines (elements of diameter <0.08 mm) is 15 to 20% ;
- o A liquid limit WL between 31% to 48% ;
- o An index of plasticity Ip between 11% to 27%;

- o This is a fine soil (according to the classification LCPC), this is "Clays little plastic to plastics" named Ap ;
- o The rock portion of this material has a coefficient of fragmentability $Fr = 10.53\%$. This is a fragmentable material because $FR > 7$.

- Compact schist

This material has a coefficient of Los Angeles test $LA = 26\%$. It is in this case a soil which is class according to standard NF P 18-650-2/A1, that is to say « $20 < LA < 50$: high quality of material ».

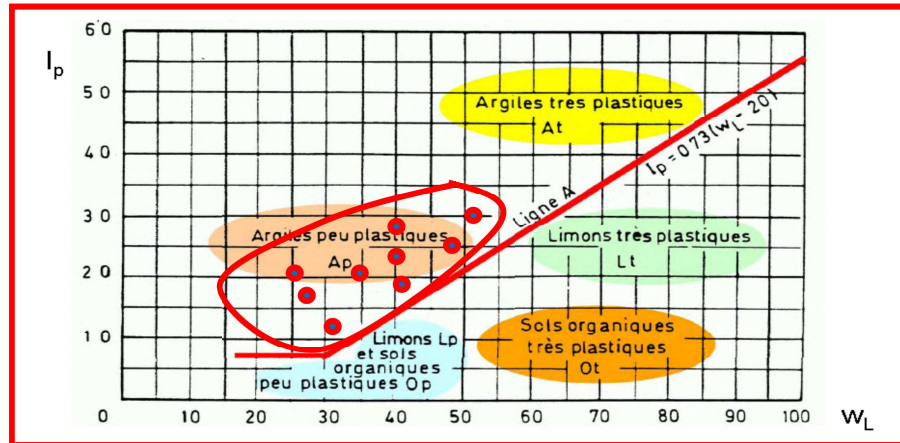


Fig. 4. Soil classification in the laboratory. Diagram of plasticity[7]

The projection of points on the diagram for soil classification allows us to classify these soils in clay soils little plastic.

3.3 DEFINITION OF THE TYPE OF INSTABILITY VIA SLIDE 5.0

The terrain consists of a mixture of gravelly clay, colluvium, schists and limestone pleated; these shale facies in sound condition will be considered coherent rocks do not generate instability, but this is not really the case in the study area.

To understand the stability of the site, the software analyzes in Slide5.0 to find the factors of safety FS as was described earlier in this article, has allowed us to make a comparison between the slope in the natural state (before the start of construction in 2008) and the state of the slope after earthworks (2011).

To do this we performed three (3) passing through the various polls profiles:

- A first profile through the polls G1-G2-G3-G4-G5-G6 ;
- A second profile through the polls G8-G9-G10-G11 ;
- A third profile through the polls S1-S2-S3.

It should be noted that this software takes into account mainly the topography, but also the mechanical parameters of the soil were determined in the laboratory. These parameters are taken as a result: a value of soil cohesion $C = 1 \text{ kN/m}^2$, a density of the material $d = 18 \text{ kN/m}^3$ and an internal angle of rubbing $\phi = 30^\circ$.

3.3.1 SAFETY FACTOR BEFORE EARTHMOVING (NATURAL SLOPE)

The first step of the simulation is done on the different profiles in the natural state of the site before work begins.

The result of the safety factors FS obtained by Bishop simplified method for different profiles are shown as following:

- Profile 1

The analysis has given a coefficient of minimum security $FS=0,865$.

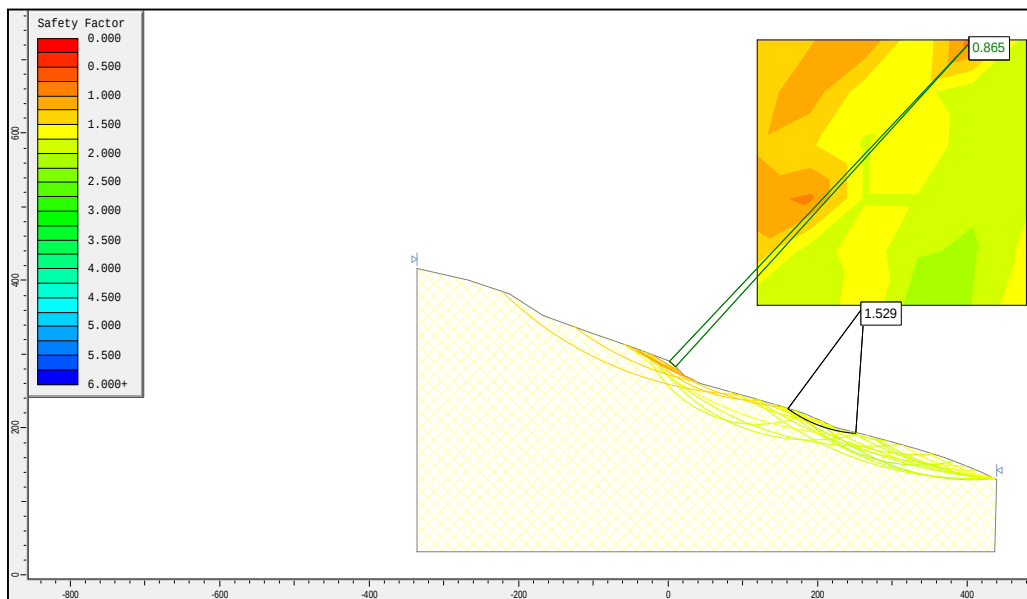


Fig. 5. Results of the analysis for the first profile before earthmoving

- Profile 2

The analysis has given a coefficient of minimum security $FS=1,301$.

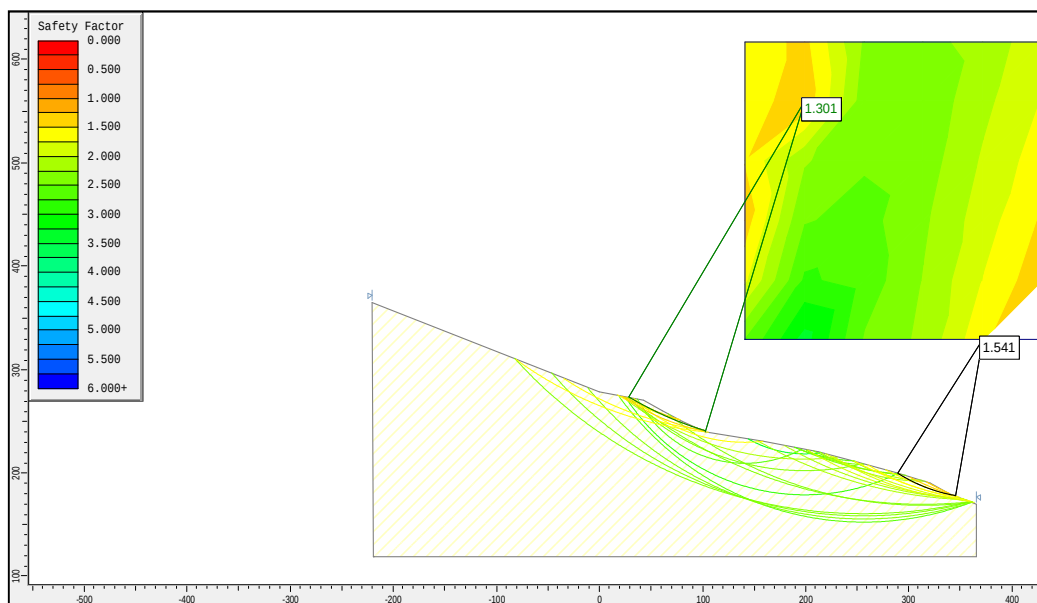


Fig. 6. Results of the analysis for the second profile before earthmoving

- Profile 3

The analysis has given a very low safety factor FS of the order of 0.751.

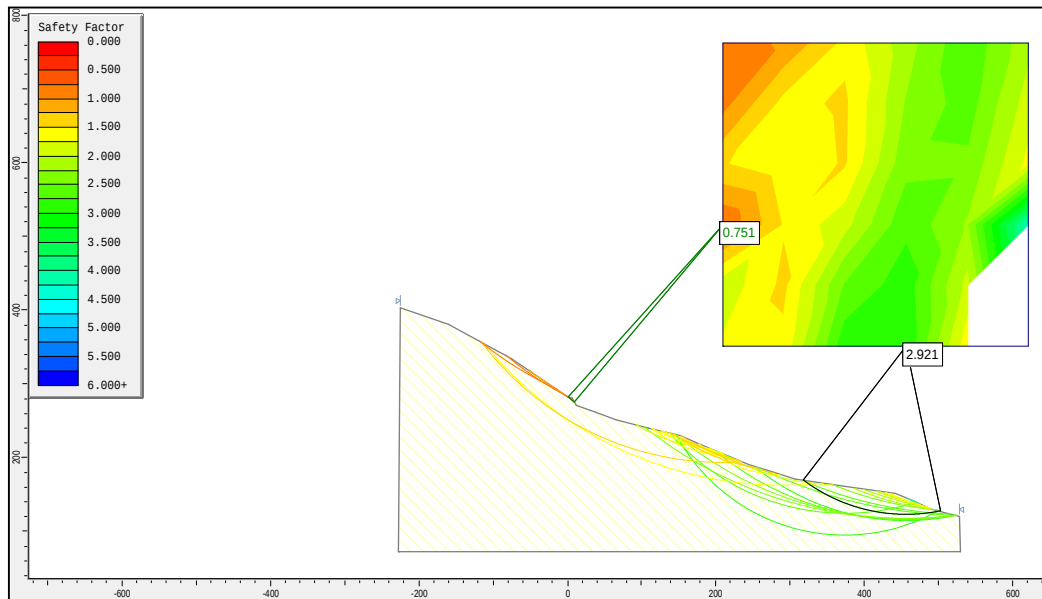


Fig. 7. Results of the analysis for the third profile before earthmoving

3.3.2 SAFETY FACTOR AFTER EARTHMOVING

Respectively for the same profiles passing through the various polls we obtained the following results:

- Profile 1: a minimum safety factor FS= 0,938.

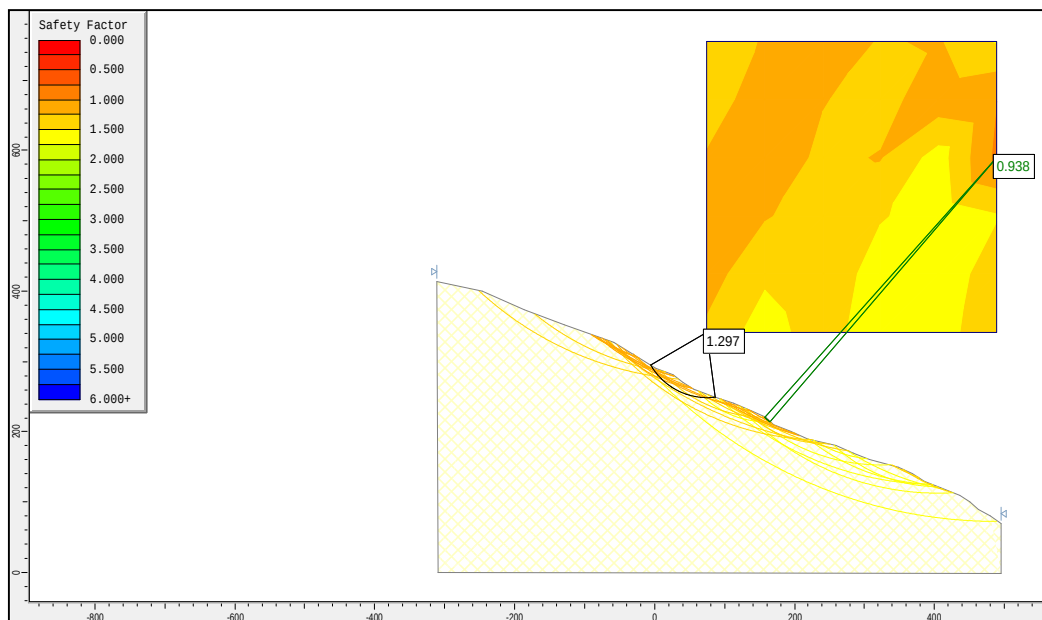


Fig. 8. Results of the analysis for the first profile after earthmoving

- Profile 2: a minimum safety factor $FS = 0,919$.

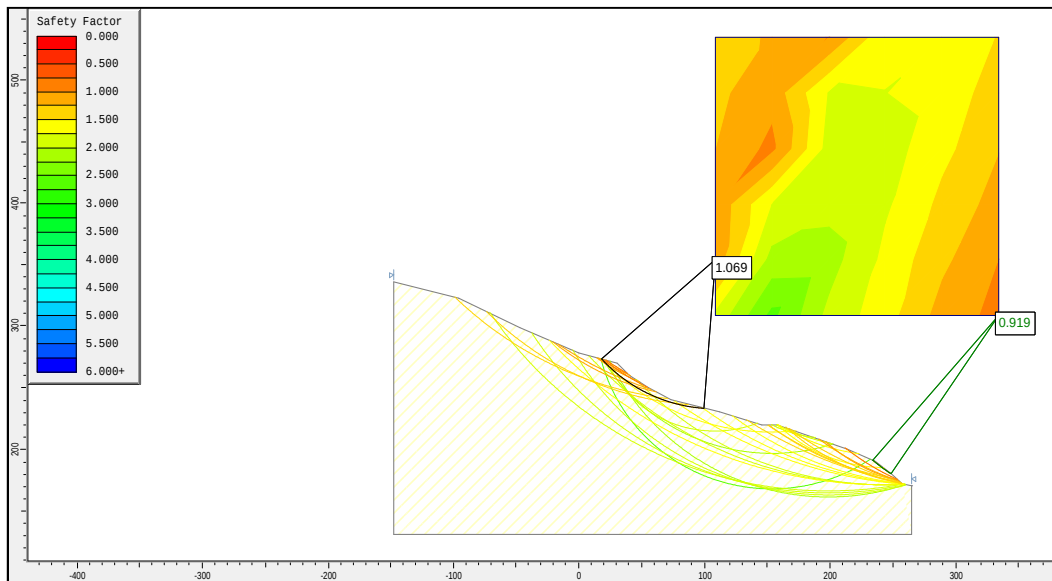


Fig. 9. Results of the analysis for the second profile after earthmoving

- Profile 3: a minimum safety factor $FS = 0,997$.

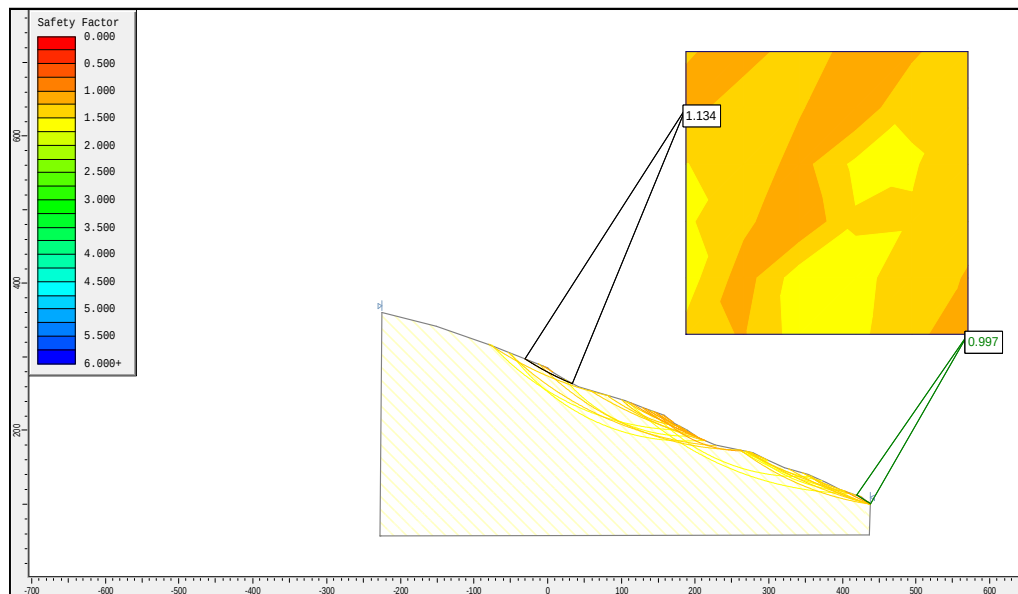


Fig. 10. Result of analysis for the third profile after earthmoving

Thus, we can see that the values of FS before earthmoving are relatively low in the case of the first and the third profile, unlike the second profile ($FS = 1.3$), but these values show that there has already had the rupture. Compared to the results of the analysis after the start of earthworks, there is a marked improvement in FS at profiles 1 and 3, in contrast to a decrease of FS at the profile 2. In all cases, these values do not reach the minimum permissible value for the security of some important structures which is the order of 1.25 to 1.4. Thus the study site risks possible instability phenomena taking into account the parameters of topography in this study.

Table 1: Value of the safety factor according to the structure [8]

FS	Structure
<1	Danger
1.0-1.25	contestable safety
1.25-1.4	Satisfactory security for minor structures contestable safety for dams, or when the rupture would be catastrophic
>1.4	Satisfactory for dams

However, we can define the unstable zone that develops on the bedrock composed of dark and reddish clays, schists containing quartzite. This lithology corresponds to the Silurian of Akaili (Ghomarides).

Two types of instability can arise in this area:

- Sliding bench on bench of the schists: schist is rocks foliated, their stability depends mainly on their inclination. In the presence of water, interbeds movements may arise and cause generally superficial movements and / or prismatic dislocations.
- Rockslide of clayey gravel: phenomenon mainly due to steep slopes and the change in the water status of these facies.

3.3.3 INTERVENING FACTORS IN THE INSTABILITY

These instabilities are determined by intrinsic and extrinsic factors on the ground.

- Intrinsic factors

This is the set of characters and specific parameters to the ground; it is the topographic slope, lithology and structure.

o Topographic slope

The terrain is characterized by relatively important slopes to facilitate movements. Generally, the large number of instability affects slopes moderately pitched and moderately high. These instabilities become scarce in areas with low and high slopes.

In the case of low slopes, the action of gravity is too weak to drag the rock masses. While in the second case (steep slopes) that are often cliffs, these are phenomena of rockslide or collapse blocks of various sizes that manifest themselves. Thus, our study can be classified according to the degree of slope, among the areas at risk of sliding as shown in the analysis from the slide 5.0 software.

o Lithology

Lithological point view, the ground consists of shale and limestone with folds. These facies show in the metric and centimetric scale, several planes orthogonal from each relation to others and spaced a few centimeters. This is a very jointed structure and the rock is more consistent as a whole by acquiring an eroded appearance. The core drilling implanted in the stable area of the site (upstream) showed a schist being flush between 1 to 2 m in depth. These schists are generally altered and debited to all depths recognized.

o Structure

Besides the diaclasses, the ground shows a larger scale; the presence of a set of faults that affect it. Indeed, the study of terrain and geomorphological analysis on the map and aerial photos clearly show the existence of a large number of these faults.

It is mainly vertical normal faults or steeply dipping to the sea and some setbacks. The faults are grouped into several families: NNW- SSE à N-S, NW-SE, E-W, NE-SW.

The family NNW-SSE to N-S materialized by three major faults along the sector from its southern boundary to become farther north (Tamernoute), the coast line in cliff.

The family NW-SE is represented by faults segmented; whose junctions are often hidden by the vegetable mold or deposits recent slopes.

- **Extrinsic factors**

Mention of these factors, the slope exposure east wind, high rainfall area and significant seismic activity frequency. In our case, it is predisposed to generate movements, joints and faults that have weakened the rock also play plans for infiltration of rainwater. This water allocates far in altering the rock, reducing its internal cohesion and overcharging of the first meters of the soil. This phenomenon is getting worse because of the slope exposure humid winds from the east (Cherki) which increases the water content of soil and decreases the evaporation.

Such a sol, including all factors favoring landslides, simple vibrations (seismic) can at any time trigger instability. This one, according to this study often takes plans faults NNW-SSE à NW-SE as a primer.

Detachment of blocks and their fall on the slopes are often caused by neotectonic deformations which are exerted in the steep escarpments, these blocks rush down the slopes up softening their slopes where they stop.

4 CONCLUSION

The Study area is characterized by a particular geomorphology, which is that of the entire Rif chain, with very complex character.

The geotechnical study of the project showed that the soils are predominantly schistose. The crumbled schists are permeable, thus facilitate the passage or flow of water in the soil (which consists mainly of clay), and when the soil is saturated with water, its internal cohesion decreases rapidly, which causes the sliding.

The core drilling and geological study of the site have detected landslide areas located downstream of the site.

Studies also demonstrate that it is better to take an angle for earthworks $\alpha=27^\circ$ to 30° instead of 45° , because the ground becomes unstable when the earthmoving is made at an angle relative to 45° .

We can say that: this sliding is a set of small sliding "parasites" from a very old and large rotational landslide or curve, and in recent years when quantities of materials has become quite large and abundant accompanied by a significant rainy season, new fracture surfaces have arisen.

When we want to stabilize a sliding, not matter whether the rupture surface is circular, planar, etc ...; it would be of great importance to know its dimensions and have an idea about its origin, that is to say if it is an overload, a water flow, soil alteration or simply runoff exceptional, because the choice of the stabilization method into depends.

Faced with a problem of stability, a first solution is to franking movements of unstable slopes without preventing. Thus, we need to know whether to:

- Implement or move the buildings, the art or the road outside the work area moving in a sector recognized as a stable?
- Design the work so that it is not damaged by the landslide: adapting the method of construction so that the foundations are separated from the moving soil?

ACKNOWLEDGMENT

Thanks to all co-authors from this paper for their participation; to the Georet labortory, to National service for external scholarship and the Moroccan Agency for International Cooperation.

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VIBRATION ANALYSIS OF DAMPING SUSPENSION USING CAR MODELS

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ABSTRACT: This paper gives an insight on the suspension dynamics of the two most widely used models for vehicle dynamics with their complete state space analysis, simulated by using Mat Lab platform. In this paper we investigate the responses of the quarter car and a half car model as the vehicle ride performance is generally assessed at the design stage by simulating the vehicle response to road excitation. This requires the development of a vehicle model to analysis its responses. The time responses and frequency responses of the sprung and unsprung masses have been studied. The optimal solution here is the damping, which has been optimized with the given set of fixed parameters.

KEYWORDS: Suspension damping coefficient, Quarter car model, half car model, unsprung mass, Sprung mass, Tyres Suspension.

1 INTRODUCTION

The performance of the suspension system is typically rated as to provide improved passenger comfort and avoid hitting it suspension travel limits. The main target of the suspension system is to isolate the car body from the road disturbances. Primary suspension is the term used to designate those suspension components connecting the axle and wheel assemblies to the frame of the vehicle. This is in contrast to the suspension components connecting the frame and body of the vehicle, or those components located directly at the vehicle's seat, commonly called the secondary suspension. There are two basic types of elements in conventional suspension systems. These elements are springs and dampers. The role of the spring in a vehicle's suspension system is to support the static weight of the vehicle. The role of the damper is to dissipate vibrational energy and control the input from the road that is transmitted to the vehicle. The basic function and form of a suspension is the same regardless of the type of vehicle or suspension Hall [1]. Primary suspensions will be divided into passive, active adjustable and semi active systems. A passive suspension system is one in which the characteristics of the components (springs and dampers) are fixed. These characteristics are determined by the designer of the suspension, according to the design goals and the intended application. Passive suspension design is a compromise between vehicle handling and ride comfort. In an active suspension, the passive damper or both the passive damper and spring are replaced with a force actuator. The force actuator is able to both add and dissipate energy from the system, unlike a passive damper, which can only dissipate energy. With an active suspension, the force actuator can apply force independent of the relative displacement or velocity across the suspension, gives the correct control strategy, these results in a better compromise between ride comfort and vehicle stability as compared to a passive system. Semi active suspension systems were first proposed in the early 1970's. In this type of System, the conventional spring element is retained, but the damper is replaced with a controllable Damper.

Vehicle system modelling is studied by Hovarth [2] in order to suggest a method of obtaining the dynamic response of full vehicle when the dynamic responses and characteristics of each component are known. A comparison was made between the Finite Element Method (FEM) and Modal Modelling. Vibration isolation performance has been investigated by Ghosh and Dinavahi [3] for a vehicle system supported on a damper-controlled variable-spring-stiffness suspension system. Modal modelling was further studied by fitting the model to measure frequency responses. Daberkow and Kreuzer [4] studied the integration of Solid Modelling Computer Aided Design (CAD) systems within a dynamic simulation environment. The modelling of a mechanical system by means of a multi-body system is based on the composition of several individual parts

like rigid bodies, interconnected by joints, springs, dampers and actuators. The applied forces and torques on the rigid bodies are the force elements, which include springs, dampers and actuators acting in discrete attachment points. Joints with different kinematics properties have several effects on a mechanical system.

Huang and Chao [5] used a quarter-car Two-Degree of freedom system to design and construct a four-wheel independent suspension to simulate the actions of an active vehicle suspension system. They employed the free fuzzy logic control algorithm to design a controller for achieving vibration isolation. For satisfying the expectations of customers the requirements of ride comfort and driving performance are major development objectives of modern vehicles. The suspension system is an important factor to the ride comfort and driving capability. The active suspension consists of a spring, damper and actuator between the unsprung mass and sprung mass where the sprung mass is considered as a rigid body. A 14- Degree of freedom mathematical model was developed and analysed to predict the handling dynamics of a four-wheel vehicle by Speckhart [6]. He did not give any allowance for deflection of any member of assembly. Hence, while deriving the dynamic equations for the vehicle, he treated the vehicle as an assembly of rigid masses. He suggested that the greatest source of error in predicting the dynamic responses of the system is due to the uncertainty in determining exact vehicle parameter and performance of tires. This study also determined that small changes in suspension design can lead to noticeable difference in handling. As the model was rigid, it was not real. In this research the sprung mass and unsprung masses are not rigid, keeping the model more close to real situation. In contrast, Simic and Petronijevic [7] focused on the car body as an elastic assembly. The modal vector, driving force, frequency and vibration characteristics of the elastic automobile structure determine the frequency response. They measured the vibration characteristics of the suspension system under harmonic excitation at 5 different points. The car body tested was freely supported on four springs. They realized the input signals could determine the actual vibration condition of a particular area of a car body. The research suggested that possible helpful tools in the process of designing and developing the car body are: Shape of vibration modes and location of neutral lines. They linked the frequency response of the automobile structure to modal vector, driving force, frequency and vibration characteristics. The input here is purely road profile. In the past the vehicle's sprung mass is modeled as a rigid body, but in the present research, it is modeled as a linearly deformable body.

Varadi *et al.* [8] studied three-dimensional and computationally inexpensive vehicular model. The theory of a Cosserat point was introduced to model three-dimensional deformable bodies with large deformations. When the theory of a Cosserat point is applied to vehicle dynamics, it is assumed that the sprung mass is deformable. "When applied to the sprung mass of a vehicle, it results in a mathematical model with relatively few degrees of freedom whose deformation can be used to explain the vents arising during a collision". The methods used for rigid body models can be applied to the modelling of the unsprung mass of the vehicle and the tyre/road interaction which is implied research also unsprung mass has got allowance for deflection. In these studies, two typical models Four Degree of Freedom Half Car Model, and Two Degree of Freedom Quarter Car Model have been developed with researches related to the study of dynamic behaviour of vehicle and its vibration control which are shown in Fig. 1 and Fig. 2. The mass representing the moving parts such as wheel, tyre, brakes and part of the suspension linkage mass, is referred to as the unsprung mass and the relatively fixed parts such as car.

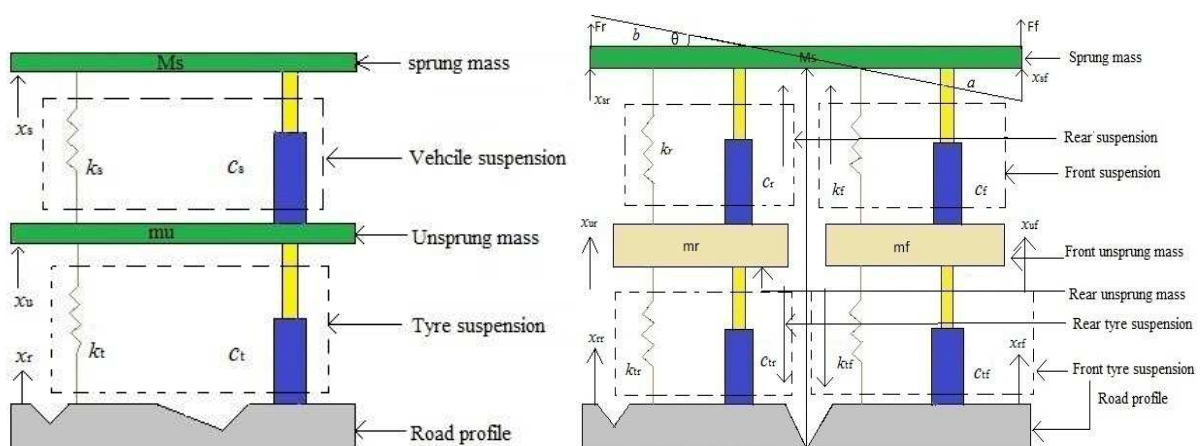


Fig. 1 Two Degree of freedom Model Fig. 2 Four Degree of freedom Model

Body mass is known as sprung mass. The quarter-car model is used only when the heave motion needs to be considered. A half-car model is shown in Fig. 2. It is a two wheel model (front and rear) for studying the heave and pitch motions. This

four degree-of-freedom model allows the study of the heave and pitch motions with the deflection of tyres and suspensions. Quarter Car and Half Car model have been used for this analysis. This paper focuses on mathematical modeling of suspension system, and its dynamic analysis to identify the inputs and state variables. Secondly, the paper also focuses on optimization of the damping coefficient of the suspension system for desired performance characteristics.

2 MATERIALS AND METHODS

The model of a quarter car and half-car suspension systems is shown in Fig. 1 and Fig. 2. The vehicle suspension models are represented as a linear system. They consist of a single sprung mass (car body) connected to two unsprung masses (front and rear wheel assembly masses) at each corner. The sprung mass is free to heave and pitch, while the unsprung masses are free to bounce vertically with respect to the sprung mass.

2.1 DERIVATION OF GOVERNING MATHEMATICAL EQUATIONS

2.1.1 QUARTER CAR MODEL

Derivation of Governing Equations of Motion Using Newton's second law of motion, the equations of motion for the system shown in Fig. 1 becomes;

$$M_s \ddot{x}_s = k_s (x_u - x_s) + c_s (\dot{x}_u - \dot{x}_s) \quad (1)$$

$$m_u \ddot{x}_u = k_t (x_r - x_u) + c_t (\dot{x}_r - \dot{x}_u) - k_s (x_u - x_s) - c_s (\dot{x}_u - \dot{x}_s) \quad (2)$$

To study the effect mathematically, transfer function is derived with the above equations and relationship between input and output is derived by rearranging and manipulating, which is follows:

Since from equation (1), it can noted that;

$$x_u = \frac{(M_s D^2 + k_s + c_s D) x_s}{k_s c_s D}$$

Putting above equation in equation (2) gives equation (3) represents the ratio of sprung mass displacement to road inputs;

$$\frac{x_s}{x_r} = \frac{(c_s c_t D^2 + (c_s k_t + c_s k_s) D + k_s k_t)}{M_s m_u D^4 + (M_s c_t + M_s c_s + m_u c_s) D^3 + (M_s k_t + M_s k_s + m_u k_s + c_s c_t) D^2 + (c_s k_t + c_s k_s) D + k_s k_t} \quad (3)$$

The above equation is written in time Domain (D Domain). In order to transfer this equation in Lap lace form the "D" will be replace by "s", thus rewriting the equation (3) as;

$$\frac{x_s}{x_r} = \frac{(c_s c_t s^2 + (c_s k_t + c_s k_s) s + k_s k_t)}{M_s m_u s^4 + (M_s c_t + M_s c_s + m_u c_s) s^3 + (M_s k_t + M_s k_s + m_u k_s + c_s c_t) s^2 + (c_s k_t + c_s k_s) s + k_s k_t} \quad (4)$$

The Above Equation can be written as;

$$\frac{x_s}{x_r} = \frac{As^2 + Bs + C}{Es^4 + Fs^3 + Gs^2 + Bs + C}$$

Where,

$$A = c_s c_t; \quad B = c_s k_t + c_s k_s; \quad C = k_s k_t; \quad E = M_s m_u; \quad F = M_s c_t + M_s c_s + m_u c_s;$$

$$\text{and} \quad G = M_s k_t + M_s k_s + m_u k_s + c_s c_t$$

Similarly the ratio unsprung mass displacement to road inputs is given as;

$$\frac{x_u}{x_r} = \frac{M_s A D^4 + (M_s B + c_s A) D^3 + (M_s C + k_s A + c_s B) D^2 + (k_s B + c_s C) D + k_s C}{c_s E D^5 + (c_s F c_t + k_s E) D^4 + (c_s G + k_s F) D^3 + (c_s B + k_s G) D^2 + (C c_s + k_s B) D + k_s C} \quad (5)$$

This can be further simplified as;

$$\frac{x_u}{x_r} = \frac{K s^4 + L s^3 + M s^2 + N s + O}{P s^5 + Q s^4 + R s^3 + S s^2 + T s + U} \quad (6)$$

Where;

$$\begin{aligned} K &= M_s A; \quad M = M_s C + k_s A + c_s B; \\ L &= M_s B + c_s A; \quad N = k_s B + c_s C \\ O &= k_s C; \quad P = c_s E; \quad Q = c_s F + k_s E; \\ R &= c_s G + k_s F; \quad S = c_s B + k_s G \\ T &= C c_s + k_s B; \text{ and } U = k_s C \end{aligned}$$

2.1.2 HALF CAR MODEL

The model of a half-car suspension system is shown in Fig. 2. The model is represented as a linear four-Degree of freedom system. It consists of car body (single sprung mass) connected to front and rear wheels (two unsprung masses) at each corner. The sprung mass is free to heave and pitch. The sprung masses are free to bounce vertically with respect to the unsprung mass. The suspensions between the sprung mass and unsprung masses are modelled as linear viscous dampers and spring elements, while the tyre is modelled as a simple linear spring without damping characteristic. Displacement of the centre of gravity and for angular displacement of the vehicle body, the equation of motion for the heave is:

For Front;

$$M_s \ddot{x}_{sf} = -k_f (x_{sf} - x_{uf}) - c_f (\dot{x}_{sf} - \dot{x}_{uf}) - k_r (x_{sr} - x_{ur}) - c_r (\dot{x}_{sr} - \dot{x}_{ur}) + f_f + f_r - a M_s \ddot{\theta} \quad \dots\dots\dots 6$$

For Rear;

$$M_s \ddot{x}_{sr} = -k_f (x_{sf} - x_{uf}) - c_f (\dot{x}_{sf} - \dot{x}_{uf}) - k_r (x_{sr} - x_{ur}) - c_r (\dot{x}_{sr} - \dot{x}_{ur}) + f_f + f_r + b M_s \ddot{\theta} \quad (7)$$

Now applying Newton's second law again on unsprung masses, the equations of motion can be written as:

For Front;

$$m_f \ddot{x}_{uf} = k_f (x_{sf} - x_{uf}) + c_f (\dot{x}_{sf} - \dot{x}_{uf}) - k_{tf} (x_{uf} - x_{rf}) - f_f \quad (8)$$

For Rear

$$m_r \ddot{x}_{ur} = k_r (x_{sr} - x_{ur}) + c_r (\dot{x}_{sr} - \dot{x}_{ur}) - k_{tr} (x_{ur} - x_{rr}) - f_r \quad (9)$$

The equation of motion for pitch is given by;

$$J \ddot{\theta} = -F_f a + F_r b \quad [\text{Moment balance}]$$

Now using equation (8) and equation (9) we have,

$$J \ddot{\theta} = a k_f (x_{sf} - x_{uf}) - b k_r (x_{sr} - x_{ur}) + a c_f (\dot{x}_{sf} - \dot{x}_{uf}) - b c_r (\dot{x}_{sr} - \dot{x}_{ur}) - a f_f + b f_r$$

Now using $J = M r^2$, we can write

$$\ddot{\theta} = \frac{1}{Mr^2} [ak_f(x_{sf} - x_{uf}) - bk_r(x_{sr} - x_{ur}) + ac_f(\dot{x}_{sf} - \dot{x}_{uf}) - bc_r(\dot{x}_{sr} - \dot{x}_{ur}) - af_f + bf_r] \quad (10)$$

3 RESULTS AND GRAPHS

The simulation data has been taken such real values of the suspension system parameters, as to obtain responses as close to real conditions [for more details see chalasani 1986 and Krtolica & Hrovat, 1992)]. The simulation data for quarter car model is: $M_s = 345\text{Kg}$, $m_u = 31\text{Kg}$, $k_s = 55000\text{N/m}$, $k_t = 305000\text{N/m}$, $c_t = 0\text{N.s/m}$. The value of suspension damping varies to obtain the optimum values. The data for half car model selected for this study is (Krtolica & Hrovat, 1992), $a = 1.30\text{m}$, $b = 1.50\text{m}$, $k_s = 55000\text{N/m}$, $k_t = 305000\text{N/m}$, $M_s = 630\text{Kg}$, $m_r = 50\text{Kg}$, $m_r = 83\text{Kg}$, $J = 250\text{Kg-m}^4$.

3.1 QUARTER CAR MODEL

The amplitude response of the sprung mass at $c_s = 2000, 3000$ and 4000 N.s/m is shown in Fig. 3. It can be noted that amplitude is decreasing with respect to time. Also the settling time is dropped to around 1.8 seconds. So, there is drop in overshoot with decrease in settling time. If the damping is increased further, it is seen that settling time is decreasing with very less drop in overshoot, which is undesirable for good ride and handling of the vehicle. Responses for unsprung mass were also simulated damping value ranging between $2000 - 4000 \text{ N.s/m}$ as shown in Fig.4. It was suggested that for used parameters of half car model the optimum Range of the damping is between $3000-4000\text{N.s/m}$. Also Frequency response was derived in this damping range as shown in Fig. 5. When damping value is large $c_s > 4000 \text{ N.s/m}$, the amplitude ratio equals to natural frequency of Sprung mass which is desirable, but the bandwidth is large which means small rise time and small settling time, and suspension will behave like a solid bar instead of absorbing shock loads. But at $c_s = 3000\text{N.s/m}$ bode diagram has got reasonable bandwidth and amplitude ratio. So it is the optimized damping value for Quarter car model. In Fig. 6 stability analysis is done at optimized damping values of the suspension system via root locus method and poles are lies on negative real axis which suggest the stability of the system.

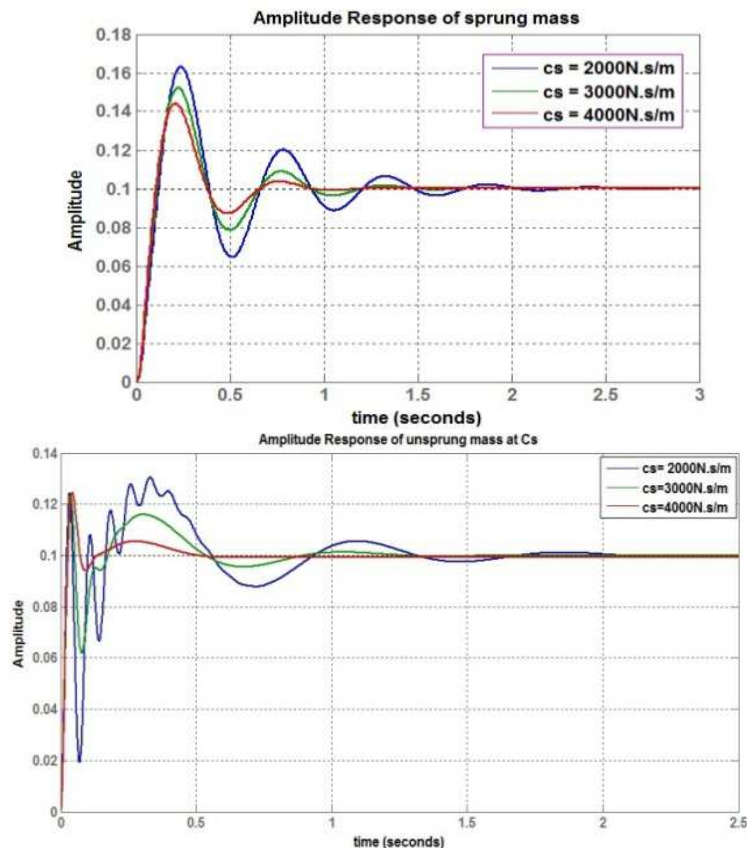


Fig. 3 Amplitude Response of Quarter Car Model Sprung Mass Fig. 4 Amplitude Response of Quarter Car Model Unsprung Mass

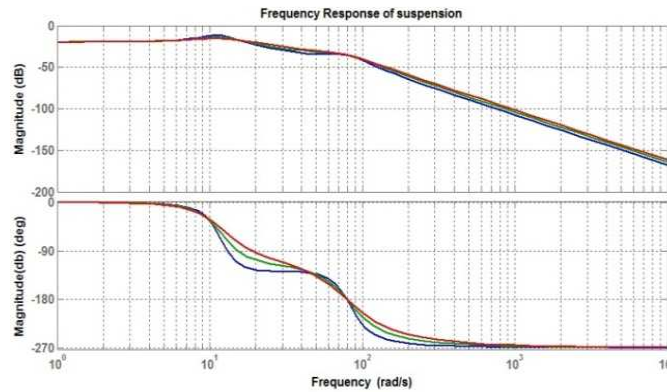


Fig. 5 Frequency Responses for Sprung Mass for Quarter Car Model.

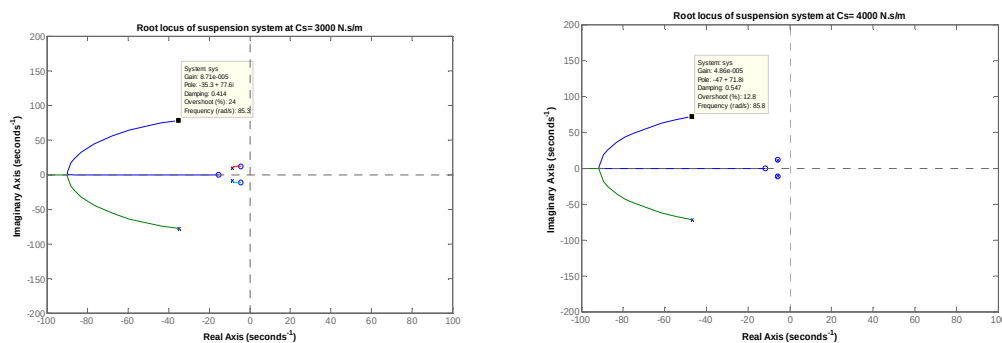


Fig. 6 Root Locus Plot for Quarter Car Model

3.2 HALF CAR MODEL

The half car dynamics can be simulated to suggest optimal damping value for the suspension. In Fig. 7 shows the amplitude response of front sprung mass at 1500Ns/m and 2000Ns/m damping values. It can be noted that when no damping is provided the amplitude of vibration is increased with time which means passengers will be getting lots of vibrations and also there can be damage to the vehicle. After further increasing the damping, amplitude of vibration goes on decreasing also resulting decrease in the settling time.

From Fig. 7 it is observed that at 2000Ns/m damping values the settling time is 2.0 seconds as compared to settling time 2.5 seconds at 1500Ns/m . It is observed that the optimum value of damping coefficient for front suspension lies between $1500\text{Ns/m} - 2000\text{Ns/m}$.

Rear Sprung Mass displacement for different damping values are shown in Fig.8. The response of rear sprung mass with no damping the amplitude of vibration is increased with times as obtained in case of front mass which indicates passengers will be exposed to lots of vibrations and also there can be damage to the vehicles and lots of wear and tear in the system. Fig. 8 show the amplitude response of rear sprung masses with different damping coefficient values as indicated from the fig. that with increase in damping values smoothness in the response and hence better comfort for the passengers.

The Amplitude for displacement has a peak of 0.138 with settling time 2.5seconds at 1500Ns/m and the peak amplitude have 0.136 with settling time 1.6 seconds at 2000Ns/m . It is observed that the optimum value of damping coefficient for rear suspension lies between $1500\text{Ns/m} - 2000\text{Ns/m}$.

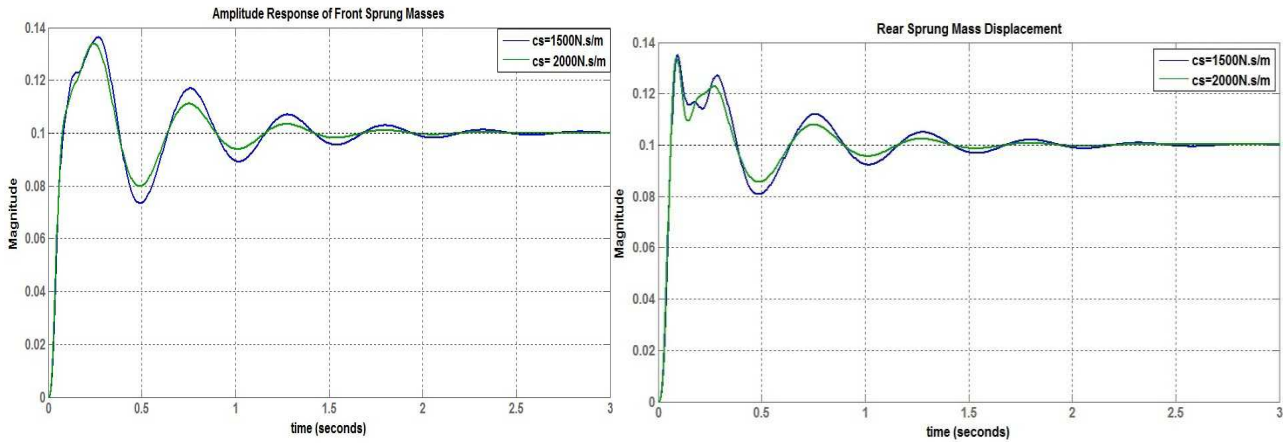


Fig. 7 Amplitude Response of Half Car Model Front Sprung Mass**Fig.8. Amplitude Response of Half Car Model Rear Sprung Mass**

In frequency analysis four peaks can be seen for frequency response of Front Sprung masses and Rear Sprung masses with zero damping coefficient values and these peaks are due to sprung and unsprung mass of the vehicle. The first two peaks are represented by the sprung mass of the vehicle having a magnitude at a resonance of approximately about 120 dB in both case respectively.

Fig. 9 shows the frequency response of front sprung mass having damping coefficient 1500 N.s/m and 2000 N.s/m whereas Fig. 10 shows the frequency response of rear sprung mass having c_s values 1000 N.s/m and 1500 N.s/m . It is also noted that as the c_s value is increased the sprung and unsprung mass frequency decreases due to fact that amplitude ratio is decreasing. This shows the vehicle will be safe from vibration and oscillation and vehicle travels safely that leads to safety of the passenger inside the car.

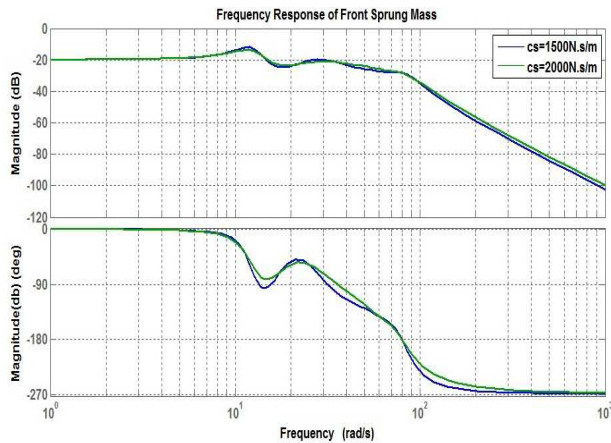


Fig.9 Frequency Responses for Sprung Mass for Half Car Model.

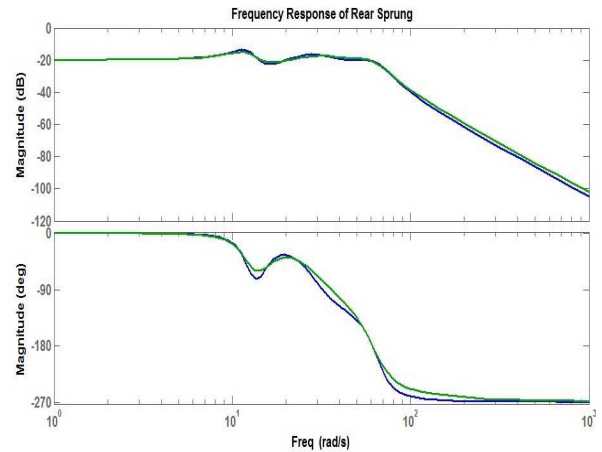


Fig.10 Frequency Responses for Sprung Mass for Half Car Model.

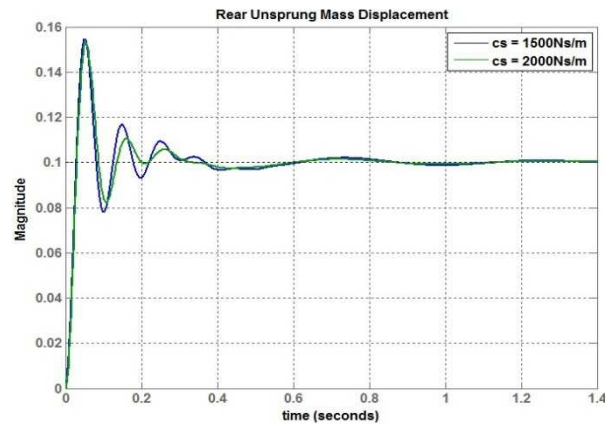
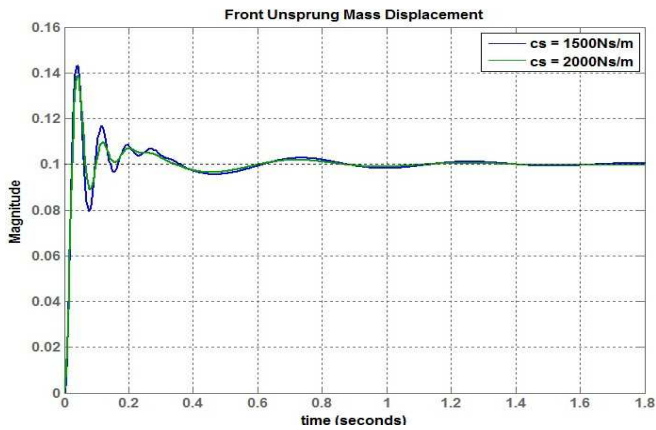


Fig. 11 Amplitude Response of Half Car Model Front unsprung Mass **Fig. 12. Amplitude Response of Half Car Model Rear unsprung Mass**

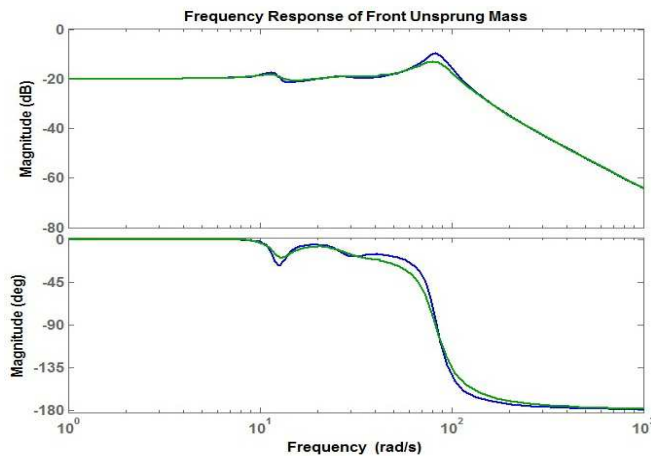


Fig.13. Frequency Response of Half Car Model Front unsprung Mass

The frequency response approach presented that gave a method of analysis which is readily applied and which circumvents the necessity of making full solutions of system equations in order to understand the dynamic nature of a system. The frequency response approach utilizes the steady- state part of the system while root locus approach is associated with the transient part of response. A root loci plot is simply a plot of the s zero values and the s poles on a graph with real and imaginary ordinates. The root locus is a curve of the location of the poles of a transfer function as some parameter (generally the gain K) is varied. The locus of the roots of the characteristic equation of the closed loop system as the gain varies from zero to infinity gives the name of the method. Such a plot shows clearly the contribution of each open loop pole or zero to the locations of the closed loop poles. This method is very powerful graphical technique for investigating the effects of the variation of a system parameter on the locations of the closed loop poles. General rules for constructing the root locus exist and if the designer follows them, sketching of the root loci becomes a simple matter. The closed loop poles are the roots of the characteristic equation of the system. From the design viewpoint, in some systems simple gain adjustment can move the closed loop poles to the desired locations. Root loci are completed to select the best parameter value for stability. A normal interpretation of improving stability is when the real part of a pole is further left of the imaginary axis.

From the Root Loci Plots,

1. The stability of the system can be studied.
2. The effect on response of varying system constants can be studied, and limits of such constants can be established.

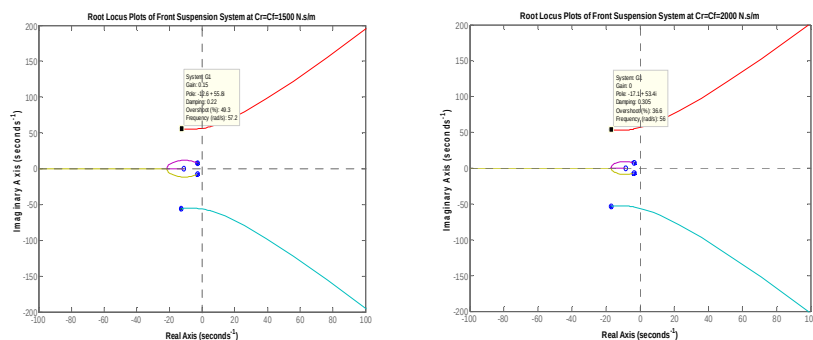


Fig. 14 Root Locus Plot for Front Half Car Model

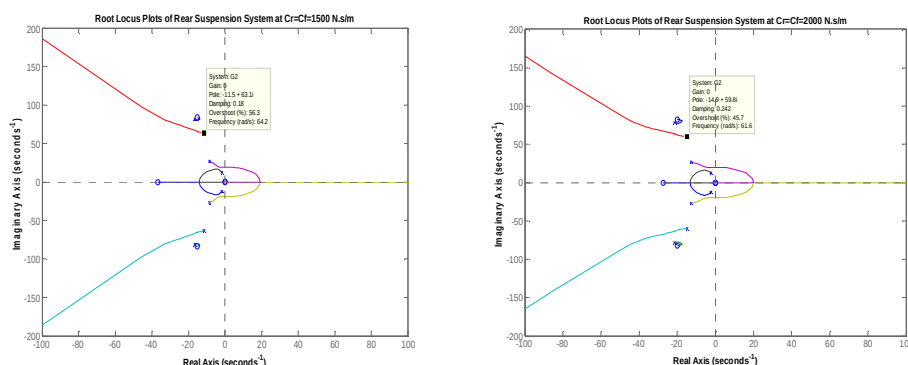


Fig.15 Root Locus Plot for Front Half Car Model

The root locus plots for Four Degree of freedom model are as shown in Fig. 11 and Fig. 12. Plots drawn in Fig. 11 are for front suspension with damping coefficient 1500Ns/m and 2000Ns/m respectively.

Similarly Fig. 12 is for rear suspension with damping coefficient 1500Ns/m and 2000Ns/m respectively. It can be seen that the two graphs are quite similar. The poles and zeroes are moving into negative real axis and close to imaginary axis which shows that system is stable.

4 CONCLUSION

The damping characteristic of the suspension damper has to be optimised in accordance with other vehicle dynamics parameter like sprung mass, unsprung mass, tyre stiffness and damping, suspension stiffness and road input. So that after encountering a bump on the road, vehicle should not vibrate with high amplitude and for unacceptably longer time giving discomfort to the passenger and also causing failure of the vehicle itself. Among these parameters road profile and vehicle velocity can vary. However, for simplified analysis and to study the interaction of these system parameters road input is taken as constant and vehicle is assumed to be moving with constant velocity, while the damping value has been increased in steps to get the optimized response.

For verification of the result firstly a mathematical model of suspension system was developed and by doing complete dynamic analysis. Thereafter putting it in Mat Lab and simulate it for obtaining optimized system response. The Two-Degree of freedom model dynamics has been analysed in detail using Laplace Transformation and State space techniques. The mathematical equations were used to develop Mat Lab programs for obtaining the system characteristics. The sprung mass responses were obtained for Two-Degree of freedom model using Laplace Transformation and State Space Variable in Mat Lab. The responses obtained for Two-Degree of freedom shows exactly same nature with both the techniques that verifies the time response. Same was the case with frequency analysis where exactly identical responses were observed. Later for checking the stability of the system the Root Loci plots were drawn and it was suggested after analysing the time response, frequency response and stability of the system, that optimized damping coefficient ranges for the data used is between 3000

$N.s/m - 4000 N.s/m$. The Four- Degree of freedom model was also solved mathematically deriving all its dynamic equations and were transformed into State Space Variable to simulate in Mat Lab. Responses for Front and Rear part of the half car model for all the state variables was analysed and studied followed by the stability check. The optimum damping range obtained for the data considered was found to be in the range of $1500 Ns/m$ to $2000Ns/m$. It was also found that suspension system was stable in this range. In quarter and half car model is developed, the vehicle dynamics of the passenger car has been analysed to develop a mathematical model to study the suspension system responses at different level of damping, till the optimum response of the system is obtained. Apart from the displacement response for the system frequency with phase angle response has been consider in the present study, which followed by the stability check at the optimised damping values obtained.

ACKNOWLEDGEMENT

“In the name of **ALLAH**, the most Beneficent and Merciful”, First of all I am highly indebted and thankful, the lord of universe (GOD), the most merciful and benevolent to all, who taught men that which he knew not and bestowed the men with epistemology and gave him the potential to ameliorate the same. It is His blessing, which inspired and enabled me to complete this work. It is my pleasant duty to acknowledge the help received from several individuals during this work.

I wish to express my profound gratitude, respect and honour to my supervisor **Dr. Ahmad Ali Khan**, Professor, Department of Mechanical Engineering, Z H College of Engineering & Technology, AMU, Aligarh, for his illuminative and precious guidance, constant supervision, critical opinion and timely suggestion, constant useful encouragement and technical tips which has always been a source of inspiration during the preparation of the study.

I would like to thank my friends Mohammad Furqan and Husain Mehdi for their kind help and support during this dissertation work. I would also like to thank my all classmates and friends for their good and cordial company, healthy discussion and helpful attitude during the study.

I wish to thank my entire family for providing a loving environment and encouragement for pursuing this work, without their constant assurance and assistance, completion of this project would have not been possible.

(Arshad Mehmood)

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A Preliminary Survey and distribution of Land snails of Katana region, Southern Kivu, Democratic Republic of Congo

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ABSTRACT: We investigated land snail fauna of Katana region, along the Lake Kivu and the Kahuzi-Biega National Park in Democratic Republic of Congo, using a combination of direct search and leaf litter sieving techniques. Four plots, in different habitats (Forest, wetland, cultivated area and fallow) were studied, covering low altitude (1400 - 1590 m), middle altitude (1600 - 1790 m) and high altitude (1800 - 2000 m). A total of 31 species and 2209 individual land snails belonging to 9 molluscan families and 23 genera were collected from all habitats. Species richness was ranged from 25 to 10 at different habitats and different altitudes. The wetland has high species richness (25) and the fallow has low species richness (10). *Achatina achatina* and *Achatina fulica* (Achatinidae) were recorded in all the habitats in the region (constant species), where *Arion rufus* (Arionidae), *Homorus amputatus* (Achatinidae) and *Subulinuscus ruwenzorensis* (Achatinidae) are found in one habitat (25 %) and are uncommon in Katana region (accidental species). The land snail species inventories will increase our knowledge of the molluscan fauna of the Katana region and assist in conservation management.

KEYWORDS: Land snail, distribution, Katana, Democratic Republic of Congo.

1 INTRODUCTION

In contrast to well-studied groups, such as plants, birds and aquatic snails [1], [2], [3], [4], [5], [6], [7], [8], [9] Congolese's land snails are so poorly known [10] that conservation needs cannot be determined reliably.

Land snails occur in nearly every terrestrial habitat types and play significant ecological roles as prey and nutrient cyclers [11], [12], including as a calcium source for bird eggshells [11]. It is also serving as food items for salamanders, small mammals, birds, humans and some arthropods as well as processing decaying plant material [13], [14] and serves as useful biological indicators of soil quality and chemistry [15], [16].

Land snails include several distinct lineages of terrestrial gastropods and belong to the second largest phylum after arthropods in terms of number of species with more than one lakh described species [17]. Land snails constitute about six per cent of the total species on Earth [18].

A large part of molluscan fauna in many tropical regions of the world is still poorly known. Land snails prove to be valuable research subjects for studies in evolutionary biology, biogeography, phylogeography, biodiversity, ecology and conservation biology [19], [20]. With their generally low dispersal powers, land snails tend to exhibit conservative distribution patterns, making them valuable subjects in studying historical biogeography [21], [22], [23]. Highly various and narrowly distributed, land snails are good indicators of areas of conservation importance and endemism when compared to widely distributed groups such as vertebrates [24].

However, past collectors rarely recorded environmental data, so habitat associations of snails are poorly known. Quantifying land snail richness and density along with other habitat parameters may allow their use as indicator taxa in

understanding effects of habitat change from acid rain [25], climate change [26], or disturbance [27]. The distribution and activity of land snails depend on several factors including precipitation, soil pH, soil calcium content, canopy density, etc. [11] Documenting species distributions will identify uncommon species having potential conservation needs.

In Democratic Republic of Congo in general and in Katana region in particular, studies related to the land snails don't exist except the studies of [10], [28], [29], [30], [31] and [32], who presented some species collected in other regions of Democratic Republic of Congo, long time ago contrary to other regions in the world where a large number of studies highlighting the need for mollusc conservation globally [33], [34],[35], [36], [37].

It is hypothesized that land snails are largely distributed in the Katana region in the different existing habitats. The objective of this study is to identify the land snails of the Katana region and determine their distribution in different habitats.

2 MATERIAL AND METHODS

2.1 STUDY AREA

Katana region is located on the western flank of Lake Kivu, between latitudes 2°15' and 2°30'S and longitudes 28°45' and 28°85' E.

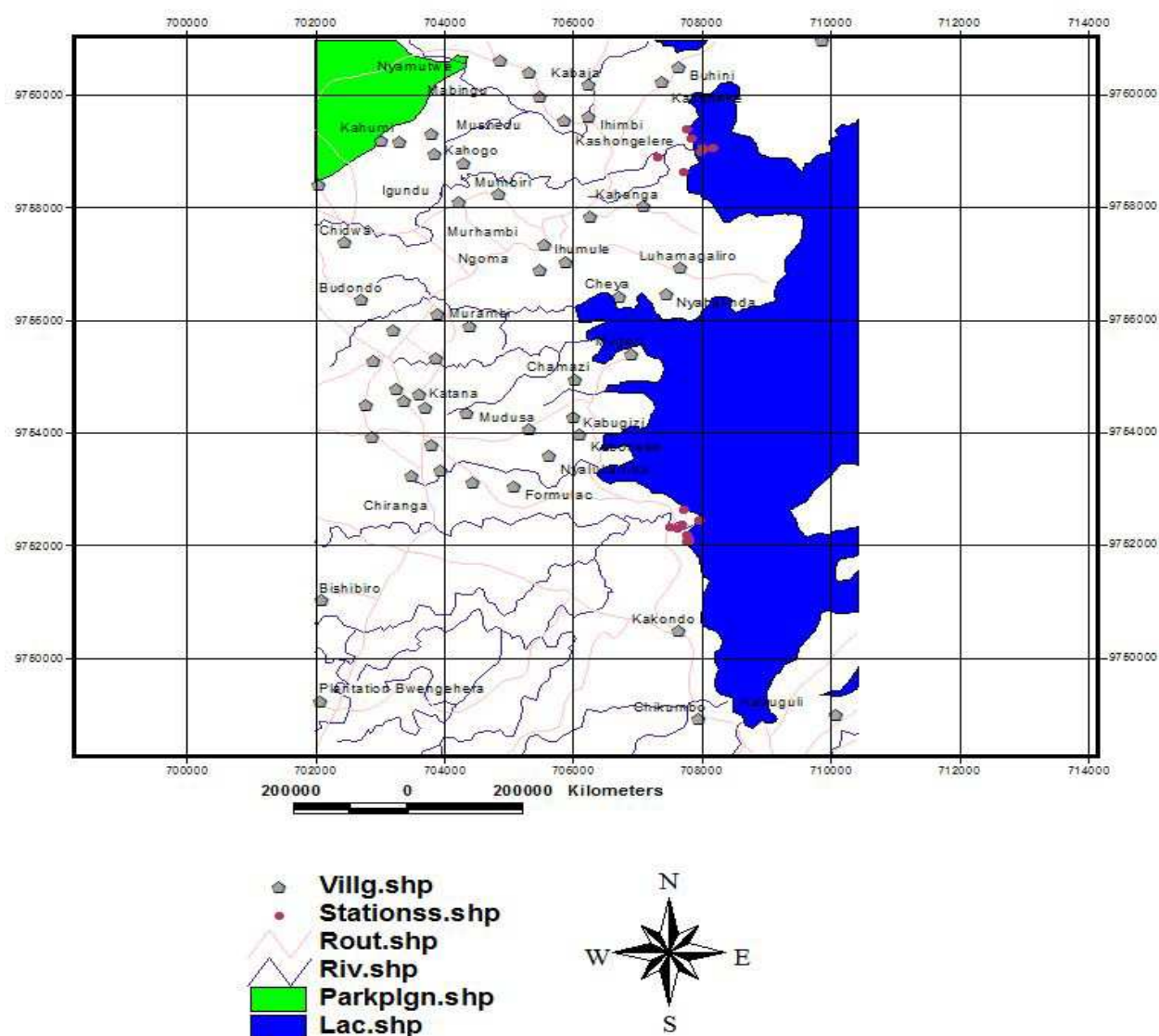


Figure 1: Katana region's Map

It is covered by 4 localities, namely Irhambi/Katana, Bugorhe, Luhihi and Bushumba in the territory of Kabare, province of South-Kivu, Democratic Republic of Congo. Its rainfall is about 1500 mm annually [6]. The soil comprises clay and rich volcanic soil, which is easily eroded. The geological composition is of Precambrian metamorphose sediments (metamorphic rocks) and Preterozoic platform sediments [38].

Ref [39] describes metamorphic limestone and numerous travertines along Lake Kivu and Lake Edward: carbonates for the production of cement are also found at the north and north-west of Lake Kivu. The sampling sites include forest, fallow, cultivated area and wetland.

2.2 DATA COLLECTION AND ANALYSIS

Systematic field collections were conducted in various ecological units which were potentially interesting for molluscs habitats ranging from forest, wetland, and fallow to cultivated area. Collection techniques varied widely depending upon the habitat but included visual searches and leaf litter sieving [40]. A total of 24 sampling points were made from the 3 gradients of altitude [low altitude (1400 - 1590 m), middle altitude (1600 - 1790 m) and high altitude (1800 - 2000 m)]. For each point, two quadrats and hunting sight have been made. This method is to collect the litter on a surface of 1m² using a small shovel

gardening. The quadrat method used stratified random sampling, which differs in that it will sample chosen microhabitat areas most likely to support snails, because at no site are gastropods completely homogeneous in distribution. The litter collected is then screened so most gastropods in this litter are collected [41], [42], [43], [44]. Hunting sight is a complementary method to quadrat widely used in entomology [24]. It involves directly observe individuals in their habitat, tree trunks, under windfalls, under stones, on the old walls, etc. This method is very interesting and is complementary to quickly draw up an initial list; it is less accurate, especially for smaller species which are often ignored. The duration of the hunting sight was set at 10 minutes per habitat sampling. For identification, the shells of individuals were first sorted by morphological resemblance and studied most often using a binocular microscope. The identification was carried out mainly by using the key of identification ([10], [45], [46].

Snail species were sorted, counted and entered into an Excel spreadsheet and their presence and abundance were summarized for each habitat, altitude and plot. ANOVA analysis was conducted to compare Habitats and altitudes, and the Shannon Diversity (H') was calculated for each habitat. Shannon's index accounts for both abundance and evenness of the species present. The proportion of species relative to the total number of species is calculated, and then multiplied by the natural logarithm of this proportion. The resulting product is summed across species, and multiplied by -1 .

To classify the snail species presence/absence data into representative associations, a hierarchical agglomerative cluster analysis was performed on the most common species data using Ward's linkage method and Euclidian distance measure. Cluster analysis creates groups by sequentially merging sample units into larger groups [47].

3 RESULTS

Land snails collected in different habitats and altitudes in the Katana region are presented in the table 1.

Table 1. Checklist and classification of land snail of Katana region, DR Congo

Class	Order	Family	Genus	Species
Gasteropoda	Pulmonata	Achatinidae	Achatina	tincta
Gasteropoda	Pulmonata	Achatinidae	Achatina	fulica
Gasteropoda	Pulmonata	Achatinidae	Achatina	achatina
Gasteropoda	Pulmonata	Achatinidae	Achatina	osborni
Gasteropoda	Pulmonata	Achatinidae	Burtoa	nilotica emini
Gasteropoda	Pulmonata	Achatinidae	Burtoa	nilotica obliqua
Gasteropoda	Pulmonata	Achatinidae	Curvella	bathytoma
Gasteropoda	Pulmonata	Achatinidae	Homorus	Ampuctatus
Gasteropoda	Pulmonata	Achatinidae	Limicolaria	distincta
Gasteropoda	Pulmonata	Achatinidae	Limicolaria	laeta medjensis
Gasteropoda	Pulmonata	Achatinidae	Nothapalus	paucispira xanthophaes
Gasteropoda	Pulmonata	Achatinidae	Perideriopsis	fallsensis
Gasteropoda	Pulmonata	Achatinidae	Pseudoglessula	walikalensis
Gasteropoda	Pulmonata	Achatinidae	Subulinus	ruwenzoriensis
Gasteropoda	Pulmonata	Arionidae	Arion	rufus
Gasteropoda	Pulmonata	Enidae	Cerastus	bequaerti
Gasteropoda	Pulmonata	Enidae	Pachnodus	rutshuruensis
Gasteropoda	Pulmonata	Helicidae	Theba	pisana
Gasteropoda	Pulmonata	Limacidae	Lehmannia	valentiana
Gasteropoda	Pulmonata	Streptaxidae	Gullela (Pupigullela)	pupa ituriensis
Gasteropoda	Pulmonata	Urocyclidae	Ataxon	faradjense
Gasteropoda	Pulmonata	Urocyclidae	Trichotoxon	pardus
Gasteropoda	Pulmonata	Urocyclidae	Trichotoxon	maculatum perforatum
Gasteropoda	Pulmonata	Urocyclidae	Bukobia	cockerelli
Gasteropoda	Pulmonata	Urocyclidae	Trichotoxon	ruwenzoriense
Gasteropoda	Pulmonata	Vaginulidae	Pleuroprocta	silvatica
Gasteropoda	Pulmonata	Vaginulidae	Loevicaulis (Arion)	schnitzleri (distinctus)
Gasteropoda	Pulmonata	Zonitidae	Mesafriarion	putzeysi
Gasteropoda	Pulmonata	Zonitidae	Helixarion	insularis
Gasteropoda	Pulmonata	Zonitidae	Gymnarion	aloyisabaudiae
Gasteropoda	Pulmonata	Zonitidae	Mesafriarion	maculifer pilsbry

Twenty four sites were sampling in this study included *forest, wetland, and fallow to cultivated area*. Thirty one species of land snails were recorded in Katana region during the study. These species were subdivided into 23 genera, 9 families, 1 order and 1 class. The genera *Achatina* and *Trichotoxon* are largely represented in the samples with respectively 4 and 3 species each followed by the genera *Limicolaria* and *Mesafriarion* represented by two species each. Others genera are less represented with one species. *Achatinidae* family is the most representative with 13 species divided in 7 genera, followed by *Urocyclidae* family with 5 species divided in 3 genera and the *Zonitidae* family with 4 species and 3 genera. The families *Enidae* and *Vaginulidae* are represented by 2 species each divided in 2 genera each. The less representative families are *Streptaxidae*, *Arionidae*, *Limacidae* and *Helicidae* with one species each.

All these species was recorded in different habitats in the Katana region (Table 2)

Table 2. Survey of species collected in different habitats

Species	Wetland	Forest	Cultivated area	Fallow	Total	Frequency (%)
<i>Achatina achatina</i>	X	X	X	X	4	100
<i>Achatina fulica</i>	X	X	X	X	4	100
<i>Achatina osborni</i>		X		X	2	50
<i>Achatina tinctoria</i>	X	X	X		3	75
<i>Arion rufus</i>	X				1	25
<i>Ataxon faradjense</i>	X		X	X	3	75
<i>Bukobia cockerelli</i>	X	X	X		3	75
<i>Burtoa nilotica emini</i>		X	X	X	3	75
<i>Burtoa nilotica obliqua</i>	X	X	X		3	75
<i>Cerastus bequaerti</i>	X		X		2	50
<i>Curvella bathytoma</i>	X	X	X		3	75
<i>Gullela pupa ituriensis</i>	X	X	X		3	75
<i>Gymnarion aloysiisabaudiae</i>	X		X		2	50
<i>Helixarion insularis</i>	X		X		2	50
<i>Homorus amputatus</i>		X			1	25
<i>Lehmannia valentiana</i>	X		X		2	50
<i>Limicolaria distincta</i>	X		X		2	50
<i>Limicolaria laeta medjensis</i>	X	X	X		3	75
<i>Loevicaulis schnitzleri</i>		X		X	2	50
<i>Mesafricarion maculifer pilsbry</i>	X		X		2	50
<i>Mesafricarion putzeysi</i>	X		X		2	50
<i>Nothapalus paucispira xanthophaes</i>	X		X	X	3	75
<i>Pachnodus rutshuruensis</i>	X		X		2	50
<i>Perideriopsis fallsensis</i>	X		X		2	50
<i>Pleuroprocta silvatica</i>	X			X	2	50
<i>Pseudoglossula walikalensis</i>	X			X	2	50
<i>Subulinuscus ruwenzorensis</i>		X			1	25
<i>Theba pisana</i>	X				1	25
<i>Trichotoxon ruwenzoriense</i>	X		X	X	3	75
<i>Trichotoxon maculatum perforatum</i>	X		X		2	50
<i>Trichotoxon pardus</i>	X		X	X	3	75
Species richness	25	13	22	10		

* Constance species ($F \geq 50\%$), secondary species ($25 < F < 50\%$), accidental species ($F \leq 25\%$) [47]

The wetland has high species richness (25) and the fallow has low species richness (10). *Achatina achatina* and *Achatina fulica* (Achatinidae) was recorded in all the habitats in the region (constant species), where *Arion rufus* (Arionidae), *Homorus amputatus* (Achatinidae) and *Subulinuscus ruwenzorensis* (Achatinidae) are found in one habitat (25 %) and are uncommon in Katana region (accidental species). The first one was collected in the wetland and the two last were recorded in the forest only ; the Shannon index shows a variation between the habitats, as observed in the figure 2.

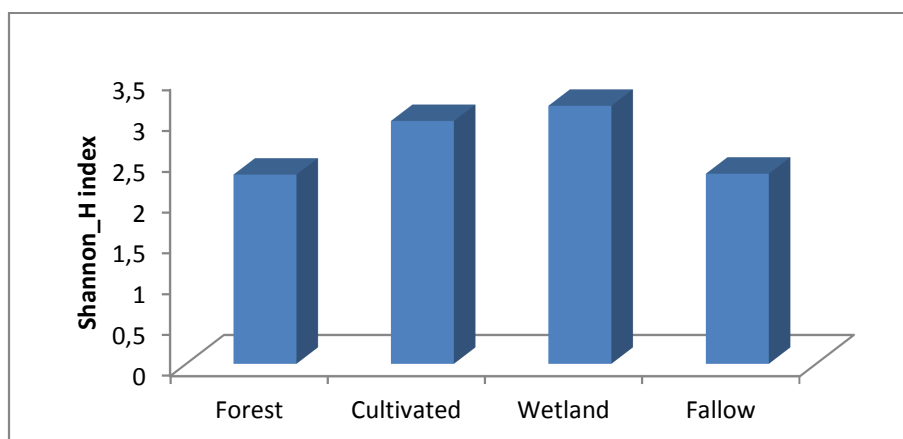


Figure 2. Shannon index for the different habitats of land snails in the Katana region

Shannon index varied between the different habitats in the Katana region. It is high in the wetland and cultivated area than in forest and fallow. The total number of land snails collected in the different habitats is presented in table 3.

Table 3. Number of land snails collected in different habitats in Katana region

Taxa	Wetland	Forest	Cultivated area	Fallow	Total
<i>Achatina achatina</i>	14	30	80	23	147
<i>Achatina fulica</i>	5	10	27	12	54
<i>Achatina osborni</i>	0	11	0	20	31
<i>Achatina tinctoria</i>	7	9	92	0	108
<i>Arion rufus</i>	3	0	0	0	3
<i>Ataxxon faradjense</i>	20	0	107	32	159
<i>Bukobia cockerelli</i>	2	5	49	0	56
<i>Burtoa nilotica emini</i>	0	10	46	16	72
<i>Burtoa nilotica obliqua</i>	7	16	29	0	52
<i>Cerastus bequaerti</i>	19	0	41	0	60
<i>Curvella bathytoma</i>	46	4	48	0	98
<i>Gullela pupa ituriensis</i>	15	3	40	0	58
<i>Gymnarion aloysiisabaudiae</i>	7	0	58	0	65
<i>Helixarion insularis</i>	25	0	33	0	58
<i>Homorus ampuctatus</i>	0	4	0	0	4
<i>Lehmannia valentiana</i>	20	0	98	0	118
<i>Limicolaria distincta</i>	79	0	116	0	195
<i>Limicolaria laeta medjensis</i>	67	17	141	0	225
<i>Loevicaulis schnitzleri</i>	0	4	0	13	17
<i>Mesafricarion maculifer pilsbry</i>	12	0	44	0	56
<i>Mesafricarion putzeysi</i>	30	0	34	0	64
<i>Nothapalus paucispira xanthophaes</i>	10	0	44	15	69
<i>Pachnodus rutshuruensis</i>	13	0	53	0	66
<i>Perideriopsis fallsensis</i>	17	0	39	0	56
<i>Pleuroprocta silvatica</i>	13	0	0	39	52
<i>Pseudoglossula walikalensis</i>	20	0	0	15	35
<i>Subulinuscus ruwenzorensis</i>	0	6	0	0	6
<i>Theba pisana</i>	4	0	0	0	4
<i>Trichotoxon ruwenzoriense</i>	5	0	54	16	75
<i>Trihotoxon maculatum perforatum</i>	10	0	58	0	68
<i>Trichotoxon pardus</i>	26	0	37	15	78
Total	496	129	1368	216	2209
Per cent (%)	22.45	5.84	61.93	9.78	

Limicolaria laeta medjensis, *Limicolaria distincta*, *Achatina achatina*, *Lehmannia valentiana* and *Ataxon faradjense* are the most land snails collected with high number of individuals during the sampling period (abundant species). Some species are uncommon (rare species) such as *Theba pisana*, *Homorus ampuctatus*, *Loevicaulis schnitzleri* and *Arion rufus* with one individual collected during the sampling [47]. Cultivated area contribute with 61.93 % of the total land snail collected; wetland with 22.45 %, forest with 5.84 % and fallow with 9.78 %. The cluster analysis of the different habitats (Figure 3) shows that there are similarity between fallow and forest and cultivated area and wetland following the number of land snails recorded in the different habitats.

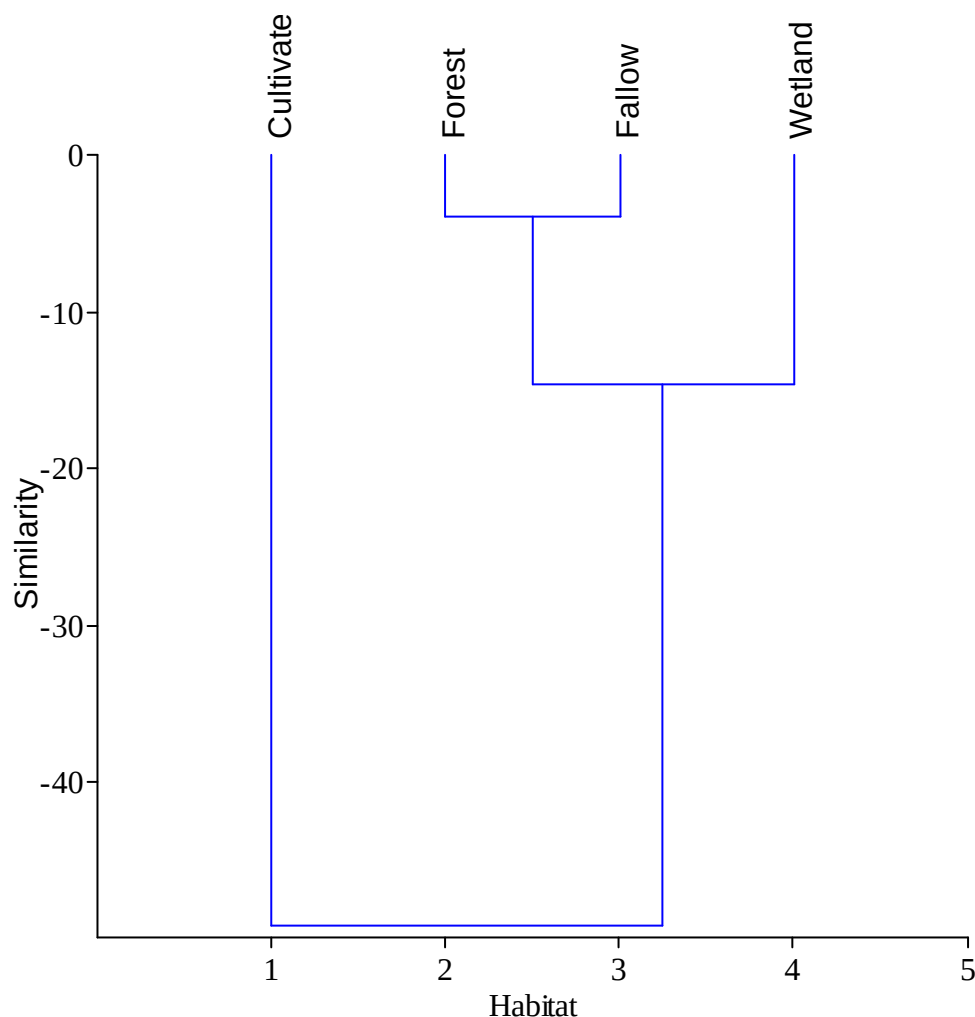


Figure 3. Cluster analysis of number of land snails recorded in different habitats in Katana region

The number of land snails collected at different habitats and altitudes range is presented in the Figure 4.

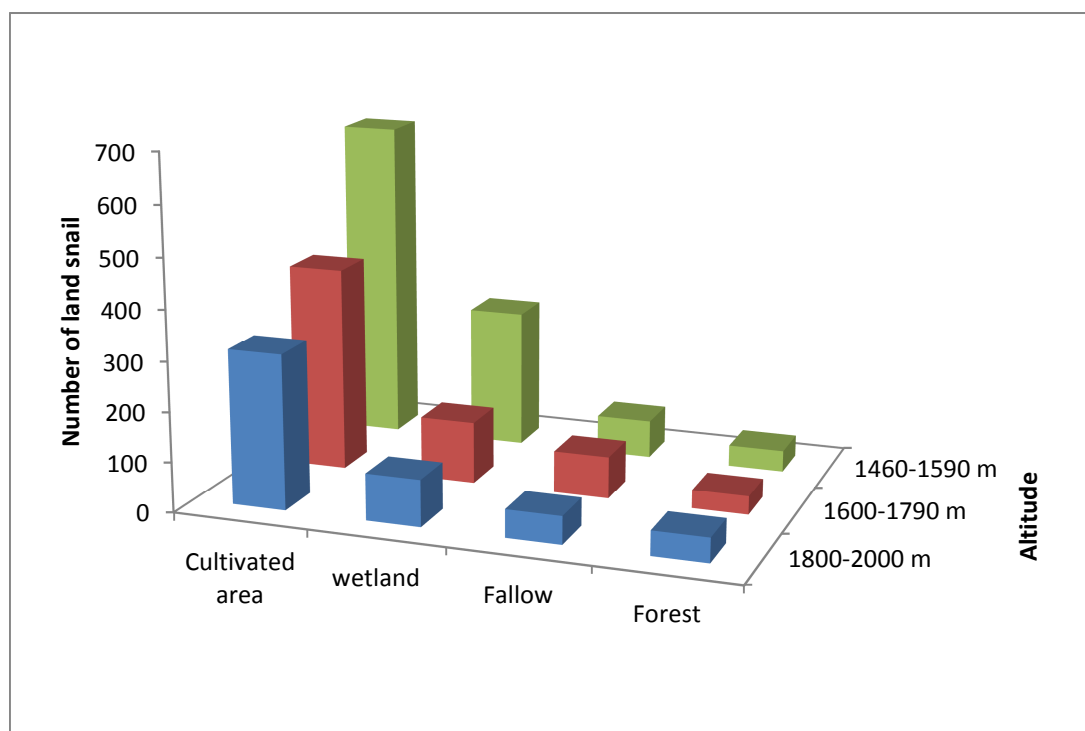


Figure 4. Number of land snails collected in different habitats and at different altitudes in Katana region

It is observed that the number of land snails is high in cultivated area at different altitudes in the Katana region. Snail abundance declined with increasing altitude. Low numbers are recorded in fallow at different altitudes except in the range of 1460 – 1590 m where it was recorded in forest area. This range of altitude contains high number of land snails in all habitats. The Person's r correlation between the different habitats is present in the table 4.

Table 4. Person's r correlation between the different habitats of land snails in Katana region

	Cultivated area	Wetland	Fallow	Forest
Cultivated area	0			
Wetland	0.99	0		
Fallow	0.51	0.38	0	
Forest	-0.29	-0.15	-0.97	0

The cultivated area is very positively correlated with wetland, positive correlated with fallow but weak negative correlated with forest. Wetland is weak positive correlated with fallow and weak negative correlated with forest. The fallow land is strong negatively correlated with forest. The cluster similarity of the different habitats and different altitudes range shown two major classes (Figure 5). The land snails collected to the altitude 2 (1600 – 1790 m) and altitude 3 (1800 – 2000 m) are similar as shown by the cluster and the altitude (1460 – 1590 m) has its own class.

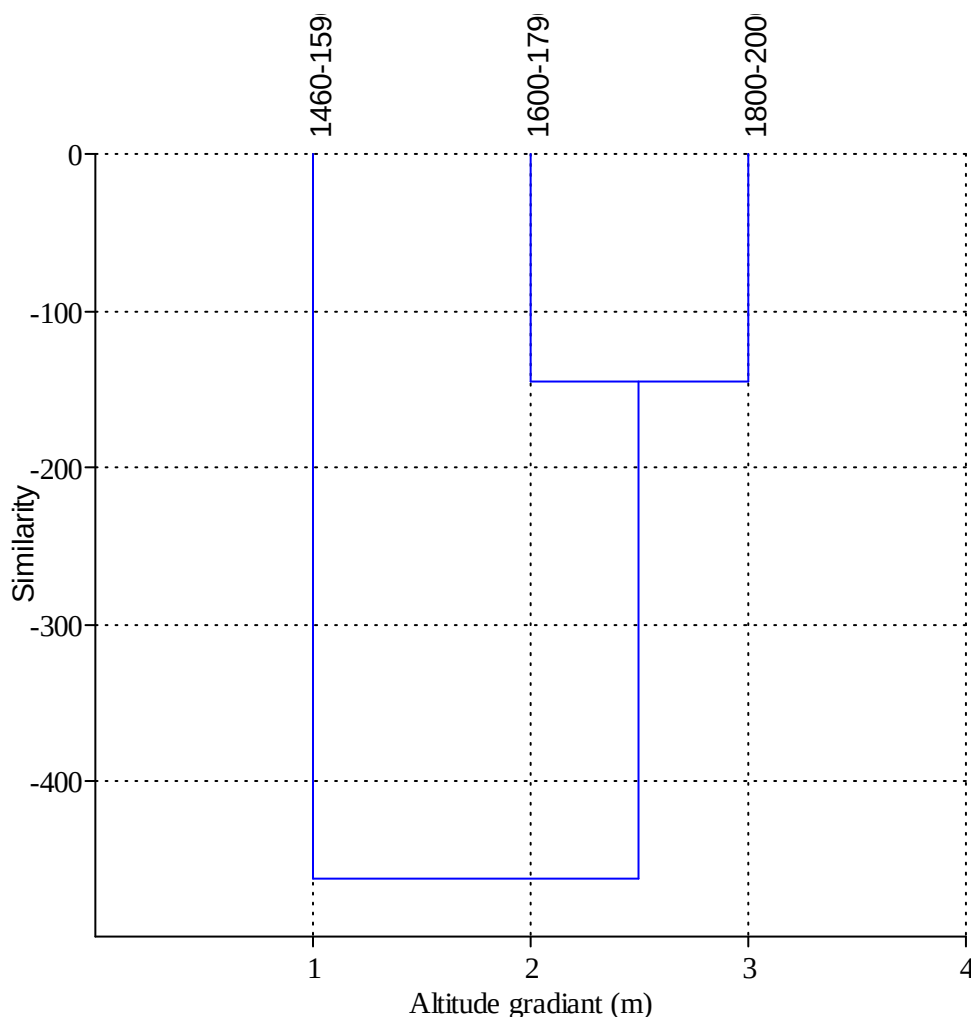


Figure 5. Cluster analysis of land snails collected at different altitudes range in the Katana region

For quantitative data, the results obtained in the several quadrats in different habitats are presented in the table 5.

Table 5. Mean density of land snails collected in the different habitats and altitudes in the Katana region

	1460-1590 m	1600-1790 m	1800-2000 m
Forest (Nber/m ²)	1.3	0.9	0.75
Cultivated area (Nber/m ²)	2.9	1.4	1.16
Wetland (Nber/m ²)	1.58	1.08	0.66
Fallow (Nber/m ²)	1.4	0.75	0.58

Cultivated area has relatively a high mean density of land snails (2.9 individuals / m²) by repeat at the other habitats in the Katana region. For the altitude of 1460 – 1590 m, the forest area has a low mean density of land snails (1.9 individual / m²) collected but when altitude increased the fallow become less populated by the land snails.

4 DISCUSSION

Katana region contains different habitats in different altitudes range comprising relic forests, wetlands, fallows and cultivated areas. A big area is constituted by cultivated areas and built-up areas. Due to poverty of detailed malacological

surveys involving the Katana region, DR Congo, only fragmentary information on land snail fauna exists in the literature [30], [31] and [32].

Despite the relative diversity of habitats and inaccessibility of some locations, as displayed in our results, the malacological diversity of the Katana area should be much higher than is presently known. *Limicolaria laeta medjensis*, *Limicolaria distincta* and *Ataxon faradjense* were the most dominant taxa. On the other hand, *Arion rufus*, *Homorus ampuctatus*, *Subulinuscus ruwenzorensis* and *Theba pisana* were determined from single habitat.

Overall, species richness and Shannon diversity index varied in different habitats, as observed in other studies [48].

The sampling effort is thought to be adequate, but increasing the collection sites to cover all habitat types present, resampling in different periods of the year, and applying soil/litter sampling methods would improve sampling efficiency.

Achatina fulica and *Achatina achatina* are herbivorous species, and therefore, may be considered as crop pest and others, are hosts for the rat-lung worm, which can transmit meningitis to humans [49], [37].

Accordingly, variation of species assemblages along the altitudinal data was analyzed by Anova and cluster analysis using 3 altitudinal groups (1460 – 1590 m, 1600-1790 m, and 1800 - 2000 m). There is a trend towards differences among habitats, and these were significant ($p < 0.05$). The altitude of 1460 – 1590 m contained high number of land snails in all the habitats because, probably of the calcium contain in the soil [39]. In these areas, thermal water is a principal source of calcium in soil [39].

A linear relationship between altitude and species richness, that decreases slightly with altitude, was observed contrary to the observation in Mut District in Turkey [50] and in Italy forest [51].

[49] found that Africa may provide tentative evidence for a maximum level of land-snail richness at intermediate elevations of about 1000–1500 m.

During the field study, it was observed that habitat quality (rock structure, vegetation cover, and exposure) was effective in species richness. However, the altitude factor was observed to be effective in species composition as observed by [50].

Given the large number of species recorded only once and the small sample size, and considering the lower sampling efficiency and extensive habitat variability, it is evident that there are other species awaiting discovery. Nevertheless, our findings enable us to draw a number of biogeographical and ecological conclusions.

Research on land snails in DR Congo should focus on their distribution patterns, taxonomy and ecology. Taxonomic expertise is a basic foundation for estimation of global biodiversity and formulation of policy on conservation of biological diversity [52]. Thus, research should also focus on the biogeographical patterns, phylogeny and evolution of DR Congo land snail fauna in general and Katana region in particularly. Further, studies to resolve the taxonomically problematic groups through molecular phylogenetic applications or through DNA barcoding should be initiated.

5 CONCLUSION

For informed conservation measures that will be implemented, detailed studies on land snail systematics, on threats to survival and on identifying “hot-spots” for narrow range endemics are urgently needed. Serious attention will be paid towards protecting remaining forested areas and wetlands. Priority should be given to conserve critical habitat for conservation of land snails.

ACKNOWLEDGEMENT

We would like to thank especially the field assistants of the Laboratory of Malacology, Department of Biology, Centre de Recherche en Sciences Naturelles of Lwiro for their field and laboratory works for the realization of the present article.

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Peat soil stabilization with Rice husk ash and lime powder

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ABSTRACT: Peat soil is said to be problematic soil for any Engineering construction. Hence for any civil engineering construction on peat soil requires either replacement of soil or stabilization, in this paper an attempt is made to stabilize the peat soil using lime and rice husk ash. Rice husk ash being the waste material from rice industry and has pozzolanic property. A stabilizer was prepared by mixing 70% of rice husk ash and 30% of lime. Almost all the standard laboratory tests were conducted for peat soil and also by adding the stabilizer by varying the dosage as 5, 10, 15% by weight of soil. Finally study of the contribution of stabilizer on the properties of peat soils and its feasibility for various civil engineering applications is evaluated. The results show the increment of soil properties like dry density and unconfined compressive strength. From the study it was found that 15% of stabilizer yielded maximum density and strength indicating significant improvement in the engineering behavior.

KEYWORDS: stabilizer, RHA, Dolomitic lime, peat soil, calcium silicates.

1 INTRODUCTION

For construction of any civil engineering structures, the foundation is very important and has to be strong to support the entire structure. In order for the foundation to be strong, the soil around and below it plays a very important role. Hence the soil properties and factors affecting their behaviour are very important for foundation design, pavement design and design of embankments.

The soil having low strength is not suitable for construction; hence it has to be replaced or stabilized.

The term soil stabilization means the improvement of stability or bearing power of the soil by use of controlled compaction, proportioning and/or addition of suitable admixture or stabilizers. This helps to achieve the required properties in a soil needed for the construction work.

Peat soil is known as a very soft soil with high organic content ($\geq 75\%$), it is composed of high contents of fibrous organic matters and is produced by the partial decomposition and disintegration of mosses, sedges, trees, and other plants that grow in marshes and other wet places in the condition of lack of oxygen. These soils are geotechnically problematic as they show low bearing capacity and very high compressibility and low shear strength. In the present study an attempt is made to stabilize the peat soil with the help of lime and Rice Husk Ash (RHA) and to study the effectiveness of using RHA as a pozzolanic material to enhance the lime as a stabilizing material of peat soil.

Rice milling generates a by-product known as husk. This surrounds the paddy grain. During milling of paddy about 78% of weight is received as rice, broken rice and bran. Rest 22% of the weight of paddy is received as husk. This husk is used as fuel in the rice mills to generate steam for the boiling process. This husk contains about 75% organic volatile matter and the remaining 25% of the weight of this husk is converted into ash during the firing process, known as Rice Husk Ash (RHA). This RHA in turn contains around 85% - 90% amorphous silica. So for every 1000 kg of paddy milled, about 220 kg (22%) of husk is produced, and when this husk is burnt in the boilers, about 55 kg (25%) of RHA is generated. India is a major rice producing country and the husk generated during milling is mostly used as a fuel in the boilers for processing paddy, producing energy through direct combustion and/or by gasification. About 20 million tonnes of RHA is produced annually. This RHA is a great

environmental threat causing damage to the land and the surrounding area in which it is dumped. Lots of ways are being thought for disposing it by making commercial use of RHA.

As a stabilizer The Rice Husk Ash would appear to be an inert material with the silica in the crystalline form suggested by the structure of the particles, it is very unlikely that it would react with lime to form calcium silicates. It is also unlikely that it would be as reactive as fly ash, which is more finely divided. So Rice Husk Ash would give great results when it is used as a stabilizing material.

Lime in the form of quicklime (calcium oxide – CaO), hydrated lime (calcium hydroxide – Ca [OH]2), or lime slurry can be used to treat soils. Quicklime is manufactured by chemically transforming calcium carbonate (limestone – CaCO3) into calcium oxide. Hydrated lime is created when quicklime chemically reacts with water. Most lime used for soil treatment is "high calcium" lime, which contains no more than 5 percent magnesium oxide or hydroxide. On some occasions, however, "dolomitic" lime is used. Dolomitic lime contains 35 to 46 percent magnesium oxide or hydroxide. Dolomitic lime can perform well in soil stabilization, although the magnesium fraction reacts more slowly than the calcium fraction.

From various literatures it was found that 70%and 30%of rice husk ash and lime respectively was mixed to from the satabilizer.

1.1 EXPERIMENTAL STUDIES

A number of laboratory tests were done for the physical properties as well as the engineering properties of peat and black cotton soil. Properties were compared without stabilizer and after addition of stabilizer. Sp Gravity, Liquid limit, Plastic limit were found out. Soil is classified as per Indian Standard Classification System ISCS (IS 1498-1970).

For peat soil $I_p = W_L - W_p$

$$= 43.491 \% - 22.58\%$$

$$= 20.91 \%$$

A_{Line} Equation, $I_p = 0.73 (W_L - 20)$

Soil is classified as OH. This soil is highly organic soil with high compressibility. This can be readily identified by colour, odour, spongy feel and fibrous texture.

1.2 FORMULATION OF EXPERIMENTS

Table 1. Physical Properties of Peat Soil

Properties	Peat Soil
Specific gravity	1.58
Natural Moisture content	64.7 %.
Liquid Limit	43.491 %
Plastic Limit	22.58%
p ^H	3.2.
Direct shear	10.67 kPa
Unconfined compression test(UCC)	18.65 kPa

1.3 OPTIMIZATION OF STABILIZER IN PEAT SOIL

1.3.1 BY USING COMPACTION TEST

Compaction factor test conducted on soil alone and varying percentages of stabilizer mixed with soil such as 5%, 10%, 15%, the pest soil mixed with 10%stabilizer yielded maximum dry density. Table 2 below shows the variation of maximum dry density and optimum moisture content of peat soil with varying percent of stabilizer.

Table 2. Variation of maximum dry density and optimum moisture content of peat soil with varying percentage of cement

Sl.No	Mixture	Maximum dry density(KN/m^3)	Optimum moisture content
1.	Peat soil	1.91	12.58
2.	Peat soil+5% Stabilizer	1.90	14.56
3.	Peat soil+10% Stabilizer	1.96	17.02
4.	Peat soil+15% Stabilizer	1.93	18.23

1.3.2 BY USING UNCONFINED COMPRESSIVE STRENGTH TEST

From Table 3 it indicates unconfined compressive strength of untreated and 5%, 10%, 15%, percent stabilizer treated peat soil. In order to optimize stabilizer content in soil unconfined compressive strength test were conducted by compacting soil to optimum moisture content, maximum dry density and both immediate as well as 10,20,30 days curing test were conducted. Samples which are intended for immediate test were tested on the same day where as samples which are planned with curing were tested 10, 20, 30 days all the test were conducted at a strain rate of 1.25mm per minute for each trial combination three samples were tested out three samples which ever two samples having close values were taken as unconfined compressive strength. From test conducted peat soil+10% stabilizer yielded maximum strength compared to other dosage of stabilizer.

Table 3. Variation strength with curing period of soil alone compared with CI soil 1 to 6% cement

Sl no	Mixture	Unconfined compressive strength(kN/m^2)			
		Curing period (Days)			
		0 Day	10 Days	20 Days	30 Days
1	peat Soil	10.60	10.60	10.60	10.60
2	peat Soil+5%stabilizer	13.51	17.21	20.23	21.56
3	peat Soil+10%stabilizer	15.60	18.46	22.78	27.00
4	peat Soil+15%stabilizer	14.56	17.23	21.21	23.24

2 CONCLUSION

1. The use of 10% stabilizer material (30% lime + 70% rice husk ash) is able to improve physical and engineering characteristics of peat soil, those are: specific gravity and wet unit weight increase; water content and void ratio decrease; soil shear strength increases and its compression decreases.
2. Curing period very much improve the stabilized peat soil properties; the increment of curing period causes the increase of specific gravity and wet unit weight; and it decreases water content, organic content, and acidity level.
3. The acidity and organic content of the stabilized peat soil decreases so that it becomes neutral peat soil with low organic content.
4. 10% stabilizer and 30 days of curing period is able to increase the shear strength about 25% from the initial condition (undisturbed peat soil) and significantly decrease the total compression.

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Effect of integrated use of organic and mineral fertilizer on some quality parameters of maize (*Zea mays* L.)

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ABSTRACT: Afield experiment was conducted to study the effect of integrated use of organic and inorganic fertilizers on some quality parameters of two maize cultivars in arid land in west Saudi Arabia during two seasons 2012/2013 and 2013/2014. The experiment was laid out in split split plot arranged in a randomized complete block design with three replications. The experiment consisted of two maize cultivars, three levels of chemical fertilizers NPK (20:20:20) applied at 100, 500 and 1000kg/ha and eight treatments of alfalfa green manure, chicken manure, cow manure and their combinations. The quality parameters studied were protein, oil and minerals content. The results indicated that protein content of maize grains was increased significantly with the increasing of chemical fertilizer for the two seasons, whereas the application of organic fertilizers increased the protein content significantly only in the second season. All measured quality parameters under organic treatments were recorded the highest and significant values in the second season. Among the organics, the combination of alfalfa, chicken and cow manures was superior to other treatments in term of protein content and minerals, where the highest protein content recorded in the second season was 11.14% comparing to the lowest value recorded by the control which was 9.63%, the mineral content in the second season for the same treatment for potassium, calcium, iron and zinc was 17.99, 2.09, 0.69 and 0.18 g/kg whereas for the control was 16.65, 1.29, 0.473 and 0.074 g/kg for K, Ca, Fe and Zn respectively. The oil content was affected by organic manures only in the second season. Alfalfa green manure recorded the highest oil content in the second season with a percentage of 5.6% whereas the lowest content was recorded by the control which was 5.11%.

KEYWORDS: Zea mays, organic manure, protein content, oil content, minerals content, NPK.

INTRODUCTION

Organic inputs such as green manure and animal manures has great potential for improving soil properties and crop yield as well as nutrients availability, however, sole application of organic sources of plant nutrients do not produce remarkable increase in crop yields due to their low nutrient status. Therefore, to maintain soil productivity on a sustainable basis, combination of organic and chemical sources of nutrient needs to be adopted. Continuous use of plant and animal organic nutrient sources help to build up soil organic matter, encourage microbial activity, and improve physical properties of the soil. Whereas, the sole use of chemical nutrient sources provide mainly one or more essential plant nutrient which the soil cannot supply in adequate quantities. Generally, arid land soils are of low essential fertility and therefore require external inputs to be improved. On the other hand the disposal of organic wastes is representing a serious environmental problem and therefore, the decomposing of these wastes into organic fertilizers for crop production will help in sustaining soil productivity and decreasing agricultural inputs (Bruce et al., 2007). Application of available sources of organic plant nutrients for enhancing soil fertility and sustaining crop productivity should be used in an integrated manner (FAO, 1993). Recently, there is a growing interest in the tropical world in using organic sources of plant nutrients for improving soil productivity in order to reduce the use of inorganic fertilizers [Ayei and Adetunji, 2010]. Moreover, there is abundance of organic sources such as farm residues, green manure and animal manures, in addition, the effect of integrated use of organic and mineral fertilizers on improving the quality of crops didn't receive much research attention. These reasons demanded the need to

study the possible use of available organic sources and mineral fertilizer to improve the yield and quality of such crops. It is within this context that this study was carried out in arid land in west of Saudi Arabia to quantify the effects of organic and mineral fertilizers and their combinations on protein, oil and minerals content of grain of two maize cultivars.

MATERIALS AND METHODS

Field Experiments

The field experiment was conducted on loamy sand soil at the Agricultural Research Station of faculty of meteorology, environment and arid land agriculture, King Abdulaziz University, Saudi Arabia. The experiment was laid out in split split plot arranged in a randomized complete-block design with four replications. The treatments included two maize cultivars, Single Hybrid 13 Bashair (white grain) and Trihybrid 352 (yellow grain), these two cultivars represented the main plots and they named later CV1 and CV2 respectively. NPK (20:20:20) was applied in the subplots at three levels (100, 500 and 1000 kg ha⁻¹), while organic fertilizer comprised of eight treatments including alfalfa green manure, chicken, cow manures and their combination were applied in the sub sub plots of the experiments at 20 t/ha. NPK fertilizer was split into four doses, the first dose was applied 15 days after sowing and then 15 days interval for the other three doses, while the organic fertilizer was incorporated into soil one month before sowing. After harvesting, three representative samples of grain powder of each treatment were taken for determining protein oil and mineral content.

Table 1. The treatments of organic nutrients sources and their combinations

Treatment No	Organic amendment
1	Control (No amendment)
2	Alfalfa manure
3	Cattle manure
4	Chicken manure
5	Alfalfa + Cattle manure
6	Alfalfa + Chicken manure
7	Cattle manure + Chicken manure
8	Alfalfa + Cattle +Chicken manure

Determination of grain protein content (%)

Triplicate representative grains samples from each treatment were taken at maturity stage from each treatment for the determination of nitrogen content. The samples were oven dried at 70 °C to a constant weight. The content of nitrogen was determined by digestion methods using Micro-Kjeldahl's apparatus as described by American Association of Cereal Chemists (AACC, 2000). The percentage of protein in the grain was calculated by multiplying the grain N content with a constant factor of 6.25 and results were expressed on dry weight basis.

Determination of oil content

Oil contents were determined by Soxhlet Fat Extraction method described by Low, 1990.

Deamination of mineral content

potassium (K) was determined by Flame Spectrophotometry, while Calcium (Ca), Iron (Fe), and Zinc were determined by Atomic Absorption Spectrophotometry.

Statistical Analysis

All data were analyzed by analysis of variance (ANOVA) procedures using SAS program (2006). After analysis of variance, the treatment means were separated by revised LSD test according to El-Nakhlawy (2010).

RESULTS AND DISCUSSION

Protein content

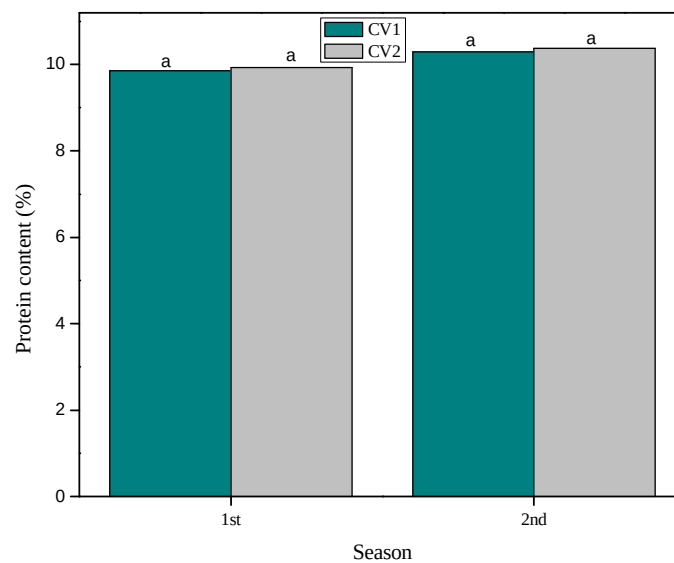


Figure 1. Effect of two maize cultivars on protein content

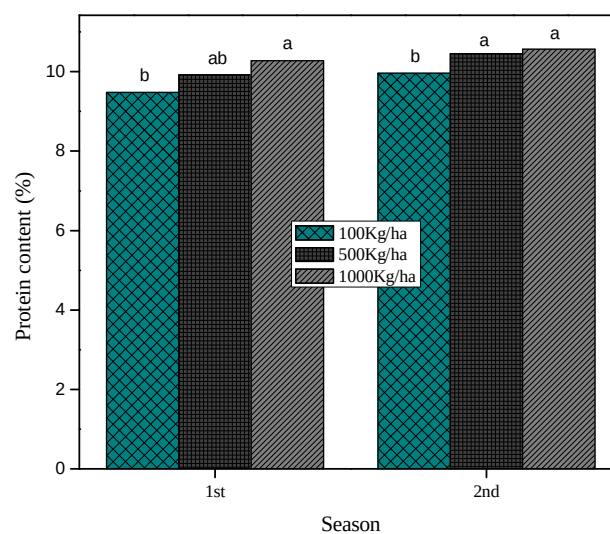


Figure 2. Effect of different levels of NPK fertilizer on protein content

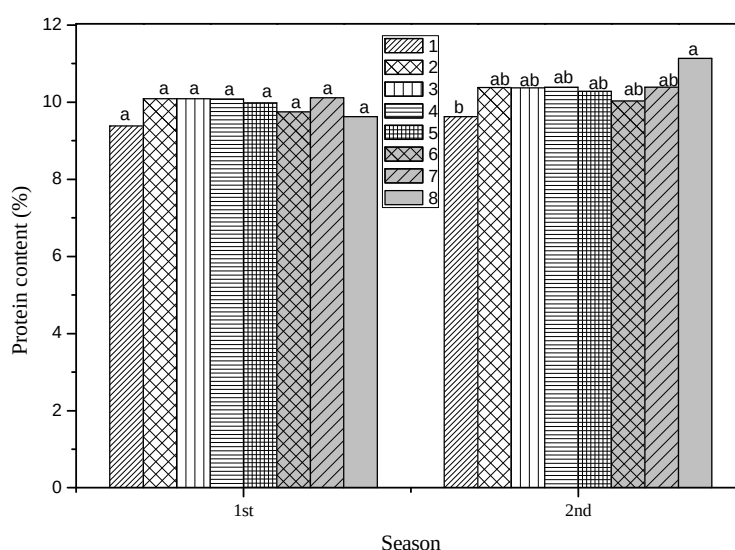


Figure 3. Effect of different sources of organic fertilizers and their combinations on protein content

Combined application of organic and inorganic source of nutrients on protein content of maize grain indicated that protein content increased significantly among various treatments. In the first and second season, the two cultivars did not show any significant differences. The average protein content for CV1 was 9.93% and 10.37%, while for CV2 was 9.85% and 10.29% for the first and second season respectively (Figure 1).

Application of NPK fertilizers at different levels affected the protein content of maize grain significantly. In the first season, the protein content increased steadily with the increase of NPK fertilizer. In the second season the protein content was also increased according increasing level, however there was no significant difference in protein content of NPK dose of 500 and 1000kg/ha. The protein concentration values in respective for the first season were 100, 500 and 1000kg were 9.48, 9.92 and 10.27 while for the second season were 9.96, 10.45 and 10.57% respectively (Figure 2).

Application of organic sources and their combinations increased the protein content over the control in the first season, however, there was no significant differences among all the treatments, the highest value was 10.11%, which was recorded by the combination of alfalfa, cow and chicken manures, while the lowest value was 9.75% which was recorded by the control. In the second season, all the treatments of organic sources increased the protein content of maize grain significantly over the control, the highest value was recorded by the combination of alfalfa, cow and chicken manures, which was 10.39%, while the value of the control was 10.03% (Figure 3). The increase of protein content of maize grain could be attributed mainly to nitrogen added from either organic or inorganic sources. Nitrogen is the most important constituent of plant proteins and is required throughout the crop growth stages to enhance the formation of amino acids. The result of this study proved that the content of protein increased significantly with increasing dose of NPK application, similar result was observed by Weiser and Seilmeier (1998) who found that protein content was strongly influenced by nitrogen. Triboi et al. (2000) also reported that nitrogen is the main factor that affect the protein content of maize grain. Recently, Karasu (2012) reported similar result when he observed that protein content increased with increasing of nitrogen rate. This increase in overall protein content was due to consistent increase in different fractions of proteins. The protein is formed by different amino-acids which are constituted in higher amount due to availability of nitrogen in split doses during the all growth stages of the crop. Secondly, the slow release of nitrogen from organic sources was directly contributed to the grain protein formation and different fractions. Application of nitrogen at the optimum level was improved the protein content of maize (Amanullah et al., 2009), whereas the application of the nitrogen higher or lower than the optimum dose has adverse effects on the quality of maize (Stone et al., 1998). Therefore, the availability of nitrogen during grain filling stage is necessary to improve the protein content. Integration of organic and inorganic nitrogen sources is important for maize crop to have easy access to nitrogen whenever is needed throughout all growth stages. Increase in grain protein content of maize as a result of application of slow release source of nitrogen was reported by Amany et al. (2006).

Oil content

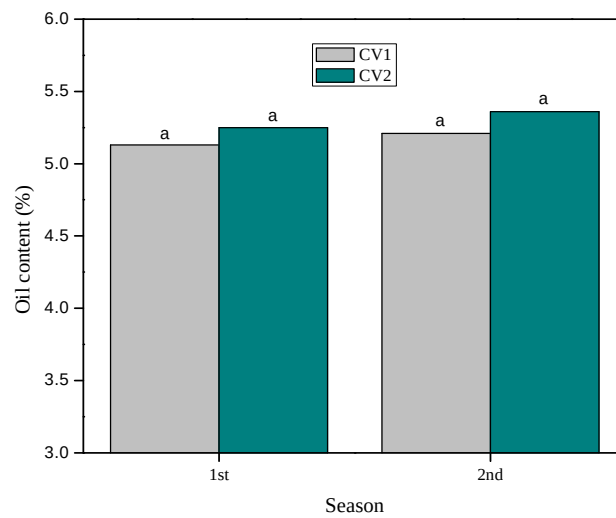


Figure 4. Effect of two maize cultivars on oil content

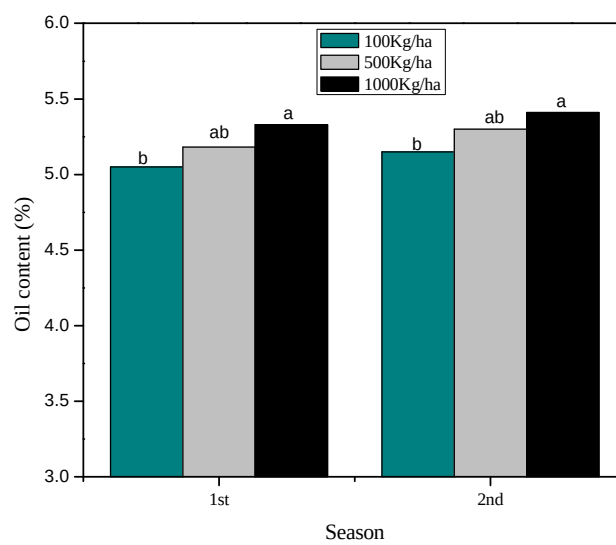


Figure 5. Effect of different levels of NPK fertilizer on oil content

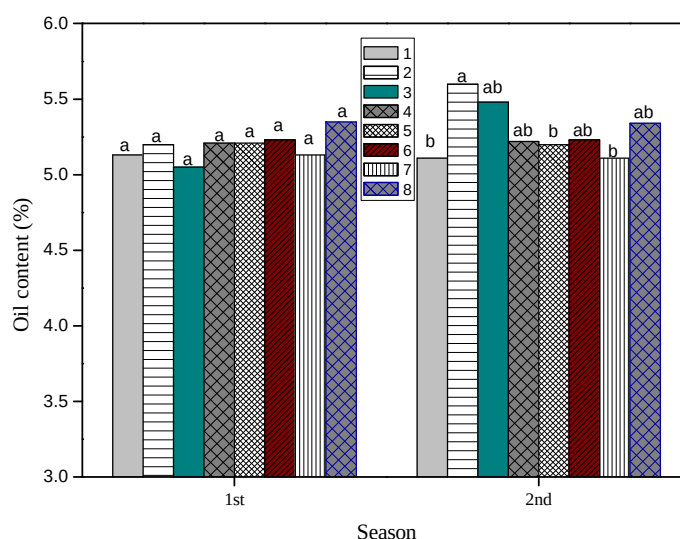


Figure 6. Effect of different sources of organic fertilizers and their combinations on oil content

Combined application of organic and inorganic source of nutrients on oil content of maize grain indicated that oil content increased significantly among various treatments. In the first and second season, the CV2 recorded higher oil content than CV1, however, the difference statistically was not significant. The average of oil content for the first season was 5.13% and 5.25%, while for the second season was 5.21% and 5.36% for CV1 and CV2 respectively (Figure 4).

Application of NPK fertilizers at different levels affected the oil content of maize grain significantly. In both seasons, the oil content increased steadily with the increase of NPK fertilizer. The oil content values for the three levels of NPK 100, 500 and 1000kg/ha in respective for the first season were 5.05%, 5.18% and 5.33% , while for the second season were 5.15%, 5.30 and 5.41% respectively (Figure 5). Application of organic sources and their combinations increased the oil content of some treatments over the control in the first season, however, there was no significant differences among all the treatments, the highest value was 5.35%, which was recorded by the combination of alfalfa, cow and chicken manures, while the oil content of the control was 5.2. In the second season, all the treatments of organic sources increased the oil content of maize grain significantly over the control, the highest oil content was recorded by the treatment of alfalfa green manure, the recorded value was 5.6 %, while the lowest value was recorded by the control, which was 5.11% (Figure 6). There was no significant difference among the treatments under the organic manures treatments in the first season, whereas in the second the season all the treatments increased the oil content of maize grain, the main reason was attributed to accumulation sulfur released by organic sources in the soil. Promoting effect of sulfur in grain oil content may be due to reason that sulfur is needed for the formation of disulfide bond between polypeptide chains. It has been found that oil contents of grains increases due to the disulphide bond formation between polypeptide chains which increases as sulfur concentrations increases. Sulfur is responsible for oil content increment as it is required in synthesis of co-enzyme A which involved in oxidation and synthesis of fatty acids. These results are in conformity with findings of (Azhar et al., 2011), (Rasheed *et al.*, 2004) and (Vilela *et al.*, 1995) [9] who found that sulfur induced higher oil contents in maize grains.

Minerals content

Table 2. Means for minerals content (K, Ca, Fe and Zn)

Treatments	Minerals content (g/Kg)							
	K		Ca		Fe		Zn	
	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
Maize cultivars								
CV 1	16.82 a	17.27 a	1.097 b	1.415 b	0.420 b	0.467 b	0.075 b	0.116 b
CV2	16.42 b	16.97 a	1.510 a	2.206 a	0.541 a	0.673 a	0.106 a	0.178 a
LSD (0.05)	0.233	0.362	0.101	0.166	0.083	0.1123	0.028	0.026
NPK rates Kg/ha								
100	16.13 c	16.86 b	1.320a	1.762a	0.501a	0.567a	0.081a	0.129b
500	16.71 b	17.16 ab	1.329a	1.892a	0.458a	0.562a	0.094a	0.166a
1000	17.0243a	17.34 a	1.261a	1.777a	0.483a	0.581a	0.097a	0.145ab
LSD (0.05)	0.285	0.444	0.124	0.203	0.101	0.138	0.034	0.032
Organic fertilizers								
1	16.44 bc	16.65 c	0.869 c	1.296 d	0.427 bc	0.473 a	0.069 b	0.074 b
2	16.54 bc	16.93 bc	1.456 a	1.835 abc	0.459 bc	0.515 a	0.087 ab	0.148 a
3	16.52 bc	17.24 bc	1.219 b	1.895 abc	0.427 bc	0.535 a	0.082 ab	0.146a
4	16.44 bc	17.61 ab	1.489 a	2.082 a	0.559 ab	0.650 a	0.098 ab	0.157 a
5	16.09 c	16.74 c	1.187 b	1.691 bc	0.386 c	0.601 a	0.135 a	0.175 a
6	16.73 ab	16.69 c	1.379 ab	1.628 c	0.523 abc	0.489 a	0.856 ab	0.150 a
7	16.58 ab	17.11 bc	1.367 ab	1.966 ab	0.440 bc	0.609 a	0.082 ab	0.143 a
8	17.05 a	17.99 a	1.462 a	2.089 a	0.624 a	0.688 a	0.086 ab	0.181 a
LSD (0.05)	0.466	0.726	0.203	0.331	0.165	0.225	0.056	0.052

Means with same letter (s) in each column, are not statistically different at $P \leq 0.05$

Organic nutrients sources affected the content of minerals in maize grain significantly. K is highly important for the seeds for sowing as low concentrations of K in seeds in general can negatively affect the rapidity of germination and development of seedlings (Hejman et al. 2012, Nadeem et al. 2012), all the treatments were affected the content of potassium in maize grain. For both seasons the potassium content increased significantly with increasing rate of NPK fertilizer. Organic fertilizers treatments influenced the content of potassium, the highest values for the two seasons were recorded by the combination of alfalfa, chicken and cow manure which was 17.0 and 17.9 g/kg for the first and second season respectively. Calcium content was not affected by NPK fertilizers at all applications rates, whereas the organic treatment were increased the calcium content significantly over the control for the two seasons. The highest values for the two seasons were recorded by the combinations of alfalfa, chicken and cow manures which were 1.462 and 2.089 g/kg whereas the lowest values were recorded by the control which were 0.869 and 1.296 mg/kg for the first and second seasons respectively. The chemical fertilizer didn't affect the content of iron in maize grain, whereas some organic fertilizer treatments recorded higher values over the control. The combination of alfalfa, chicken and cow manure treatment recorded the highest iron content which were 0.624 and 0.688g/kg whereas the control values for the two seasons were 0.427 and 0.473 g/kg for the first and second season respectively. In the first season zinc was not affected by NPK application, while in the second season, NPK at 500 kg/ha increased the content of zinc significantly. All organic manure treatments increased zinc content significantly over the control for the second seasons. The maximum values for the two seasons were noticed with the treatment of the combination of alfalfa and cow manures, which were 0.135 g/kg and 0.175 g/kg for the first and second season respectively, whereas the lowest values were noticed with the control for the both seasons which were 0.069 g/kg and 0.074 g/kg respectively (Table 2). The integration of organic and inorganic fertilizers promoted significantly ($P < 0.05$) the minerals content in maize grain. This might be attributed to the micronutrient content in the organic manure and also the effect of organic acids produced during decomposition of soil minerals. Effect of mineral and organic manures on maize grain mineral content was observed by many studies. Prasad (1981) opined that organic manures increased the Zn and Fe content of maize from deficiency to sufficiency level, which caused the improvement in maize yield of calcareous soil. Kher and Minhas (1991) reported that the combined application of recommended dose of NPK and farm yard manure to maize-wheat rotation significantly increased the uptake of Zn, Mn and Fe in both crops. Ghosh *et al.* (2001) reported that application of farm yard

manure along with recommended dose of NPK fertilizer considerably increased the uptake of Zn, Mn, Cu and Fe by wheat over absolute control and recommended dose of fertilizer treatment.

CONCLUSION

The results presented herein prove that the application of organic and chemical sources improved the measured quality parameters of maize grain. The combination of alfalfa, chicken and cow manures with 500 kg/ha NPK (20:20:20) was the best among all studied treatments. Organic fertilizers containing micronutrients increase the content of minerals which are prerequisite for nutrition. Availability of soil nutrients should be checked on a regular basis to ensure easy accessibility and crop quality.

ACKNOWLEDGEMENTS

The authors are grateful and greatly indebted to King Abdulaziz City for Science and Technology (KACST) for full financial support of this project No (22- ط 12- ت). Field and laboratory assistance by laboratory and research farm station staff is highly acknowledged.

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Power Quality Improvement in Wind Grid Energy System using STATCOM With BESS -Control Scheme

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ABSTRACT: The grid connected wind energy generation system for power quality improvement by using STATCOM-control scheme is simulated using MATLAB. When the wind power is connected to an electric grid affects the power quality. The effects of connecting wind turbine in grid system covers power quality areas are the active power, reactive power, and variation of voltage, harmonics and electrical behavior of switching operations. The installation of wind system with the grid introduces the power quality problems which can be determined by studying this paper. By using the Static Compensator (STATCOM) with a battery energy storage system (BESS) at the point of common coupling to improve the power quality of the grid. The battery energy storage used to maintain real power from varying wind power. At low power demand hours the generated power can be stored in the batteries. The combination of battery storage with wind energy generation system will stabilize the grid system by absorbing or injecting reactive power and enable the real power flow required by the load. This relieves the main supply source from the reactive power demand of the load and the induction generator in this proposed scheme.

KEYWORDS: Static compensator STATCOM, International Electro-technical Commission (IEC), Battery Energy Storage System (BESS), Point of Common Coupling (PCC), and Total Harmonic Distortion (THD).

1 INTRODUCTION

The renewable energy resources like wind, hydro, biomass etc are necessary to growth and social progress. So the integration of wind energy into power system is used to minimize the environmental impact on conventional plant. A continuous proliferation of non-linear loads is due to the intensive use of power electronics converter-based power processing units in industries and residential applications. The non-linear loads generate serious harmonic currents and reactive power to the distribution and transmission System, which results in a low power factor. Current harmonics due to non-linear loads have been dealt with using passive filters consist of inductor, capacitor and resistors (damping resistors). They provide simple solution but having large size and weight; they cannot provide flexible compensation and may cause resonance problems. Nowadays, the development of power electronics and microelectronics makes it possible to consider active power filters, which can provide flexible current harmonic compensation and contribute to reactive power control and load balancing. Hence Power electronic based FACTS devices like STATCOM can be effectively utilized to improve the quality of power supplied to the customers. The increase in use of power electronic based loads (adjustable Speed drives, SMPS, etc) to improve system efficiency and Controllability is increasing concern for harmonic distortion levels in end use facilities and on overall power system. The use of passive tuned filters generates new system resonances, depending on specific system conditions. In addition, passive filters also significantly overrated to account for possible harmonic absorption from power system. Various low-power based electronic appliances such like TV sets, personal computers, and adjustable speed heat pumps generates a large amount of harmonic current in power systems even though a single low power electronic appliance,

consist of single-phase diode rectifier with a dc link capacitor is as utility interface, produces negligible amount of harmonic current.

A concept that can improve the power quality is the active power filters. This type of filters can meet diverse load conditions. In addition improve the power factor, as well as appears to be an attractive and viable method for reducing voltage and current harmonic distortion and other power quality problems such as flicker. Thus active power filter improves the system power quality by injecting equal-but opposite currents to compensate harmonic distortion and reactive power. Ideally, this active power filter should monitor and minimize voltage and distortion of connected load. Wind energy generating system is to use the induction generator connected directly to the grid system. The induction generator has advantages of cost effectiveness and robustness. However; the induction generators needs reactive power for magnetization. When the generated active power of an induction generator is varied due to variation of wind, absorbs reactive power and terminal voltage of an induction generator can be affected. A proper control scheme in wind energy generation system is required under normal operating condition to allow the proper control over the active power production. On increasing of grid disturbance, battery energy storage (BESS) system for wind energy generating system is generally required to compensate the fluctuation generated by wind turbine. A STATCOM based control methodology has been proposed for improving the power quality which can technically manages the power level associates with the commercial wind turbines.

2 POWER QUALITY ISSUES

Perfect power quality means that the voltage is continuous and sinusoidal having constant amplitude and frequency. Power quality can be expressed in terms of physical characteristics and properties of electricity. It is mostly described in terms of voltage, frequency and interruptions.

2.1 GRID SIDE POWER QUALITY ISSUES

The power quality problems in the grid side that affect the WEG (Wind Electric Generator) are mainly concerned with the quality of voltage that is being supplied by the utility.

2.2 VOLTAGE VARIATIONS

Voltage variation has implications on both real and reactive power associated with wind farms. A decreased voltage condition increases the current through the generator, making line losses to increase. Decreasing voltage also affects the power factor as the capacitive VAR generated out of the installed capacitor decrease as voltage decreases.

2.3 FREQUENCY VARIATIONS

The variation in frequency affects the power generation in Wind Energy Generator (WEG) to a large extent changing the aerodynamic efficiency. Frequency changes lead to imperfect tip speed ratios and reduced efficiencies. These leads to decrease the energy capture and output power of wind turbines.

2.4 VOLTAGE UNBALANCE

Voltage unbalance is caused due to large unbalanced non-linear loads. The unbalance in voltage causes negative sequence currents to flow in induction machines, causing overheating.

2.5 GENERATION OF CURRENT HARMONICS

Current harmonics are generated due to starting of induction generators during motoring mode. This causes distortion in the line voltage and affects all the consumers connected to the line.

2.6 INJECTION OF FLUCTUATING POWER

Power in wind is varied by nature and is checked by annual, monthly, daily and hourly variations. This results in generation and supply of a power that is fluctuating and leading to operational problems.

3 POWER QUALITY IMPROVEMENT TOPOLOGY

The STATCOM based current control voltage source inverter injects the current into the grid in such a way that the source current are harmonic free and their phase-angle with respect to source voltage reaches a desired value. The injected current cancel out the reactive and harmonic part of the load and induction generator current, thus it improves power factor and power quality of system. To accomplish these goals, the grid voltages are sensed and are synchronized in generating the current command for the inverter. The grid connected system is implemented for power quality improvement at point of common coupling (PCC), as The grid connected system shown in Fig. 1, consists of wind energy generation system and battery energy storage system with STATCOM. *Wind Energy Generating System* The wind generating system (WEGS) consists of turbine, induction generator, interfacing transformer, and rectifier to get dc bus voltage. For constant dc bus voltage, the power flow is represented with constant dc bus current. In this configuration, wind generations are based on constant speed topologies with pitch control turbine. The induction generator because of its simplicity, does not require any separate field circuit, and can be connected with constant and variable loads. The available power of wind energy system is presented by equation:

$$P_{\text{wind}} = \frac{1}{2} \rho A V_{\text{wind}}^3 \quad (1)$$

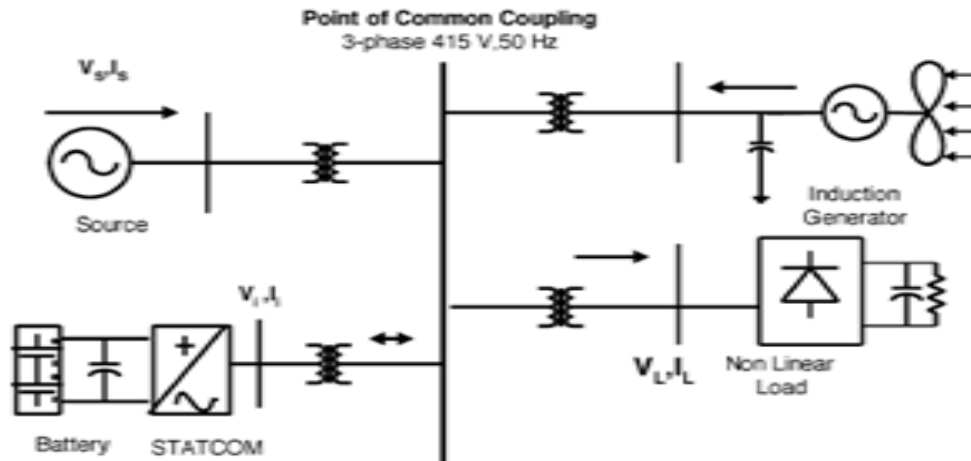


Fig. 1. Grid connected system for power quality improvement

Where ρ (kg/m³) is the air density and A (m²) is the area swept out by turbine blade, V is the wind speed in meter/s. It is not possible to extract all kinetic energy of wind, thus it extract a fraction of wind power, called wind turbine power coefficient C_p , and it is given by the equation:

$$P_{\text{mech}} = C_p P_{\text{wind}} \quad (2)$$

Where C_p (power coefficient), depends on the type and operating condition of wind turbine. This coefficient also express as a function of tip speed ratio and pitch angle. The mechanical power produce by wind turbine is given as:

$$P_{\text{mech}} = \frac{1}{2} \rho \pi R^2 V_{\text{wind}}^3 C_p \quad (3)$$

Where R is the radius of the blade (m).

3.1 BESS-STATCOM

The STATCOM (or Static Synchronous compensator) is a shunt-connected reactive-power compensation device that is capable of generating and/ or absorbing reactive power and in which the output can be varied to control the specific parameters of an electric system. In general it is solid state switching converter device which is capable of generating or absorbing independently controllable real and reactive power at its output terminals when it is fed from an energy source at its input terminals. Basically, the STATCOM considered in this is a voltage-source converter from a given input of dc voltage produces a set of 3-phase ac-output voltages, each in phase with and coupled to the subsequent ac system voltage through leakage reactance. For the voltage regulation in STATCOM, the battery energy storage system (BESS) is used as an energy storage element. The BESS naturally maintains dc capacitor voltage constant and it is best for STATCOM since it rapidly injects or absorbs reactive power to stabilize the grid system. It also controls the power fluctuations occurs distribution and transmission system with very fast response by charging and discharging of DC link capacitor. The battery is connected in parallel to the dc capacitor of STATCOM. The STATCOM is a three-phase voltage source inverter having the capacitance on its DC link and connected at the point of common coupling.

A STATCOM can improve power-system performance in following areas:

- The dynamic voltage control in electrical (Transmission and Distribution) system;
- The transient stability;
- The voltage flicker control; and
- It also controls real power flow in line when it is needed.

3.2 ADVANTAGES OF STATCOM

- It occupies small area by replacing the large passive banks and circuit elements with compact converters.
- Reduces site work and time.
- Its response is very fast.

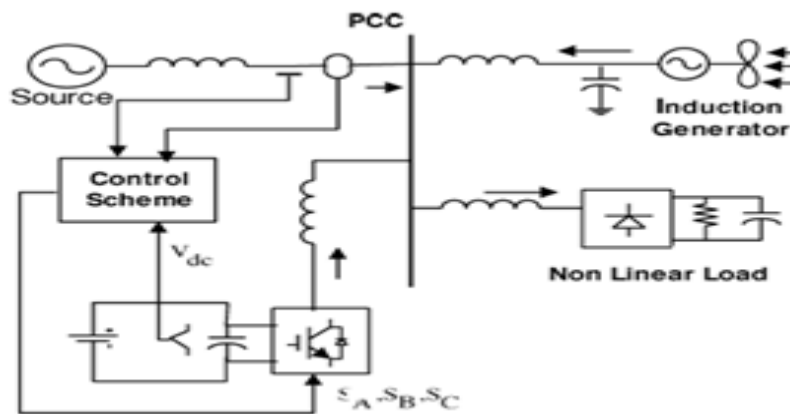


Fig. 2. System operational scheme in grid system

4 CONTROL SCHEME OF SYSTEM

The control scheme of **Grid Connected Wind Energy System** approach is based on injecting the current into the grid using hysteresis band using hysteresis band. Using such techniques controller keeps the control system variables between the boundaries of hysteresis area and thus gives correct switching signals. The control algorithm needs the measurements of several variables such as three-phase source current i_{sabc} , DC voltage V_{dc} , inverter current i_{iabc} with the use of sensor. The current control block, receives an input of reference current i_{sabc}^* and actual i_{sabc} current are subtracted so as to activate the operation of STATCOM in current control mode Hence; the inverter maintains the continuous power for the critical load.

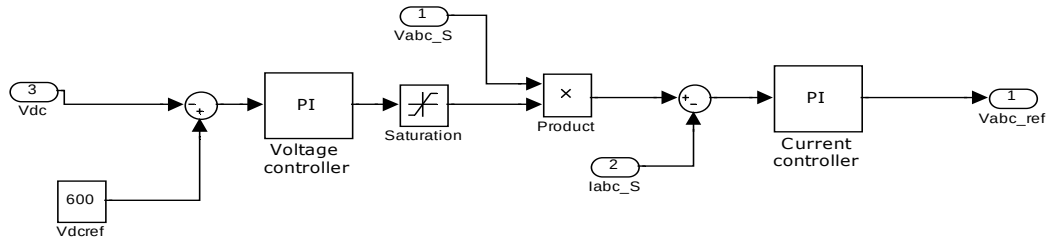


Fig. 3. Control system scheme

4.1 HYSTERESIS BASED CURRENT CONTROLLER

Current control based hysteresis controller is used in this scheme. The reference current is generated as in and the actual current is detected by current sensors that are subtracted for obtaining current errors for a hysteresis based controller. ON/OFF pulse signals for IGBT switches of inverter are derived from hysteresis current controller. When the measured current is higher than the generated reference current, it is necessary to get negative inverter output voltage so that corresponding switches are commutated. Thus output voltages are decreased so that the output current reaches the reference current. Also, if the measured current is less than the reference current, positive inverter output voltage are obtained by commutating particular switch. Thus output current increases to the reference current. Hence, the output current will be within a band around the reference one. The switching function S_A for phase 'a' is expressed as follows:

$$i_{sa} > (i_{sa}^* + HB) \text{ then } S_A^+ = 0 \quad (4)$$

$$i_{sa} < (i_{sa}^* - HB) \text{ then } S_A^+ = 1 \quad (5)$$

Where HB is a hysteresis current-band, similarly the switching function S_B , S_C can be derived for phases "b" and "c," respectively [9]. The current control mode of inverter injects the current into the grid in such a way that the source currents are harmonic free and their phase-angles are in phase with respect to source voltage. The reactive and harmonic part of load side is cancel out by the injected current at shunt part. Thus, overall it reduces harmonic content and improves the source current quality at the PCC. As soon as battery energy system is fully charged with the help of micro-wind generator, the power transfers take place [4]. The source voltage is sensed and synchronized in generating the desired reference current command for the inverter operation.

5 STATCOM—PERFORMANCE UNDER LOAD

The Grid Connected Wind Energy System is connected having the nonlinear load. The functioning of the system is measured by switching the STATCOM at time $t = 0.3$ s in the system. When STATCOM controller is turn ON, without change in load condition parameters, it starts to extenuate for reactive demand as well as harmonic current. This additional demand is fulfill by STATCOM compensator when the load in variation. Thus, STATCOM can regulate the available real power from source. The DC link voltage regulates the source current in the grid system, which maintained constant across the capacitor. The current through the dc link capacitor indicating the charging and discharging operation.

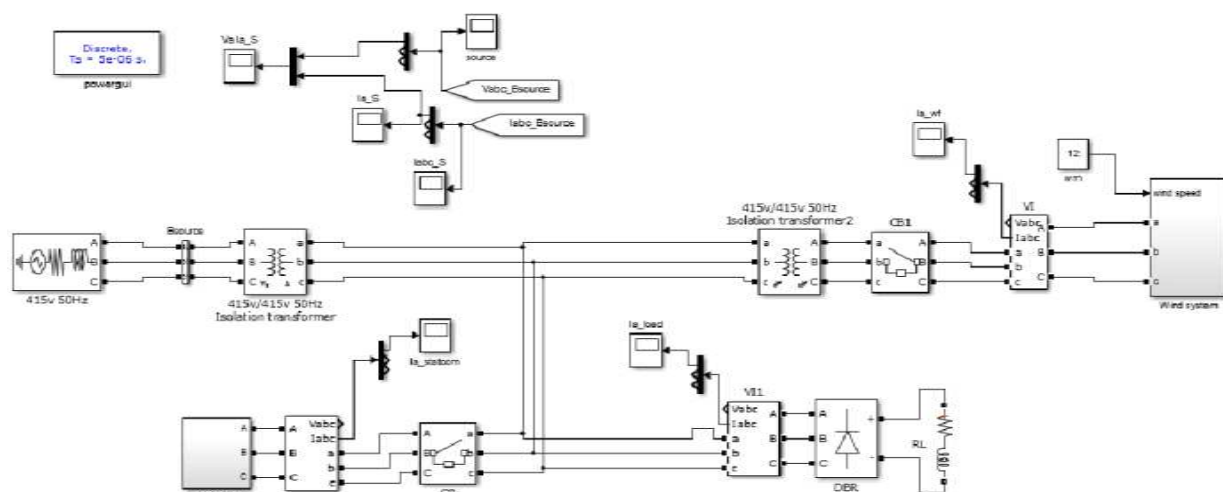


Fig. 4. Matlab Dig Of Grid Connected Wind Energy System using STATCOM

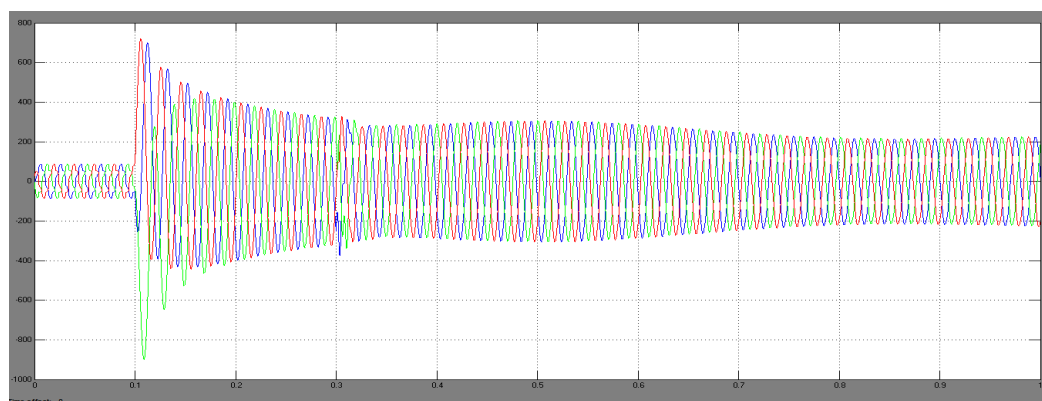


Fig. 5. Output wavefome of source current

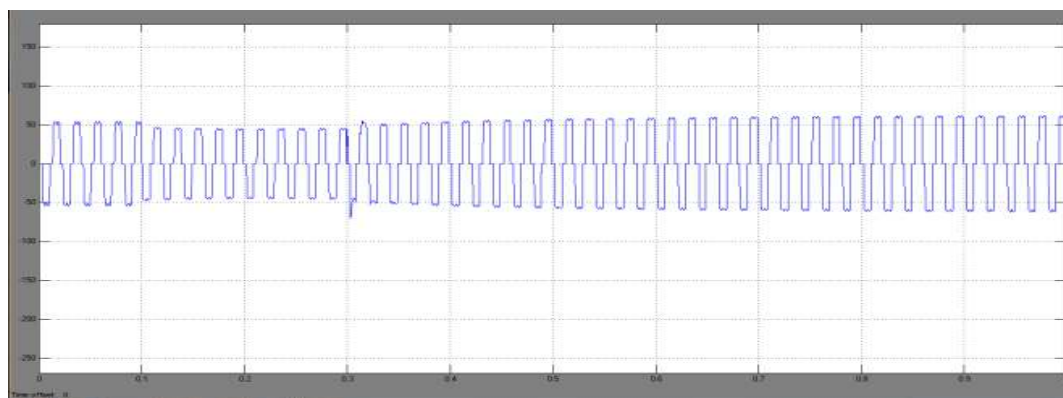


Fig. 6. Output wavefome of load current

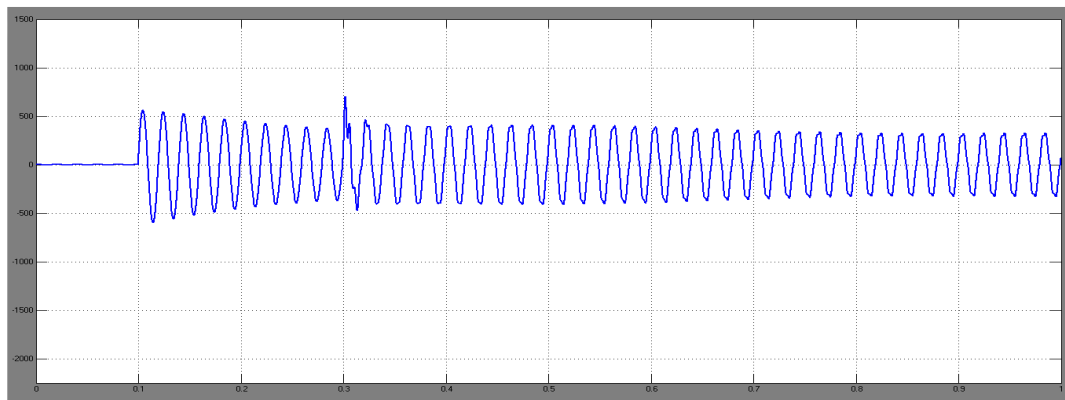


Fig. 7. Output waveform of wind current

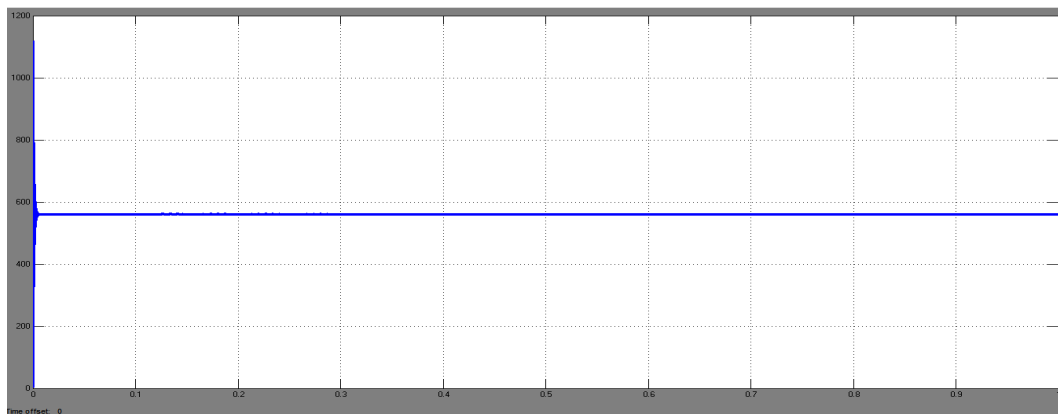


Fig. 8. Output waveform of DC link voltage

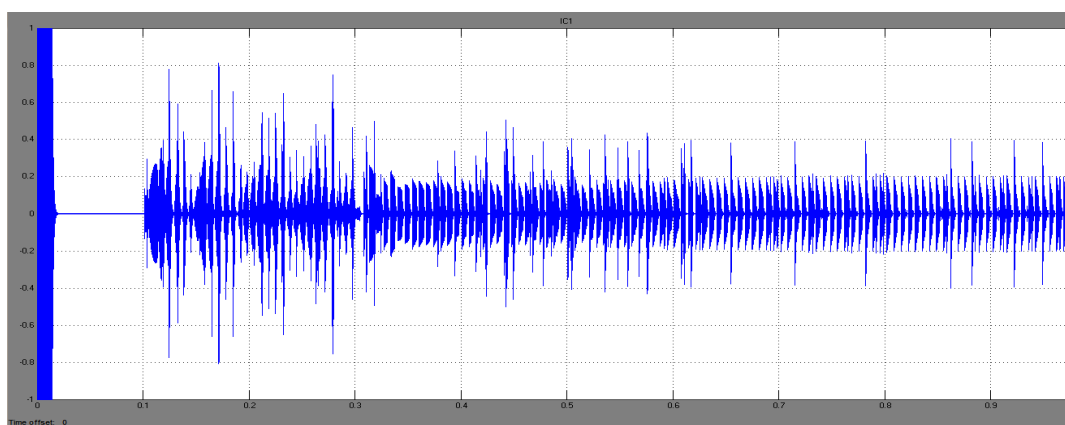


Fig. 9. Output waveform of current across capacitor

6 CONCLUSION

In this paper we present the STATCOM based control scheme for power quality improvement in wind generating system on integration to the grid and with nonlinear load. The power quality issues and its effects on the consumer end and electric utility are shown. The operation of the control system developed for the STATCOM in MATLAB/SIMULINK for maintaining the power quality is to be simulated. It has potentiality to cancel out the harmonic parts of the load end current. It maintains the source voltage and current in-phase and support the reactive power during demand for the wind generator and load at PCC in the wind grid system, thus it enhance the utilization factor of transmission line also. The integrated wind generation and FACTS device with BESS have shown with the outstanding performance. Thus the proposed scheme in the wind grid connected system fulfils the power quality norms as per the IEC standard 61400-21.

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Immune status among Moroccans uremic patients

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ABSTRACT: End stage renal disease (ESRD) is characterized by disorders of both the innate and adaptive systems. No study is available on disturbance of immune system in ESRD Moroccans patients under dialysis treatment. The aim of this study is to describe the immune status in these patient groups. Our results show the need for a further study in our patients, who are in a state of chronic inflammation following activation of complement, and immune dysfunction leading to impaired function of cells T, B and NK, accompanied by decreased production of antibodies. Understanding the mechanisms behind the immune dysfunction in ESRD generates a perspective to improve lifestyle and reduce mortality in this group of patients.

KEYWORDS: Immune status, uremic patients, antibodies.

INTRODUCTION

Although the proportion of deaths from infection among dialysis patients has markedly decreased in recent years, going from more than 40% in the early 1970s to about 15% from the 1990s in most centers, infection is still second only to cardiovascular disease as a cause of death in end-stage renal disease (ESRD) patients. This high susceptibility of ESRD patients reflects their state of immunodeficiency [2].

It should be noted that the immune dysfunction in uremia is associated with alterations in the two major branches of the immune system, innate and adaptive immunity [3, 4, 5].

Thus, ESRD-associated inflammation is due to activation of innate immune system, orchestrated by monocytes, macrophages, granulocytes, and cellular constituents of other organs/tissues. This is coupled with immune deficiency that is caused by depletion of naive and central memory T cells and B cells, and impaired phagocytic function of polymorphonuclear leukocytes (PMNs) and monocytes. [1, 3]

Immune dysregulation is present in chronic renal failure patients long before the start of dialysis therapy [6], hemodialysis further enhances activation of immune system via dialysis membrane bioincompatibility [7] and impure dialyzate [8], inducing a chronic inflammation.

OBJECTIVE

The aim of this work is to describe the immune status among hemodialysis patients in Morocco, attempting to deduce the potential role of the disturbances of the innate and adaptive immune systems as cause for the high mortality in this patient population.

SUBJECTS AND METHODS

Patients

Fifty chronic hemodialysis patients (twenty nine women and twenty one men) from Department of Nephrology, University Hospital of Casablanca, who gave informed consent were included in this study. Exclusion criteria were the presence of an acute or chronic inflammatory process, the use of immunosuppressive drugs or evidence of malignancy. Mean age of the patient was $40,41 \pm 8,31$ years (interval of 18 to 60 years). They had been on dialysis at study entry for an average of $12,04 \pm 6,12$ years. Two patients died from cardiovascular complications during the course of the study. All patients had been treated three times per week.

Table 1. Baseline clinical characteristics of the study population

No. of patients	Age (year) Mean ± SD	Sex Ratio (M/F)	Duration in dialysis (year) Mean ± SD	Primary kidney diseases				
				Nephropathy Glomerulo- nephritis	Ischemic nephropathy	Lupus nephritis	Diabetic nephropathy	Unknown etiology
50	40,41 ± 8,31	0,72	12,04 ± 6,12	15	7	2	1	25

Blood collection

In all ESRD patients, whole blood was collected after cannulation of the vascular access was completed but before the initiation of dialysis.

Peripheral blood lymphocyte subtyping

Immunophenotypic analysis of the cells was performed using a FACScan flow cytometer (Becton Dickinson).

The percentages of CD3, CD4, CD8, CD11+ CD18+, CD16 + 56+, CD19, CD25, CD38, CD45RA and CD45RO were measured using monoclonal antibodies in peripheral blood samples. For each sample, data from 10 000 cells were collected and analyzed. Forward and side scatters were used to gate and exclude cellular debris. Data analysis was performed using Flowjo software.

We used the blood count formula to convert percentages of lymphocyte subpopulations by cytometrie in absolute value.

Complement and immunoglobulin by nephelometric assay

Measurement of complement components (C3 and C4) and antibodies (Immunoglobulins G, A and M) was performed by nephelometric methods, using the MININEPH analyser with the recommended dilutions of sera.

RESULTS

Immunoglobulins:

The prevalence of HBV among patients in our series was 6% (3 patients), whereas it is 46% for HCV (23 individuals). One patient showed a co-infection with both viruses.

All these patients have already been vaccinated against HBV, but only 16 patients (32%) who responded by synthesizing anti-HBV antibodies.

Normal values of immunoglobulins vary by age. Measurement of serum immunoglobulins has detected anomalies in the levels.

Table 2. Normal values of Immunoglobulin [9-10] and complement components (g / L) in adults. [11]

IgG	IgA	IgM	C3	C4
6,6 - 12,8	0,7 - 3,4	0,5 - 2,1	0,89 - 1,87	0,165 – 0,380

We observed high levels of IgG in 46 patients (92%), the remaining 4 patients had normal IgG levels. Our results showed also an excessive production of IgA in 14 persons (28%), however only one patient showed a low IgA level (2%).

A high titer of IgM was found in 1 patient, whereas 3 individuals showed an IgM deficiency (6%). (Table 3)

Complement:

High levels of C3 and C4 were detected in 18 (36%) and 23 (46%) patients, respectively.

Our results showed C3 deficiency in 3 patients (6%) and decreased C4 level in 5 patients (10%). (Table 3)

No patient in our study presented an associated anomaly of C3 and C4, except one that has a high rate of C4, associated with a low concentration of C3. He has a combined infection of HBV and HCV.

The only patient in our series to be grafted, with an immediate rejection, had high level in C3 and C4 associated with a high rate of IgG and IgM. She has a positive genotyping to HCV RNA (genotype 1b).

We reported also a case of association of C4 and IgM deficiency in the unique patient in the study who had diabetic nephropathy as the primary renal disease.

Table 3. Frequency of abnormal levels of immunoglobulin and complement components in our series. (%)

IgG		IgA		IgM		C3		C4	
High	Low	High	Low	High	Low	High	Low	High	Low
92	0	28	2	2	6	36	6	46	10

Lymphocyte phenotyping:

The cellular components of the immune system are identified and isolated by flow cytometry. Analysis results of cell counts, compared with the normal values (Table 4), showed some disturbances.

Table 4. Reference values of lymphocyte subpopulations in adult (in absolute value: cells 10^9 /l). [10, 12]

Leucocytes	LT CD3	LT CD4	LT CD8	LB CD19	NK CD16/CD56	PMNs
1,4 – 3,3	1 – 2,2	0,53 – 1,3	0,33 – 0,92	0,11 – 0,57	0,07 – 0,48	2-7,5

Exploration of subpopulations lymphocyte was performed in 43 patients. All patients in this series have a normal white cell count. However, 22 of 43 patients (51,16%) have lymphopenia.

Lymphopenia or subset deficiency was defined as a value below the 5th percentile of normal values according to age [13].

It was also noticed that the CD4+/CD8+ ratio showed no changes among all patients, because when T cells decrease, both CD4+ and CD8+ are affected.

Also the number of B and NK cells circulating is decreased. In 43 patients, 20 (46.51%) had a decrease in B cell number, while 12 (27.90%) are deficient in NK.

Only one patient showed neutropenia, moreover, it is associated with lymphopenia and a reduced rate of LB and NK.

We analyzed our results about naïve (CD45RA) and memory (CD45RO) T cells, with data reported by Pasquine Saule [14]. Indeed, in 25 patients, we explored distinct- populations in T lymphocytes, naïve and memory. Results are reported in table 5.

Table 5. Results of number of CD4+ and CD8+ T cells subpopulations (% of patients)

T cells	% in CD4+ T cells			% in CD8+ T cells		
	Normal	High	Low	Normal	High	Low
Naïve	84	0	16	52	16	32
Memory (TCM)	12	12	76	52	48	0

Most patients have a normal percentage of naïve TCD4 (84%), while 76% have a deficit in CM TCD4.

The number of patients with Naïve and CM TCD8 normal levels is dominant (52%), but 32% have a low percentage of naïve TCD8. Also 48% of patients have a high percentage of CM TCD8.

CD11b / CD18 are members of the b2 integrin family; Integrin CD11b/CD18 is expressed by neutrophils and monocytes.

Our patients showed high expression of CD11b (88,3%). Only five individuals had a normal expression, they started hemodialysis not more than year. While mean dialysis duration in our patients is 12,04 years $\pm$ 6,12, and 44 patients (88%) were dialyzed for more than 5 years.

A search activation marker CD25 and CD38 was performed only in 10 patients, and preliminary results are in favor of an increase in expression of these markers on T and B lymphocytes.

DISCUSSION

Several hypotheses have been put forward to elucidate the mechanisms of immune system dysregulation in dialysis patients [2].

An intact complement system, at least through C1, C2, C4 and C3, is necessary for a normal humoral immune response [15-16]. Our data indicates a lack of C3 or C4 in 5 patients (10%).

Patients with a deficiency of C3 have a markedly increased susceptibility to infection with encapsulated bacteria. Similarly, patients with a deficiency of one of the early components of the classical pathway, C1, C4, C2 or in factors H and I (inhibitors of the alternative pathway which causes excessive consumption of C3) also have an increased susceptibility to infection, rheumatic diseases and manifested membranoproliferative glomerulonephritis. Similarly, nearly 80% of C1 deficient patients or C4 deficient patients have presented with a collagen vascular disease [15-17].

Accumulating evidence from the past 30 years has shown the involvement of complement in hemodialysis-related inflammation. Though huge progress has been made towards the selection and manufacturing of dialysis filters with better biocompatibility, these efforts have proven to be insufficient at completely eliminating complement activation and related inflammation [18].

In our series, 26 patients (52%) have high levels of C3 and / or C4. While only 17 individuals (34%) who have normal levels of C3 and C4.

Thus, patients undergoing maintenance hemodialysis still suffer from poor quality of life and low long-term survival rates, warranting further analysis of the mechanisms induced complement activation, to block the unwelcomed effects resulting from chronically acute inflammation

Indeed, the development of complement therapeutics targeting specific proteins and pathways may benefit from the reduced production costs of small peptides compared to other types of drugs, ultimately leading to the development of practical, cost-effective treatments to improve the lifestyle of those undergoing hemodialysis. Clearly, the attenuation of inflammatory complications related to hemodialysis through the inhibition of complement activity already shows high promise and may result in urgently desired novel treatment options for patients suffering from ESRD [18].

It is well established that patients with chronic renal failure exhibit peripheral blood lymphopenia, which can explain the decreased number of T cells observed in our study [19, 20].

This decline in T cells affects both CD4+ and CD8+ and that explains why CD4+/CD8+ ratio is not significantly decreased in our patients [21, 22]. However, many authors support the argument that CD4+/CD8+ ratio is significantly reduced in uremia [3, 23, 24, 25, 26-27].

In our study, 76% of patients have a deficit in CM TCD4, 16% are a reduced naïve TCD4, and 32% have a low percentage of naïve TCD8.

The relative proportions of TCM and TEM in blood vary in the CD4 and CD8 compartments [28], may explain that 48% of patients have a high percentage of CM TCD8.

The selective reductions of the naïve and CM T cells in the peripheral blood of ESRD patients may be due either to increased apoptosis or accelerated activation and differentiation of T cells into EM T cell subsets [29-31, 32].

The increased T-lymphocytes apoptosis concerns mainly the naïve and the central memory T-lymphocytes, but not the effector memory T-lymphocytes [25].

In ESRD patients, a functional T and B cell impairment may be accompanied by decreased production of antibodies to specific stimuli by B cells [19], or by allo-reactive T cell recognition of processed auto-antigens, leading to production of auto-antibodies [33]. This would be in keeping with increased levels of immunoglobulines production, simultaneous to decreasing antibody responses to hepatitis B vaccines in our HD patients.

However, it has been documented that Ig levels, serum IgG isotypes, and both IgM and IgA production are normal in dialysis patients [4, 25]. Even more a change of IgG subclasses was reported, with elevated levels of IgG3 prior to immunisation [34].

The reasons for these conflicting results in studies of immunoglobulins in uraemia are unclear, but may result from defective production of antibodies of individual subclasses in response to certain types of antigen but not others [34].

Indeed, the serological response to strong antigenic stimuli such as CMV is not affected in ESRD patients [35]. However, the response to pneumococcal vaccines that do not require generation of antigen-specific T cells for their efficacy is reduced in these patients compared with that of healthy controls [34, 36].

Increased apoptosis has been confirmed for B-lymphocytes in patients with ESRD [25, 37]. Similar to T cells, progressive loss of renal function is associated with a gradual decline in circulating numbers of B cells, eventually leading to marked B-cell lymphopenia [3, 4, 21, 32, 38-39].

The neutrophil is a critical effector cell in both innate and humoral immunity. However, the capacity for bacterial killing carries with it an implicit capacity for host tissue destruction, as observed in inflammatory and autoimmune disease; accordingly, neutrophil function must be tightly regulated [1, 40, 41].

Natural killer cell function in dialysis patients has been analysed previously [13, 42-47], with conflicting results. Some report increases in NK cell numbers [19-48], or decreases in numbers and cytotoxic activity [13, 42-45, 49-51] or no change [46-47]. In our study, Level of NK cells circulating is decreased in 12 patients (27.90%).

A significant negative correlation was detected between age and NK cell cytotoxic activity, a higher age being related to lower NK cell activity [52].

Migration is an essential anti-infection property of PMNs. It is necessary for a rapid mobilization of these cells to the inflammatory site. Several uremic toxins have the ability to inhibit neutrophil migration in response to classical chemoattractants, thereby reducing the number of effector cells to the inflammatory site and therefore bacterial clearance [53-56]. PMNs migration and adhesion to endothelial cells depends on CD11/CD18 [57].

Complement activation by hemodialysis leads to increased CD11b expression. Pre-treatment with compstatin, which blocks C3 convertase activity and prevents C5a and terminal complement complex production, prevented the increases in CD11b expression [18, 58].

Comparing the results regarding neutrophil functions between different studies is difficult due to the diverse methods and the different conditions of the experiments [59].

The time since the start of dialysis should be taken into account in studies of immune function in dialyzed populations [37]. It can explain the high expression of CD11b showed in our patients (88,3%), as they are in dialysis for $12,04 \pm 6,12$ years.

Preliminary results of search activation markers CD25 and CD38 are inconclusive, even if they are in favor of an increase in expression of these markers on T and B lymphocytes.

In the perspective of introduce other activation markers such as CD40 in a study with a significant sample.

CONCLUSION

Disturbances of immunity in HD patients are many and diverse. They are caused by uremia per se, the HD procedure, complications of chronic renal failure, and therapeutic interventions for their treatment. They involve both, the innate and the adaptive systems, generating a complex and still not fully understood immune dysfunction.

Interestingly, the main causes of death in patients with chronic kidney disease (CKD) are cardiovascular and infectious diseases, both being pathologic processes closely linked to immune function.

Therefore, measures aimed at attenuating immune abnormalities in ESRD should be a main research area as this could lead to increased survival and better quality of life in HD patients.

DISCLOSURES: None.

CONFLICT OF INTEREST STATEMENT: None declared.

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BREEDING RAM SELECTION AND ITS ROLE IN IMPROVEMENT OF BALOCHISTAN SHEEP BREEDS

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ABSTRACT: An old saying states that “the ram is half the flock”, since his genes will provide one-half of the genetic makeup of his lambs. One of the primary tools which sheep breeders have at their disposal for the improvement of their herds is selection of breeding ram. Rams are the primary means by which genetic improvement can be made in a flock. If the ram's daughters will be retained in the flock for breeding purposes, he should come from a productive ewe or line. His dam should be one of the most productive members of the flock. Therefore choose rams from good ewes.

The selection, of course, is a group term that includes many activities: recording, identifying, and the use of formal programs involving Record of Performance (R.O.P) testing and so on.

In Balochistan sheep farming communities it may not be possible to fulfill the requirements of a sound R.O.P testing mainly due to noncommercial small ruminant production practices and very low level of literacy. However through this article the sheep farmers of the province can be helped in selecting their breeding rams through visual appraisal on certain desired breeding traits/ characters. The farmers in the province mostly practice breed specific selective breeding and like to retain ewe lambs, from their own breeding rams. Therefore much attention is required towards selection of true to type breeding rams. The ram must bear the traits which are heritable and, definable, by visual methods and which have an economic value. The breeding goals in addition to body growth and conformation must emphasise fleece characters such as fibre length, fibre density and above all the wool colour which should be white with minimum grease, etc.). Use only selected rams for breeding and castrate all males so as to enforce the required breeding traits. Strive to keep inbreeding below 5% per generation. As the coefficient of inbreeding (COI, the degree of relatedness) increases in a flock, inbreeding depression may occur, during which fertility, growth, and other reproductive traits tend to decline. Such declines are especially dramatic when the COI reaches or exceeds 30%. It is therefore advised that the sheep breeders exchange breeding rams.

KEYWORDS: Breeding Ram Selection, Balochistan Sheep Breeds.

VISUAL APPRAISAL OF RAM FOR BREEDING

When visually appraising rams, one has to be much more critical than appraising breeding ewes. Just because a ram has testicles doesn't mean he should be allowed to mate with ewes. If a ram has a serious jaw defect or other genetic flaw, many lambs will be potentially affected, including potential replacement lambs.

There are many things to consider when selecting a new ram for your flock. In this leaflet are listed several general factors that are important to keep in mind when selecting that replacement ram.

BREED CHARACTERISTICS

The province of Balochistan is blessed with four sheep breeds, famous for producing carpet quality coarse wool. Every breed has different characteristics therefore if you want to choose a certain breed ram you should first look up all the criteria it takes for it to be considered like that breed. Balochi breed for example is comparatively a larger framed type sheep that is predominantly white bodied with black muzzle, drooping ears and black dots on ears and around eyes. They also have a roman nose which is arched. This is breed specific. Similarly every breed has different things that make them disqualified, for example if a Bibrik, which is all white, has any black spots in the wool that is a disqualification. For sheep farmer's guidance the main characteristics of all four breeds are summarized as:



- i. **Biverrigh (Bibrik):** medium size, fat tail, white body, black or brown muzzle and average adult live weight 27 kg.
- ii. **Balochi:** large size, fat tail, white body, black or brown spots on head, legs and some time on body, average adult weight 34 kg.
- iii. **Harnai:** medium size, fat tail, body predominantly white, black or brown spots on ears and face, average adult body weight 30-32 kg.
- iv. **Rakhshani:** medium to small size, fat tail, white body, white head, black and brown muzzle, finer wool, average adult body weight 28-30 kg.

CONFORMATION OR STRUCTURAL CORRECTNESS

Choosing a ram that is structurally sound is very important. Therefore choose a ram that structurally has the ability to breed ewes on the terrain of your production facility. When looking for structural correctness keep these things in mind: the legs should be straight with good heavy stout bones. Front legs should be set under the animal and not out at sides. Pasterns should be short with toes pointing straight ahead. An animal should walk with a long, smooth stride and should track as wide or wider on the hind legs as the front legs. Therefore select a Ram that is sound, is in good physical condition and free from serious defects. A sound animal will survive and be productive for a longer time than an animal which has physical problems.



HEALTH

When selecting ram for breeding, the most important criteria is health. Starting with unhealthy ram dooms the shepherd to failure. A healthy ram is bright and alert. It does not separate itself from the rest of the flock. It is in good body condition, relative to its stage of production and plane of nutrition. Ram that limp, has abscesses, pink eye, or sore mouth lesions, show respiratory symptoms, or is in extremely poor body condition should not be considered for breeding.



GROWTH AND DEVELOPMENT

Growth and development is another important aspect in selecting a new ram. You should not select a ram that produces lambs that are slow growing and mature out at a smaller size and structure. This is important and great way to see how a ram produces would be to look at his sire and see all the lambs he has produced and how they look compared to him. If you are selecting an older established ram to purchase then you should go to the farms when lambs are on the ground to see what type of lambs he generally produces and compare the farmers' ewes to yours to get an idea what he might do for your flock.



TESTICLE SIZE

When selecting a replacement ram you must analyze testicle size. Testicle size is directly related to fertility. Larger testicles indicate more sperm producing ability. Though scrotal size varies by breed, body condition, and season, ram lamb to be used for breeding should have a scrotal size of at least 30 centimeters; mature rams, 32 centimeters. Scrotal size affects a ram's semen output. There are also correlations between a ram's scrotal size and the reproductive performance of his daughters. Therefore while choosing a Ram Scrotal Circumference can also be used as an analytical tool. A general rule of thumb states that any ram prospect with a Scrotal Circumference under 30 cm should not be used. In addition, the ram's testicles should be palpated to determine that they are well-developed and normal. They should be firm, evenly sized, and move freely within the scrotum.



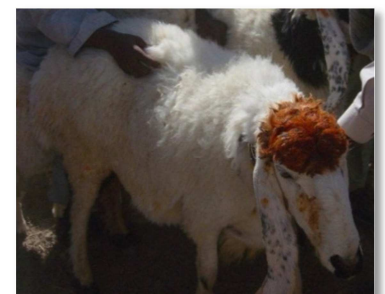
TEETH

The condition of a ram's teeth depends upon its diet and the land where it lives. Animals on a rough, coarse diet will grind their teeth away faster than animals on an easily eaten diet. The molar teeth are far more important than the incisor teeth. They do the grinding of feed. To evaluate the molar teeth, you have to feel on the outside of the cheek and jaw. Bad breath can be a sign that there is something wrong with the molar teeth. Animals with teeth problems should be not selected for breeding.



WOOL

When wool production is an important aspect of the sheep enterprise, breeding ram selection criteria should include fleece traits: fiber diameter, staple length, uniformity of length and diameter, and freedom from defects. White-wooled sheep should be free from colored fibers. Fleeces should be dense and free from Kemp and medulated fibers. Rams that have excessive wrinkles should not be selected for breeding. For the guidance of project farmers the wool characteristics of all four breeds are summarized as:



- I. **Biverrigh (Bibrik):** Fleece weight-1.54 Kg/year, wool colour 100% white, staple length 5.2 cm with fibre diameter 43.5 microns, true wool fibres 59.4%.
- II. **Balochi:** Fleece weight-2.4 Kg/year, wool colour 100% white, staple length 5.2 cm with fibre diameter 43.5 microns, true wool fibre 68.9 %.
- III. **Harnai:** Fleece weight-1.37 Kg/year, wool colour 90 % white, staple length 7.0 cm with fibre diameter 30.7 microns, true wool fibres 76.7%.
- IV. **Rakhshani:** Fleece weight-0.9 Kg/year, wool colour 95.5% white, staple length 7.3 cm with fibre diameter 30.9 microns, true wool fibres 70.8%.

Hash Table Collision Resolution Using a Multi-dimensional Array

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ABSTRACT: This paper presents a new and innovative technique for handling collisions in hash tables based on a multi-dimensional array. The proposed strategy followed the standard ways of evaluating and implementing algorithms to resolve collisions in hash tables. This technique is an effective way of handling the problem of collisions in hash table slots or cells but at a slight expense of space. It was discussed that an optimal representation of this scheme is to minimize or completely remove the empty spaces created within the array.

KEYWORDS: Open Addressing, Separate Chaining, Linear Probing, Quadratic Probing, Double hashing, Hash Function

1 INTRODUCTION

Open addressing and separate chaining are the 2 broad ways of collision resolution to be reviewed. They play a vital role in the analysis and discussions [1]. In open addressing, all elements are stored in the hash table itself. Table slots are systematically examined during search until the desired element is found. Elements are not stored outside the table. This is not the case for separate chaining where elements are stored outside of the hash table by means of linked lists. Three techniques are commonly used to compute probe sequences required for open addressing: linear probing, quadratic probing, and double hashing. These techniques all guarantee that $(h(k,0), h(k,1), \dots, h(k,m-1))$ is a permutation of $(0,1,\dots,m-1)$ for each key k . However none of these techniques fulfills the assumption of uniform hashing [2].

1.1 LINEAR PROBING

In linear probing, original hash value is taken and successive values of a linear nature are added to the starting value. Linear probing uses the hash function $h(k,i) = (h(k) + i) \bmod m$ for $i=0, 1, \dots, m-1$. It suffers from primary clustering even though it is easy to implement. Clusters arise since an empty slot preceded by i full slots gets filled next with probability $(i+1)/m$. The average search time for linear probe increases due to the building up of long runs of occupied slots [2].

1.2 QUADRATIC PROBING

In quadratic probing, original hash value is taken and successive values of an arbitrary quadratic polynomial are added to the starting value. The idea here is to skip regions in the table with possible clusters [3]. It uses the hash function of the form:

$$h(k, i) = (h(k) + i^2) \bmod n \quad \text{for } i = 0, 1, 2, \dots, n-1 \quad [3]$$

1.3 DOUBLE HASHING

Double hashing is another method of collision resolution, but unlike the linear collision resolution, double hashing uses a second hashing function which normally limits multiple collisions. The idea is that if two values hash to the same spot in the table, a constant can be calculated from the initial value using the second hashing function which can then be used to change the sequence of locations in the table, but still have access to the entire table [4].

1.4 SEPARATE CHAINING

This is a collision resolution technique where linked list of items are chained to the various addresses of the hash table depending on where the keys hash to. Multiple lists could be created or built and these lists have to be maintained. In separate chaining, items that collide are chained together in separate linked lists. In the open addressing schemes, keys are converted into table addresses. As with elementary sequential search, lists can be kept in a sorted or unordered order. For separate chaining, the time savings are less significant (because the lists are short) and the space usage is more significant (because there are many lists) [5].

2 MATERIALS AND METHODS

Secondary data was used for the analysis basically from literature, journals, websites, and lecture notes. The NOF algorithm was implemented in C++ programming language using Dev-C++ IDE. The concept of multi-dimensional arrays was adopted in the design of the NOF collision resolution strategy.

3 RESULTS

The NOF strategy or technique is implemented as an algorithm and is expressed as a pseudocode. It is then implemented using C++ programming language. Further illustration is given with respect to how the algorithm functions.

3.1 PSEUDOCODE

```
Declare variables: key, size, rem, j, assign
Declare arrays: h[size], arr[size][size]
Assign zero to rem
Assign zero to j
Assign zero to max
FOR a=0 to size
    FOR b=0 to size
        Assign zero to arr[a][b]
    END FOR
END FOR

FOR i=0 to size
    Prompt user to enter a key
    Get key

    Compute rem as key%size
    Assign zero to j
    Assign 'false' to assign

    DO
        IF arr[rem][j] is equal to zero
            Assign key to arr[rem][j]
            Assign 'true' to assign
        ELSE
            Increment j by 1
        END IF
    WHILE assign is equal to 'false'
```

END FOR

End Line

FOR a=0 to size

 Display a

 FOR b=0 to size

 IF arr[a][b] is greater than zero

 Display arr[a][b]

 END IF

 End Line

END FOR

END FOR

3.2 C++ IMPLEMENTATION

```
#include<iostream>
#include<iomanip>
using namespace std;
int main()
{
    int key, size, rem=0, j=0;
    bool assign;

    //Accepting the size of the hash table
    cout<<"Please specify the size of hash table:";
    cin>>size;
    int h[size], arr[size][size];

    //Initializing the array
    for(int a=0;a<size;a++)
        for(int b=0;b<size;b++)
            arr[a][b]=0;

    //Accepting the keys, hashing and placing them in appropriate location in array
    for(int i=0;i<size;i++)
    {
        cout<<"Please enter the keys to be hashed:";
        cin>>key;

        rem=key%size;
        j=0;
```

```

        assign=false;

        do
        {
            if(arr[rem][j]==0)
            {
                arr[rem][j]=key;
                assign=true;
            }
            else
                j++;

        }while(assign==false);

    }

    cout<<endl;

    //Displaying the contents of the array
    for(int a=0;a<size;a++)
    {
        cout<<a;
        for(int b=0;b<size;b++)
            if(arr[a][b]>0)
                cout<<setw(5)<<arr[a][b];

        cout<<endl;
    }

    return 0;
}

```

3.3 BIG O NOTATION

```

#include<iostream>
#include<iomanip>
using namespace std;
int main()
{
    int key, size, rem=0, j=0;

```



```
bool assign;
```

```
//Accepting the size of the hash table
```

```
cout<<"Please specify the size of hash table:";
```

```
cin>>size;
```

```
int h[size], arr[size][size];
```

```
//Initializing the array
```

```
for(int a=0;a<size;a++)
```

```
    for(int b=0;b<size;b++)
```

```
        arr[a][b]=0;
```

$O(N)$

$O(N)$

```
//Accepting the keys, hashing and placing them in appropriate location in array
```

```
for(int i=0;i<size;i++)
```

```
{
```

```
    cout<<"Please enter the keys to be hashed:";
```

```
    cin>>key;
```

```
    rem=key%size;
```

```
    j=0;
```

```
    assign=false;
```

$O(1)$

$O(1)$

$O(1)$

$O(N)$

```
    do
```

```
    {
```

```
        if(arr[rem][j]==0)
```

```
        {
```

```
            arr[rem][j]=key;
```

```
            assign=true;
```

```
        }
```

```
        else
```

```
            j++;
```

$O(1)$

$O(1)$

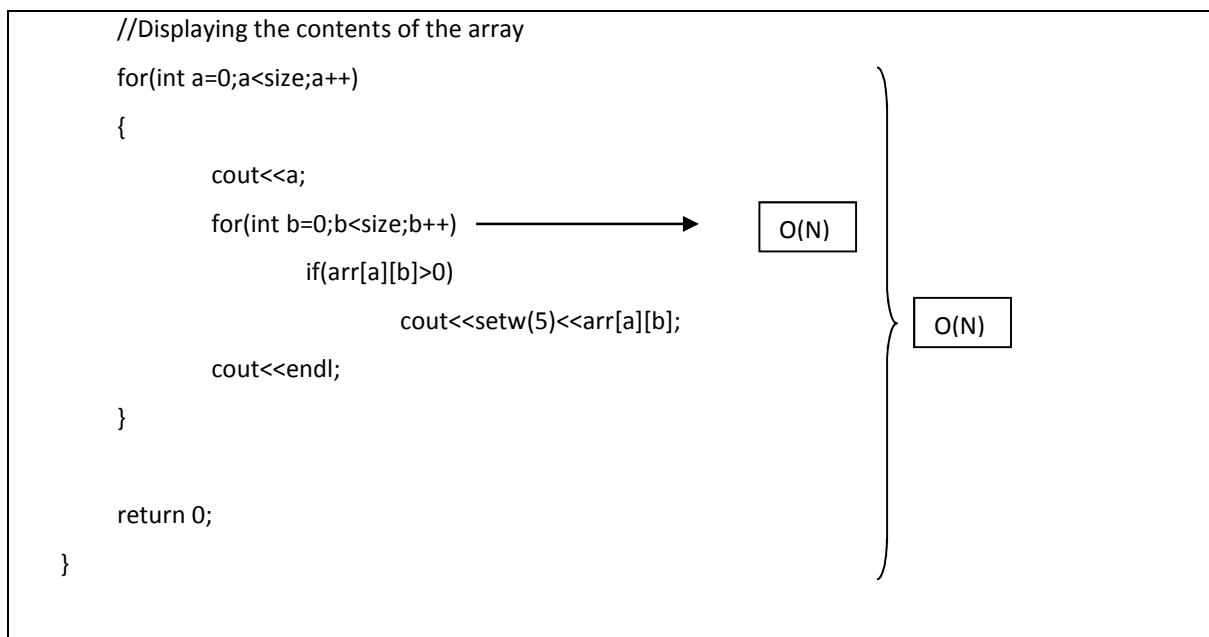
$O(1)$

$O(N)$

```
    }while(assign==false);
```

```
}
```

```
cout<<endl;
```



Big O-Notation Time Efficiency Analyses

$$T(N) = [O(N)(O(N)+O(1))] + [O(N)(O(1)+O(1)+O(1)+O(N)(O(1)+O(1)+O(1))] + [O(N)(O(N))]$$

$$T(N) = [O(N^2) + O(N)] + O(N) + O(N) + O(N) + O(N^2)(O(1)+O(1)+O(1)) + O(N^2)]$$

$$T(N) = [O(N^2) + O(N) + O(N) + O(N) + O(N) + O(N^2) + O(N^2) + O(N^2) + O(N^2)]$$

$$T(N) = [O(N^2) + O(N^2) + O(N^2) + O(N^2) + O(N^2) + O(N) + O(N) + O(N) + O(N)]$$

As $N \rightarrow \infty$ all constants can be ignored

$$T(N) \approx [O(5N^2) + O(4N)]$$

In this case as N becomes very large $O(N^2)$ is considered the most significant factor of the Big O-Notation obtained from the above $T(N)$ deductions. Hence in the worst case scenario the algorithm's time efficiency complexity can be measured by $T(N) = O(N^2)$

3.4 ILLUSTRATION

Step by step operations are outlined using linear probe, separate chaining and NOF (algorithm being proposed). The elements to be hashed are 45, 67, 25, 13, 23, 5 and 88.

3.4.1 LINEAR PROBING

The hash function is given by $h(x) = x\%7$

For the 1st Element ($x=45$)

$$h(45) = 45\%7 = 3$$

This implies the 1st element will be stored in slot 3 of bucket array.

For the 2nd Element ($x=67$)

$$h(67) = 67\%7 = 4$$

This implies the 2nd element will be stored in slot 4 of bucket array.

For the 3rd Element ($x=25$)

$$h(25) = 25\%7 = 4$$

This implies the 3rd element will be stored in slot 4 of bucket array.

For the 4th Element ($x=13$)

$$h(13) = 13\%7 = 6$$

This implies the 4th element will be stored in slot 6 of bucket array.

For the 5th Element ($x=23$)

$$h(23) = 23\%7 = 2$$

This implies the 5th element will be stored in slot 2 of bucket array.

For the 6th Element ($x=5$)

$$h(5) = 5\%7 = 5$$

This implies the 6th element will be stored in slot 5 of bucket array.

For the 7th Element ($x=88$)

$$h(88) = 88\%7 = 4$$

This implies the 7th element will be stored in slot 4 of bucket array.

Table 1: Hash Table Representation

0		
1		
2	23	5 th Element
3	45	1 st Element
4	67	2 nd Element
5	25	3 rd Element here due to collision at slot 4
6	13	4 th Element

Analysis

- The 3th Element (25) should have gone to slot 4 but there is a collision since the element 67 is already occupying that slot. The next available slot (slot 5) was empty hence element 25 was placed there.
- The 6th Element (5) which should have been stored in slot 5 is occupied by element 25. The next slot which is slot 6 is occupied. Afterwards, there is no next available slot due to the incremental approach adopted by linear probing.
- Again the 7th Element (88) which should have been stored in slot 4 is occupied by element 67. The next slot which is slots 5 and 6 are occupied. Afterwards there is no next available slot due to the incremental approach adopted by linear probing even though slot 0 and 1 are empty.

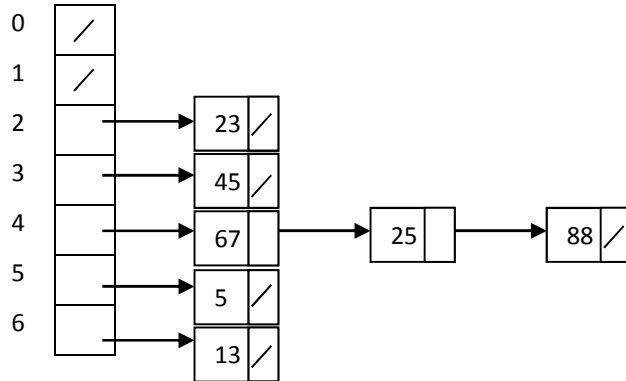
Limitations

- The hash table is not full to capacity yet not all the elements can be stored in the hash table due to the incremental approach adopted by the linear probe. For instance element 5 had to be stored in slot 5 but then that slot is occupied. So the next available slots which could have stored the element were not available. Hence there is a dead end.
- The hash function should have placed elements in specific slots but because of collision they have been displaced or moved elsewhere. Hence relating some of the elements to their corresponding slots is complex.

3.4.2 SEPARATE CHAINING

Using the same function $h(x) = x\%7$ and the elements (45, 67, 25, 13, 23, 5 and 88), separate chaining using linked list is represented in Table 3 below.

Table 2: Hash Table Representation



Limitations

- The hash table is not optimally used because there are empty slots at 0 and 5.
- Keeping track of the multiple linked lists becomes extremely difficult.

3.4.3 NOF

The hash function is given by $h(x) = x\%7$

For the 1st Element ($x=45$)

$$h(45) = 45\%7 = 3$$

This implies the 1st element will be stored in row 3, column 0 of the $n \times n$ array.

For the 2nd Element ($x=67$)

$$h(67) = 67\%7 = 4$$

This implies the 2nd element will be stored in row 4, column 0 of the $n \times n$ array.

For the 3rd Element ($x=25$)

$$h(25) = 25\%7 = 4$$

This implies the 3rd element will be stored in row 4, column 1 of the $n \times n$ array.

For the 4th Element ($x=13$)

$$h(13) = 13\%7 = 6$$

This implies the 4th element will be stored in row 6, column 0 of the $n \times n$ array.

For the 5th Element ($x=23$)

$$h(23) = 23\%7 = 2$$

This implies the 5th element will be stored in row 2, column 0 of the $n \times n$ array.

For the 6th Element ($x=5$)

$$h(5) = 5\%7 = 5$$

This implies the 6th element will be stored in row 5, column 0 of the $n \times n$ array.

For the 7th Element ($x=88$)

$$h(88) = 88\%7 = 4$$

This implies the 7th element will be stored in row 4, column 2 of the $n \times n$ array.

Table 3: Hash Representation

Row numbers of the $n \times n$ array (7 x 7)

	0	1	2	3	4	5	6
0							
1							
2	23						
3	45						
4	67	25	88				
5	5						
6	13						

A better approach will be to use an $n \times m$ array where n is equal to the size of the hash table and m is equal to the number of elements in the row with the highest number of elements. In the case above, the maximum number of elements in row 4 is 3. Hence the value of m is 3. The new look of the array (7 x 3) is shown below in Table 4.

Table 4: Hash Representation

Row numbers of the $n \times m$ array

	0	1	2
0			
1			
2	23		
3	45		
4	67	25	88
5	5		
6	13		

Limitations

- The multidimensional array is not optimally used because there are empty slots or cells, hence not very efficient storage-wise.

4 DISCUSSION

Studies review that there are other approaches for resolving collision in hash tables. Most common schemes such as linear probing, quadratic probing, double hashing, and separate chaining have some shortfalls. For example, performance is degraded in linear probing as the hash table get nearly full; in quadratic probing, there is no guarantee of finding an empty cell once the table gets more than half full. The proposed scheme is not very different in terms of disadvantages. Its primary issue of concern is the unutilized empty spaces which makes the scheme not efficient storage-wise. Despite this concern, it is proven to be very effective and efficient in collision resolution. In the implementation of NOF, a further and better representation of the array size which was trimmed down or resized enhanced the space utilization though it could not

eliminate it completely. It could be realized that an optimal implementation of the above technique is to remove or de-allocate the empty spaces.

5 CONCLUSION

NOF (an abbreviation for Nimbe-Opoku-Frimpong) is a collision resolution strategy experimented on numeric values. NOF is being proposed and is earnestly hoped it will add to the body of knowledge due to the fact that it has resolved the problem of collisions in hash tables. The adoption of NOF will in effect eliminate primary clustering and deterioration in hash table efficiency; which are common in the open addressing schemes. Future works to resolve collisions in hash tables will be conducted with other data structures.

ACKNOWLEDGMENT

It has been God's grace and revelation that this paper has been completed. All praises and gratitude is given unto God. Amen! Families and Friends are acknowledged for their encouragement and unyielding support. Reviewers and experts are also shown gratitude for their assessments, contributions and comments towards this paper.

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Evaluating the Critical Factors for Electronic Medical Record Adoption Using Fuzzy Approaches

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ABSTRACT: Using Electronic Medical Records (EMRs) has a great possibility for rising physician's performance in their daily work which improves quality, safety and efficiency in healthcare that are slowly being adopted throughout the world. The adoption of EMRs as a new technology in healthcare system is an important issue which has to be scrutinized as well. In physician practices, the rate of EMRs adoption has been slow and restricted in spite of the cost savings through lower administrative costs and medical errors related to EMR systems. Hence, this research is conducted to identify, categorize, and analyze Meso-level dimension which introduced by [27], for the adoption of EMRs in the healthcare context. To collect data, Likert-based and pairwise questionnaires were designed and distributed among the public experts and physicians healthcare organizations. Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (F-TOPSIS) and Fuzzy Analytic Hierarchy Process (F-AHP) was applied involves in quantitative approach in the ranking and weighting of the factors presented in Meso-level dimension framework. As a result, in this study, we develop a Multi Criteria Decision Making (MCDM) framework for healthcare industry improvement and adoption of EMR. The purpose of ranking and weighting using the F-TOPSIS and F-AHP is to inspect which factors are most imperative in EMRs adoption among primary care physicians. Performing F-TOPSIS and F-AHP is as novelty methods in this study for identifying the critical factors of EMRs adoption to assist healthcare organizations specifically hospitals setting in pursuing their key users' behavior towards accepting of this new technology. We find that seven factors, namely time investment, screen/room, hybrid system, planning, resource training, workflow, and weight, are the most influential criteria and strongest drivers in the adoption of EMR in Malaysia's primary care setting.

KEYWORDS: EMRS, Adoption, Fuzzy TOPSIS, Fuzzy AHP, Meso-Level Adoption Factors, HIS.

1 INTRODUCTION

Currently, there is a vast investment in Information Technology (IT) by healthcare providers that looked at the development and adoption of Hospital Information System (HIS) for instance Electronic Medical Records (EMRs) [1,2,21,22]. IT is utilized by physicians for billing purposes, but unfortunately the number incorporating IT into their practices for clinical purposes such as EMRs are low [8]. According to [43] "It is estimated that the healthcare industry is at least ten years behind other industries in terms of IT investment". Despite ITs' increasing ubiquity, decreasing costs, and the potential for benefits in the clinical decision-making process, the low rate of adoption occurs among physicians practices specifically in developing countries [16,18,21,47]. Healthcare organizations are dissimilar from organizations operating within other business contexts, especially about individual autonomy and operational independence [17]. EMRs adoption has been attracted by little interest

in the Management Information Systems (MIS) literature [30]. In this research, an EMR explained as a computerized HIS where provider's record detailed encounter information such as patient demographics, encounter summaries, medical history, allergies, intolerances, and lab test histories. Some may support order entry, results management and decision support and some may also contain features or be integrated with software that can schedule appointments, perform billing tasks, and generate reports. The level of primary care in medical area is becoming a core and essential part of healthcare community. The term of "general practice" was considered to refer to the same care setting as the term "primary care". Primary care is defined as the first point of contact a patient has with the health system and usually refers to family practice. This is the point where people receive care for most of their everyday health needs [28].

In this research, the Meso-level factors has been investigated which previous studies indicating its significant effect on adoption of EMRs. The framework of three dimensions consisting of Micro, Meso, and Macro-level for EMR success developed by Lau et al. [27], in systematic review study. Their study described the impact of EMR on physician practices in physicians' office setting [27]. Basically, this study applied the proposed framework in Malaysia as a successful developing country to identify the crucial factors influencing EMR adoption among primary care physicians. In addition, this research seeks to validate the developed framework to foster IT innovation in context of healthcare in increasing the advantages of serving a better and faster service by facilitating and extending such innovation among medical professionals. Therefore, the crucial factors in Meso-level framework are determined to increase the knowledge of hospitals in adopting of EMRs among medical professionals specially physicians as important users of such a technology. In addition, this study provides contextual analyses of the factors by conducting two effective methods to contribute in further understanding of the EMRs adoption.

The remainder of this paper is structured as follows. The Section 2 introduces the proposed research model of this study. In Section 3, the research methodology has been described step by step. Section 4, 5 and 6 allocated to the data collection and background mathematical of F-TOPSIS and F-AHP, respectively. Finally, we present the results of F-TOPSIS, F-AHP and conclusion in Sections 7 and 8, and 9 respectively.

2 PROPOSED RESEARCH MODEL

The EMR adoption model of physician in primary care provides a conceptual model to identify the most determinant factors that have a more significant effect on adoption of EMRs. This study will evaluate and extend Clinical Adoption (CA) framework which developed through a systematic review study conducted by Lau et al. [27] which was based on aforementioned dimensions. Their study was based on DeLone and McLean [13] with regard to the IS success model that was followed. Lau's CA framework comprised of Micro, Meso and Macro-level dimensions. Each dimension has its own category and sub-category which would influence physicians in EMRs adoption. In the current research, it has been concentrated on the Meso-level of a particular framework. At Meso-level, the adoption framework of primary care physician explains Clinical Information System Success (CISS) in particular of the EMRs system. In this study, EMR adoption has been examined in practice of physicians in primary care setting through the lens of CA framework. Hence, this study concentrated on Meso-level dimension combining of the relevant criteria that influence an EMR adoption. At the end, the proposed model of physician adoption model in Meso-level dimension developed and showed in Figure 1. At the Meso-level dimension, there are three main factors, including people, organization and implementation. The following described each of the main factors in detail and its sub factors respectively.

People are the integral part of the system success that may adopt or refuse the new technology based on their characteristics, expectations and responsibilities. Factors in the context of people covers personal characteristics and expectations like the prior EMRs experience of the users [45], and their personal time investment in exchange for the benefits expected from the system [29]. Roles/responsibilities included the need for champions and staff participation [5], and a shift in tasks (documentation by staff VS physicians) [28,29]. That could lead to role ambiguity and conflict [11]. Organization factors covered structure/processes and culture that emphasized EMRs adoption/use [11], EMRs-practice fit (hybrid EMRs/paper systems), and EMRs-supported office and workflow design [11] such as the placement of computer screens in consulting rooms. Return-on value concentrated on verified value at the practice level, such as the replacement effect from guideline driven test orders and prescribing, and tangible cost-efficiency gain with larger practice size and patient volume [32]. Factors in the context of implementation covered the area that the introduction of EMRs into the practice was designed and conducted as a priority project with devoted time and resources [42]. The service support provided during implementation was essential [38], since they influenced the disruptions that physicians and office staff had to defeat while learning to use the EMRs and redesign their work routines.

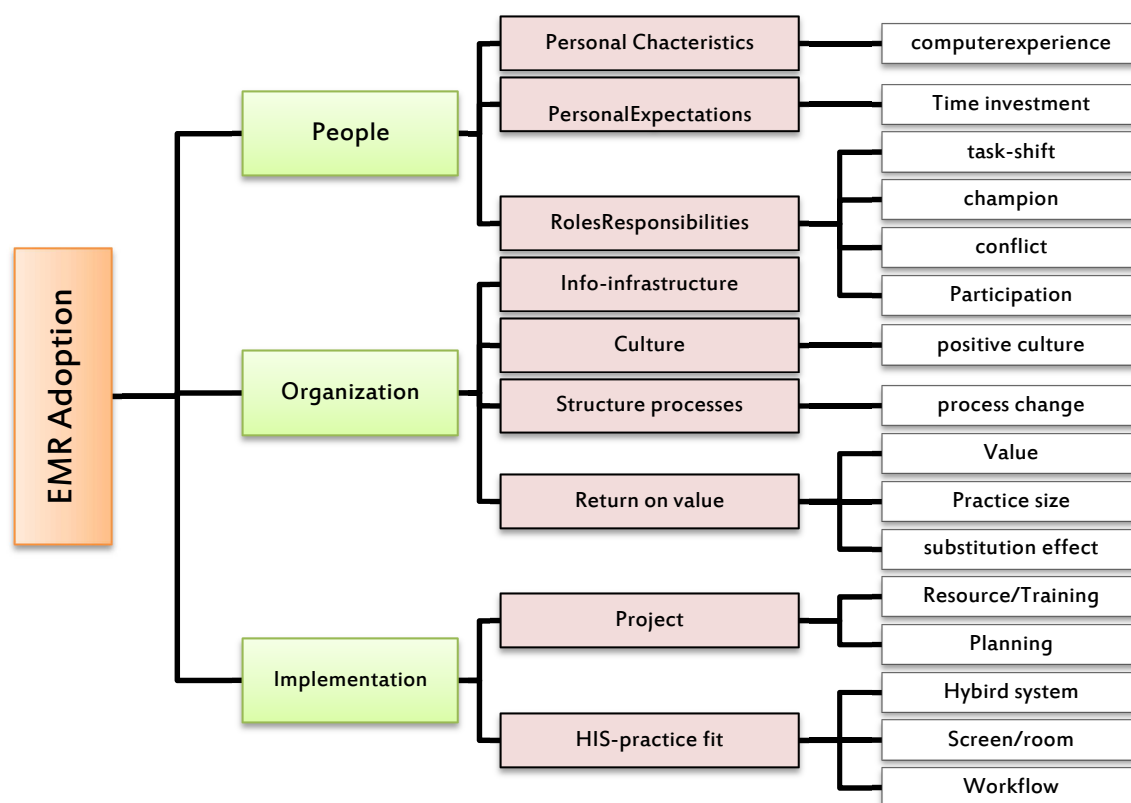


Fig. 1. Physician EMR Adoption Model in Meso-Level

3 RESEARCH METHODOLOGY

EMR in the study at hand has been considered as a new technology in primary care which has been trying to describe the factors which have the more priority in its adoption. A set of pairwise questionnaire and Likert questionnaire, pertain to the survey-based study was carried out and analyzed to determine and explaining the most influential criteria that have an impact on EMR adoption. Eight Malaysian primary care clinics in various specialties have been chosen to conduct this research. 12 experts with experiencing of EMR system was chosen to fulfill the set of pairwise questionnaire to more validating the findings of this study and the Likert questionnaire survey was emailed in electronic website to 350 physicians who work in office settings in the Malaysia primary care. In overall, 12 experts and 300 physicians fulfilled the questionnaire in this study and the rest did not complete due to their time constrain. The survey contains numbers of questions that were designed to capture information about the constructs in the developed research model. The items that were measured were based on people, organization and implementation dimensions with their relevant sub-factors. F-TOPSIS and F-AHP were used to obtain the ranks and weights of parameters in Meso-level dimension of EMRs adoption. Figure 2, contains a description of each step taken by the present study.

Table 1. Meso-Level dimension influenced EMRs adoption

People	People sub-factors	References
Individuals-groups	Personal characteristics	[45]
	Computer experience	
	Personal expectations	[23,28,29,39]
	Time investment	
	Roles-responsibilities	[23,31,44,5,11]
	Task shift	
	Champion	
	Conflict	
	Participation	
Organization	Organization Sub-factors	References
Strategy	Culture	[4,11,12]
	Structure-processes	
	Info-infrastructure	[29,32]
	Return on value	[32]
	Value	
	Practice	
	Substitution effect	
Implementation	Implementation Sub-factors	References
Stage	Project	[9,11,38,42,46]
	Resource/training	
	Planning	
	HIS-Practice Fit	
	Hybrid system	
	Screen/room	
	Workflow	

4 DATA COLLECTION

In this study, the primary data was collected through 2 sets of pairwise and Likert questionnaires which delivered to the physicians and experts in using the EMR system. One of the ways in which questionnaire can be administered is the emailed questionnaire; one of the most general approach to collecting information is to send the questionnaire to prospective respondents by email. Obviously, this approach presupposes that should have access to their addresses. In this research, the questionnaires by email applied by researchers as an efficient and effective instrument to collect data from the respondents. For this study, numbers of respondents for first pairwise questionnaire, were 12 (n=12) experts. Numbers of respondents for a second set of Likert questionnaire, were approximately 350 (n=350) physicians. All experts give the feedback in the pairwise questionnaire. But in the second stage of the questionnaire (Likert) almost (85%) of the respondents provided answers to all the questions in the instrument. The first section comprises of information on respondent demographic profile, twelve sections on the independent variable, namely, personal characteristics, personal expectations, roles, responsibilities, strategy, culture, structure-process, info infrastructure, returns on value, stage, project, HIS practice fit. Five options (index) ranked from 1-5 for the raised questions as: 1= very low important 2=low important 3=moderately important 4= high important 5= very high important. Table 2 provides the respondents' demographic profile. About sixty four percent of physicians were male and almost thirty seven percent were female who as medical professionals in primary care office settings were. For the expert respondents, 12 experts in the field of HIS with expertise in one to over ten years of experience in particular with regard to EMRs technology.

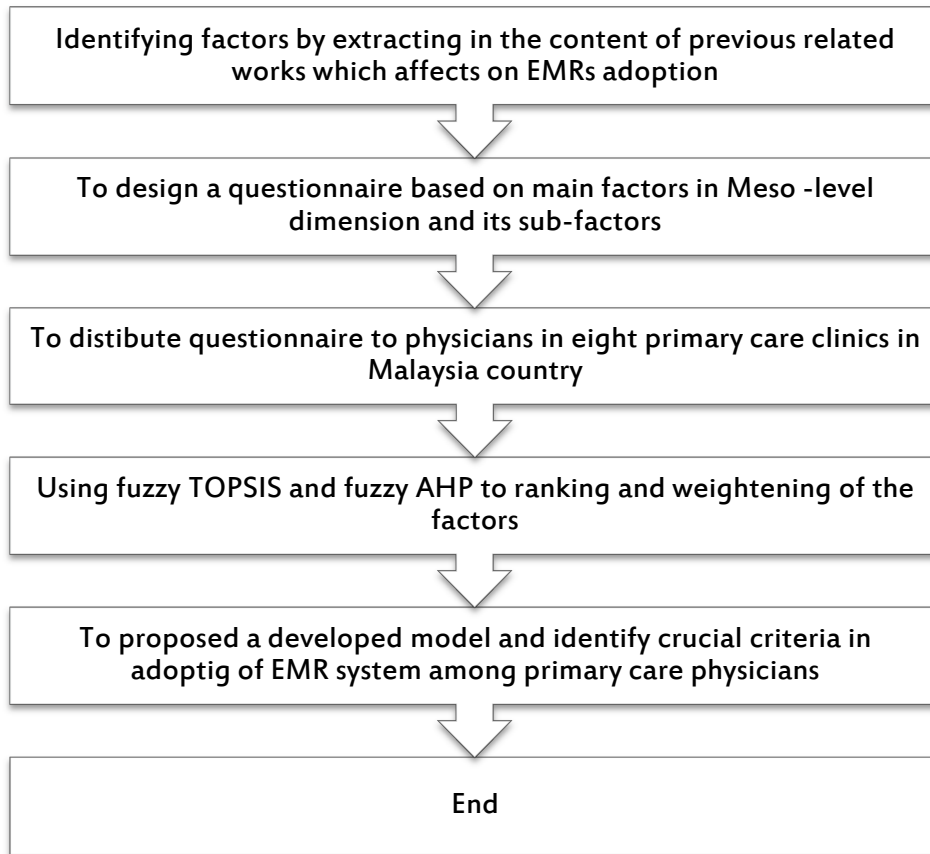


Fig. 2. Research Methodology

5 BACKGROUND OF FUZZY TOPSIS

TOPSIS, one of the known classical MCDM methods [34], was first developed by Hwang and Yoon [19] that can be used with both normal numbers and fuzzy numbers. In addition, TOPSIS is attractive in that limited subjective input is needed for decision makers. The only subjective input needed is weights. Since the preferred ratings usually refer to the subjective uncertainty, it is natural to extend TOPSIS to consider the situation of fuzzy numbers [3]. F-TOPSIS can be intuitively extended by using the fuzzy arithmetic operations as follows [33,36].

Given a set of alternatives, $A = \{A_i \mid i = 1, \dots, n\}$, and a set of criteria, $C = \{C_j \mid j = 1, \dots, m\}$, where $\tilde{X} = \{\tilde{x}_{ij} \mid i = 1, \dots, n; j = 1, \dots, m\}$ denotes the set of fuzzy ratings and $\tilde{W} = \{\tilde{w}_j \mid j = 1, \dots, m\}$ is the set of fuzzy weights.

The first step of TOPSIS is to calculate normalized ratings by:

$$\tilde{r}_{ij}(x) = \frac{\tilde{x}_{ij}}{\sqrt{\sum_{i=1}^n \tilde{x}_{ij}^2}}, \quad i = 1, \dots, n; \quad j = 1, \dots, m \quad (1)$$

and then to calculate the weighted normalized ratings by:

$$\tilde{v}_{ij}(x) = \tilde{w}_j \tilde{r}_{ij}(x), \quad i = 1, \dots, n; \quad j = 1, \dots, m. \quad (2)$$

Table 2. The respondents' demographic profile

Likert Questionnaire			
Aspects	Category	Respondents (n)	Respondents (%)
Gender	Male	190	63.33%
	Female	110	36.66%
Age	26-33	45	15%
	34-50	90	30%
	51-65	165	55%
Medical specialization	Generalist	178	59.33%
	Specialist	122	40.66%
Pairwise Questionnaire			
Gender	Male	3	25%
	Female	9	75%
Age	30-40	4	33.33
	40-45	5	41.66
	45-50	3	25
Years of electronic medical records experience	1-5	4	33.33%
	6-10	5	41.66%
	Over 10	3	25%

Next the Positive Ideal Point (PIS) and the Negative Ideal Point (NIS) are derived as:

$$PIS = \tilde{A}^+ = \{\tilde{v}_1^+(x), \tilde{v}_2^+(x), \dots, \tilde{v}_j^+(x), \dots, \tilde{v}_m^+(x)\} \\ = \{(\max_i \tilde{v}_{ij}(x) | j \in J_1), (\min_i \tilde{v}_{ij}(x) | j \in J_2) | i = 1, \dots, n\} \quad (3)$$

$$NIS = \tilde{A}^- = \{\tilde{v}_1^-(x), \tilde{v}_2^-(x), \dots, \tilde{v}_j^-(x), \dots, \tilde{v}_m^-(x)\} \\ = \{(\min_i \tilde{v}_{ij}(x) | j \in J_1), (\max_i \tilde{v}_{ij}(x) | j \in J_2) | i = 1, \dots, n\}. \quad (4)$$

Similar to the crisp situation, the following step is to calculate the separation from the PIS and the NIS between the alternatives. The separation values can also be measured using the Euclidean distance given as:

$$\tilde{S}_i^+ = \sqrt{\sum_{j=1}^m [\tilde{v}_{ij}(x) - \tilde{v}_j^+(x)]^2}, i = 1, \dots, n \quad (5)$$

And

$$\tilde{S}_i^- = \sqrt{\sum_{j=1}^m [\tilde{v}_{ij}(x) - \tilde{v}_j^-(x)]^2}, i = 1, \dots, n. \quad (6)$$

Where

$$\max\{\tilde{v}_{ij}(x)\} - \tilde{v}_j^+(x) = \min\{\tilde{v}_{ij}(x)\} - \tilde{v}_j^-(x) = 0. \quad (7)$$

Then, the defuzzified separation values should be derived using one of defuzzified methods, such as CoA to calculate the similarities to the PIS. Next, the similarities to the PIS is given as:

$$C_i^* = \frac{D(S_i^-)}{[D(S_i^+) + D(S_i^-)]}, i = 1, \dots, n \quad (8)$$

Where $C_i^* \in [0, 1] \quad \forall i = 1, \dots, n$.

Finally, the preferred orders are ranked according to C_i^* in descending order to choose the best alternatives. Fuzzy-TOPSIS method is another type of fuzzification for the TOPSIS method in fuzzy environment that is defined and investigated by credibility measure. In this method, trapezoid-fuzzy numbers are used for ranking all sub-criteria of website quality. Therefore, using fuzzy trapezoid numbers enabled us to change normal TOPSIS into F-TOPSIS which is more precisely as the result shows in the next paragraph. One of the characteristic of fuzzy numbers is fuzzy sets with special consideration for easy calculations. Trapezoid Fuzzy Numbers Let $\tilde{A} = (a, b, c, d)$, $a < b < c < d$, be a fuzzy set on $R = (-\infty, \infty)$. It is called a trapezoid fuzzy number, if its membership function is:

$$\mu_{\tilde{A}}(x) = \begin{cases} \frac{x-a}{b-a}, & \text{if } a \leq x \leq b \\ 1, & \text{if } b \leq x \leq c \\ \frac{d-x}{d-c}, & \text{if } c \leq x \leq d \\ 0, & \text{otherwise} \end{cases} \quad (9)$$

Figure 4 shows the shape of a fuzzy trapezoid number:

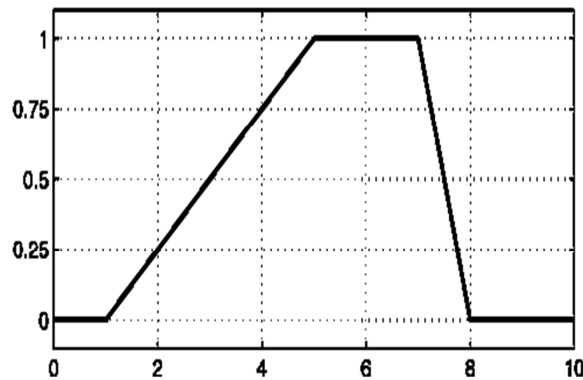


Fig. 3. Fuzzy trapezoid number

All process of F-TOPSIS will be calculated upon three of trapezoid numbers that average numbers of experts are shown in Table 3 and Figure 4:

Table 3. Fuzzy trapezoid number for fuzzy TOPSIS method

Linguistic Variable	Range of Fuzzy trapezoid number
Non Important	[0.6, 0.8, 1.6, 1.8]
Low Important	[1.4, 1.6, 2.5, 2.7]
Moderate	[2.3, 2.5, 3.8, 4]
Important	[3.6, 3.8, 4.6, 4.8]
Very Important	[4.4, 4.6, 5.2, 5.4]

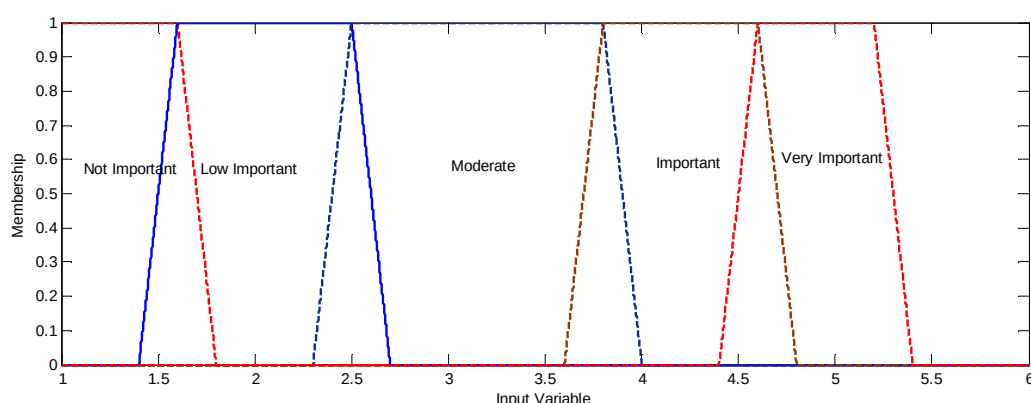


Fig. 4. Illustrating fuzzy trapezoid number for the fuzzy TOPSIS method

6 FUZZY AHP

The Analytic Hierarchy Process (AHP) method was proposed by [40,41]. Among MCDM techniques, it is a powerful approach to solve complex decision problems [20,35,37]. AHP rank and prioritizes the relative importance of a list of criteria in decision making problems. The elements for ranking can be critical factors and sub-factors which through pairwise comparisons amongst the factors by relevant experts using a nine-point scale are prioritized. Fuzzy Analytic Hierarchy Process (F-AHP) was proposed by Buckley (1985) with incorporating the fuzzy theory into the AHP. Buckley [7], started the F-AHP derives more precisely results rather than AHP for vague and subjective decision making problems. Both quantitative and qualitative can be used in F-AHP. In F-AHP, the uncertain comparison, judgment can be represented by the fuzzy number. There are several types of membership functions for F-AHP where triangular fuzzy number is the special class of the fuzzy number whose membership defined by three real numbers, expressed as (l, m, u). The triangular fuzzy numbers are represented as follows:

$$\mu_{\tilde{A}}(x) = \begin{cases} \frac{x-l}{m-l}, & \text{if } l \leq x \leq m \\ \frac{u-x}{u-m}, & \text{if } m \leq x \leq u \\ 0, & \text{otherwise} \end{cases} \quad (11)$$

For constructing pairwise comparisons of alternatives under each criterion or about criteria from the experts, similar to the pure AHP, a triangular fuzzy comparison matrix is defined as follows (it can be any type of membership functions):

$$\tilde{A} = (\tilde{a}_{ij})_{n \times n} = \begin{bmatrix} (1,1,1) & (l_{21}, m_{12}, u_{12}) & (l_{1n}, m_{1n}, u_{1n}) \\ (l_{21}, m_{21}, u_{21}) & (1,1,1) & (l_{2n}, m_{2n}, u_{2n}) \\ (l_{n1}, m_{n1}, u_{n1}) & (l_{n2}, m_{n2}, u_{n2}) & (1,1,1) \end{bmatrix} \quad (12)$$

Where $\tilde{a}_{ij} = (l_{ij}, m_{ij}, u_{ij}) = \tilde{a}_{ij}^{-1} = (1/u_{ij}, 1/m_{ij}, 1/l_{ij})$

Different methods can be used for total weighs and preferences of alternatives which one of them is Fuzzy Extent Analysis proposed by Chang [10]. The steps of Chang's extensive analysis can be summarized as follows:

First step: In this step we compute the normalized value of row sums (i.e. fuzzy synthetic extent) by fuzzy arithmetic operations presented in Equation 13.

$$\tilde{S}_i = \sum_{j=1}^n \tilde{a}_{ij} \otimes \left[\sum_{k=1}^n \sum_{j=1}^n \tilde{a}_{kj} \right]^{-1} . \quad (13)$$

In Equation 13, $\otimes$ denotes the extended multiplication of two fuzzy numbers.

Second step: In this step, we compute the degree of possibility of $\tilde{S}_i \geq \tilde{S}_j$ by Equation 14:

$$V(\tilde{S}_i \geq \tilde{S}_j) = \sup_{y \geq x} [\min(\tilde{S}_j(x), \tilde{S}_j(y))] . \quad (14)$$

This can be equivalently expressed as,

$$V(\tilde{S}_i \geq \tilde{S}_j) = \begin{cases} 1 & m_i \geq m_j \\ \frac{u_i - l_j}{(u_i - m_i) + (m_j + l_j)} & l_j \leq u_i, i, j = 1, \dots, n; j \neq i \\ 0 & otherwise \end{cases} . \quad (15)$$

Third step: In this step, using Equation 16, we calculate the degree of possibility of $\tilde{S}_i$ to be greater than all the other (n-1) convex fuzzy numbers $\tilde{S}_j$.

$$V(\tilde{S}_i \geq \tilde{S}_j \mid j = 1, \dots, n; j \neq i) = \min_{j \in (1, \dots, n) j \neq i} V(\tilde{S}_i \geq \tilde{S}_j), i = 1, \dots, n . \quad (16)$$

Fourth step: In this step, using Equation 17, we define the priority vector $W = (w_1, \dots, w_n)^T$ of the fuzzy comparison matrix $\tilde{A}$ as:

$$w_i = \frac{V(\tilde{S}_i \geq \tilde{S}_j \mid j = 1, \dots, n; j \neq i)}{\sum_{k=1}^n V(\tilde{S}_k \geq \tilde{S}_j \mid j = 1, \dots, n; j \neq k)}, i = 1, \dots, n . \quad (17)$$

7 RANKING PARAMETERS USING FUZZY TOPSIS

For applying F-TOPSIS method after gathering data from the respondents, Table 4 was organized. In Table 4, fuzzy trapezoid numbers have been multiplied to base the fundamental of the F-TOPSIS.

Table 4. Applying fuzzy number on questionnaire data

R_{ij}	Selected Option	Fuzzy Number1				Selected Option	Fuzzy Number2				Selected Option	Fuzzy Number3				Selected Option	Fuzzy Number4				Selected Option	Fuzzy Number5			
Q. No	1	0.6, 0.8, 1.6, 1.8				2	1.4, 1.6, 2.5, 2.7				3	2.3, 2.5, 3.8, 4				4	3.6, 3.8, 4.6, 4.8				5	4.4, 4.6, 5.2, 5.4			
1		0	0	0	0		28	32	50	54		138	150	228	240		360	380	460	480		528	552	624	648
2		0.6	0.8	1.6	1.8		14	16	25	27		69	75	114	120		284.4	300.2	363.4	379.2		792	828	936	972
3		6	8	16	18		28	32	50	54		46	50	76	80		360	380	460	480		660	690	780	810
4		6	8	16	18		56	64	100	108		115	125	190	200		360	380	460	480		440	460	520	540
5		36	48	96	108		56	64	100	108		103.5	112.5	171	180		198	209	253	264		440	460	520	540
6		15	20	40	45		35	40	62.5	67.5		345	375	570	600		360	380	460	480		435.6	455.4	514.8	534.6
7		1.2	1.6	3.2	3.6		28	32	50	54		184	200	304	320		417.6	440.8	533.6	556.8		360.8	377.2	426.4	442.8
8		0.6	0.8	1.6	1.8		1.4	1.6	2.5	2.7		110.4	120	182.4	192		540	570	690	720		440	460	520	540
9		2.4	3.2	6.4	7.2		22.4	25.6	40	43.2		184	200	304	320		288	304	368	384		528	552	624	648
10		6	8	16	18		28	32	50	54		46	50	76	80		360	380	460	480		660	690	780	810
11		6	8	16	18		56	64	100	108		115	125	190	200		360	380	460	480		440	460	520	540
12		3.6	4.8	9.6	10.8		21	24	37.5	40.5		202.4	220	334.4	352		435.6	459.8	556.6	580.8		308	322	364	378
13		3.6	4.8	9.6	10.8		112	128	200	216		27.6	30	45.6	48		511.2	539.6	653.2	681.6		264	276	312	324
14		6	8	16	18		30.8	35.2	55	59.4		92	100	152	160		280.8	296.4	358.8	374.4		660	690	780	810
15		6.6	8.8	17.6	19.8		42	48	75	81		46	50	76	80		320.4	338.2	409.4	427.2		660	690	780	810
16		20.4	27.2	54.4	61.2		84	96	150	162		207	225	342	360		129.6	136.8	165.6	172.8		352	368	416	432

A calculation between two fuzzy trapezoid numbers can be defined as:

$$D1 = (a_1, b_1, c_1, d_1) \Rightarrow D1 + D2 = (a_1 + a_2, b_1 + b_2, c_1 + c_2, d_1 + d_2) \quad (10)$$

$$D2 = (a_2, b_2, c_2, d_2)$$

Therefore, Table 5 was calculated from Table 4 by summing of trapezoid numbers. In the next step, each cell of Table 5 will be divided by 300 in order to make the 16 fuzzy numbers for starting F-TOPSIS (see Table 6).

Table 5. The sum of four trapezoid numbers

Sum of Trapezoid Numbers			
1	2	3	4
1054	1114	1362	1422
1160	1220	1440	1500
1100	1160	1382	1442
977	1037	1286	1346
833.5	893.5	1140	1200
1190.6	1270.4	1647.3	1727.1
991.6	1051.6	1317.2	1377.2
1092.4	1152.4	1396.5	1456.5
1024.8	1084.8	1342.4	1402.4
1100	1160	1382	1442
977	1037	1286	1346
970.6	1030.6	1302.1	1362.1
918.4	978.4	1220.4	1280.4
1069.6	1129.6	1361.8	1421.8
1075	1135	1358	1418
793	853	1128	1188

Table 6. Sixteen fuzzy non trapezoid numbers

$(R_{ij})^2$								
Q. No	a	L1	L2	B	c	d	R1	R2
1	12.34351	0.04	1.405333	13.78884	20.6116	22.4676	0.04	-1.896
2	14.95111	0.04	1.546667	16.53778	23.04	25	0.04	-2
3	13.44444	0.04	1.466667	14.95111	21.22138	23.10404	0.04	-1.922666667
4	10.60588	0.04	1.302667	11.94854	18.37551	20.13018	0.04	-1.794666667
5	7.719136	0.04	1.111333	8.870469	14.44	16	0.04	-1.6
6	15.75032	0.070756	2.111331	17.9324	30.15108	33.14305	0.070756	-3.062724
7	10.92523	0.04	1.322133	12.28736	19.27795	21.07422	0.04	-1.836266667
8	13.25931	0.04	1.456533	14.75584	21.66903	23.57103	0.04	-1.942
9	11.66906	0.04	1.3664	13.07546	20.02264	21.85251	0.04	-1.869866667
10	13.44444	0.04	1.466667	14.95111	21.22138	23.10404	0.04	-1.922666667
11	10.60588	0.04	1.302667	11.94854	18.37551	20.13018	0.04	-1.794666667
12	10.46738	0.04	1.294133	11.80152	18.83849	20.61463	0.04	-1.816133333
13	9.371762	0.04	1.224533	10.6363	16.54862	18.21582	0.04	-1.7072
14	12.7116	0.04	1.426133	14.17774	20.60555	22.46128	0.04	-1.895733333
15	12.84028	0.04	1.433333	14.31361	20.49071	22.34138	0.04	
16	6.987211	0.04	1.057333	8.084544	14.1376	15.6816	0.04	
Sum	135.7516	0.510756	16.57253	152.8349	235.7786	258.1897	0.510756	-19.44725733
SQRT	11.65125	0.714672	4.070937	12.36264	15.35508	16.06828	0.714672	0
1/SQRT	0.085828	1.399243	0.245644	0.080889	0.065125	0.062234	1.399243	0

Therefore trapezoid number will be $(d, c, b, a) = (0.085828, 0.080889, 0.065125, 0.062234)$. Afterward, each cell in Table 6 should be multiplied by $(0.085828, 0.080889, 0.065125, 0.062234)$ that is trapezoid. Table 7 demonstrates result of this multiplication.

Table 7. The 14 fuzzy trapezoid numbers for fuzzy TOPSIS processes

Q.No	n_{ij}				
	a	b	c	d	Area
1	0.768186	0.897998	1.667252	1.928349	0.964708
2	0.930467	1.077023	1.863683	2.1457	1.000946
3	0.836702	0.973691	1.716576	1.982974	0.944579
4	0.660046	0.778149	1.486377	1.727733	0.887957
5	0.480393	0.577689	1.168037	1.373248	0.741602
6	0.980205	1.167848	2.438891	2.844602	1.56772
7	0.679921	0.800214	1.559374	1.808758	0.943999
8	0.82518	0.960974	1.752786	2.023054	0.994843
9	0.726212	0.851539	1.619611	1.875557	0.958709
10	0.836702	0.973691	1.716576	1.982974	0.944579
11	0.660046	0.778149	1.486377	1.727733	0.887957
12	0.651427	0.768574	1.523827	1.769312	0.936569
13	0.583242	0.692689	1.338602	1.563428	0.813049
14	0.791094	0.923325	1.666762	1.927807	0.940075
15	0.799102	0.932174	1.657473	1.917516	0.921857
16	0.434842	0.526506	1.143576	1.34592	0.764074

In this step, for finding minimum and maximum fuzzy trapezoid number for A^+ and A^- , was tried to calculate the area under each of the curve. Each curve forms a trapezoid shape. Table 8 shows minimum and maximum trapezoid numbers with their membership functions. Therefore, the maximum and minimum vectors are for question number 6 and 5, respectively.

In Table 9 the square of the distance between the fuzzy number and the Ideal number, $(v_{ij^-} - v_{j+})^2$, has been calculated. In the similar way, the square of distance between minimum point and each point was calculated that has been shown in Table 10. Finally, d_i^+ and d_i^- can be calculated as presented in Table 11.

Table 8. Maximum and minimum of fuzzy trapezoid numbers for A+ and A-

Max Vi	No.6			
A+	0.980205	1.167848	2.438891	2.844602
Min Vi	No.5			
A-	0.480393	0.577689	1.168037	1.373248

Table 9. The square of distance between maximum point and each point

$(v_{ij^-} - v_{j+})^2$	$(v_{ij^-} - v_{j+})^2$	$(v_{ij^-} - v_{j+})^2$	$(v_{ij^-} - v_{j+})^2$
0.082825	0.102598	0.249215	0.308137
0.202567	0.249334	0.483923	0.596682
0.126956	0.156817	0.300895	0.371766
0.032275	0.040184	0.10134	0.12566
0	0	0	0
0.249812	0.348287	1.615069	2.164881
0.039811	0.049517	0.153145	0.189669
0.118878	0.146907	0.341931	0.422248
0.060427	0.074994	0.203919	0.252314
0.126956	0.156817	0.300895	0.371766
0.032275	0.040184	0.10134	0.12566
0.029253	0.036437	0.126586	0.156867
0.010578	0.013225	0.029092	0.036168
0.096535	0.119464	0.248727	0.307535
0.101576	0.125659	0.239548	0.296227
0.002075	0.00262	0.000598	0.000747

Table 10. The square of distance between minimum point and each point

$(v_{ij^-} - v_{j-})^2$	$(v_{ij^-} - v_{j-})^2$	$(v_{ij^-} - v_{j-})^2$	$(v_{ij^-} - v_{j-})^2$
0.044952	0.072819	0.595427	0.839519
0.002474	0.008249	0.330865	0.488463
0.020593	0.037697	0.521739	0.742402
0.102502	0.151865	0.907283	1.247396
0.249812	0.348287	1.615069	2.164881
0	0	0	0
0.090171	0.135154	0.773549	1.072972
0.024033	0.042797	0.47074	0.674941
0.064512	0.100051	0.671219	0.939047
0.020593	0.037697	0.521739	0.742402
0.102502	0.151865	0.907283	1.247396
0.108095	0.15942	0.837342	1.156247
0.15758	0.225776	1.210636	1.641406
0.035763	0.059791	0.596183	0.840513
0.032798	0.055542	0.610614	0.859488
0.297421	0.411319	1.67784	2.246045

Table 11. The square distance between minimum and maximum for d_i^+ and d_i^-

d_i^+				d_i^-			
0.082825	0.102598	0.249215	0.308137	0.044952	0.072819	0.595427	0.839519
0.202567	0.249334	0.483923	0.596682	0.002474	0.008249	0.330865	0.488463
0.126956	0.156817	0.300895	0.371766	0.020593	0.037697	0.521739	0.742402
0.032275	0.040184	0.10134	0.12566	0.102502	0.151865	0.907283	1.247396
0	0	0	0	0.249812	0.348287	1.615069	2.164881
0.249812	0.348287	1.615069	2.164881	0	0	0	0
0.039811	0.049517	0.153145	0.189669	0.090171	0.135154	0.773549	1.072972
0.118878	0.146907	0.341931	0.422248	0.024033	0.042797	0.47074	0.674941
0.060427	0.074994	0.203919	0.252314	0.064512	0.100051	0.671219	0.939047
0.126956	0.156817	0.300895	0.371766	0.020593	0.037697	0.521739	0.742402
0.032275	0.040184	0.10134	0.12566	0.102502	0.151865	0.907283	1.247396
0.029253	0.036437	0.126586	0.156867	0.108095	0.15942	0.837342	1.156247
0.010578	0.013225	0.029092	0.036168	0.15758	0.225776	1.210636	1.641406
0.096535	0.119464	0.248727	0.307535	0.035763	0.059791	0.596183	0.840513
0.101576	0.125659	0.239548	0.296227	0.032798	0.055542	0.610614	0.859488
0.002075	0.00262	0.000598	0.000747	0.297421	0.411319	1.67784	2.246045

As can be seen in Table 12 and Figure 5, first rank goes to the question number 2 with the area under the curve 2.39; the second rank is for question number 15 with the 2.3 area under the curve and so on.

Table 12. Ranked parameters by fuzzy TOPSIS

Parameters ranking by Fuzzy TOPSIS	
Area	Question No.
0.178	1
0.2	5
0.34	8
0.4	6
0.45	7
1.09	3
1.24	11
1.28	8
1.3129	4
1.32	10
1.61	9
1.8	16
2.0192	12
2.0643	13
2.1869	14
2.3	15
2.39	2

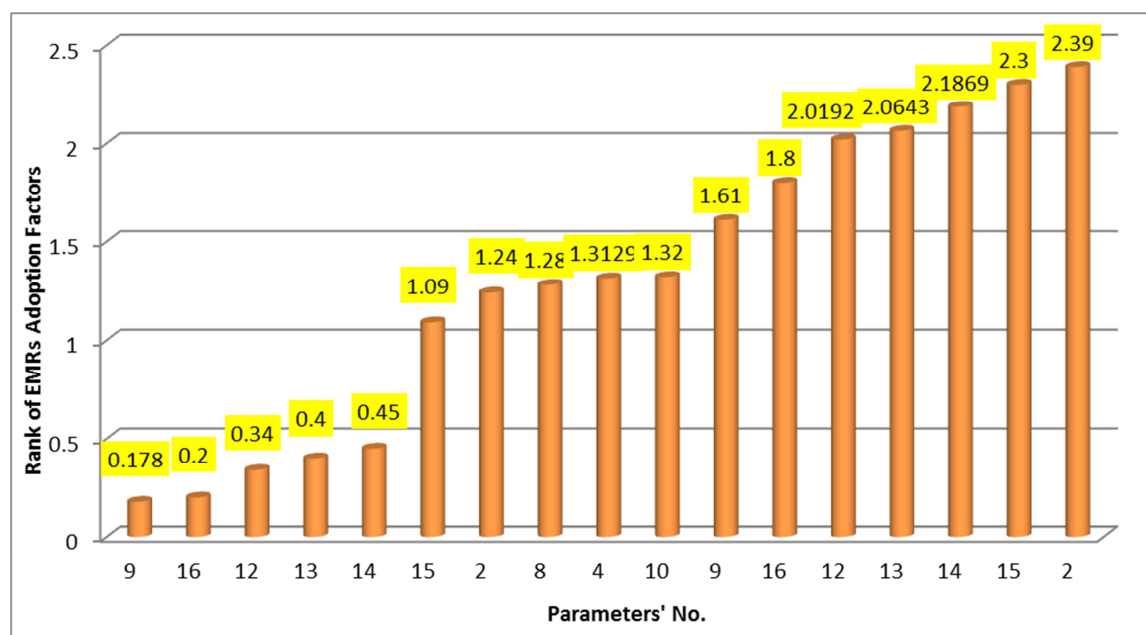


Fig. 5. Illustrating parameters' rank obtained by fuzzy TOPSIS

8 RESULTS OF FUZZY AHP

After comparing the results of the F-TOPSIS method and ranked the parameters and clarified seven of the most important criteria, it is time to choose them and make a pairwise matrix in order to interview with experts and starting F-AHP. Finally, seven criteria which were the most important ones from F-TOPSIS has obtained, a second questionnaire adjusted just for experts that was a pairwise matrix, then using the matrix data, all analyzed with the F-AHP. At the end weight of eight selected factors was calculated by F-AHP that is shown in Table 13 and Figure 6.

Table 13. Weights of parameters by fuzzy AHP

Parameters ranking by Fuzzy TOPSIS	
Parameters	Area
9	0.1923
16	0.1945
12	0.2034
13	0.2289
14	0.2193
15	0.3473
2	0.3512

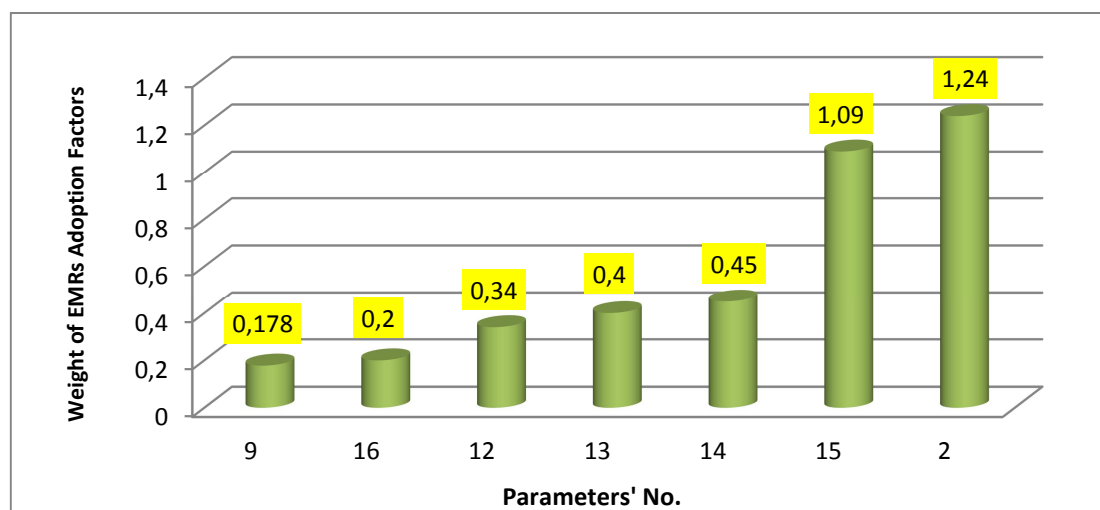


Fig. 6. Illustrating parameters' weight calculated by fuzzy AHP

Table 14 shows the most important seven criteria that ranked at first with F-TOPSIS in the left column and in the second time ranked by F-AHP based upon their weight that first rank is Time Investment with the weight 0.3512, the second rank for Screen/Room with approximately weight of 0.3473, Hybrid System with the weight of 0.2193, planning with the weight of 0.2289, resource training with the weight of 0.2034, workflow with weight almost 0.1945 and lastly value with weight of 0.1923.

Table 14. Parameters ranked by fuzzy AHP and fuzzy TOPSIS

Parameters	Rank by TOPSIS	Rank by AHP
9	7	7
16	6	6
12	5	4
13	4	5
14	3	3
15	2	2
2	1	1

9 CONCLUSION

The present study provided contextual analyses pertain to the Meso-level dimension framework which would contribute in fostering the EMRs adoption within the physician's practices in Malaysian primary care. Thus, it is hoped that this study can add some more knowledge concerning the behavioral science research with regard to the adoption of such a new technology in the healthcare environment. In this study, the criteria in Meso-level dimension based on study of Lau et al. [27] have been examined and focused in purpose of identifying the most influential factors related to primary care physicians EMR adoption. Moreover, the findings of the present study were used to address the adoption of EMRs technology within the physician community in primary care setting. Furthermore, the findings indicated that Physicians tended a positive perception towards some features related to technological adoption success and more importantly emphasized the positive impact of EMR on their HIS practices. In the study at hand, the F-TOPSIS and F-AHP method was applied as a new contribution which is based on MCDM to rank and weighting the critical factors in the adoption of technology innovation. Consequently, this would help IS researchers to apply the aforementioned methods as a new trend with the aim of increasing the prediction power in adopting new technologies. At the end, the physician EMRs adoption model in Meso-level dimension has been developed and the seven most influential factors found out in making sense of EMRs adoption among physicians. Future study can gain more validation through testing of the proposed framework in the current study with regard to developing countries to more fostering the adoption trend of EMR adoption in individual level into the healthcare industry.

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Numerical Investigation of Fluid Flow and Aerodynamic Performance of a Dragonfly Wing Section for Micro Air Vehicles (MAVs) Applications

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ABSTRACT: A comprehensive numerical simulation of fluid dynamics based study of a pleated wing section based on the wing of Aeshna Cyanea has been performed at ultra-low Reynolds number corresponding to the gliding flight of these dragonflies in order to explore the potential applications of pleated airfoils for micro air vehicle applications. The simulation employs an unstructured triangular mesh based on finite volume discretization done in the ANSYS-14.0 using WorkBench14.0. Whenever, dragonfly wing interacts with the fluid (air taken), several forces and vibrations results out. These forces and vibrations cause certain changes over the dimensional structure over the wing and also influence the flows characteristics. A critical assessment of the computed results was performed.

In this work, various flow patterns and aerodynamic performance of pleated airfoil has been obtained at ultra-low Reynolds numbers (2000-3000) at different angle of attacks (AOA) ranging from 0° to 15° . Also there effects on coefficient of Lift and Drag have been analysed. The simulations demonstrate that pleated airfoil produces higher lift and moderate drag that lead to an aerodynamic performance and hence pleated airfoil is an excellent choice for a fixed wing micro-air vehicle application.

KEYWORDS: Lift Coefficient, Drag Coefficient, Angle of Attack, Reynolds Number, MAVs.

1 INTRODUCTION

A number of insect species including locusts, dragonflies, and damselflies employ wings that are pleated along the chord. These ultra-light membranous insect wings support a variety of aerodynamic and inertial forces during flight. The pleated framework provides stiffening against span wise bending [1][2]. The dragonfly has a flapping frequency between 30 Hz and 50 Hz [3] and typically flies with its forewings and hind wings beating out of phase[4]. Gliding flight is also observed frequently in dragonflies; for instance, *Pantalaflavescen* scan sustain glides of 10–15 s at a flight speed of about 15 m s⁻¹[5]. The dragonfly of the genus *Aeschna* is capable of gliding for up to 30 s without any appreciable loss in altitude[6]. Smaller dragonflies had gliding periods lasting 0.5 s, covering a distance of approximately 1m and achieving maximum gliding speeds of up to 2.6 m s⁻¹[7].

The typical Reynolds number of dragonflies can range from 100 to 10 000 which can be categorized as being in the ultra-low Reynolds number flow regime [7]. The pleated wing is structurally stabilized primarily by the folded configurations, which increases flexural rigidity[8].

Gliding flight is an advantageous flight mode as it requires virtually no effort from the dragonfly[9]. At high temperatures, large dragonflies run the risk of overheating during active flapping flight, and can avoid this by sustaining longer glides per wing beat [10]. It has also been hypothesized that dragonflies adopt this gliding mode to take advantage of convective

cooling during hot weather. In gliding flight, the dragonfly elevates into the air using powered (flapping) flight and makes use of potential energy to move horizontally above the ground [6]. It is well known that high aspect ratio wings are advantageous in gliding flight and this is the reason why wings with high aspect ratios are employed in sail planes as well as by large soaring birds.

Interestingly, dragonflies have some of the highest aspect ratio wings in the insect world which allow them to possess a better glide performance and consume less energy during gliding [11]. For particular *Aeschna juncea*, Ellington calculated aspect ratios of 11.63 and 8.4 for the forewing and hind wing respectively. The crane fly (*Tipulapaludosa*) is comparable to the dragonfly with an aspect ratio of about 11. The dragonfly's wing aspect ratio is quite high compared to other insects such as the fruit fly (*Drosophila virilis*) which has an aspect ratio of 2 and the bumblebee (*Bombusterrestris*) with an aspect ratio of 6.4 [12] [13]. Dragonflies have highly corrugated wings where the pleated configuration varies along the span wise and chord wise directions. The pleats provide stiffening against span wise bending, while allowing for torsion and the development of camber [14] [15] [2] [16]. Stiffness in the span wise direction arises from the construction of a pleated wing since the longitudinal veins are located at the maximum and minimum peaks and are connected by the cross veins [17]. The pleated wing is structurally stabilized primarily by the folded configurations, which increases flexural rigidity [8]. Rigidity varies throughout the wing, and the factors which cause this variation are the depth of the pleats and the rigidity of the longitudinal cross veins [17].

A number of hypotheses have been suggested to explain the fundamental mechanism of the rather unexpected aerodynamic performance improvement of corrugated dragonfly airfoils or wings over conventional smooth airfoils. By conducting wind tunnel experiments with scaled corrugated wing models, Rees [8a] and Rudolph [18] suggested that fluid flowing over the corrugated airfoil would be trapped between the corrugation valleys where it either becomes stagnant or rotates slowly, resulting in the corrugated airfoil functioning as a streamlined airfoil.

Newman et al. [15] suggested that the improved aerodynamic performance would be associated with the earlier reattachment of the flow separation on the corrugated wings. As the angle of attack increases, airflow would separate from the leading edge to form a separation bubble, and the separated flow would reattach sooner due to the corrugation compared with smooth airfoils. Rudolph [18] also found that, compared with a streamlined technical airfoil, the tested corrugated airfoil would delay flow separation at higher angles of attack, and a stall did not occur abruptly.

Based on detailed experiments to investigate the aerodynamic characteristics of dragonfly wings and model wings at a Reynolds number ranging from 11,000 to 15,000, Okamoto et al [19] found that the corrugated wing model outperformed the flat plate at all angles of attack. The lift produced by a dragonfly wing was found to be higher than that produced by streamlined airfoils. Their experimental results focused on the effect of thickness, camber, pleats and leading edge sharpness.

Based on pressure measurements on the surfaces of a dragonfly wing model in addition to total lift and drag force measurements at a chord Reynolds number of 10,000 Kesel [20] suggested that negative pressure would be produced at the valleys of the corrugated dragonfly wing models, which would contribute to the increased lift. He also compared aerodynamic performance of cross sections at different positions along the span of a wing of an *Aeschna cyanea* to develop the pleated models and its corresponding profiled airfoil at chord Reynolds number of 10,000 and results showed that the pleated airfoils generated higher lift than profiled airfoils. He also noticed trapped vortices present in the folds that serve to change the effective profile of the airfoil. Based on detailed experimental work Buckholz [21] concluded that at Reynolds number 1500 pleats help in increasing lift.

Wakeling and Ellington [7] also come to the same conclusion when filming free gliding dragonflies and conducting wind tunnel experiments on their wings at a Reynolds number ranging from 700 to 2400. C_L max recorded for free gliding dragonflies was 0.93 and 1.07 when tested in a wind tunnel environment. Wakeling and Ellington [7] stated that the enhanced lift produced by dragonflies is not attributed to the Reynolds number, the aspect ratio or the wing area, but rather a surface feature, mainly the corrugations found in dragonflies.

More recently, Luo and Sun [22] and Vargas et al [23] conducted numerical studies to investigate the flow behaviors around corrugated dragonfly wings. Their simulation results confirmed that corrugated dragonfly wings would perform (in terms of the lift-to-drag ratio) as well and sometimes slightly better than smooth technical airfoils. The existence of small vortex structures in the valleys of the corrugated dragonfly airfoils were revealed clearly from the simulation results. The small vortex structures in the valleys of the corrugated cross-section were also revealed qualitatively in the flow visualization experiments of Kwok and Mittal [24].

Despite different explanations about the fundamental mechanism for the improved aerodynamic performance, most of the studies agree that corrugated dragonfly airfoils or wings work well in low Reynolds number regimes, which naturally point to the potential applications of employing such corrugated airfoils or wings for MAV designs.

A large number of studies conducted on pleated wing have concluded that pleated wing provides a structural benefit, allowing for a low mass yet stiff structure, but the question remains as to what precisely is the effect of the pleated structure on the wing aerodynamics. With the advent of micro-aerial vehicles (MAVs), it has become clear that there is much that can be learned from insect flight that could be translated into engineered systems. For fixed wing MAVs, wings that simultaneously provide a superior aerodynamic performance and structural robustness are critical.

Thus, if it is found that the pleats have an aerodynamic benefit, then such wings could be excellent choice for micro-aerial vehicles and this is the primary motivation for this work.

In this work, in order to investigate the steady flow, unsteady flow and aerodynamic performance for spatio-temporal dynamics of a cut section of dragonfly (*Aeshna cyanea*) numerical analysis has been performed at ultra-low Reynolds numbers (2000 to 3000) at different angle of attacks ranging from 0° to 15° . These parameter ranges are relevant for both dragonflies and micro-aerial vehicles. Past experimental studies [19] [20] [21] have found no intrinsic three-dimensional effects at these low Reynolds numbers. Thus 2D simulations are implemented in this work to encompass a relatively wide range of the parameter space necessary to draw some general conclusions regarding pleated airfoils which can be further utilized for MAVs applications. The pleated airfoil implemented in the numerical simulation corresponds to a cross-section located at the midsection of the forewing of a dragonfly (*Aeshna cyanea*). The specific profile chosen for the numerical simulations corresponds to 'Profile 2', which was extracted from the paper of Vargas *et al* [23] (which is the same as Profile 2 from Kesel [20]). From the three pleated geometries to select from the paper of Kesel [20], 'Profile 2' was chosen due to its horizontal leading edge, thus eliminating the issue that the orientation of the leading edge has an influence on the aerodynamic performance [19] as shown in Figure 1(b).



Fig. 1. Typical pleated cross-section found in dragonfly wings used by Kessel[20] and Vargas *et al* [23]

For the purposes of reducing the resolution requirements in the simulation, the sharp edges of the pleats were rounded out slightly without affecting the basic geometry of the pleats and the overall shape of the airfoil as shown in Figure 10.

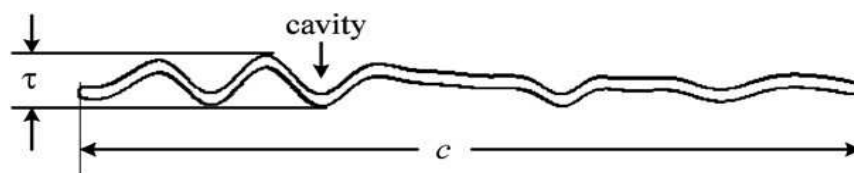


Fig. 2. Two dimensional Pleated airfoil representing a cross-section of the forewing of a dragonfly (*Aeshna Cyanea*) having $\tau/c = 7.531\%$

2 GOVERNING EQUATIONS

The equations governing the flow in the numerical solver are the time-dependent, viscous incompressible Navier–Stokes equations. The momentum and continuity equations are as follows:

$$\frac{\partial u_i}{\partial x_i} = 0 \quad (1)$$

$$\frac{\partial u_i}{\partial t} + \frac{\partial(u_i u_j)}{\partial x_j} = -\frac{\partial(p)}{\partial x_j} + \frac{1}{Re} \frac{\partial^2(u_i)}{\partial x_j \partial x_j} \quad (2)$$

Where the indices, $i = 1, 2, 3$, represent the x , y and z -directions, respectively, and the velocity components u_1 , u_2 and u_3 correspond to u , v and w respectively.

Here, Re corresponds to Reynolds number which is defined as below:

$$Re = \frac{\rho u_0 c}{\mu} \quad (3)$$

The key quantities that are to be examined here are Coefficient of Lift and Coefficient of Drag which can be defined as:

$$F_L = 1/2 C_L \rho A u^2 \quad (4)$$

$$F_D = 1/2 C_D \rho A u^2 \quad (5)$$

And $\text{Gliding Ratio} = C_L / C_D \quad (6)$

3 VALIDATION CASE

In order to validate the current numerical solver, same flow parameters and geometrical dimensions as used by Kesel [20] and Vargas et al [23] have been used and simulations of flow past a pleated airfoil has been performed and compared to published results of Vargas et al [23]. Lift and Drag coefficients at Reynolds Number 2000 and angles of attack (AOA) 0° and 4° were the results of interest in this particular validation case. The numerical results displayed in the Table1 are time averaged Lift and Drag values at different time units and at particular time step size.

Table1 shows a near- zero Lift coefficient (C_L) obtained numerically in this present work as expected for airfoils.

Table 1. Comparison of C_L and C_D with the results from Vargas et al [23] at $\alpha = 0^\circ$ and 4° at $Re = 2000$

Reynolds Number (Re)	AOA(α)	Lift Coefficient C_L Present	Drag Coefficient C_D Present	Lift Coefficient C_L [23]	Drag Coefficient C_D [23]
2000	0	0.025853	0.061631	0.0005	0.0785
	4	0.027964	0.088867	0.2732	0.0812

Also there were lesser difference in the present Drag coefficient (C_D) at different AOA (α) in comparison to that of Vargas et al. Overall, numerical results were in good agreement with those obtained by Vargas et al [23] for both angles of attack and chord Reynolds Number.

This validation case clearly demonstrates that current solver is capable of accurately simulating flow past airfoils at ultra-low Reynolds Number.

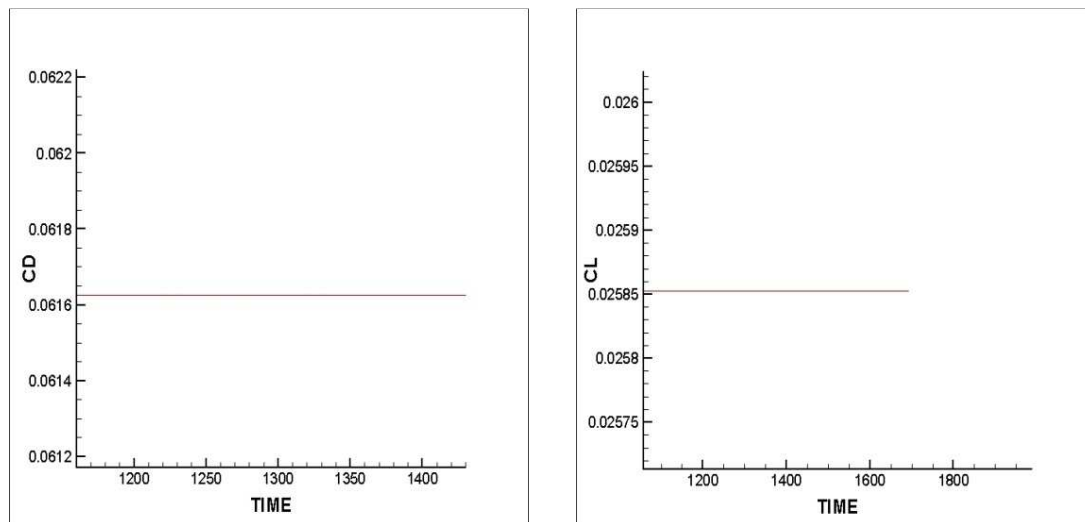
4 RESULTS AND DISCUSSION

Results obtained at different conditions are shown in Table 2. The Flow patterns (steady flow 'S' & unsteady flow 'U') so obtained and Gliding Ratio at these conditions are also described.

Table 2. Essential parameters required for aerodynamic performance at different Reynolds number and different AOA

Reynolds Number (Re)	AOA(α)	C_D	C_L	Gliding Ratio C_L/C_D	S or US
2000	0	0.061631	0.025853	0.419476	S
	4	0.088867	0.027964	0.31467	S
	5	0.019308	0.08116	4.203522	US
	10	0.084114	0.243084	2.889923	US
	12.5	0.101456	1.03869	10.23787	US
	15	0.126534	0.49659	3.924553	US
3000	0	0.022238	0.064985	2.922169	S
	4	0.024894	0.108852	4.372654	S
	5	0.05126	0.156658	3.056167	US
	10	0.081645	0.282252	3.457053	US
	12.5	0.107013	0.464502	4.340607	US
	15	0.125616	0.518605	4.128511	US

It was observed that for all the simulation performed flow always remained steady at Reynolds number 2000 and 3000 for angle of attacks 0° and 4° and a constant line was obtained for C_D and C_L at different time intervals. In order to represent the Steady flow (constant line), graph so obtained at Re2000 and AOA 0° is shown in figure3.

**Fig. 3. Variation of C_D and C_L with time at Re 2000 and AOA 0°**

At rest of angle of attacks flow was Unsteady and inconsistent lines at different time intervals were obtained. In order to represent the unsteady flow (inconsistent line), graph so obtained at Re3000 and AOA 15° is shown in figure4

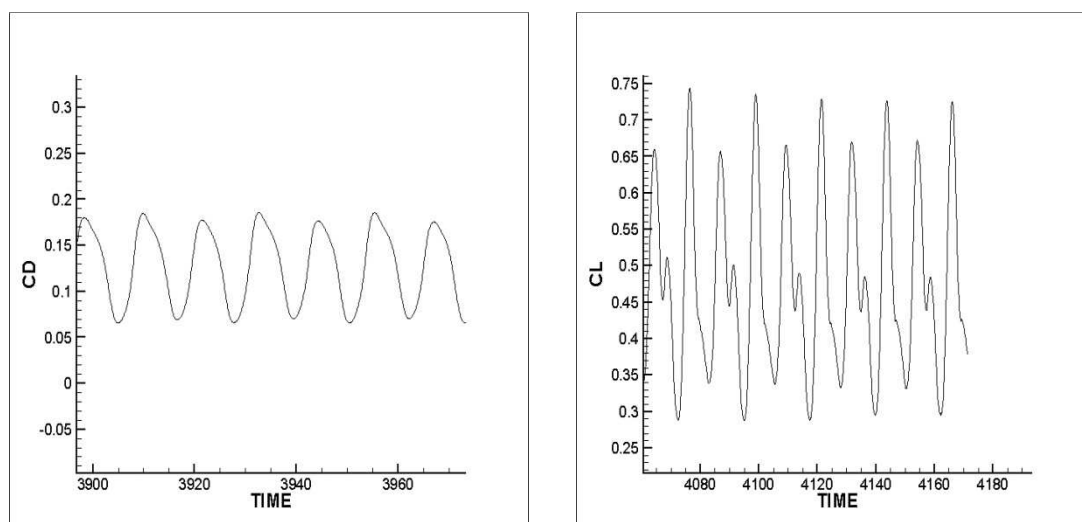


Fig. 4. Variation of C_D and C_L with time at $Re\ 3000$ and $AOA\ 15^\circ$

4.1 EFFECT OF ANGLE OF ATTACK AND REYNOLDS NUMBER

It was observed that pleated airfoil reached maximum $C_L = 1.03689$ (which is almost similar to that suggested by Wakeling J M and Ellington [7] at $Re2000$ with angle of attack 12.5° and minimum $C_L = 0.025853$ at $Re2000$ with angle of attack 0° . Further, it was noted that pleated airfoil reached maximum $C_D = 0.088867$ at $Re2000$ with angle of attack 4° and minimum $C_D = 0.019308$ at $Re2000$ with angle of attack 5° as shown in figure 5. It was also found that value of lift coefficients at $Re\ 3000$ with angle of attacks $0^\circ, 4^\circ, 5^\circ, 12.5^\circ$ and 15° was maximum compared to that of drag coefficients at same conditions. The basic steps in understanding the aerodynamic performance at all Reynolds numbers were to analyze the flow at 0° and 4° angle of attack.

Gliding Ratio which is most important parameter in analyzing the aerodynamic performance of pleated airfoils was found maximum at $Re2000$ with angle of attack 12.5° as shown in figure 6(a). Its value is 10.23787 which is very much appreciable and can be explored for MAVs applications.

For $AOA = 0^\circ, 4^\circ, 10^\circ$ and 15° gliding ratio increases with increasing Re , while it decreases for $AOA = 12.5^\circ$ and 5° as shown in figure 6(b).

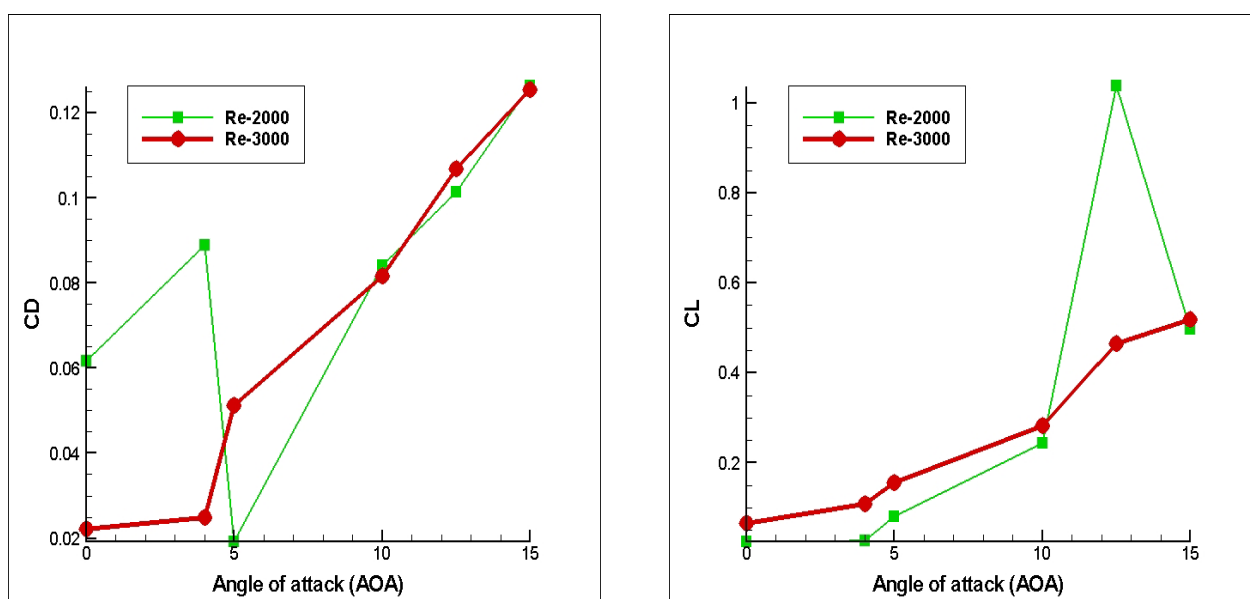


Fig. 5. Variation in C_D and C_L with AOA for $Re2000$ and $Re3000$

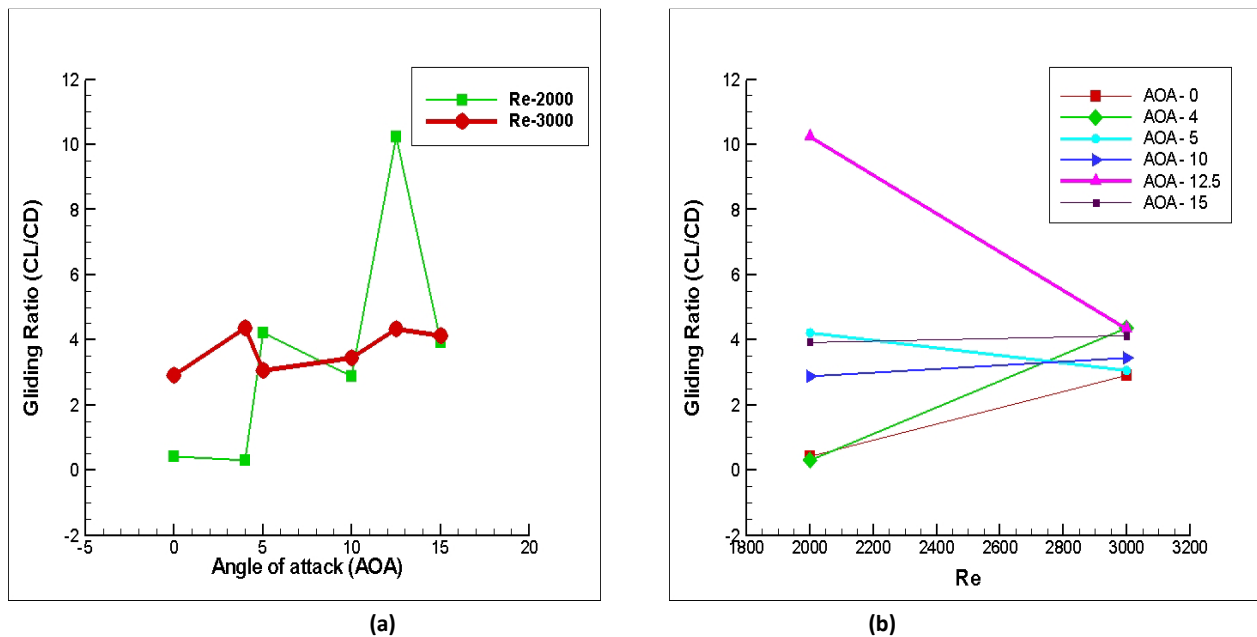


Fig. 6. Variation in Gliding Ratio with (a) AOA for Re2000 and Re3000 (b) Re for different angles of attack

5 CONCLUSIONS

In this work, numerical simulations were performed at Re 2000 and 3000 with different angle of attack ranging from 0° to 15° and further investigations were made. It was observed that coefficient of lift increase with increase in angle of attack and was maximum at Re2000 with angle of attack 12.5° .

Further Gliding Ratio was found maximum at Re2000 with angle of attack 12.5° . The simulations demonstrate that pleated airfoil produces higher lift and moderate drag in most of the cases that lead to an aerodynamic performance. These features could possibly be used for MAVs applications.

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Evaluation of physical properties and heavy metal composition of manure of some domestic animals

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ABSTRACT: Heavy metal content in animal manure could influence soil quality, contaminate crops and cause health risks to both livestock and humans. The objective of this study was to evaluate the physical properties and heavy metal composition of manure of some domestic animals. Manure samples were collected from six domestic animals (goat, cow, donkey, pig, turkey and layer chickens). Standardized protocols were followed for sample preparation and analysis of heavy metal content. The physical properties (physical appearance, moisture content and organic matter) of the samples were observed and recorded. The metals measured were Calcium (Ca), Magnesium (Mg), Iron (Fe), Manganese (Mn), Zinc (Zn), Lead (Pb), Copper (Cu), Cadmium (Cd) and Nickel (Ni). Concentrations of heavy metals were measured using flame atomic absorption spectrometry (FAAS). The results showed that donkey manure had the lowest Zn, Cu, Pb, Ni and Mg contents. Pig manure had the highest Fe content as well as the lowest Mn, Cd and Ca contents. It is recommended that manure of farm animals be cautiously examined for heavy metal content before its application to the soils of agricultural farms or fields.

KEYWORDS: Physical properties, Heavy metals, Animal manure, Bioaccumulation, Health hazards.

1 INTRODUCTION

Animal wastes include livestock manure, beddings, litter materials, dairy parlour waste water, feedlot run-off, silage juices from trench silos and wasted feed [1]. Animal manures are economic sources of Nitrogen (N), Phosphorus (P) and Potassium (K) as well as other nutrients needed for plant growth. They can reduce the need for commercial fertilizer. Their use for crop production is a common practice in many cropping systems. They are well adopted by farmers for crops such as vegetables, potatoes and to a lesser extent, for rice and local tuber crops. Animal manures can add organic matter to the soil, improve water holding capacity, improve soil tilth, increase crop yield and improve soil fertility [2]. Heavy metals such as Zinc (Zn), Copper (Cu), Iron (Fe) and Manganese (Mn) could be considered as useful trace elements for crop growth while Cadmium

(Cd), Lead (Pb), Nickel (Ni) and Mercury (Hg) are not essential because they increase soil acidity [3]. Reference [4] reported that the concentration of metals can vary considerably among animal manures. The perception of many scientists has been that animal manures contain considerable quantity of heavy metals which could be detrimental to human health. The accumulation of heavy metals in the human body can cause diseases such as heart attack, brain damage, cancer, diseases in digestive system, anaemia, gout, chronic nephritis, encephalopathy etc. [5 and 6]. Some of the heavy metals (e.g. Mercury (Hg), Cadmium (Cd), Arsenic (As), Chromium (Cr)), are dangerous to the environment, some are corrosive (e.g. Zinc and Lead) and others are harmful in other ways [7]. The continuous and heavy application of animal manures could lead to bioaccumulation which increases soil toxicity, affect crops' chemical composition as well as release heavy metals into water supplies [3]. Such manures in surface water reduce oxygen and endanger aquatic life. When this water is allowed to seep into ground water, the water quality is jeopardized. Nitrates in well water can be particularly dangerous to infants due to oxygen depletion in the blood [8]. In consideration of the ever increasing use of animal manure as sources of organic manure for crop production, it is important to evaluate the contribution of heavy metals from different animal manure sources. Therefore, this study was carried out to evaluate the physical properties and heavy metal composition of manure of some domestic animals.

2 SAMPLE COLLECTION

12 manure samples (two samples per animal) were obtained from six domestic animals namely: goat, cow, donkey, pig, turkey and layer chickens. Cow and goat dungs were collected early in the morning from Ipata abattoir, Ilorin, Nigeria. The manure samples were collected fresh to retain their fertility and avoid contamination from sand or other dirt. Pig dung was collected from a piggery in Ilorin and preserved. Donkey dung was collected from the biological garden, University of Ilorin, Nigeria. Poultry (turkey and layer chickens) droppings were collected from the Animal Production Department of the University of Ilorin, Nigeria. The physical properties (physical appearance, moisture content and organic matter) of the manure samples were observed and recorded. The moisture content was determined by observing the differences in weight before and after drying. The percentage moisture content was also obtained using the formula:

$$\% \text{ Moisture content} = (\text{Initial weight} - \text{final weight}) / \text{Initial weight} \times 100.$$

The organic matter content was determined by digestion process. The mass of the filter paper used was measured before and after filtering the samples during digestion. The percentage organic matter content was calculated as:

$$\% \text{ Organic matter content} = (\text{Mass of filter paper} + \text{organic matter} - \text{mass of filter paper}) / \text{mass of filter paper} \times 100.$$

The manure samples were sun-dried for seven days to reduce their moisture content. The dried samples were then grinded with porcelain pestle and mortar into fine particles for easy use. 2g of each sample was then weighed on a weighing balance for the experiment. The reagent, aqua-regia was prepared by mixing concentrated HNO_3 (tetraoxonitrate (V) acid) and concentrated HCl (Hydrochloric acid) in the ratio 3:1. The dried and grinded samples were then digested in 15ml of the prepared aqua-regia in a conical flask. The digestate obtained was cooled, filtered and made up to 50ml by adding distilled water. The digestate were put in labeled sample bottles for further laboratory analysis. Calcium (Ca), Magnesium (Mg), Iron (Fe), Manganese (Mn), Zinc (Zn), Lead (Pb), Copper (Cu), Cadmium (Cd) and Nickel (Ni) contents were measured by flame atomic absorption spectrometry (FAAS) technique using a GBC Avanta flame atomic absorption spectrophotometer, after the previous internal validation. Other apparatus and reagents used include aqua-regia, plastic funnels, pipette, measuring cylinder, standard volumetric flask, beakers, thermometer, paper tape, petri dishes, polythene bags, stirrer, electric hot plate, glass bottles, concentrated HNO_3 (tetraoxonitrate (V) acid), concentrated HCl (Hydrochloric acid), distilled water and tap water.

3 RESULTS AND DISCUSSION

3.1 PHYSICAL PROPERTIES OF MANURE OF SOME DOMESTIC ANIMALS

Physical properties of manure of some domestic animals are presented on Table 1. Percentage organic matter was highest in pig manure than for other animals. This can be explained by the minerals added to the pig feed for their antimicrobial and growth stimulating effect [9]. Percentage moisture content was highest in turkey manure. This could be attributed to dilution achieved by adding straw and probably also the origin of the samples analyzed [10]. Similar colour, state and percentage moisture content were observed in goat and cow manure. There is a large variety of dry matter content from 16 to 53%. High moisture may be due to rainfall. There is usually no protection of manure heaps, but the storage of run-off is compulsory. Sheep and goat manures are drier than cow manures. Chicken manure is also dry [11]. Similar dark brown

colour was observed in donkey, pig and turkey manures. Similar liquid state was observed in turkey and layer chickens' manures. This could be due to similar nature of feed given and physiology.

Table 1: Physical properties of manure of some domestic animals

Manure sources	Colour	State	% moisture content	% organic matter
Goat	Dark	solid	2.9	43.50
Cow	Dark	solid	2.9	46.90
Donkey	dark brown	mould like	0.9	56.25
Pig	dark brown	semi-solid	3.3	71.90
Turkey	dark brown	liquid	5.7	43.75
Layer chickens	Whitish black	liquid	4.3	53.15

3.2 HEAVY METAL COMPOSITION OF MANURE OF SOME DOMESTIC ANIMALS

Table 2 shows the heavy metal composition of manure of some domestic animals. Zinc (Zn), Lead (Pb), Nickel (Ni) and Magnesium (Mg) were highest in layer chickens' manure. High contents of these heavy metals in layer chickens' manure may be associated with their addition to poultry feed for disease prevention and enhanced feed efficiency. High concentration of trace metals in poultry manure enhanced poultry litter-amended soils [12]. High Pb content can be explained by the fact that Pb is introduced into the agricultural cycle mainly by deposition from the atmosphere. Reference [10] reported that animals with a high proportion of roughages will take up higher amount of Pb than those fed mainly on grains. Manganese (Mn) and Cadmium (Cd) were highest in cow manure. These high values could always be traced back to high inputs in the feed. Iron (Fe) was highest in pig manure. This may be also due to the concentration in the feed consumed and efficiency of feed conversion by the animals. Copper (Cu) and Calcium (Ca) were highest in goat manure. This result is in contrast with the report of Reference [10]. High Cu content was often linked with high Zn content. There is a close dependence between the heavy metal content of the ration and the manure produced. Each of the heavy metals studied have a particular importance in soil economy. Cd and Pb are the heavy metals of most concern because they may affect human health. Cu and Zn represent necessary micro-elements which could be harmful only if the concentration is too high. Additional variation in the concentration of metals in animal manures is associated with the age of the animal, type of ration, housing type and waste management practice. The type of bedding material in animal waste units may influence the litter's dry matter content and other chemical properties [13]. Some countries have established tolerance limits on heavy metal additions to soil because their long-term effects are unknown [14].

Table 2: Heavy metal composition of manure of some domestic animals

Manure sources	Metals (%)							
	Zn	Fe	Mn	Cu	Cd	Pb	Ni	Ca
Goat	3.94	17.52	4.30	1.50	0.15	0.24	0.24	350.50
Cow	3.43	21.27	8.03	0.43	0.45	0.34	0.13	132.25
Pig	3.00	26.47	3.79	0.67	0.02	0.28	0.15	38.25
Donkey	2.54	18.68	6.50	0.31	0.03	0.16	0.12	86.00
Turkey	4.66	26.16	5.55	0.67	0.06	0.26	0.34	336.50
Layer chickens	4.70	23.65	6.39	1.12	0.08	0.36	0.40	135.00

Zn- Zinc, Fe- Iron, Mn- Manganese, Cu- Copper, Cd- Cadmium, Pb- Lead, Ni- Nickel, Ca- Calcium, Mg- Magnesium

4 CONCLUSION

Heavy metal contents vary considerably between manures from different animal sources and from different farms or locations. Donkey manure had lowest Zn, Cu, Pb, Ni and Mg contents. Pig manure had the highest Fe content as well as the lowest Mn, Cd and Ca contents. It is recommended that manure of farm animals be cautiously examined for heavy metal content before its application to the soils of agricultural farms or fields. It is important to remember not to apply fresh manure to plants and crops as the manure may scorch the plants.

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A Comprehensive Study on Natural Language Processing and Natural Language Interface to Databases

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ABSTRACT: It was highly desirable for a machine to interact more friendly with the users so that the field of Natural Language Processing (NLP) emerged and Natural Language Interface to Databases (NLIDBs) systems are built and design. A major problem faced by the users of the data bases is that the databases generally make use of special purpose languages familiar only to the trained users like Structured Query Language (SQL). Natural Language Interface to Databases provides the interface in which queries are written in the form Natural Language. These queries are passed through the machine, machine translates these queries. There are different levels of it, after passing these levels machine produce relevant results. This paper will provides comprehensive understanding about Natural Language Processing and Natural Language Interface to Databases.

KEYWORDS: Machine Translation, Semantic, Pattern, Query, Lexical, Linguistic.

1 INTRODUCTION

Natural language interfaces to databases (NLIDBs) is the branch of Natural Language Processing (NLP) and the Natural Language processing is becoming most active technique in Human-Computer Interaction [1] and it is also be the branch of Artificial Intelligence [2]. The purpose of NLP research is to create such environment in which database usage does not require any programming skills and need little or no prior training.

In comparison of Natural Language Interfaces other user interfaces are less natural to interact. In their databases management systems queries are written in the form of complex language like SQL, SPARQL etc which is difficult for the causal and non-technical users that limits the access to the databases whereas a Natural Language Interfaces to Databases (NLIDBs) helps the users to enhance their performance by providing them the access to the information stored in a database naturally and conveniently. The users can perform flexible and easy queries that are expressed in some natural language and get the answer in the same language (e.g. English). For this purpose there are different techniques that are used e.g. semantic grammar that interleaves semantic and syntactic processing, pattern matching and syntactic grammar.

The purpose and the aim of this paper is to provide a comprehensive knowledge about NLP and NLIDBs, different levels of NLP and approaches and techniques which are used, NLIDBs history, development and future.

2 NATURAL LANGUAGE PROCESSING

Natural Language Processing is the area of research and application of different computational techniques for processing, understanding and manipulating the input and output to the system in human like natural language and this is also the main goal of it. It is the subset of both linguistics and computer science. Mainly Natural Language Processing is the branch of Artificial Intelligence (AI) that used for different domain like machine translation, information retrieval and expert systems etc.

2.1 LEVELS IN NATURAL LANGUAGE PROCESSING (NLP)

There are different levels in natural language processing and all these levels are depends upon each other.

2.1.1 MORPHOLOGICAL ANALYSIS

In NLP, the level of Morphological Analysis [3] is related to the internal structure of the words and a word is made up of small unit called morphemes e.g. “editing” is a word which is made up of two morphemes “edit” and “ing”.

2.1.2 LEXICAL ANALYSIS

In NLP, Lexical Analysis [4] is the process of converting string of word into tokens and tokens are the meaningful character string. A Lexical grammar is also associated with this which includes set of rules to define lexical syntax.

2.1.3 SYNTACTIC ANALYSIS

In NLP, Syntactic Analysis or parsing [5] is the analysis of the words in a string that how they are related to each other according to the rules of formal grammar.

2.1.4 SEMANTIC ANALYSIS

In NLP, Semantic Analysis determines possible meanings of the words in a string as this focus on the meanings of the words in a string that is way this analysis is related with syntactic analysis.

2.1.5 PRAGMATIC ANALYSIS

In NLP, the level of Pragmatic Analysis [6] is about the use of the sentences in different contexts and how that context affects the meanings of the sentences for this purpose this level may require vast amount of world knowledge.

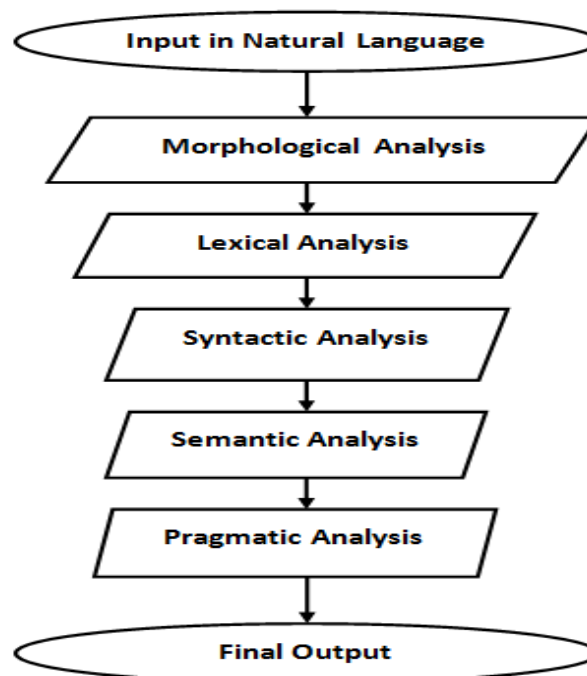


Fig. 1. Levels in Natural Language Processing

3 NATURAL LANGUAGE INTERFACE TO DATABASES (NLIDBs)

Natural language interfaces to databases (NLIDBs) are systems that translate a natural language question into a database query. Their major focus is to provide effortless, effective, user friendly and robust communication to the users regardless of their experience and expertise. Different NLP approaches are used to develop NLIDBs.

3.1 NATURAL LANGUAGE PROCESSING APPROACHES USED TO DEVELOP NLIDBs

Different approaches are used to develop NLIDBs these approaches are written below.

3.1.1 SYMBOLIC APPROACH (RULE BASED APPROACH)

For several decades Natural Language Processing research has been dominated by this symbolic approach [7] because in this approach the words are the symbols that stand for objects and concepts in the real worlds they are put together into sentences that follow well specified grammar rules. Language is analyzed at various levels of this approach to obtain information and certain rules are applied to achieve linguistic functionality on this obtained information. It is supported well as human language capable to include rule-based reasoning. Rules are formed for every level of linguistic analysis and it tries to capture the meaning of the language based on these rules.

3.1.2 EMPIRICAL APPROACH (CORPUS BASED APPROACH)

Empirical approaches [8] are based on statistical analysis and other data driven analysis of raw data which is in the form of text corpora and a corpus is collections of machine readable text. A number of techniques have been emerged to enable the analysis of corpus data. Recent researches in computational linguistics indicates that empirical or corpus based approach is currently the most promising approach to developing robust and efficient natural language processing (NLP) systems.

3.1.3 CONNECTIONIST APPROACH (USING NEURAL NETWORK)

In the recent years, the field of connectionist or neural network [9] processing has seen a remarkable development. There has been significant research applying neural network methods to language processing. As human language has capabilities that are based on neural network in the brain, the artificial neural networks or connectionist network provides an essential starting point for modeling language processing. This approach is based on distributed representations instead of the symbols which correspond to statistical regularities in language.

3.1.4 MAXIMUM ENTROPY APPROACH

Maximum entropy approach [10] is also based on statistical analysis that combines diverse pieces of contextual evidence in order to estimate the probability of linguistic. This approach allows the unrestricted use of contextual features and combines them in a principled way.

4 HISTORY OF NLP AND NLIDBs

The history of Natural Language interfaces to Databases as old as the history of Natural Language Processing (NLP) research and NLP history starts from the late 1940's that may also be called the first phase of NLP that focuses on the Machine Translation (MT) and MT was the first computer based application for natural language. In 1946 the two scientists While Weaver and Booth starts one of the earliest MT projects. In 1957 Chomsky [11] introduces the idea of generative grammar by publishing Syntactic Structure. In 1967 W.A WOODS introduced procedural semantics [12] for question-answering machine and in 1970 he introduced the ATNs i.e. Augmented Transition Networks [13]. From 1980's towards a lot of research have been done by many researchers some of them including Discourse Representation Theory "a theoretical framework for dealing with issues in the semantics and pragmatics of anaphora and tense" in 1981 [14], MUMBLE system [15] by David D. McDonald in 1980, Non-context-freeness of NL syntax proven by Stuart M. Shieber in 1985 [16] etc. if we look at the history of Natural language processing, we will found that it has different application over the period including in Machine and Automatic Translation, Information Retrieval (IR), Information Extraction (IE), Dialogue Systems and Question-Answering etc. As Natural Language Interface is the most easy and helpful way for the novice and casual users to access database who do not understand the complex database query languages, so that a lot of effort has been done by the researchers to provide the intelligent Natural Language Interface to Databases (NLIDBs) to these users.

5 HISTORICALLY DEVELOPED NLIDBs

In this section an overview is given about some of the historically developed NLIDBs.

5.1 LUNAR

The LUNAR [17] was the system that answers questions about samples of rocks brought from the moon. The system uses Augmented Transition Network Parser and Wood's procedural Semantics. Two different databases were used in this system one for chemical analyses and one for literature references. The performance of this system was quite impressive. It can handle about 78% of requests without any errors and this ratio increase up to 90% when dictionary errors were corrected.

5.2 RENDEZVOUS

In this RENDEZVOUS system users were able to access databases through unrestricted natural language. In this system, special emphasis given on query paraphrasing and in engaging users in clarification dialogs when there is difficulty in parsing user input.

5.3 PHILIQA

This system was known as Philips Question Answering System [18] this system uses a syntactic parser which runs as a separate pass from the semantic understanding passes. The system is mainly involved with problems of semantics and there for has three separate layers of semantic understanding. First layer is about English Formal Language, second layer is about World Model Language and third layer is about Data Base Language and appear to correspond roughly to the "external", "conceptual", and "internal" views of data.

5.4 LIFER/LADDER

This LADDER [19] system was designed about US Navy ships information as a natural language interface to a database. The system uses the technique of semantic grammars that interleaves syntactic and semantic processing. The question answering is done through parsing. This system support only simple one-table queries or multiple table queries with easy join conditions.

5.5 PLANES

This system includes an English language front-end with the ability to understand and explicitly answer user requests. PLANES (Programmed LANguage-based Enquiry System) [20] carried out the database based upon information of the U.S. Navy 3-M (Maintenance and Material Management) which contains complete records of aircraft and flight data.

5.6 CHAT-80

CHAT-80 [21] system was developed and implemented in Prolog language. The CHAT-80 was an impressive, efficient and sophisticated system in which English text is transferred into prolog expressions, prolog is basically logic programming language that is associate with artificial intelligence and computational linguistic , which were evaluated against the Prolog database.

5.7 ASK

The ASK system allowed the end users to teach new words and concepts to the system at any point during the interaction. ASK was basically a complete information management system that provides its own built-in database and have the ability to interact with multiple external databases, electronic mail program and other computer applications. All the applications connected to this system were accessible to the end-user through natural language request.

5.8 EUFID

The EUFID (End-User Friendly Interface to Data Management) [22] is a flexible system. This system consists of three major modules that are analyzer module, map per module and translator module. The system is written in FORTRAN and C programming languages.

5.9 DATALOG

This system DATALOG (Database Dialogue) [23] is highly portable and extendable. This is a Natural Language in English database query system which based on Cascaded ATN grammar and provides separate representation schemes for linguistic knowledge, general world knowledge, and application domain knowledge.

5.10 TEAM

The system TEAM [24] was designed to be easily configurable by database administrators with no knowledge of NLIDBs because at that time a large part of the research was devoted to portability issues. In TEAM, an English query transform into a database query in two steps. In First step the DIALOGIC system constructs a representation of the literal meaning or logical form of the query. In Second part the data-access component translates the logical form into a formal database query.

5.11 JANUS

This system JANUS [25] was similar to multiple underlying systems (databases, expert systems, graphics devices, etc). The system used a hybrid approach to representation, employing an intentional logic for the representation of the semantics. JANUS system also supports temporal questions.

Table 1. Historical Developed NLIDBs

System Name	Year	Domain
LUNAR	1972	Scientific : Rocks sample from the moon
RENDEZVOUS	1977	General
PHILIQA	1977	General
PLANES	1978	U.S Navy 3-M
LADDER	1978	US-Navy Ships
EUFID	1980	General
CHAT-80	1980	General
DATALOG	1985	General
TEAM	1987	General
JANUS	1989	General
ASK	1996	Information Management

6 RECENTLY DEVELOPED NLIDBs

In this section an overview is given about some of the recently developed NLIDBs.

6.1 PRECISE SYSTEM

PRECISE [26] introduces the idea of semantically tractable sentences which are sentences that can be translated to a unique semantic interpretation by analyzing some lexicons and semantic constraints. The model used for this is called Semantic Tractability Model. The system adopts a heuristic based approach. It was evaluated on two database domains. The first one is the ATIS domain, the second domain is the GEOQUERY domain.

6.2 NALIX SYSTEM

NALIX (Natural Language Interface for an XML Database) [27] can be classified as syntax based system. The transformation processes are done in three steps, generating, validating and then translating the parse tree to an XQuery expression. The way in which system was built implements a reversed-engineering technique by building the system from a query language toward the sentences.

6.3 WASP SYSTEM

WASP (Word Alignment-based Semantic Parsing) [28] is a system that learns to build a semantic parser given a corpus a set of natural language sentences annotated with their correct formal query languages. The whole learning process is done using statistical machine translation techniques and it does not requires any prior knowledge of the syntax. WASP was also evaluated on the GEOQUERY domain. The system was evaluated on different natural languages including English, Japanese, Turkish and Spanish.

6.4 STEP SYSTEM

The STEP (Schema Tuple Expression Processor) system [29] is for natural language access to relational databases. This system use bidirectional grammar to paraphrases queries back to the natural language. It uses structured semantic grammar through coupling phrasal patterns.

6.5 GENERIC INTERACTIVE NATURAL LANGUAGE INTERFACE TO DATABASES (GINLIDB)

The Generic interactive natural language interface to databases (GINLIDB) system [30] is designed and developed by the use of UML and Visual Basic.NET-2005. This system is generic in nature. This system has also uses Augmented Transition Network and ATN grammar that can add to knowledge bases if new queries are entered.

6.6 C-PHRASE SYSTEM

The C-Phrase system [31] is a web-based natural language interface and the database made available to the users through a web-based query interface. It runs under LINUX operating system.

Table 2. Recently Developed NLIDBs

System Name	Year	Domain
PRECISE	2004	ATIS (Air-Travel) & GEO-Query (U.S. Geography)
NALIX	2005	General
WASP	2006	General
STEP System	2007	General
GINLIDB System	2009	General
C-Phrase System	2010	Web-based

7 NATURAL LANGUAGE INTERFACES OTHER THAN ENGLISH LANGUAGE

This section includes of some of the recently developed NLIDBs that are in other natural languages than that of English.

7.1 URDU NATURAL LANGUAGE INTERFACE

The interface [32] that is proposed for this system is based on formal semantics and use AV mapping algorithm to deal with the tokens. This algorithm maps the particular value of token into corresponding attribute token. This converts the query from Urdu language to SQL query. There is about 85 % accuracy in results produces by this system.

7.2 HINDI NATURAL LANGUAGE INTERFACE

This interface [33] maps the query in Hindi language to SQL query and produces the result in same Hindi language by using semantic matching. The architecture for this system have different phases, first it tokenize the query (i.e. in Hindi) and then map it and form SQL query and execute it.

Table 3. NLIs other than English Language

System Name	Year	Domain
Efficient Transformation of a Natural Language Query to SQL for Urdu	2009	General
Hindi Language Interface to Database using Semantic Matching	2013	Employee Database

8 TECHNIQUES FOR DEVELOPING NLIDBS

Here are the techniques that are following in different NLIDBs

8.1 PATTERN MATCHING

Some of the early developed NLIDBs rely on pattern matching techniques [34] to answers the questions of the users. The advantage of using pattern matching technique is that its simplicity that is no elaborating parsing and interpretation modules are needed and systems easily implemented. This technique also helps the systems to come up with reasonable answers even if the questions are out of the range for which the systems are designed.

8.2 SYNTAX BASED

The syntax based systems are those in which the users questions are parsed (i.e. syntactically analyzed) and resulting parse tree is directly mapped an expression in some database query language. It is normally very difficult to devise mapping rules that will directly transform parse tree into some database query language expression. This system uses a grammar that describes the possible syntactic structure of the question by the users.

8.3 SEMANTIC GRAMMAR

The Semantic grammar system also handle question answering by parsing input and mapping the parse tree to database query. The only difference in this technique is that the grammar's categories that are non-leaf nodes that will appear in the parse tree do not necessary correspond to syntactic concepts. This introduced as an engineering methodology, which allows including semantic knowledge into the system easily. Systems that are developed on this semantic grammar are difficult to port into other knowledge domain because semantic grammars contain hard-wired knowledge about a specific knowledge domain.

8.4 INTERMEDIATE REPRESENTATION LANGUAGES

This technique Intermediate Representation Languages [35] is used by most current NLIDBs, they first transform natural question into an intermediate logical query that expressed in some internal meaning representation language. In this approach the system can be divided into two portions. The first portion starts from a sentence up to the generation of a logical query in this part the use of logic query languages makes it possible to add reasoning capabilities to the system by embedding the reasoning part inside a logic statement, and the second portion starts from a logical query until the generation of a database query.

9 FUTURE OF NLP AND NLIDBS

The future of NLP and NLIDBs is very bright but we should notice that there are some limitations. If we somehow successful to elaborate more conveniently the grammars, semantic and syntactic rules etc during development we can achieve more accurate and reliable natural language interfaces. It may be thought that in future these systems gives further help and support to the users to interact with without hesitations. Those users may have the goal to always interact with the

system in natural language. All data processing qualities and upward capability may increase and may also give efficient and trustworthy support.

10 CONCLUSION

This paper has been attempted with the purpose to serve the reader with field of NLIDBs and NLP. A lot of research has been done from last few decades in this field. Although several NLIDBs system have been developed so far but the use of NLIDBs systems is not wide spreader and also it is not a standard option for interfacing to a database. Many new interfaces are also developed that bring some hope that in near future the domain of natural language interfaces will get impressive output from the users in terms of usage because the expert users are also fed up with traditional queries writing by keyboarding.

ACKNOWLEDGMENT

We are very thankful to our worthy and respected teachers including Dr. Muddesar Iqbal (Director of Computing&IT), Mr. Mubbashar Hussain (HOD of IT.dep), Mr. Fiaz Majeed, Miss Qamar-Un-Nisa and Miss Komal Zaman for their support and guidance.

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Relationship between Self-Esteem and Social Anxiety among Physically Handicapped People

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ABSTRACT: The present study is aimed to investigate the relationship and gender differences between self-esteem and social anxiety in physically handicapped people. The sample consists of 150 disables (75 males, 75 females) taken from Government schools for special learners and other vocational training institutes from 3 cities of Southern Punjab, Rahim-yar-khan, Bahawalpur, Multan through purposive sampling technique. Age of participants ranged 18-25 years. Rosenberg Self-esteem scale (Rosenberg, 1965) and Leibowitz social anxiety scale (Liebowitz, 1987), were applied to assess self-esteem and social anxiety of participants. Statistical analysis was done through SPSS, Pearson product-moment correlation co-efficient and independent sample t-test was applied for evaluation of results. Results indicate that self-esteem is negatively correlated with social anxiety ($r = -.321^{**}$, $p = .000$) in physically handicapped. The findings of result showed that physically handicapped women have low self-esteem as compared to men [$t = 7.720$ (0.000), $p < 0.05$]. The findings also showed that physically handicapped female experienced high levels of social anxiety as compared to male [$t = -8.094$ (0.000), $df = 148$, $p < 0.05$].

KEYWORDS: Self-Esteem, Social Anxiety, Physically Handicapping.

1 INTRODUCTION

Present study aimed to explore the correlation of self-esteem and social anxiety in physical handicap people. Furthermore it aimed to identify the gender difference in self-esteem and social anxiety. Demographic variables of physical handicapped are also important factor which influence on the self-esteem and social anxiety.

Previous researches describe that there is a negative correlation between self-esteem and social anxiety. It was observed that disabled females have low self-esteem and high social anxiety as compared to males. This study aimed to explore this phenomenon. In Pakistan, attention is not paid on physical disabled population. Unfortunately physically handicapped persons are ignored in our society with this pathetic factor considerable amount of researches have been done in the field of clinical psychology. Self-esteem is a very considerable and helpful perspective in all areas of life which leads to success and achievement. As well as anxiety disorders especially social anxiety is a very burning issue related to special population. Many researches have been done to explore the correlation between self-esteem and anxiety or depression but very rare researches have been done on physically handicapped population. Some physically handicapped especially females cut off from society and limited to home. In this way, they lose self-esteem and face adjustment difficulties in social environment. Education and socio economic status effect on self-esteem and self-esteem negatively correlates with social anxiety. So, this research is an effort to explore the correlation between self-esteem and social anxiety in people with physical disabilities. Social anxiety disorder (also known as Social phobia) is frequently co-morbid with major depression, and low self-esteem or worthlessness.

1.1 HANDICAPPED

Word handicap and disability are interrelated. A disability is an umbrella term, covering impairments, activity limitations, and participation restrictions. Impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situations. Thus disability is a complex phenomenon, reflecting an interaction between features of a person's body and features of the society in which he or she lives (WHO, 2012).

The pervasive negative social attitudes of non-disabled individuals toward those with disabilities and the problems encountered by disabled persons in social adaptation have been documented for several years; but now Indeed, in an analysis conducted over two decades ago, of attitude of non-disable person toward those with disabilities (Dion, 1972).

1.2 BEHAVIOR OF PARENTS TOWARDS PHYSICALLY HANDICAPPED CHILDREN

Disability could be visible or invisible, temporary or permanent. The first major and systematic records of disabled persons in Pakistan are available from 1961 census. According to this record nearly 2% of the population suffered from all kinds of disabilities, particularly the children of age group 0-14 years (1981). After the initial crisis, many parents develop healthy and constructive attitude towards handicapped children. As many as 70% populations of Pakistan lives in rural areas so majority of the children are born and brought up there (Perveen, 2000). The overall condition of our villages gives their life as start with multiple disadvantages. Children suffer from illness caused by malnutrition and non-hygienic condition. The situation of handicapped children is far from satisfactory. The causes of this tragedy may be poverty, ignorance, malnutrition, poor housing facilities, inadequate healthcare and environment act as a catalyst for infection. Good physical and mental growth cannot be achieved in an environment where there is poverty and misery, food and shelter is inadequate and health services are either lacking or are extremely inadequate. Te adverse social, economic and environmental conditions can be considered responsible for the poor intellectual performance of many children, who in more favorable environment could develop abilities within a spectrum (Perveen, 2000).

A disability may be present from birth, or occur during a person's life time. According to World Health Organization (2011), more than one billion people have some form of disability and among them 200 million have functioning difficulties. California State University (2012) described the physical disability as any impairment which limits the physical function of one or more limbs or fine or gross motor ability.

According to the United Nations report (2009) about 80% of disabled people are living in developing world and 20% of them are living under poverty. It is observed that People don't pay attention to physically disabled individuals and as a result they become psychological disturbed. The emotional disturbance of these disabled individuals further causes depression, anxiety, low self-esteem and life satisfaction. It has been observed that highly emotional disturbed individuals with physically disability are not able to adjust properly in the life.

Like other developing countries unfortunately in Pakistan physically disable individuals are not much accepted in the general population. Physically handicapped are criticized, stigmatized and are not properly encouraged for independent life. It has been widely observed that disapproval of physically disable individuals from the society lead them psychological distress. Ahmad, (1993) described that a disabled member becomes an extra burden for their families due to loss of additional labor, increased expenditures for his special care and need to compensate with higher facilities. There is no proper infrastructure for care of the disabled individuals. Moreover, it explored that physically disabled individuals are stigmatized by society, as one is not secure emotionally and always ignore by others (Ahmad, 1993).

Gigantino, (2009) describes that word "co morbid" is used to describe secondary or tertiary illnesses or disorders that exist in a person in addition to a primary illness or it is a casual link between disorders. Manzella (2008) described that co morbidity is a condition that coexists with a primary disease but also stands on its own as a specific disease. The brain is the body's first line of defense against illness, and the mind is the emergent functioning of the brain. This mind-body approach incorporates ideas, belief systems, and hopes as well as biochemistry, physiology, and anatomy.

Robert and Hirschfeld (2001) reported that depression and anxiety are common co morbid factors of any kind of disability. Comorbidity means the presence of one or more disorders in addition to a primary disease or disorder, or the effect of such additional disorders or diseases (Valderas et al., 2009).

Co morbidity of the physical and mental health problems is seriously documented. It is important when illness becomes chronic (Dersh et al., 2002).

1.3 SELF ESTEEM

Self-esteem is “how much a person likes, accepts, and respects one overall as a person”. It refers to an individual’s sense of one’s own value or worth, or the extent which a person values, approves of, appreciates, prizes, or likes him or herself (Blascovich and Tomaka, 1991).

There is some misconception and confusions over what is the meant by term “Self-Esteem”. Reasoner (2000) has described that self-esteem is merely “feeling good” or having positive feelings about oneself as well as equate self-esteem with egoism, arrogance, conceit, narcissism, a sense of superiority, and a trait leading to violence. Such characteristics cannot be attributed to authentic, healthy Self-Esteem, because they are actually defensive reaction to the lack of authentic Self-Esteem, which is sometimes referred to as “Pseudo self-esteem” (Reasoner, 2000).

Self-Esteem means to value, appraise, estimate, to have great regard for, value highly, favorable opinion, high regard (Webster, 1965). Self-esteem covers a lot of concepts. It is one’s value as a person, the job one’s does, one’s achievements, how one thinks others see you, your purpose in life, your place in the world, your potential for success, your strengths and weaknesses, your social status and how you relate to others, and your independence and ability to stand on your own feet (Robis, 1999).

Rosenberg (1965) viewed the self as made up of two elements “identity” which represents cognitive variables, and “self-esteem” representing affective variables. The cognitive variable, or “identity, involves perceiving and interpreting meaning. He referred to “self-esteem” as the subjective life of the individual, largely one’s thoughts, feelings, and behavior.

Self-Esteem is referred as, “the disposition to experience oneself as being competent to cope with the basic challenges of life and to being worthy of happiness”. The national institute for self-esteem modified this definition as the experience of being capable of meeting life’s challenges and being worthy of happiness (Nathaniel, 1972).

Self-Esteem is considered as the evaluative function of the self-concept. Self-Esteem, thus, is the affective or emotional experience of the evaluations one makes with respect to one’s personal worth. Self-Esteem consists of two basic components, self-efficacy and self-respect. Self-efficacy refers to confidence in one’s ability to think, learn, choose, and make appropriate decisions. Self-respect refers to confidence in one’s right to be happy. It also refers to confidence that achievement; success, friendship, respect, love, and fulfillment are appropriate for oneself. Self-concept and self-efficacy are the dual pillars and defining characteristics of Self-Esteem (Robins, 1990).

Self-esteem is generally considered the evaluative component of the self-concept, a broader representation of the self that includes cognitive and behavioral aspects as well as evaluative or affective ones. While the construct is most often used to refer to a global sense of self-worth, narrower concepts such as self-confidence or body-esteem are used to imply a sense of self-esteem in more specific domains. It is also widely assumed that self-esteem function as a trait; that is, it is stable across time within individuals. Self-esteem is an extremely popular construct within psychology, and has been related to virtually every other psychological concept or domain, including personality (e.g., shyness), behavioral (e.g., task performance), cognitive (e.g., attribution bias), and clinical concepts (e.g., anxiety and depression). While some researchers have been particularly concerned with understanding the nuances of the self-esteem construct, others have focused on the adaptive and self-protective functions of self-esteem (Blascovich and Tomaka, 1991).

Self-Esteem can be positive or negative, high and low. Low or negative Self-Esteem is called pseudo Self-Esteem whereas positive or high Self-Esteem is called authentic Self-Esteem. Low Self-Esteem is the result of poor self-image caused by negative attitude towards oneself. People with low self-esteem will: Demean his own talents, Feel that others don’t value him, Feel powerless, Be easily, influenced by others, Express a narrow range of emotions, Avoid situations that provoke anxiety, Become defensive and easily frustrated, Blame others for their own weaknesses. Low self-esteem has been correlated with low life satisfaction, loneliness, anxiety, resentment, irritability and depression (Rosenberg, 1965).

Peoples with defensive or low Self-Esteem typically focus on trying to prove themselves or impress others. They tend to use others for their own gain. They generally lack confidence in themselves, often have doubts about their worth and acceptability. They often hesitate to take risks or expose themselves to failures. They don’t take responsibility for their action and they blame others for their shortcomings (Reasoner, 2000).

People with high Self-Esteem will be confident. People with high Self-Esteem will act independently, assume responsibility, be proud of accomplishments, approach new challenges with enthusiasm, exhibit a broad range of emotions, tolerate frustration well, and feel capable of influencing others. High self-esteem has been correlated with academic success in high school, internal locus of control, high family outcome, and positive sense of self-attractiveness (Wiltfang and Scarbeez, 1990).

Tolerance and respect for others characterize individuals with high Self-Esteem. Individuals who accept responsibility for one's actions, have integrity, take pride in accomplishments, who are self-motivated, willing to take risks, capable of handling criticism, love and lovable, seek the challenge and stimulation of worthwhile and demanding goals, and take command and control of lives. People with high Self-Esteem are enabling to face failure and learn from them. Avoiding making the same mistakes again and not is trapped in past and become able to face fears (Abraham & Carl, 1989).

1.4 FACTORS THAT EFFECTS SELF-ESTEEM

Gender: Gender has an important impact on Self-Esteem. Usually in our society male is more dominating in every field of life. Females have high Self-Esteem as compare with men as they are less aggressive, more social, and able to deal with every situation more sensibly. For women, one's family, peer support, reflected appraisals and family relationships are important determiners of self-esteem (Robis, 1999).

Nature of Work: Self-esteem has an impact on the nature of the work individuals choose to do. Those who are self-confident to begin with make it more likely that will engage in relatively complex work later on. Due to this factor, students with high self-esteem usually select technical subjects to read. Younger persons who start out with self-deprecating tendencies that appears significantly more likely to hold jobs, which are closely supervised. Self-direction in their jobs makes individuals feels more positively about themselves, more able to do complex work and require less close supervision. Closeness of supervision tends to result in self-deprecating tendencies (Abraham, 1989).

Health: When provided with specific tasks, people with high Self-Esteem are confident about success in the task are not overly concerned with failure, and look at setting as an opportunity to do well. Even, if failed to attain the task, work hard to get success next time. Whereas, people with low Self-Esteem feel considerable uncertainty, doubt positive attributes; expect negative attributes, concerned about failing, may even prepare for failure. And if got failed, become not surprised because consistent with past experience. In result, decrease motivation and usually withdraw from task, lack confidence, self-concept and efficacy, cannot dismiss weakness, usually look others for reinforcement and accept negative feedback as much as possible and believe in it (Robin, 1990).

Self-Esteem is directly affected by the education of parents. Educated parents will deal children perfectly, can develop positive self-concept in children. Wiltfang and Scarbecz (1990) found that father's education had a small positive relationship with adolescents' Self-Esteem (Wiltfang & Scarbecz, 1990).

Psychological Wellbeing: The well-established relationship between self-esteem and psychological well being (e.g., depression, social anxiety, loneliness, alienation) may be an important factor in understanding the self-esteem health relationship. Bernard, Hutchison, Lavin, and Pennington (1996) found high correlations among self-esteem, self-efficacy, ego strength, hardiness, optimism, and maladjustment, and all of these constructs were significantly related to health (Blascovich and Tomak, 1991).

Socialization: Socialization of a person could be effected by the Self-Esteem of a person. Self-esteem affects how children relate to other people. Children who feel good about them tend to have positive relationships with others people. On the other hand, children who don't like themselves often have trouble relating to other people (Robis, 1999).

1.5 APPROACHES TOWARDS SELF ESTEEM

A study of mathematical skills compared students in eight different countries. American students ranked lowest in mathematical competence and Korean students ranked highest. But the researchers also asked students to rate how good they were in mathematics. The Americans ranked highest in self-judged mathematical ability, while the Koreans ranked lowest. Mathematical self-esteem had an inverse relation to mathematical accomplishment. This is certainly an example of a feel-good psychology keeping students from an accurate perception of reality. The self-esteem theory predicts that only those who feel good about themselves will do well, which is supposedly why all students need it. But in fact, feeling good about yourself may simply make you over confident, narcissistic and unable to work hard. Rather, the research mentioned above shows that measures of self-esteem have no reliable relationship to behavior, either positive or negative. In part, this is simply because life is too complicated for so simple a notion to be of much use. But for other reasons we should expect this failure in advance (Burgess and Conger, 1989).

1.6 SOCIAL ANXIETY

Social anxiety, sometimes known as social phobia or social anxiety (SAD) is a common form of anxiety disorder that cause sufferers to experience intense anxiety in some or all of the social interactions and public events of everyday life. For instance, some sufferers have difficulty attending parties or meetings, making a phone call, walking into a shop to purchase goods or asking for help (Elieze, Feinstein2001).

DIAGNOSTIC CRITERIA FOR SOCIAL ANXIETY DISORDER ACCORDING TO DSM-V (APA-2013)

1. Marked fear or anxiety about one or more social situations in which the individual is exposed to possible scrutiny by others. Examples include social interactions (e.g., having a conversation), being observed (e.g., eating or drinking), or performing in front of others (e.g., giving a speech).
2. The individual fears that he or she will act in a way or show anxiety symptoms that will be negatively evaluated (e.g., be humiliated, embarrassed, or rejected) or will offend others.
3. The social situation(s) almost always provoke fear or anxiety. (Note: in children, the fear or anxiety may be expressed by crying, tantrums, freezing, clinging, shrinking, or failure to speak in social situations.)
4. The social situation(s) are actively avoided or endured with marked fear or anxiety.
5. The fear or anxiety is out of proportion to the actual threat posed by the social situation. (Note: "Out of proportion" refers to the socio-cultural context.)
6. The fear, anxiety, or avoidance is persistent, typically lasting six or more months
7. The fear, anxiety, and avoidance cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.
8. The disturbance is not attributable to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or another medical condition.
9. The disturbance is not better accounted for by another mental disorder (e.g., anxiety about having Panic Attacks in Panic Disorder, agoraphobia situations in Agoraphobia, separation from attachment figures in Separation Anxiety Disorder, public exposure to perceived physical flaws in Body Dysmorphic Disorder, or social communication problems in Autism Spectrum Disorder. Failure to speak is not better accounted for by stuttering or expressive language problems in Communication Disorders, or refusal to speak due to opposition in Oppositional-Defiant Disorder.
10. If another medical condition (e.g., stuttering, Parkinson's disease, obesity, disfigurement from burns or injury) is present, the fear, anxiety, or avoidance is unrelated or is out of proportion to it (Bögels et. al., 2010).

SAD is specified If the fear is restricted to speaking or performing in public or Consistent failure to speak in specific social situations in which there is an expectation for speaking (e.g., at school) despite speaking in other situations (Lewis, et. al., 2010).

Co- morbidity of the physical and mental health problems is seriously documented. It is important when illness becomes chronic (Dersh et. al., 2002). From general observation it is cleared that presence of depression in a disable individual is common co morbid factor and Robert and Hirschfeld (2001) pointed out that depression and anxiety are so vary. Anxiety disorders are among the most prevalent mental health disorders in the United States.

About 18% of the US population will suffer from an anxiety disorder each year and almost 29% will experience an anxiety disorder at some point in their lives (Kessler et al., 2005). Prior studies of patients with specific anxiety disorders show they have large decrements in functioning and well-being and increases in disability compared to those without anxiety disorders (Blazer et al., 2002).

These disabilities manifest themselves in the absence of desire to perform activities, interference in level of performance, and avoidance of activities. While the negative impact of anxiety is fairly well-established relative to that in persons without anxiety, few studies have compared differences in functioning and disability between the anxiety disorders themselves. In addition, while individuals with more than one anxiety diagnosis appear to have increased symptom severity (Kessler and Chiu et al., 2005), less is known about whether or not co-morbidity affects levels of functioning and disability (Norberg et al., 2008), although some studies have found lower levels of quality of life (QOL) in anxiety patients with co-morbid depression compared to those with anxiety alone (Lochner et al., 2003).

A recent meta-analysis found that, compared to control samples, no particular anxiety disorder diagnosis was associated with significantly poorer overall quality of life than was any other anxiety disorder diagnosis (Olatunji et al., 2007).

1.7 RATIONALE OF THE STUDY

Unfortunately physically handicapped persons are ignored in developing societies like Pakistan. With this pathetic factor considerable amount of researches have been done in the field of clinical psychology. Self-esteem is a very considerable and helpful perspective in all areas of life which leads to success and achievement. As well as anxiety disorders especially social anxiety is a very burning issue related to special population. Many researches have been done to explore the correlation between self-esteem and anxiety or depression but very rare researches have been done on physically handicapped population. Some physically handicapped especially females cut off their society and limited to their home. In this way, they lose their self-esteem and face difficulties related to adjustment in their social environment. Education and socio economic status effect on self-esteem. And self-esteem is related to social anxiety. If self-esteem is high then level of social anxiety will be less.

The present study explored the relationship between self-esteem and level of social anxiety among male and female physical handicapped. Thus the researcher wanted to explore the relationship between self-esteem and social anxiety as well as comparison of gender with disability.

1.8 OBJECTIVES OF STUDY

1. To find out the relationship between self-esteem and social anxiety.
2. To measure the level of self-esteem in physically handicapped.
3. To evaluate the correlation of self-esteem and social anxiety among male and female physically handicapped population.

2 METHODOLOGY

2.1 RESEARCH DESIGN

Co-relational research design was used in this study. Survey method is used for data collection.

2.2 PARTICIPANTS

The sample consists of 150 physically handicapped adolescent individuals (75 males, 75 females) age ranged 18-25. Participants were taken from government schools for special learners and other vocational training institutes of Rahim Yar Khan, Bahawalpur and Multan through purposive sampling. Participants belong to different demographics and educational background.

2.3 INSTRUMENTS

Following instruments were used for evaluating relationship between self-esteem and social anxiety among male and female physical handicapped individuals.

Rosenberg Self Esteem Scale: The Rosenberg Self-Esteem Scale (1965), a widely used self-report instrument for evaluating individual self-esteem. It is 10-item scale that measures global self-worth by measuring both positive and negative feelings about the self. The scale is believed to be uni-dimensional. All items are answered using a 4-point Likert scale format ranging from strongly agree to strongly disagree.

Leibowitz Social anxiety scale: The Liebowitz Social Anxiety Scale (1987) is a short questionnaire. Its purpose is to assess the range of social interaction and performance situations feared by a patient in order to assist in the diagnosis of social anxiety disorder. It is commonly used to study outcomes in clinical trials. The scale features 24 items, 13 relating to performance anxiety and 11 concerning social situations. The LSAS was originally conceptualized as a clinician-administered rating scale, but has since been validated as a self-report scale.

2.4 PROCEDURE

Permission was taken from the head of departments of institutes. Consent form was filled by participants. Rosenberg Self-esteem scale and Liebowitz social anxiety scale were used for evaluating variables. The sample of 150 physical handicaps (75 male, 75 female) was drawn from different "Institutes for special education" and "Vocational training institutes" from Rahim

yar Khan, Bahawalpur, Multan. Participant's age range was 18-25 years. Sample was taken by using "Purposive sampling technique". Participants were provided with appropriate information about the rationale of study and they were assured that the information they provide will be keeping confidential and will be used only for research and statistical purpose for drawing results. Necessary explanations were provided to the respondent to make the questionnaire easy and understandable.

2.5 STATISTICAL ANALYSIS

Statistical analysis was done by SPSS (statistical package for social sciences) to draw results. Following statistical methods were applied

- Pearson product-moment correlation coefficient (to evaluate the relationship between self-esteem and social anxiety)
- Independent sample t-test (for the comparison of gender differences)

2.6 OPERATIONAL DEFINITION OF VARIABLES

Self-Esteem: Self-esteem is a widely used concept both in popular language and in psychology. It refers to an individual's sense of his or her value or worth, or the extent which a person values, approves, appreciate, praise or like him or herself (Blascovich & Tomaka, 1991).

Self-esteem is favorable or unfavorable attitude toward life (Rosenberg 1965).

Social Anxiety: Social anxiety is a form of anxiety disorder. Individuals suffering from this Anxiety Disorder experience unreasonable fear or anxiety in connection with exposure to social situations involving contact with people they do not know or who they expect may judge them and because of this avoid such situations whenever possible. (DSM IV-TR)

Handicapped: The word disability and handicap are interrelated. It is an umbrella term, covering impairments, activity limitations, and participation restrictions. Impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem (WHO,2012)

Hypothesis

1. Self-esteem will be negatively correlated with social anxiety.
2. Male physical handicapped will score high on self-esteem as compared to females.
3. Male physical handicapped will score low on social anxiety as compared to females.

3 RESULTS

Table 1. Relationship between self-esteem on social anxiety among male and female physically handicapped (N=150)

	Social Anxiety
Self Esteem	-.321**(0.000)

**p<0.05

Table 1 reveals the significant correlation at the 0.01 level among self-esteem and social anxiety in physical handicapped [$r = -.321$, $N=150$, $p=.000$]. It shows significant negative correlation between self-esteem and social anxiety. These results support the hypothesis that self-esteem is negatively correlated with social anxiety in physical handicapped.

Table 2. Independent sample t-test for comparing level of self-esteem among male and female physically handicapped (N=75,75)

	Sex	N	Mean	Std. Deviation	Std. Error Mean	t	p
Self Esteem	Male	75	13.47	1.510	.174	7.720	0.000*
	Female	75	11.80	1.103	.127		

df= 148, *P<0.05

Table 2 reveals significant differences in the level of self-esteem among male and female physically handicapped. There is a significant gender difference in the level of self-esteem [$t= 7.720 (0.000)$, $df= 148$, $p< 0.05$]. The results support the hypothesis that male physically handicapped score high in self-esteem test as compare to females.

Table 3. Independent sample t-test for comparing level of social anxiety among male and female physically handicapped. (N=75, 75).

	Sex	N	Mean	Std. Deviation	Std. Error Mean	t	p
Social Anxiety	Male	75	76.05	13.015	1.503	-8.094	0.000*
	Female	75	99.59	21.556	2.489		

df= 148, *P<0.05

Table 3 reveals significant differences in the level of social anxiety among male and female physically handicapped. There is a significant gender difference in the level of social anxiety [$t= -8.094(0.000)$, $df= 148$, $p<0.05$]. The results support the hypothesis that male physically handicapped will score high in social anxiety test self-esteem and as compare to that of female.

4 DISCUSSION

The present study was undertaken to investigate the relationship between self-esteem and social anxiety in physical handicapped people. This study also investigates the gender differences and its influence on the level self-esteem and social anxiety in physically handicapped male and females. Existing researches suggest that self-esteem is correlated with social anxiety and other psychological disorders. Level of self-esteem either low or high, have great effect on social anxiety. This research indicates the negative correlation between self-esteem and social anxiety. Negative correlation occur when one variable increase and due to it, the other variable decrease. If the self-esteem is low then social anxiety will be high and high self-esteem will lead toward low social anxiety. Self-esteem is independent whereas, social anxiety is dependent variable.

The results indicate that level of self-esteem had great effect on the level of social anxiety among male and females physically handicapped. If the level of self-esteem is low then the social anxiety will be high. Results also indicates that female physical handicapped have more lower level of self-esteem and higher level of social anxiety as compare to male physical handicapped. The hypothesis regarding level of self-esteem and social anxiety in physical handicapped suggests that, "Self-esteem is negatively correlated with social anxiety". This hypothesis is accepted after evaluation of results. Self-esteem is negatively correlated with social anxiety. Negative correlation is applicable when one variable increase and other decrease or vise versa. Results indicate that the level of self-esteem is low then social anxiety will keep on decrease.

The second hypothesis evaluates the gender differences. Females are sensitive then males. Physical disability make females more sensitive as compare to males. Hypothesis regarding gender differences suggest that, "Male physical handicapped will score high in self-esteem as compare to females". The hypothesis is accepted. They are very anxious and negatively evaluate themselves. They pay more attention to their disability and underestimate their abilities. In result, they develop negative and poor self-esteem which leads toward many problems and increase the level of social anxiety. Whereas, male handicapped are also concerned with their disability but as compare to females, they have high self-esteem. They are highly motivated and accept themselves with disability. They have positive attitude toward their life and have high self-esteem.

Third hypothesis suggest that, "Male physically handicapped have low social anxiety as compare to females". This hypothesis is accepted. Male handicapped easily adjust in environment but female was not coping easily and effectively. They cut off from society, due to which perhaps they find it difficult to easily mix up with others. They prefer living alone in home, avoid social places and talking with people even their own family members. They are more concerned and worried about their future. Whereas males have low social anxiety as compare to females. They are indulged in different social and extra-curricular activities. They have a broad social circle and learn many things from their society. They are highly motivated and accept themselves with disability. They have positive attitude toward their life and have high self-esteem as compare to female disables which decrease their social anxiety.

5 LIMITATIONS AND SUGGESTIONS

- The sample size is taken from 3 cities of Northern Punjab so, the result cannot be generalized to the whole population.
- Time duration for conducting the whole study was limited to achieve the required results.
- Lack of cooperation of institutes and people was a major limitation of research.
- Some suggestions for further researches are as follows,
 - In order to generalize the results, a much larger and nationally representative sample should be used.
 - For data collection from illiterate population, semi-structured interviews are also recommended.
 - It would be advantageous to supplement information obtained through questionnaire with interviews in order to have more reliable information.
- Demographic variables such as, age, socio-economic-status and education can also be taken into account to analyze the impact of demographic and cultural variables in disabled population.

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Removal of Methylene Blue Dye from Textile Wastewater using Activated Carbon Prepared from Rice Husk

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ABSTRACT: Textile industry is one of those industries that consume large amounts of water during the manufacturing process and, also, discharge great amounts of effluents with synthetic dyes to the environment causing public concern. Azo dyes are applied in textile industries, are considered to be serious health-risk factors. Several physico-chemical and biological methods for dye removal from wastewater have been investigated in the last decades. But, these treatment techniques need posterior separation process which significantly affects the economic performance of the plant. On the other hand, adsorption is one of the efficient methods and needs low capital and operational costs. Thus, this study investigates the potential use of low cost activated carbon prepared from the rice husk for the removal of Methylene Blue wastes. The rice husk was collected from rice mill and washed repeatedly until the dirt was eliminated. Then, it was heated at 500 °C for 30 min and the activated carbon had been activated with H₂SO₄ in order to make the carbon porous. A batch experiments were carried out in order to investigate the effect of various parameters. Uv-visible spectrometer was used for the analysis of final concentration of the effluent. Experimental results have shown that, the amount of dye adsorption increased with decreasing the initial concentration, adsorbent dosage, contact time and temperature. Over 99% removal efficiency were achieved for the given dosage. With respect pH, pH value of 8-10 was found to be the optimal value.

KEYWORDS: Water Pollution, Rice husk carbon, Methylene Blue, Adsorption Isotherms, Sear's method.

1 INTRODUCTION

Water pollution due to color dyestuff industrial waste becomes a major concern worldwide. Many industries including leather and textile industries use dyes extensively in different unit operation. Main pollution in textile industries came from dyeing and finishing section. These processes require a wide range of input chemicals and dyestuff, which is generally an organic compound of complex structures [1]. There are more than 100,000 commercially available dye and more than 7x10⁵ tones per year are produced annually [1], [2]. Wastewater containing dyes are very difficult to treat, since the dyes are recalcitrant organic molecules, resistant to biological degradation and are stable to light. There are different methods for the removal of textile effluents. The technologies for color removal can be divided into three major categories: biological, chemical and physical processes. The conventional biological treatment is the most economically used methods compared to other physical and chemical processes. However, biological treatment is incapable of obtaining satisfactory color elimination for concentrated wastes. This is due to their complex chemical structure and xenobiotic nature [4], [5]. Other studies complete decolourization however can be attained when applying anaerobic digestion through further non biological process [6]. The other most frequently used waste treatment method is chemical process such as coagulation, Fenton's process. But, chemical techniques are often expensive, and although the dyes are removed, accumulation of concentrated sludge creates further disposal problem [7].

Different physical treatment techniques are also successfully tested, such as membrane-filtration processes (nanofiltration, reverse osmosis, electro dialysis) and adsorption techniques. A synthetic dye in wastewater cannot be efficiently decolorized by traditional methods. This is because of the high cost and disposal problems for treating dye wastewater at large scale industries [7],[8],[9]. Nowadays; adsorption is the most effective method of dyes removal technique using low cost adsorbents as it will be reviewed in next section. Adsorption is a well known equilibrium separation process for water decontamination applications. Adsorption has been found to be superior to other techniques for water reuse in terms of initial cost, flexibility and simplicity of design and ease of operation as review [4], [10],[11]. A researcher studies the adsorption of Congo red on carbon prepared from Neem leaf litter and Raw Neem Leaf. According to the authors, adsorption of Congo red on Neem leaf litter showed the highest adsorption capacities compared to any other adsorbents [6]. It was observed that the adsorbent is effective for the removal of anionic dyes in a wastewater treatment process. [12],[13] study activated carbons prepared from teak leaf, maize corn and babool tree bark were used to study adsorption of red industrial dye under various experimental conditions. The authors demonstrated that the adsorbents were effective for the removal of Methylene red industrial dye. Thus, the objective of this work is to investigate the potential of active carbon derived from low cost local available rice husk for the removal Methylene Blue dye from textile wastes.

2 EXPERIMENTAL SECTION

2.1 CHEMICALS AND MATERIALS

Analytical grade Methylene blue Dye (purchased from AMBALA Cantt-India) was used as adsorbant. Distill water was used to prepare mother solution. Concentrated H_2SO_4 (purchased BDH Chemicals Ltd, poole England) for activation of row rice husk carbon, iron(III)Chloride salt (purchased from Finkem laboratory) for imprignation, HCl (0.1M) (purchased from Whitehouse Industrialstate,Runcorn Cheshire) or NaOH (0.1M) (purchased from Avishaker) for pH adjustment were used. The required materials/apparatus are beakers, pH meter (model: MP220, Toledo GmbH, Switzerland), Uv-visible spectrophotometer (model:I-290,intech), infrared spectrophotometer, oven (model:OV250C-England), muffle furnace(T15A,stuart scientific),grinding machine, shaker (VRN-480,Gemmy industrial crop, Taiwan), meshes,Erlmleyer flasks.

2.2 SOLUTION PREPARATION

An accurately weighed 1g of the dye dissolved in distilled water was used to prepare stock solution (1000 ppm). Solution used in the experiment for the desired concentration was obtained by successive dilutions. Dye final concentration was determined by using absorbance values measured before and after the treatment, at 668 nm with Uv-Visible Spectrometer (model: I-290, intech) [14].

2.3 BATCH ADSORPTION EXPERIMENTS

The pH of the solutions was varied from 2 to 10, by adding 0.1 M sodium hydroxide (NaOH) or 0.1 M hydrochloric acid (HCl) solutions for pH adjustment and measured using a pH meter(MP220.toledo, GmbH, siwtzerland). All the chemicals used were analytical grade. Batch mode experiments were conducted at a temperature of 25 ± 2 °C by shaking 1g of adsorbent rotary shaker (VRN150C-England) in 50 ml of Methylene blue solution of the desired concentration in 100 ml Erlenmeyer flasks. The flasks were agitated on a rotary shaker at 200 rpm for 2 h to ensure equilibrium. The influence of pH (2.0, 4.0, 6.0, 8.0, and 10.0), contact time (30, 60, 90, 120, and 150 min) and initial Methylene blue concentration (10, 15, 20, 25, 30mg/ l) on the performance of the rice husk carbon were evaluated. The Methylene blue concentration in the supernatant solution after the adsorption process was analyzed using a Uv- visible spectrophotometer(model:I-290,intech) by recording the absorbance changes at a wavelength of maximum absorbance (668 nm).The removal percentage (R%) of Methylene blue was calculated for each run using the following expression.

$$R(\%) = \left[\frac{C_i - C_e}{C_i} \right] \times 100 \quad (1)$$

C_i and C_e were the initial and final concentration of Methylene blue in the solution. Under the experimental conditions, the adsorption capacity for each concentration of Methylene blue at equilibrium was determined by the following expression.

$$q_e \left(\frac{mg}{g} \right) = \left[\frac{C_i - C_e}{m} \right] V \quad (2)$$

V is the volume of solution (in liters) and M is the mass of adsorbent (in grams) used.

2.4 CHARACTERIZATION OF ADSORBENTS (RHC)

Determination of pH Zero point charge: pH_{zpc} was determined to investigate the surface charge of RHC. For the determination of pH_{zpc}, 0.01M NaCl was prepared and its pH was adjusted between 2.0 and 12.0 by using 0.01M NaOH/HCl. 100mL of 0.01MNaCl was taken in to 250mL Erlenmeyer flasks and 0.20 g of activated carbon was added to the solutions. These flasks were kept for 48 h and the pH of the solutions was measured by using a two-point calibration pH meter (model: MP220, Toledo GmbH, Switzerland). The results were then plotted between “pH final versus pH initial”. The point of intersection of the curves of “pH final versus pH initial,” is the pH_{zpc} of ARHC [15].

Determination of Surface area of Rice Husk Carbon: Surface area per gram of the ARHC and ARHC-Fe were obtained using Sear’s method, Sear’s 1956. For this 1.5 g of carbon sample was mixed with 100 ml of water and 30 g NaCl for both adsorbents. The mixture was stirred for five minutes. To this, 0.1 N HCl was added to make final volume of 150 ml and final pH of 4.0. It was then titrated against 0.1N NaOH. The volume (V ml) of 0.1N NaOH required to raise the pH from 4.0 to 9.0 [16]. The specific area (i.e. area per gm) was obtained using the formula:

$$A = 32 \cdot V - 25 \quad (3)$$

Where A = Surface area of RHC per gram (in m²/g)

V = volume of 0.1N NaOH required to raise the pH from 4.0 to 9.0.

3 RESULT AND DISCUSSION

3.1 CHARACTERIZATION OF ADSORBENT

Determinations of ph zero point charge: determination of pH_{zpc} was performed to investigate the surface charge of RHC. The result is presented in fig.1. As it can be seen in this particular study the pH_{zpc} is found to be 8.35. It is well reported that adsorption of cation is favored at ph > pH_{zpc}, while the adsorption of anion is favored at ph < pH_{zpc} was noted J. T. Nwabanne and M. I. Mordi, (2009).

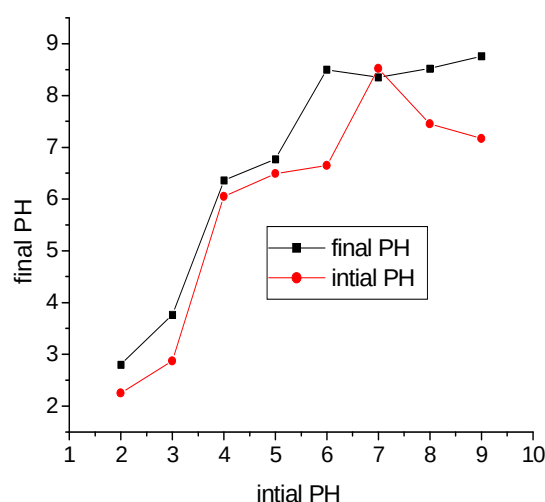


Fig.1. pH of zero point charge of activated rice husk carbon (ARHC)

3.2 SURFACE AREA ANALYSIS RICE HUSK CARBON (RHC)

The surface area of prepared carbon was determined using Sear’s method. Surface area per gram of the ARHC and ARHC-Fe adsorbent was found to be 615 and 679 m²/g respectively. The surface area of the carbon after adsorption was decreased as the concentration of dye increase. This may be due to the tendency of formation of polymerized end products at high initial concentration.

3.3 EFFECT OF OPERATING CONDITIONS

Effects of initial dye Concentration: The effect of initial concentration on the removal efficiency of activated rice husk carbon was investigated over wide range of MB concentration. The results are presented in fig.2 and 3. As it can be seen in the figure, uptake of MB was rapid at lower concentration (10-15 mg/L) and as concentration increase the amount of MB adsorbed was decreased. Percentage sorption decreased (from 99.959 to 99.128) but the amount of MB adsorbed per unit mass of adsorbent increased (from 0.5 to 1.49 mg/g) with increase in MB concentration from 10 to 30ppm. On the other hand, when all the sites are occupied, this concentration adsorbed becomes nearly constant. This suggests that formation of monolayer on carbon surface. In fact, the more concentrated the solution, the better the adsorption capacity of ARHC as noted [15] With respect to the two active carbons the carbon impregnated with iron has higher sorption capacity of MB due to high porosity of adsorbent.

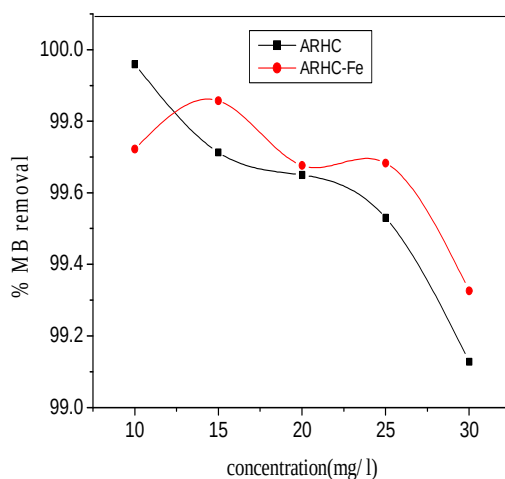


Fig.2. Effect of initial concentration the removal efficiency Methylene blue using treated rice husk carbon Conditions: pH = 8, t= 120 minutes, W_{AC} = 1g, and $T= 25 \pm 2^\circ\text{C}$.

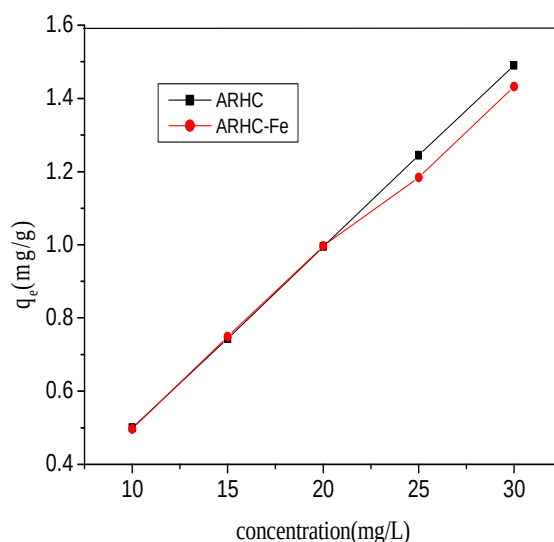


Fig.3. Effect of initial concentration on adsorption capacity of Methylene Blue using rice husk Carbon at 30 ppm. Conditions: pH = 8; t=120 minutes W_{AC} = 1g and $T= 25 \pm 2^\circ\text{C}$.

Effect of Adsorbent Dosage: The effect of adsorbent mass on the adsorption of Methylene Blue dye was investigated. To this end, a series of adsorption experiment was carried out with different adsorbent dosages at initial dye concentration of 30 ppm. Fig. 4 and 5 presents the effect of adsorbent dosage on the removal of Methylene blue using ARHC and ARHC-Fe.

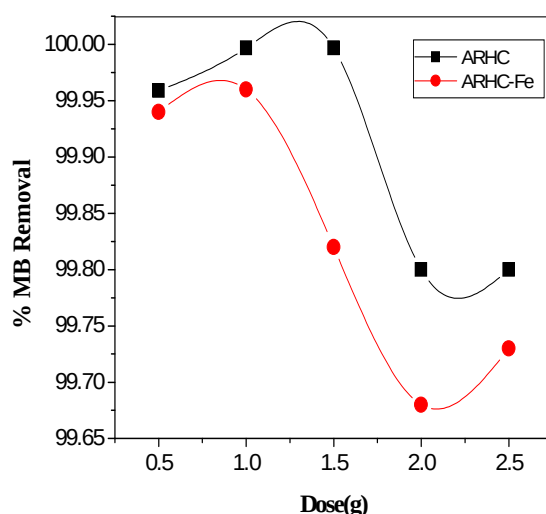


Fig. 4: Effect of adsorbent dosage on the adsorption efficiency of Methylene blue using ARHC and ARHC-Fe, at $C_0=30\text{ppm}$. $\text{pH} = 8$, $t=120\text{ min}$, $T= 25 \pm 2^\circ\text{C}$.

The results follow the expected pattern, in which the percentage sorption increased with the increased in adsorbent dosage until it reaches the equilibrium dosage (1g). On reaching equilibrium the percentage removal is decreased with increasing the amount of rice husk carbon. Several investigation demonstrated that although, increasing of adsorbent dosage leads to increase of active sites for adsorption, but this phenomenon may not lead to high adsorption capacity and adsorption efficiency of adsorbent due to the over load of the carbon area is decreased [17],[18]. It can be seen in fig. 5 that the adsorption efficiency of ARHC-Fe was lower than the ARHC. Increase of adsorbent dosage leads to increase iron content in active site so the iron may block the adsorption site of the activated carbon [19].

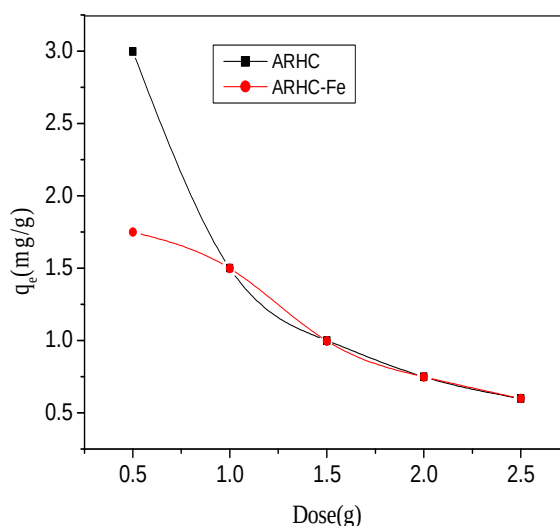


Fig.5. Effect of adsorbent dosage on the adsorption capacity of Methylene blue using ARHC and ARHC-Fe Conditions at $C_0=30\text{ppm}$. $\text{pH} = 8$, $t=120\text{ min}$, $T= 25 \pm 2^\circ\text{C}$.

Effect of contact time: The effect of contact time on the amount of dye adsorbed on the RHC is investigated at initial concentration of 30 ppm and temperature of 25°C. The system was subjected to an agitation speed of 200 rpm at different contact time. The result obtained is presented in fig. 6. As it can be seen a rapid adsorption of Methylene blue dye on ARHC and ARHC-Fe was observed at the initial stages of the adsorption and equilibrium is attained within about 120 min. Such uptake indicates high degree of affinity towards dye molecules via chemisorptions. After the rapid uptake, the capacity of the adsorbent became exhausted and the adsorption would be replaced by the transportation of dye from the external sites to the internal sites of the adsorbent particles. Similar results were reported elsewhere [14], [20].

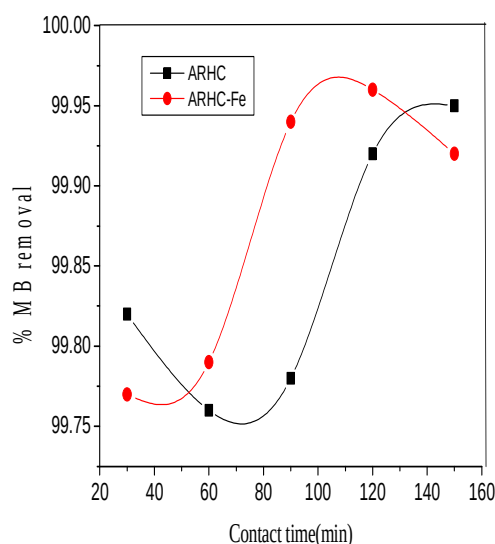


Fig. 6. Effect of contact time on the adsorption efficiency of Methylene blue using ARHC and ARHC-Fe Conditions: $C_0=30$ ppm, $PH=8$, $D= 25 \pm 2^\circ C$, $W_{AC}=1g$

Effect of pH: Studies were carried out to see the effect of pH on adsorption MB on ARHC in the pH range of 2-10. The pH of the solution was maintained by adding hydrochloric acid or sodium hydroxide. The result obtained at 30 ppm initial concentration using ARHC and ARHC-Fe is shown in Fig.7. As it can be seen in figure 7, the removal of Methylene blue increased with increasing of pH of mother solution. Lower adsorption of Methylene blue at low pH is probably due to the presence of H^+ ions competing with the cations groups on the MB for adsorption sites, thereby inhibiting the adsorption of dye.

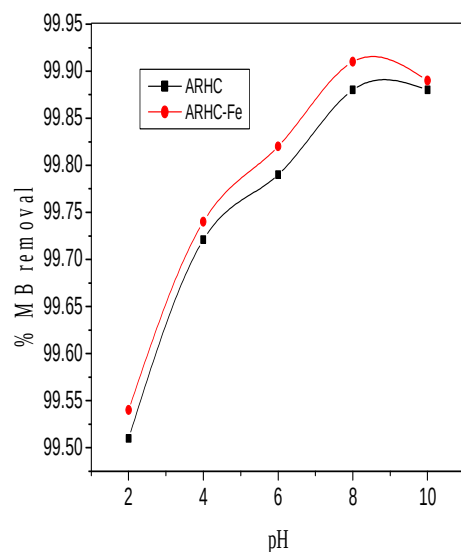


Fig.7. Effect of pH solution on the adsorption efficiency Methylene blue using treated ARHC and RHC- $FeCl_3$ at $C_0=30$ ppm. , $W_{AC} = 1g$, $t=120$ minutes and $T= 25\pm 2^\circ C$.

As surface charge density decrease with an increase in the solution pH, the electrostatic repulsion between the positively charged Methylene blue and the surface of the activated carbon is lowered; this may result in an increase in the rate of adsorption as reported [21],[22].

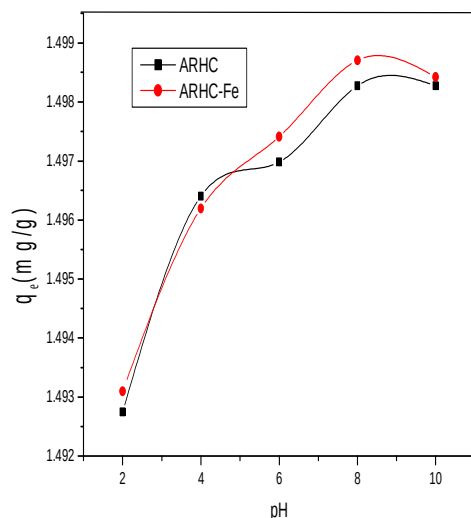


Fig. 8. Effect of pH solution on the adsorption capacity Methylene blue using treated ARHC and RHC-FeCl₃ at Co=30 ppm. , W_{AC} = 1g, t=120 minutes and T= 25±2°C.

Effect of temperature: To study the effect of temperature on the adsorption of dye over RHC, several experiments were performed at temperatures of 10 °C, 20°C, 30°C, 40°C and 50°C. Fig.9 presents the influence of temperature on the adsorption of dye onto RHCs. As it can be seen in fig.9, removal of MB decreases with increasing temperature. This suggests that the adsorption of MB on ARHC follows exothermic process. A similar result was reported elsewhere [23].

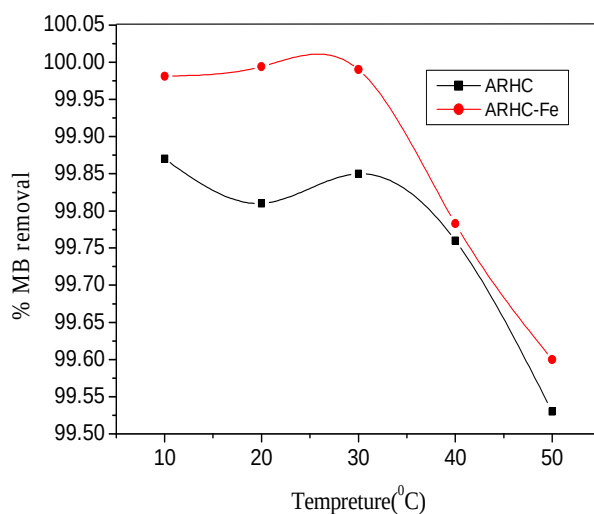


Figure 9: Effect temperature on the adsorption efficiency Methylene blue using treated ARHC and ARHC-Fe at Co=30 ppm. , W_{AC} = 1g, t=120 minutes and PH = 8.

4 CONCLUSION

In this study, ARHC with and without iron impregnated was tested and evaluated as a possible adsorbent for removal of Methylene blue dye from its aqueous solution in a batch adsorption experiment. The adsorption experiments were conducted for a wide range of solution pH, adsorbent dosage, temperature, initial concentration and contact time. It was observed that the percentage removal of Methylene blue dye decreased with an increase initial concentration, adsorbent dose and temperature while it increased with increase in solution pH and contact time. To this end, over 99% removal

efficiency of Methylene blue dye was achieved at solution pH around 8. This suggests that both ARHC and ARHC-Fe can be used in the removal of dyes from textile waste water.

ACKNOWLEDGEMENT

I am thankful to Dr. Nigus Gabbiye, for his plateful and endless constructive comment, Mr. Abrha Berhe(Chemistry Department, UoG) for his kindly cooperation in facilitating conditions and resources throughout my study ,University of Gondar for its provision of all resources necessary to accomplish my study by providing the necessary ingredients and Ministry of Education for providing sponsorship.

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Properties of particleboard based on Date palm fronds as renewable Egyptian lignocellulosic materials

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ABSTRACT: The main objective of this study was to evaluate the suitability of Egyptian biomass based on Date palm fronds, (*Phoenix dactylifera* L) for full-scale manufacturing to produce particleboard of requested quality. For the evaluation, Date palm rachises (DPR) and sugarcane bagasse (SCB) were compared for some of the chemical properties, such as holocellulose, Alfa-cellulose, lignin and ash contents, alcohol–benzene extractives, solubility in dilute alkali (1%NaOH), and hot water solubility. In addition, DPR fiber physical properties such as fiber length diameters, cell wall thickness, scanning with SEM, estimate of α -cellulose degree of polymerization (DP) and pH of DPR fibers were determined. Particleboards were made from DPR and SCB as surface and core layer were prepared and mixed with different percentages of urea-formaldehyde (UF) as a binder. The mechanical properties of produced boards such as density, thickness swelling (TS), bending strength (BS), modulus elasticity (MOE), and internal bond (IB) were measured. Chemical composition of DPR is slight better than SCB. Moreover, the values of DPR fiber lengths, diameters and cell wall thickness are also in the range of hardwoods values. The results indicated that all the panels met the requirements for Load-bearing boards for use in dry conditions type (P4) of European standard (EN 314: 2010).

KEYWORDS: Alphacellulose; bending strength; Holocellulose; Klason Lignin; modulus elasticity; thickness swelling.

1 INTRODUCTION

The shortage in natural wood resources due to deforestation and the increasing demand for the wood products due to population growth on the other hand, make the international attention is focusing on utilization of agro-residues and recycling of wood waste for manufacture of wood based panel.

In Egypt, with its poor forests resource, high demanding of wood products and high cost price of imported wood, The wood based panel production was started in 1963 based on sugarcane bagasse raw materials in Aswan governorate by Komombo company for particleboard to try solving a part of this problem, But medium density fiberboard (MDF) was started in 1996 to introduce a new type of wood based panel based on sugarcane bagasse raw materials in Quena governorate by Nag-Hamady Fiberboard company (NFB). Recently, due to expansion in other industries based on sugarcane bagasse raw material like paper industry, bio-fuel production, organic materials synthesis like alcohols, vinegar,...etc, All of those make the use of alternative fiber such as agricultural residues like date palm fronds more attractive and feasible to produce wood boards suitable for using in the furniture and construction industries. There are suitable quantities of lignocellulosic residues that are available all over Egypt; where **F.A.O. 2012** reported that the annual production of dates in Egypt equal to 1,470,000 tons, and the total area cultivated 42,500 hectares (101192.5 feddans) [1].

In addition, lignocellulosic residues are naturally abundant and attractive renewable alternative raw materials for wood board industries because their manufacturing processes can be easily adapted to various types and forms of wood board. Finally from both the economical and environmental point of view, Using of lignocellulosic residues can help to protect the environment and add a money value to this residues.

1.1 CHEMICAL COMPOSITION OF LIGNOCELLULOSIC MATERIALS

Date Palm fronds are Lignocellulosic materials, which can be used as raw materials for many chemical industries especially for manufacturing of wood based panels. The cell wall of any plant composites from three important components, cellulose, hemicellulose, and lignin, add to some cell wall chemicals called extractives.

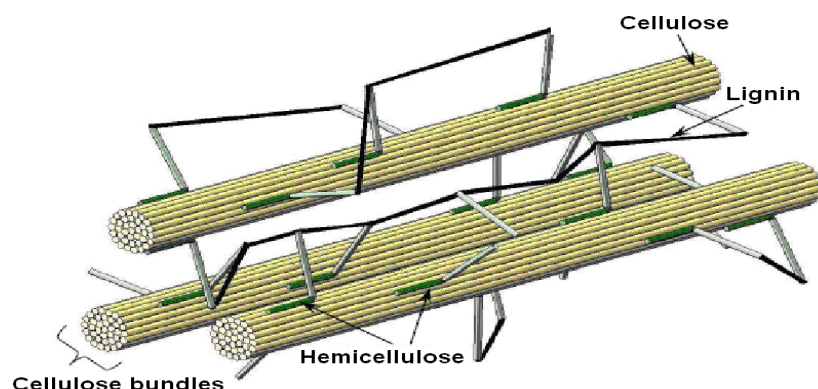


Figure1: Location and Arrangement of cellulose, hemicellulose and lignin in the lignocellulosic material [2], [3].

1.2 CELLULOSE

Cellulose is a high molecular weight linear homopolymer of repeated units of cellobiose (two anhydrous glucose rings joined via a β 1,4- glycosidic linkage) [4] (Dabhi, B.K. et al 2014). Most of these polymer chains arrange in parallel and form a crystalline structure, and the rest form a non crystalline regions. The number of glucose units in a cellulose molecule is referred to the degree of polymerization (DP). Wood cellulose has an average DP of at least 9,000 – 10,000 or higher as 15, 000, Thus molecular weight for cellulose ranging from about 10,000 to 150,000 .

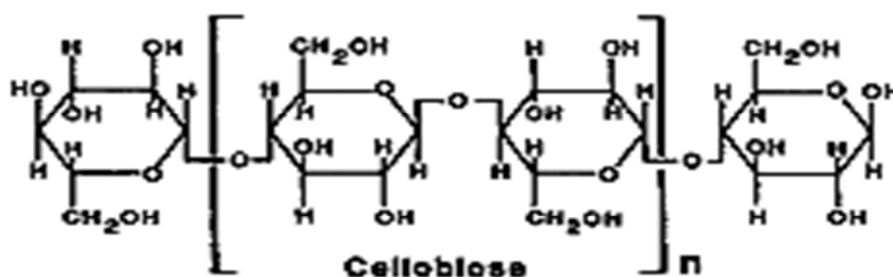


Figure 2. Structure of cellulose

1.3 HEMICELLULOSE

Hemicellulose is a linear and branched heterogeneous polymer typically made up of five different sugars. There are a slightly difference in hardwoods and softwoods hemicelluloses composition. In hardwood, the main hemicellulose is O-acetyl-4-O-methylglucuronoxylan, called glucuronoxylan or simply xylan. The content of xylan in hardwood wood fibers is about 15-30 %, depending on the species [5] (Sjostrom, 1993a). In softwood, the main hemicelluloses are O-acetyl-galactoglucomannan and arabino-(4-O-methylglucurono) xylan, simply called glucomannan and xylan, respectively. The

content of glucomannan and xylan in softwood is 20 % and 10 %, respectively. The hemicellulose polymers in wood are much smaller in size than the cellulose, as the hemicelluloses have DPs of 100-200 [5] (Sjostrom, 1993b).

1.4 PENTOSAN

Pentosan is polysaccharide compound of pentose sugar units. nonstarchy polysaccharide, hemicellulose and flour gums are the names that have been used to refer to them [6] (Lehtonen M., Aikasalo R., 1987). Mainly pentosan consists of D-xylose and L-arabinose pentose sugars.

1.5 LIGNIN

Lignins are amorphous, highly complex, mainly aromatic polymers of phenylpropane units that are considered to be an encrusting substance. The three-dimensional polymer is made up of C–O–C and C–C linkages. The precursors of lignin biosynthesis are *p*-coumaryl alcohol (Figure 3-a), coniferyl alcohol (Figure 3- b), and sinapyl alcohol (Figure 3-c). Structure (3-a) is a minor precursor of both softwood and hardwood lignins, structure (3-b) is the predominate precursor of softwood lignin, and structures (3-b) and (3-c) are both precursors of hardwood lignin [7] (Alder, 1977).

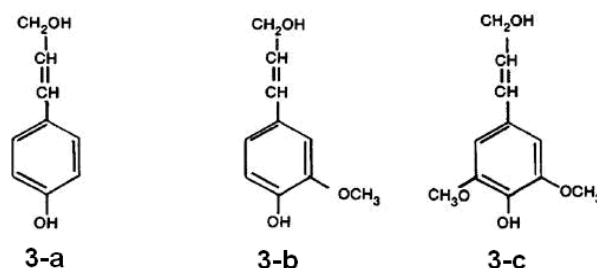


Figure 3. Chemical structures of lignin precursors: (3-a) *p*-coumaryl alcohol, (3-b) coniferyl alcohol, and (3-c) sinapyl alcohol.

Lignins can be classified in several ways, but they are usually divided according to their structural elements [5] (Sjostrom 1993c). Softwood has a range of (28.8 ± 2.6 %) lignin content [8] (Rowell M. Roger, 2005a); it is mainly a polymer of coniferyl alcohol called guaiacyl lignin. Hardwood has a range of (23.0 ± 3.0 %) lignin content [8] (Rowell M. Roger, 2005b); it is mainly a syringyl-guaiacyl copolymer.

1.6 EXTRACTIVES

Wood extractives can be defined as the chemical compounds that are extractable from wood with various neutral solvents [9] (Monica, Ek, et al 2009). Due to they are a group of cell wall chemicals, different specific types of solvents including of water, benzene, alcohol, etc or combination of more than one solvent can be used. They mainly consisting of fats, fatty acids, fatty alcohols, phenols, terpenes, steroids, resin acids, rosin, waxes, and many other of minor organic compounds. These chemicals exist as monomers, dimers, and polymers. In general, softwoods have higher extractives content than hardwoods. Some of these extractives are responsible for the color, smell, and durability of the wood.

2 MATERIAL AND METHOD

This research has been carried out at NFB laboratories and research pilot plan according to the following experimental work.

2.1 SAMPLES COLLECTION AND PREPARATION

The tested Palm fronds raw materials were collected in spring season from local areas in Quena governorate, South of Egypt. To preparing the samples for chemical analysis, Date palm rachises (DPR) were cleaned from leaves and spines. Only

rachises were cut into small strips then cut into small chips to be placed in an electrical fiber mill. Bagasse samples were collected from bagasse depither located at NFB. The samples were then placed in a shaker with sieves to pass through a 500- μm sieve. The resulting material was placed and labeled with appropriate code for physical or chemical analysis then samples were subject to the following work.

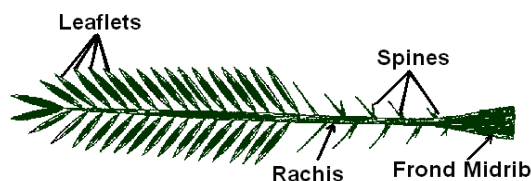


Figure 4. Date Palm frond components

2.2 METHODS

Moisture Content was determined using the oven-drying method according to (ASTM **D4442-92**) [10]. Extractives was Determined in two-step extraction process to remove water soluble and ethanol soluble material according **NREL** [11] but it was founded that it was more useful to use mixture of benzene-ethanol 1:1 (V/V) instead of ethanol alone, as it is reported in [12] (**T 204 cm-97**) the ethanol - benzene mixture appears to provide the most complete removal of residual solvent-extractable substances in pulp. Hot alkali solution extracts (NaOH 1% solubility) was done according **TAPPI, T 212 om-02** [13]. Holocellulose content & α -Cellulose content were determined according method that descried by **Rowell M. Roger, (2005)** [8]. Acid-insoluble lignin (Klason lignin) was determined according **T 222 om-11** [14]. pentosan was determined according the procedure was describe by **Herbert F. Launer and William K. Wilson (1939)** [15]. α -cellulose degree of polymerization (DP) was determined in Cadoxen soln; The method & Cadoxenn prepatation was done according to the procedure described by **Dupont,A-L (2003)** [16]. The pH of lignocellulosic fibers was measured by a previous calibrated JENWAY 3505 pH meter with a glass electrode; Five grams of oven dried fiber sample were soaked in a glass beaker with 100 ml of distilled water for 10 minutes at 20 °C. The mixture were stirred from time to time, and then filtered to check the pH value of filtrate. Density of lignocellulosic fibers was determined based on the oven dry weight as Kg/m^3 . Observation with SEM was done by using (JEOL, Japan) Instrument, JEOL - JSM-5500 LV scanning electron microscope. The sample introduce to SEM observation as it is with no preparation and it also introduced as pretreated sample. Two types of preparation was used, extractive free simple, or the sample was pretreated with sodium hydroxide 1%.

2.3 PARTICLEBOARD MANUFACTURING

Date palm rachises (DPR) were air dried in sun light for 48 hours, and then cut to 25x25x5 mm chips that suitable size for grinding in mill. Particles for three-layered particleboard were prepared by using laboratory attrition mill; for particle classification a screen shaker with six layers, particles left behind 4 mm and 3 mm screens were reground. The particles that remain on 2 mm and 1 mm sieves were used in core layer while particles on 0.5 and 0.250 mm sieves were used for surface layer .the particles were then dried to a target 3% MC. Constant weight of both core and surface particles were weighted to get target density as shown in table 1.

Three-layer particleboards 400 × 400 × 12 mm with computed density 680 kg/m^3 were produced. For the production of these particleboards, (surface and core particles) from SCB at different variants of resin addition ratio A1, A2 and A3, and compared with these particleboards from DPF at different resin addition variants B1, B2 and B3, were produced under laboratory conditions according to trials parameters, materials for surface and core layer ratio, board density , Urea formaldehyde resin addition , press cycle and press temperature are listed in table 1.

Three Particleboards were pressed from each variant at specific pressure 35 kg/cm^2 by using laboratory press of NBF research plant. After air-conditioning, these boards were cut according to standard sawing pattern into test specimens serving for the subsequent determination of basic physical and mechanical properties. Eighteen test specimens to determine density, swelling.

Table 1: Board manufacturing parameters

sample	Material	SL	CL	BD	BT	SL resin	CL resin	PT	PC
		%	%	Kg/m ³	mm	%	%	°C	Sec
A1	SCB	30	70	680	12	8	6	177	144
B1	DPR	30	70	680	12	8	6	177	144
A2	SCB	30	70	680	12	10	7	177	144
B2	DPR	30	70	680	12	10	7	177	144
A3	SCB	30	70	680	12	11	8	177	144
B3	DPR	30	70	680	12	11	8	177	144

SL= surface layer particles, CL= core layer particles, BD= board density, BT= board thickness, PC= press cycle, and PT = press temperature.

2.4 PARTICLEBOARD MECHANICAL PROPERTIES

Bending strength or modulus of rupture (MOR) and modulus of elasticity in bending test (MOE) were performed according EN 310 [17], but internal bond (IB) and swelling in thickness test were performed according EN 319 [18] & EN 317[19] respectively.

3 RESULTS AND DISCUSSION

The chemical & Physical Characterization of Date Palm rachises (DPR) were compared with those of Sugarcane bagasse (SCB), the conventional raw material, which utilizes in Particleboard and MDF production.

3.1 CHEMICAL CHARACTERIZATION OF FIBERS

DPR have slight low polysaccharides (holocellulose) and lignin content and similar to that of SCB Table 2. The hot water solubility of DPR are higher than those of bagasse and most of hardwoods. The alpha cellulose content of **DPR** are slightly lower than those bagasse and most of hardwoods. In addition, the solubility of **DPR** fiber in hot alkali is lower than that of bagasse.

Table 2: Chemical composition of Date Palm rachises

Test / Material	H.Cell %	α - Cell%	Hemi Cell%	Lignin %	Pentosan %	Water Ex.%	Solvent Ex.%	Total Ex.%	NaOH %	C.W%	Ash %
DPR	69.96	38.99	30.97	18.55	24.79	14.16	1.6	15.76	29.26	13.9	5.82
SCB	74.14	42.58	31.56	18.22	29.22	3.97	1.82	5.79	34.5	3.4	2.85

H.Cell= holocellulose %, α -cell= α -cellulose %, Water Ex & Solvent Ex = water & solvent extractives respectively, NaOH %= solubility in 1 % NaOH, C.W= Cold water solubility.

N.B. hemicellulose content = (H.Cell %) – (α -cell %), Total Extractives = Water Ex% + Solvent Ex %

Date palm rachises are a lignocellulosic material that contains a high level of holocellulose, this high content allows Date palm rachises fibers act as fiber-reinforced materials. Thus, the boards made from date palm rachises composite have suitable mechanical properties and can be introduce as a competitive product in the market.

Date Palm rachis have suitable lignin content (18.55%), which is nearest to Sugarcane bagasse content (18.22%), this lignin content just makes it a building material with higher strength suitable for particleboard manufacturing without undesirable properties.

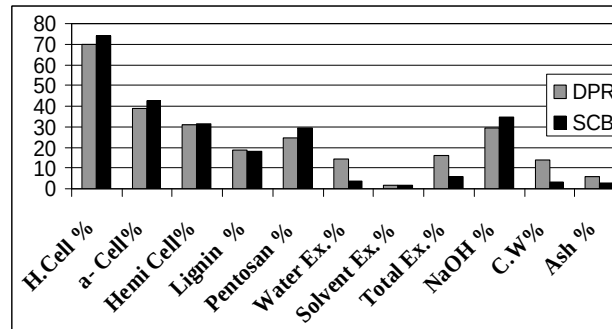


Figure 5: Chemical composition of Date Palm rachises based on data in table 2

Date palm rachis fiber have a suitable hemicellulose and pentosan content (30.97% & 24.79% respectively) comparing with bagasse fibers that explain the good mechanical properties of produced boards, where they were considered as very important factors for MOR, which is direct proportion with IB.

Date Palm rachis have suitable total extractives content 15.76% where water extractive was 14.16 % and solvent (benzene-ethanol) extractive was 1.6%. This means that the fiber will lose some of undesirable colored materials during the manufacturing process spatially in the digester sector.

Ash content is considered to be an indicator to non-organic materials in a Lignocellulosic fiber which may be undesirable matter if its presence is in very high levels. However, Date Palm rachis has suitable ash content 5.82% and this result was in agreement with those arising from other Lignocellulosic materials.

3.2 PHYSICAL CHARACTERIZATION OF FIBERS

The physical characterization of DPR was compared with those of SCB. As indicated in Table 3, DPR are slightly higher pH, density & D.P. than SCB.

Table 3: physical composition of Date Palm rachises

Raw material type	pH	Density Kg/m ³	D.P
DPR	5.7	166.8	1200.25
SCB	5.5	160	1099

D.P= degree of polymerization.

DPR like SCB fiber has suitable pH value, according [20] (Maloney T. M, 1989) the increase in acidity of fiber (pH= 4.8 to 4.4) is an undesired in the drying process of the fiber, where acidity of fiber is accelerating the curing of binder material with the lignocellulosic fiber (pre-curing of glue), therefore the part of the resin content is lost in this process, hence during the hot press, obtained lower mechanical properties and standard non-conformity.

DPR Fiber has density equal to 166.8 Kg/m³ which is in the Lignocellulosic materials range 190 - 220 Kg/m³ according [21] (Xanthos M, 2010).

As listed in Table 4, it was significantly clear that the most DPR fiber properties are similar to those of SCB, conventional raw material, which utilized in production of particleboard and MDF. However, fiber length and cell wall thickness of DPR is some higher than those of bagasse. In addition, DPR lumen width was lower than those of most hardwood and bagasse.

Table 4: fiber Date Palm rachises

Raw material type	Fiber length μm	Fiber width, μm	Lumen width, μm	Cell wall thickness, μm
DPR	1654	29.2	8.6	5.0
SCB	1564	18.17	10.21	2.89

3.3 OBSERVATION WITH SEM

By using Instrument JEOL - JSM-5500 LV scanning electron microscope (JEOL, Japan), the best result is obtained when the sample was pretreated with sodium hydroxide 1% before SEM observation. Figure 5 (SEM microphotograph) explains the surface features of Date Palm rachis. A: general surface scanning view with magnification 35 X .B: showing fiber wood cell with magnification 700x.C: showing fibers, vessel members and ray parenchyma with magnification 500 X. D: showing a longitudinal section of vessel with magnification 300 X.

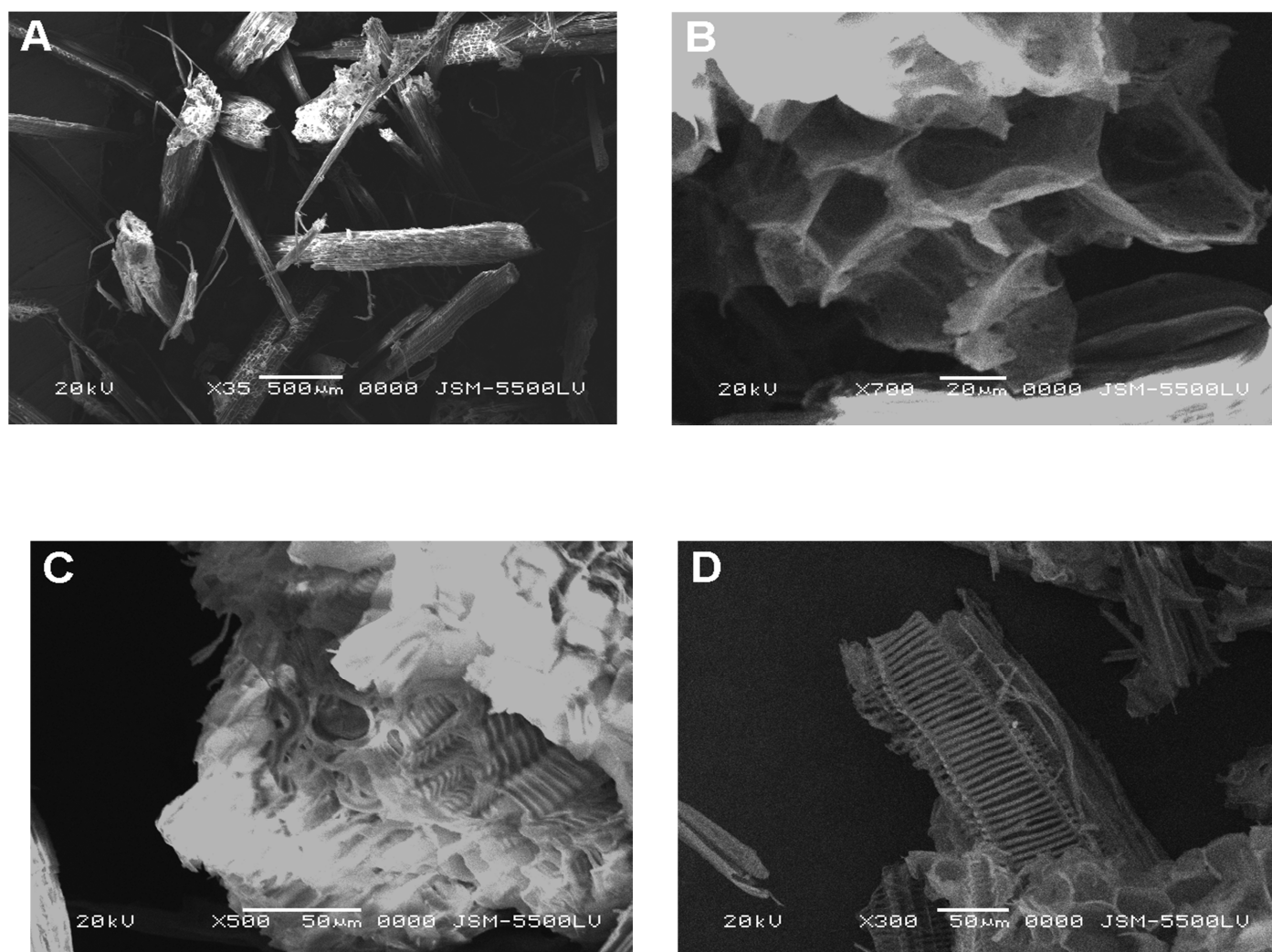


Figure.5: SEM of microphotograph of Date Palm rachis

3.4 MECHANICAL PROPERTIES OF TESTED PANELS

The physical and mechanical of particleboards made from SCB and DPR at different resin levels types A1-A3 and B1-B3 types are presented in Table 5. The results indicate that mechanical properties of DPR boards are slightly higher than those made of SCB and it was clear that the increase in MOR, MOE and IB is related to raw material type and increase in resin level. Nevertheless, both cases, the mechanical properties are satisfied the standard requirements [17] (EN314, 2010). Results are showed that there is no major difference in thickness swelling and slight enhancement is due to such reasons related to resin level, wax level and board density and both board types are met the standard requirements.

Table 5: Mechanical properties of tested panels

Sample		MOR	MOE	IB	Swelling(24h)
Unit		N/mm ²	N/mm ²	N/mm ²	%
DPR	B1	18.36	2012.33	0.6	9.05
	B2	20.57	2264.33	0.76	8.67
	B3	28.47	3049	0.90	8.44
SCB	A1	16.45	1738.33	0.46	11.47
	A2	21.34	1738.33	0.57	11.41
	A3	27.00	2865.00	0.78	9.43
standard		16	2300	0.4	16

MOR = modulus of rupture , MOE = modulus of elasticity in bending, IB = internal bond , Swelling = swelling in thickness test, & standard = EN 314 standard Type P4, with board thickness 10:13 mm. N.B all produced board thickness = 12 mm

4 CONCLUSION

Date palm rachis, which is a residue accumulated in suitable amounts in Egypt; can be a potential material for particleboard manufacturing. Using date palm fibers for manufacturing particleboards are a good solution for raw materials shortage in the Egyptian particleboard industry sector. The mechanical evaluations of UF-bonded particleboards indicate that the product is complied with the European standard requirements [17] (EN 314, 2010) for Evaluating Properties of particleboard. Finally using renewable materials like date palm rachis for manufacturing particleboards, not only could contribute to reduce the shortage of raw materials for particleboard industry but also add a money value to Palm fronds.

ACKNOWLEDGMENT

My sincere thanks to **Mr. Eng. M.Kh. Soleman** NFB board chairman and all the members of NFB for their assistance all over the research stages, from collection sample stage until manufacturing processes and producing wood based panel with acceptable quality.

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DESIGN OF LEE'S DISC ELECTRICAL METHOD FOR DETERMINING THERMAL CONDUCTIVITY OF A POOR CONDUCTOR IN THE FORM OF A FLAT DISC

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ABSTRACT: This experiment was carried out to design modified Lee's disc method of measuring the thermal conductivity of a poor conductor in the form of a flat disc. The modified Lee's disc set-up is equipped with various types of electrical device and probes. The components used to implement the design were chosen because of their ability to withstand high voltage and temperature levels. Most of these instruments are utilized in industrial settings. The designed instrument was used to test the thermal conductivity of some low insulating materials. The value of k which is the rate of flow of heat through a material per unit area per unit temperature gradient was determined. The units of k are $\text{Wm}^{-1}\text{K}^{-1}$ (from $\text{Js}^{-1}\text{m}^{-1}\text{K}^{-1}$). The thermal conductivity of the selected materials was tested to validate the effectiveness of the modified design.

KEYWORDS: Conductor, heat transfer, Lee disc, temperature and thermal conductivity.

1 INTRODUCTION

Thermal conductivity is defined as the property of a material's ability to conduct heat as a result of temperature difference under steady state boundary condition. It appears primarily in Fourier's Law for heat conduction [1]. Thermal properties depends solely on the temperature gradient which much occur for heat to be transferred [2]. Thermal conductivity, referred to as a transport property, provides an indication of the rate at which energy is transferred by the diffusion process. It depends on the physical structure of matter, atomic and molecular, which is related to the state of the matter [3]. Considering the importance of thermal conductivity in The analysis of combustion and pyrolysis of wood exposed to fire [4-5], the energy design and evaluation of energy performance of wood-frame buildings [6], Increase in the conversion rate and provision of more electricity for on-board controls and creature comforts since it is an important properties of thermoelectric materials[7] and in the design of insulator for refrigerators, coolers and food flask[8]. The knowledge of thermal conductivity is therefore vital in understanding and modelling heat transfer processes in materials. For example, Thermal conductivity that represents quantitatively the ability of wood to conduct heat is of great significance in heat transfer modeling [9]. Design and development engineers continually demand thermal and electrical property data of technically important materials. Often these data are not in the published literature and immediately measurements must be performed. Since only a handful of laboratories have the proven expertise to make such measurements, usually they are performed by inexperienced personnel using unproven apparatus [10]. Therefore there is need to develop a suitable reproducible method for the estimation of thermal conductivity of materials in a developing economy such as that of Nigeria[11]. Although development has been registered over the years in the design of thermal conductivity measuring instruments, these technology has not really benefited the developing countries like Nigeria where these instruments still remains out of reach to researchers either because of the price or it accessibility. Various articles have been published on the thermal conductivity measurements of various insulating materials here in Nigeria [11-19]. This publication suggests the design, construction and testing of models for a quick estimation of thermal conductivity of materials based on lee's disc apparatus[20-22]. Hence, this research work sought to chart her course in that same direction but with a better design that minimizes errors in measurement.

2 MATERIALS AND METHODS

2.1 BASIC WORKING PRINCIPLE OF LEE'S DISC APPARATUS

The experimental set up is shown in Figure 1. The brass disc B is hung from the stand with the help of three strings. On the brass disc, the bad conductor sample disc 'S' is placed and over that a metallic disc M is placed. On the metallic disc, a heating chamber, H with facility for steam-in and steam-out is placed.

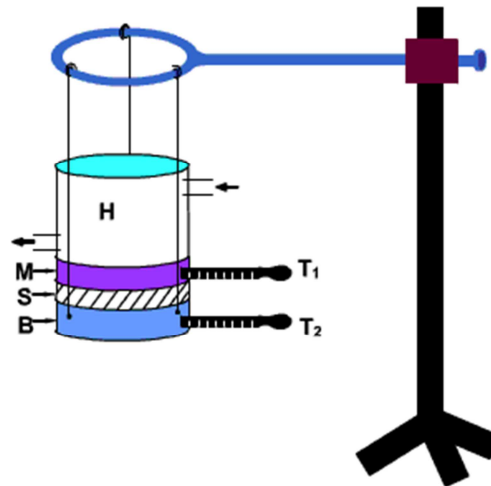


Fig 1 Lee's disc set-up Ref [23]

2.2 THEORY

When a steady state is reached with T_1 and T_2 the temperatures of metallic disc M and brass disc B. The temperature difference between the two ends of bad conductor is $(T_1 - T_2)$. The rate of heat conducted through the bad conductor is:

$$Q_1 = \frac{KA(T_1 - T_2)}{d} \quad (1)$$

Where, 'd' is thickness of the bad conductor and 'A' is the cross sectional area. The rate of heat lost by the brass disc to the surrounding under steady state is,

$$Q_2 = mc \left(\frac{dT}{dt} \right)_{T_2} \quad (2)$$

Where m-mass of the brass disc, C is the heat capacity of brass disc and dT/dt is its rate of cooling at T_2

From equation (1) and (2),

$$K = \frac{m c d \left(\frac{dT}{dt} \right)_{T_2}}{A(T_1 - T_2)} \quad (3)$$

By measuring, $(dT/dt)_{T_2}$ and $(T_1 - T_2)$ using Lee's apparatus the thermal conductivity K can be determined.

2.3 THE MODIFIED DESIGN OF LEE'S DISC METHOD FOR DETERMINING THERMAL CONDUCTIVITY OF SOLID

2.3.1 BASIC COMPONENT

Temperature Controller: Controllers receive sensor signals and control heaters or other devices to maintain a preset temperature.

Contactors: a contactor is a machine that is used to switch on a power or control circuit remotely within a motor. The activation of the contactor happens when a current or voltage lower than the required amount is sent to the control input on the contactor. The contactor is active when current passes through the electromagnet on the contactor which causes an electromagnetic field to be produced drawing the moving and fixed contacts together. When the coil in the contactor has no electrical charge the core of the electromagnet is moved by gravity back to its starting position [24].

Thermocouple: The temperature sensor is the "Nervous system" of the temperature controller. Just as one relies on his/her sense of touch, so a temperature controller relies completely on the sensor. The controller uses the sensor signal to decide whether to turn the heater on or off to maintain the desired set point temperature. It consists of two dissimilar conductors that contact each other at one or more spots. It produces a voltage when the temperature of one of the spots differs from the reference temperature at other parts of the circuit [25]. Thermocouples are a widely used type of temperature sensor for measurement and control, and can also convert a temperature gradient into electricity. Commercial thermocouples are inexpensive, interchangeable, are supplied with standard connectors, and can measure a wide range of temperatures.

Advantages of thermocouple sensor

- Simple and rugged
- High temperature operation
- Low cost
- No resistance lead wire problem
- Point temperature sensing
- Fastest response to temperature changes

Nozzle Heater: This material offers much higher thermal conductivity than mica and hard ceramic insulators used in conventional heaters. A thin layer of the high thermal conductive material electrically insulates the element wire from the inside diameter of the heater sheath. A thicker, low thermal conductivity layer backs up the element wire, directing the heat inward toward the heated part. The result is more efficient heat transfer—a performance solution that lowers element wire temperatures and increases heater life [26]. These heaters can be controlled accurately while dealing with sensitive material such as Nylon 66 with 40% glass filled. These are energy efficient, durable, and can withstand high temperatures [27]. Heater operating temperatures up to 1400°F (760°C). Watt densities up to 230 W/in² (35.6 W/cm²) are available on small diameter nozzle and Maximum voltage up to 240V.

Brass Disc: Brass is an alloy of copper and zinc of historical and enduring importance because of its hardness and workability. The metal was chosen because of its good electrical conductivity. The size of the brass was machined to 50 mm in diameter and 13mm thick. The specific heat capacity of brass is 0.38 kJ/W°C the faces were also smoothed for good thermal contact.



Fig 2. Cutting and Turning of the Metal Brass

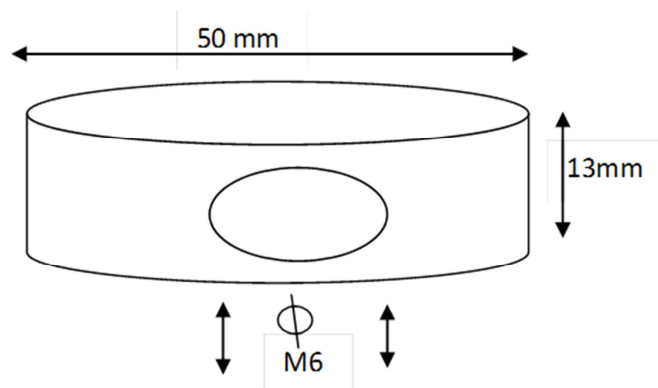


Fig 3. The metal disc with dimension

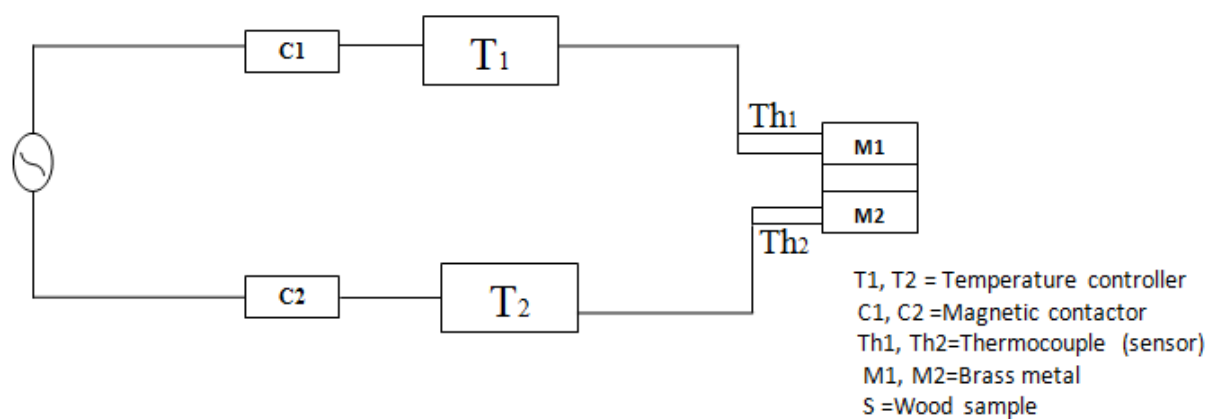


Fig 3 Block Diagram of the electrical set-up

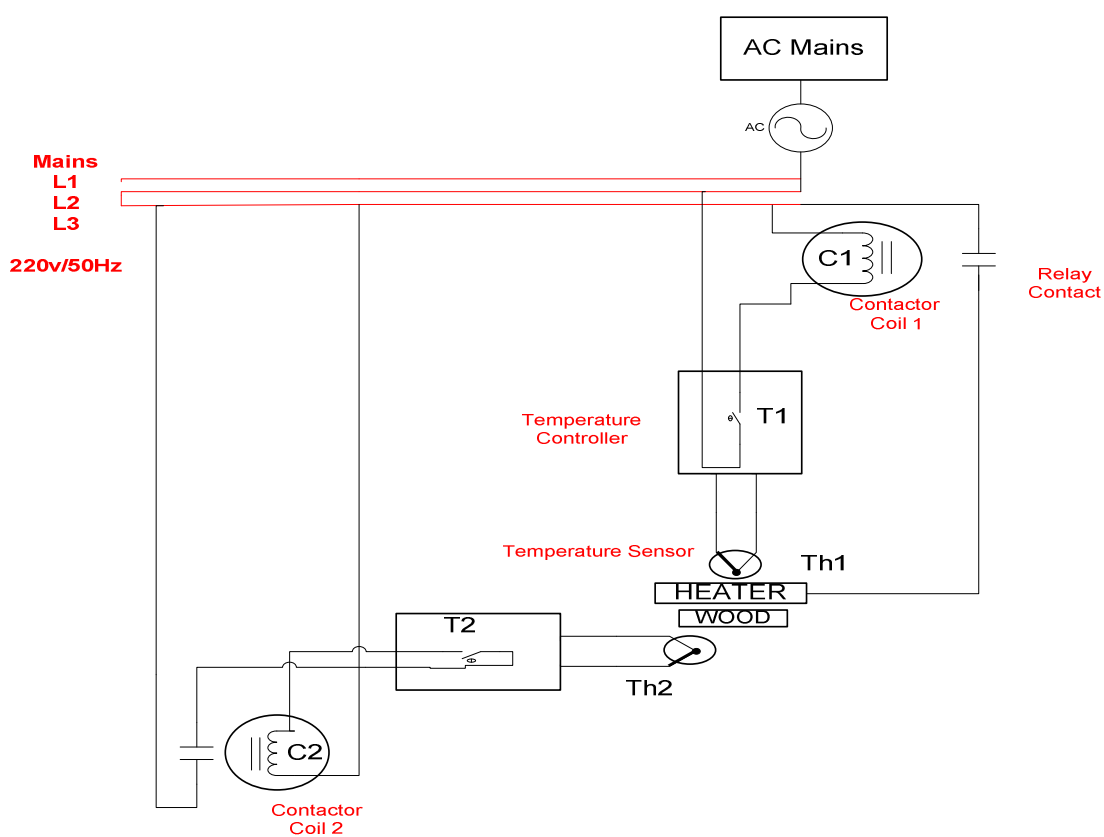


Fig 4 Circuit Diagram of the Electrical set-up



Fig 5 The front and inner components of the Electrical set-up

2.4 MODE OF OPERATION

The Block diagram depicts a Temperature controller for the determination of thermal conductivity of wood. The circuit model comprises of two digital temperature controllers (T1 and T2), two magnetic Contactor switches (C1 and C2), Two Thermo couple sensors (Th1 and Th2) and a nozzle heater H1. In the circuit configuration below, at power ON, the contactor switch C1 is activated by the source lines L2 (220v/50Hz) to supply power to C1 the heater H1. The temperature controller T1 is also activated to a preset temperature value t . The heat from the heater is transferred to the Metal Disc M1. The heat from M1 is then transferred to the material specimen placed in between metal disc M1 and M2. The two sensors Th1 and Th2 connected to the metal discs are used to sense temperature changes in the metal. When the thermocouple sensor Th1 connected to the first metal disc reaches the preset temperature t , the contactor switch c1 breaks power supply to the heater H1. However, the heat from the wood is transferred to second metal disc m2. The temperature of M2 rises till it reaches a steady temperature T_2 in the second Temperature controller. The thermal conductivity value is calculated in intervals of 5 minutes until the temperature controller T2 indicates a steady temperature value. The components used to implement the design were chosen because of their ability to withstand high voltage and temperature levels. Most of these instruments are utilized in industrial settings.

CALCULATION

$$P = I^2 R = KA \left(\frac{t_2 - t_1}{d} \right) \quad (4)$$

P = electric power (Watts)

R = Resistance of the heating element (Ω)

t_1, t_2 = temperature indicated by the respective thermocouple

A = area of the flat face of the specimen (m^2)

I = current passed to the heating element (Ampere)

d = thickness of the material

$$A = \frac{\pi d^2}{4} \quad (5)$$

$$P = mc \left(\frac{dT}{dt} \right) \quad (6)$$

Where equation 4 is equal to 6 then K will be equal to

$$K = \frac{m c d \left(\frac{dT}{dt} \right)}{A(T_1 - T_2)} \quad (7)$$

It is assumed that the radiation from the edges M1 and M2 is almost negligible by reason of the thermal insulation provided.

Procedure for Determining the Thermal Conductivity

The materials used in the study include samples of selected materials with low thermal conductivity. Materials of low thermal conductivity are usually those with high insulation i.e. non-metals examples are wood materials, plastics etc. The samples were machined down to the diameter of the Lee disc (i.e. 50 mm) and various thicknesses for convenience depending on the material. The surfaces of the samples were also smoothened for good thermal contacts. The basic apparatus used was modification of the standard Lee's disc method, for the measurement of thermal conductivity by the absolute plane parallel plate technique. This consists of two brass discs A and B drilled to accept thermocouple (Sensor) and 500 W electrical nozzle heater of the same diameter as the discs. Each sample was placed between discs A and B one after the other. The heater was placed on discs A. After tightening the clamp screw to hold all the discs together, the set-up was connected to a power supply. The whole assembly was placed in an enclosure to minimize the effects of draughts. At the beginning of each determination, the temperature of the discs (i.e. the temperatures of plates A and B) was monitored until the temperature of disc A attains a desired value of 20 - 50 °C. Readings was then taken at 5 minutes intervals during this period. In order to effectively analyze the thermal agitation in the samples, the thermal conductivity was estimated at every 5 minutes interval up to a point at which the temperatures of the discs would have stabilized to within ± 0.1 °C for at least 30 minutes [19]. The value for the thermal conductivity of each sample of thickness d and radius r was then estimated from the appropriate analytical equations governing the heat transfer process along and across the principal conductivity axes. The result was analyzed and graphs were plotted for comparison.

3 RESULT AND DISCUSSION

The thermal conductivity measurements of some selected materials are tabulated below

Materials	Thermal conductivity value ($Wm^{-1}K^{-1}$)
Gmanila wood	0.0914
Oak wood	0.1850
Rubber	0.1720
Asbestos cement sheet	0.3190
nylon	0.2300
Varied PVC	0.04-0.350

The thicknesses used for the materials were varied considering the fact that the thicknesses of all the materials can not be the same. The materials were also oven dried for wood while rubber and nylon were free from every form of moisture. The temperature for the wood materials was also varied although some measureable degree of accuracy was obtained at the 50 °C temperature. The table above shows the thermal conductivity value obtained for the various materials with asbestos cement sheet having the highest thermal value while Gmanila wood with the lowest thermal value. The experiment was conducted with high degree of accuracy eliminating possible error that could arise in the measurement of thermal conductivity [28].

4 CONCLUSION AND RECOMMENDATION

From the experimental results, the value of the thermal conductivity of the materials selected was low; this is because they are all non-metals with high insulating value. Thermal conductivity is regarded as the most important characteristic of a thermal insulator since it affects directly the resistance to transmission of heat that a material offers. The lower the thermal conductivity value, the lower the overall heats transfer. Comparing the result with other thermal insulators as reported by other researchers who have carried out similar experiment [29-32], it was evident that the modified apparatus has some measureable degree of effectiveness considering the fact that the differences in the value obtained was between 1.0-8.0 per cent.

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Contribution à l'Etude de la Contamination des Systèmes Aquifères de la Région de Kasserine par les Nitrates

[Contribution to the Study of Aquifers Systems Contamination by Nitrates in Kasserine Region]

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ABSTRACT: In Tunisia, the protection of groundwater resources, widely attacked by anthropic activities, against its contamination by nitrates has prompted the state to implement a national network for monitoring groundwater quality. The present work aims the characterization of the nitric quality of five aquifers in Kasserine region (Central West of Tunisia) and the identification of potential sources of water pollution. The study involved 22 wells water surface followed during 17 years (1996-2013). The temporal variation of nitrate showed a significant contamination with a concentration greatly exceeding the recommended norm during the period 1999-2003. The latter coincides with the phase of agricultural intensification related to the non-reasoned application of fertilizer coupled with the bad irrigation management. Nevertheless, between 2004 and 2013, the contamination tends to decrease and nitrates concentrations have stabilized around the potability threshold. The results also showed that nitrates levels are related to the soil type, irrigation techniques adopted by farmers and nitrogen supply. Indeed, excessive nitrogen inputs with a coarse texture and a gravity irrigation technique tend to increase the concentration of well water by nitrates. However, correlation between nitrates, piezometry and climatic factors, particularly, the rainfall could not be highlighted in the study area.

KEYWORDS: Nitrates, non point source pollution, aquifer, Piezometry, Kasserine.

RESUME: En Tunisie, la protection des ressources hydrique souterraines, largement agressées par les activités anthropiques, contre la contamination nitrique a incité l'Etat à mettre en œuvre un réseau national de suivi de la qualité des eaux souterraines. Le présent travail vise la caractérisation de la qualité nitrique de cinq nappes phréatiques de la région de Kasserine (Centre Ouest de la Tunisie) et l'identification des causes potentielles de leur pollution. L'étude a concerné les eaux de 22 puits de surface suivis durant 17 ans (1996-2013). La variation temporelle des nitrates a montré une contamination importante avec des concentrations dépassant largement la norme durant la période 1999-2003. Cette dernière coïncide avec la phase d'intensification agricole liée aux épandages d'engrais non raisonnés conjugués à une mauvaise gestion de l'irrigation. Néanmoins, entre 2004 et 2013, la contamination a tendance à diminuer et les concentrations en nitrates se sont stabilisées aux alentours de la norme de potabilité. Les résultats ont montré également que les teneurs en nitrates sont en relation avec le type de sol, la technique d'irrigation adoptée par les exploitants des puits et l'apport azoté. En effet, des apports excessifs d'azote avec une texture grossière et une technique d'irrigation gravitaire tendent à augmenter la

concentration des eaux de puits par les nitrates. Néanmoins, aucune corrélation entre les teneurs en nitrates, la piézométrie et les facteurs climatiques, notamment, la pluviométrie n'a pu être mise en évidence, dans la région d'étude.

MOTS-CLEFS: Nitrates, pollution diffuse, nappe phréatique, piézométrie, Kasserine.

1 INTRODUCTION

Les nitrates constituent un des principaux agents chimiques responsables de la contamination des nappes phréatiques souvent plus vulnérables que les nappes captives [1]. Cette contamination constitue une problématique environnementale majeure pour la plupart des pays du monde. Elle diminue le potentiel des ressources hydriques de bonne qualité, génère un risque sanitaire pour la population rurale et compromet le développement socioéconomique du pays [2], [3] et [4]. Toutefois, et contrairement aux pays industrialisés, les eaux souterraines sont fortement sollicitées dans les pays arides et semi-arides. Dans ces pays le degré de pollution est plus sévère à cause du taux de renouvellement limité des ressources hydriques déjà rares, du taux d'évaporation élevé [5], et de l'utilisation des eaux de qualité marginale en irrigation.

Dans les zones rurales, les nitrates proviennent essentiellement des pollutions diffuses agricoles suite à l'application excessive des engrais, des fertilisants et des produits phytosanitaires sur les terres agricoles ainsi que de l'élevage intensif [6] et [7]. Selon [8], leur transfert est contrôlé par les facteurs climatologiques (importance des précipitations, leur répartition dans le temps, température, évapotranspiration), agrologiques (propriétés physico-chimiques, hydrodynamiques et microbiologiques des sols) et agronomiques (niveau de fertilisation, type de culture, travaux culturaux). Des teneurs élevées en nitrates constituent un danger potentiel en cas d'utilisation en tant qu'eau potable et leur consommation peut engendrer la méthémoglobinémie chez les nourrissons et les maladies cancérigènes chez les adultes [3] et [9].

En Tunisie, en raison de la rareté croissante des ressources hydriques et de leur utilisation à la fois pour l'irrigation et pour l'alimentation en eau potable, la problématique de la pollution des eaux souterraines a suscité un intérêt national [10]. La protection et la préservation de leur qualité figuraient parmi les principaux objectifs dans les programmes de développement durable du pays. Ainsi, des réseaux nationaux de surveillance et de suivi du niveau et des teneurs en nitrates des nappes aquifères ont été instaurés au cours de ces deux dernières décennies. Ces réseaux comptent 1200 points de contrôle et de prélèvement (puits de surface et forage) répartis comme suit : 484 au Nord, 308 au Centre et 308 au Sud.

Dans la région de Kasserine (Centre Ouest du pays), le réseau de surveillance compte 14 nappes (5 profondes et 9 phréatiques). La présente étude a pour but de diagnostiquer la qualité des eaux de 5 nappes phréatiques de cette région vis-à-vis de la pollution par l'ion nitrate. L'étude a été basée sur des données relatives à une période de 17 ans (1996-2013), en vue de préciser l'ampleur de la pollution nitrique d'une part, et d'identifier les facteurs majeurs contrôlant les sources de cette pollution, d'autre part.

2 MATERIEL ET METHODES

2.1 RÉGION D'ÉTUDE

La région de Kasserine est localisée au Centre Ouest de la Tunisie, soit à 286 km au Sud Ouest de la capitale Tunis. Longeant la frontière Algérienne sur environ 200 km, le gouvernorat de Kasserine est limitée par les gouvernorats d'El Kef et Siliana au Nord, Sidi Bouzid à l'Est, Gafsa au Sud et l'Algérie à l'Ouest (Fig. 1).

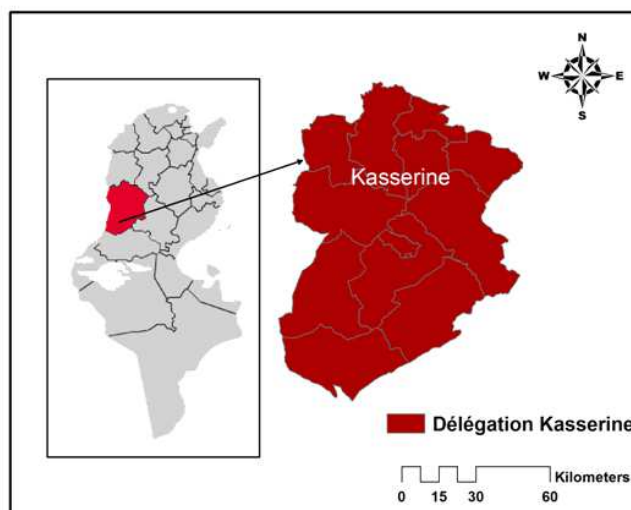


Fig. 1. Localisation de la région d'étude

Le gouvernorat de Kasserine fait partie de la région des hautes steppes de la Tunisie Centrale, zone de transition entre la Tunisie du Nord, région tellienne montagneuse froide et pluvieuse, et la Tunisie du Sud, région pré-désertique chaude et sèche. Le climat est semi aride avec une précipitation moyenne annuelle de 400 à 450 mm inégalement répartie entre les plaines et les Jebels avec une saison estivale sèche. La température varie entre un minimum de 3°C (au mois de Janvier) et un maximum de 35°C (aux mois de Juillet et Août). Les vents dominants sont le « Jebeli » en hiver, qui souffle à partir des hauteurs algériennes pour donner des températures glaciales, et le vent chaud et sec en été (à partir du mois de Mai jusqu'au mois d'Octobre) d'origine saharienne. La vitesse moyenne annuelle est d'environ 4,2 m/s.

2.1.1 GÉOLOGIE, PÉDOLOGIE ET HYDROGRAPHIE

Le relief de la région d'étude est caractérisé par un compartimentage marqué par la fréquence de fortes pentes en minichâines montagneuses isolant des plateaux et des plaines allongées de plus en plus vastes au fur et à mesure qu'on se dirige vers l'Est. Le substratum de la région est totalement d'âge secondaire, tertiaire et quaternaire qui s'étend du trias à l'historique. La lithologie est caractérisée par la prédominance des affleurements calcaires, marneux et gypseux [11]. Les sols du gouvernorat se répartissent en sols calcimagnésiques, sols d'apport alluvial, sols iso-humiques, lithosols et régosols. Sur le plan hydrographique, le réseau traversant les vastes dépressions, est dense. Il comporte plusieurs cours d'eau dont la majorité se rattache à 3 grands bassins versants : Zeroud (coté Kairouan), Mallègue (coté EL Kef) et El Kebir (coté Gafsa), d'apport moyen annuel de 88,5 ; 26,4 et 46,72 Mm³, de façon respective. La majorité des nappes phréatiques étudiées se trouve dans le bassin versant Zeroud.

2.1.2 NAPPES D'ÉTUDE

Les cinq nappes phréatiques considérées par la présente étude sont : Ain Zayen Thmed (16,47 km²), Chereyaa (76,39 km²), Alaarich (6,49 km²), Harich (172,51 km²) et Oumlagsab (172,50 km²).

La nappe Ain Zayen Thmed se trouve dans la région de Sbiba. Le synclinal d'El Gonna se plie au pied du Jebel Mghila depuis le bassin de Sbeitla au seuil d'Ain Zayen, constituant son exutoire naturel. Cet aquifère est constitué de dépôts continentaux du Miocène qui affleure largement dans l'aire de la nappe. Les sols peu évolués d'apport occupent la partie amont de la nappe ; et en allant vers l'aval on trouve les rendzines et les sols bruns calcaires en faible quantité.

La nappe Chereyaa dite aussi la nappe du bassin de Sbeitla est logée dans les grès du Miocène. Ce complexe gréseux bénéficie d'une recharge mobilisée à partir des eaux du barrage Sfisifa. Les sols sont, essentiellement, iso-humiques et les sols bruns calcaires apparaissent en faible quantité.

La nappe Alaarich se situe dans la région de Kasserine Nord. Elle est délimitée par Oued Darb au Nord Ouest et Oued Andlou au Sud Est. Elle est logée dans une formation sablo-argileuse. Ses ressources sont renouvelées annuellement par un apport en provenance des précipitations ainsi que des écoulements permanents de l'Oued Darb au cours de la période hivernale. Les sols sont, essentiellement, peu évolués d'apport. Les sols hydromorphes apparaissent sur la rive droite et gauche d'Oued Darb.

La nappe Harich se trouvant dans la plaine de Foussana, constitue le principal aquifère des structures synclinales de la Tunisie Centrale. Cet aquifère est formé de dépôts plio-quaternaire. Sa recharge se fait à partir des lâchés du barrage Riahi dont la vanne de vidange n'est pas encore installée. Les sols sont, essentiellement, peu évolués d'apport. Des sols halomorphes et hydromorphes apparaissent le long de la rive droite d'Oued Htab.

La nappe Oumlagsab se situe sur la rive gauche d'Oued Oumlagsab commune avec le gouvernorat de Gafsa (rive gauche). Elle se trouve dans la délégation de Mejel Bel Abbas. Son alimentation est liée aux apports de crues de l'Oued Oumlagsab. Les sols dominants sont iso-humiques et bruns calcaires, les sols peu évolués et minéraux apparaissent en faible quantité.

2.2 MÉTHODOLOGIE

Le diagnostic de la contamination nitrique a été basé sur les données du réseau de surveillance de la qualité des eaux souterraines de la région de Kasserine collectées durant une période d'observation s'étalant de 1996 à 2013. Les échantillons d'eau prélevés pour l'analyse des nitrates ont été effectués, avec une périodicité trimestrielle, au droit de 22 puits de surface dont 6 appartiennent à la nappe à Ain Zayen Thmed (P164, P172, P185, P387, P388, P549), 5 à Chereyaa (P22, P33, P38, P42, P172), 3 à l'Alaarich (P76, P103, P104), 5 à l'Harich (P689, P760, P859, P917, P940), et 5 à Oumlagsab (P33, P39, P47, P65, P80) (Fig. 2).

L'évolution temporelle des nitrates a été analysée en termes de concentration moyenne annuelle pour chaque nappe et de concentration intra-annuelle pour chaque puits. Toutefois, vue la non disponibilité du matériel d'analyses au laboratoire, les concentrations des nitrates sont manquantes pour les années 2011 et 2012.

Dans le but d'identifier les sources responsables de la pollution nitrique, les facteurs pouvant influencer les concentrations en nitrates ont été analysés. Il s'agit des facteurs du milieu physique notamment les précipitations, le niveau piézométrique des nappes, les types de sol, et des pratiques agricoles particulièrement l'occupation des sols. Les données piézométriques utilisées correspondent à la période 2004-2010. Pour les données de la fertilisation azotée (minérale et organique), le mode d'irrigation et l'élevage pratiqués, une enquête a été menée auprès des agriculteurs exploitants des puits concernés.

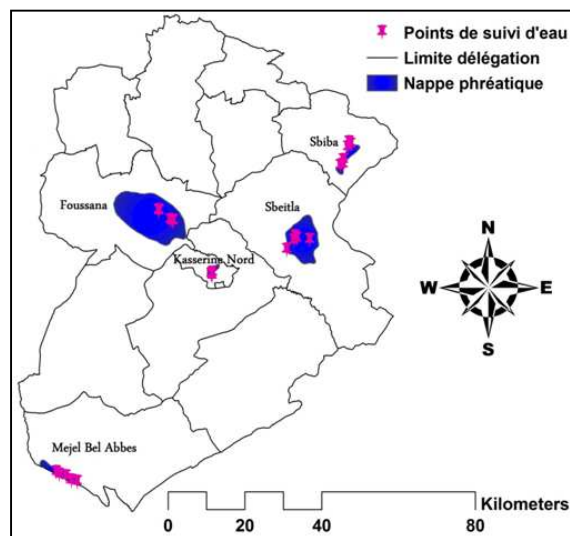


Fig. 2. Carte des points d'échantillonnage

3 RESULTATS ET DISCUSSION

3.1 EVOLUTION TEMPORELLE DES TENEURS EN NITRATES

La variation des teneurs moyennes annuelles sur la période de suivi (Fig. 3) montre une allure de distribution sensiblement identique pour les cinq nappes étudiées : des valeurs faibles ne dépassant pas la valeur admissible (à l'exception de la nappe Chereyaa) durant la période 1996-1999, puis une augmentation rapide entre les années 1999 et 2002 jusqu'à l'atteinte des valeurs maximales dépassant largement 50 mg/l, la valeur seuil fixée par l'Organisation Mondiale de la

Santé (OMS), et enfin une diminution fort importante depuis l'année 2002 pour ramener les concentrations à des valeurs inférieures à la norme.

Les concentrations moyennes maximales ont atteint les 180 et 260% la concentration admissible ; elles étaient de 131 ; 97 et 91 mg/l pour les nappes Chereyaa, Ain Zayen Thmed et Harich, de façon respective. Ces valeurs reflètent une qualité d'eau impropre à la consommation présentant des grands risques sanitaires, surtout que les exploitants ruraux s'approvisionnent directement de l'aquifère. L'intensification agricole liée à l'utilisation massive des engrais azotés et des produits phytosanitaires (herbicides, fongicides, insecticides, ...) peuvent expliquer en partie ces plages de fortes concentrations.

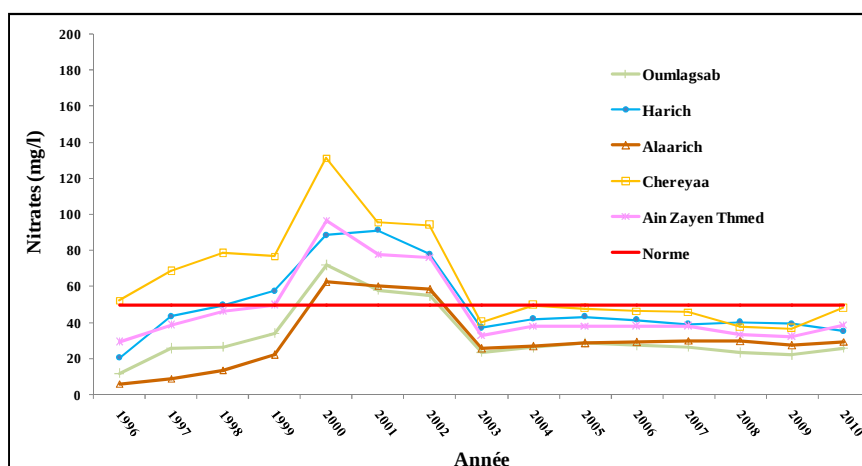


Fig. 3. Variation des concentrations nitriques moyennes annuelles

La variation intra-annuelle des concentrations en nitrates relevées dans les 22 puits en fonction du temps garde une même allure de fluctuation pour la totalité des puits de surveillance (Fig. 4). Cette dernière révèle deux périodes d'évolution, une première s'étalant de 1999 à 2002 caractérisée par une présence notable des nitrates et une deuxième, à partir de 2003, durant laquelle les concentrations ont chuté énormément pour atteindre des valeurs inférieures à la valeur seuil. Ceci est probablement en relation avec des facteurs sociaux-économiques ayant engendré une diminution de l'intensification agricole dans la région.

Les teneurs les plus élevées ont été enregistrées dans la nappe Chereyaa (Fig. 4b), avec des maximums variant de 133 (P42) à 196 mg/l (P33), qui sont trois à quatre fois la norme de l'OMS suivie par la nappe Harich (Fig. 4d) pour laquelle les maximums se trouvaient dans l'intervalle 114 mg/l (P859) et 188 mg/l (P689). Pour les autres nappes (Fig. 4a, 4c, 4e), les teneurs maximales sont relativement plus faibles et n'ont pas atteint les 125 mg/l.

Actuellement, une attention particulière doit être accordée à la nappe Chereyaa. Malgré la diminution marquée des concentrations durant la deuxième période, cette dernière reste la plus vulnérable étant donné la stabilisation des teneurs nitriques aux alentours du seuil de potabilité, notamment, dans les puits P22 (46,8 mg/l), P42 (51,3 mg/l) et P33 (54,56 mg/l). Une intensification des activités agricoles et un développement de l'élevage risque de dépasser la norme et menacer la potabilité de ses eaux. De ce fait, une étude approfondie de cette nappe permettrait de cerner les sources de contamination en vue d'adopter les mesures préventives nécessaires et d'intervenir au moment opportun.

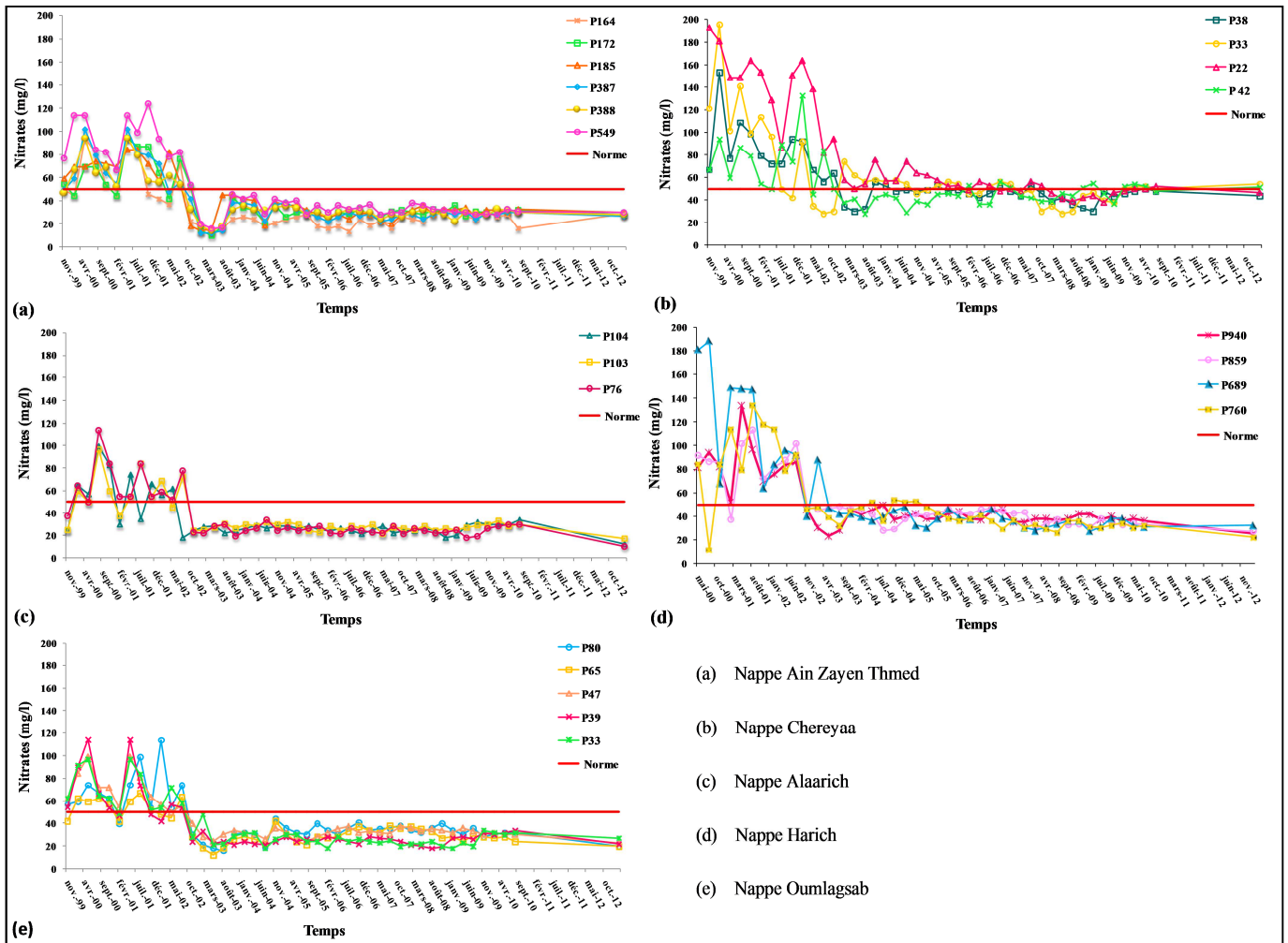


Fig. 4. Variation intra-annuelle des concentrations nitriques en fonction du temps

3.2 EVOLUTION DES TENEURS EN NITRATES EN FONCTION DE LA PLUVIOMÉTRIE ET DE LA PIÉZOMÉTRIE

L'examen des courbes de variation des teneurs en nitrates enregistrées au niveau des puits en fonction de la pluviométrie a montré l'absence d'une tendance d'évolution nette entre les deux paramètres, à l'exception des puits P33 et P38 (nappe Chereyaa) et P39 (nappe Oumlagsab). Ces derniers ont montré une tendance de diminution des nitrates avec la diminution de la pluviométrie pour la période allant de juin 2007 à juin 2008. Par ailleurs, les nitrates tendent à augmenter considérablement avec l'augmentation des précipitations (Fig. 5). Ceci pourrait être expliqué par le fait que les précipitations n'affectent pas directement les concentrations tel que démontré par les travaux de [6]. De plus, l'irrégularité de la pluviométrie de la région ne favorise pas le phénomène de dilution.

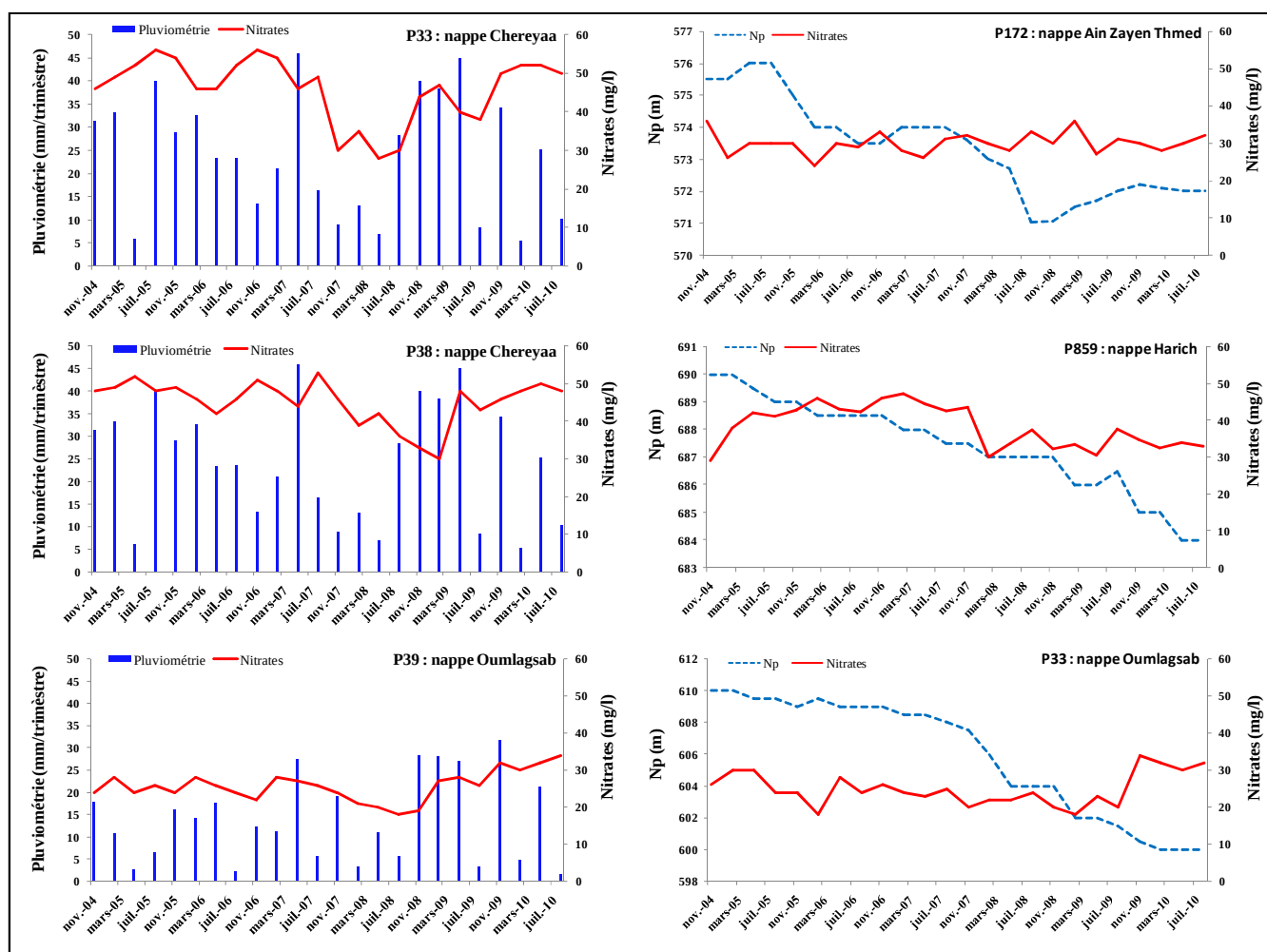


Fig. 5. Evolution des teneurs en nitrates en fonction de la pluviométrie et de la piézométrie

La chronique piézométrique des nappes étudiées a permis de constater un rabattement important entre les années 2004 et 2010. A titre d'indication, ce rabattement était de l'ordre de 3,5 m pour de la nappe Ain Zayen Thmed (P172), 6 m pour la nappe Harich (P859) et 9 m pour la nappe Oumlagsab (P33) (Fig. 5). Toutefois, les résultats n'ont pas permis de dégager de corrélations nettes entre les niveaux piézométriques et les concentrations nitriques enregistrés pour la totalité des puits surveillés. En effet, c'est particulièrement au droit de trois puits présentés dans la figure 5 qu'il y'avait une baisse de la piézométrie accompagnée d'une augmentation des concentrations en nitrates, durant la période 2004-2010.

3.3 EFFET DE LA TEXTURE DU SOL SUR LES TENEURS EN NITRATES

Afin d'examiner l'influence de la texture du sol sur la variation des nitrates, les points de surveillance ont été regroupés, selon la classe texturale, en trois catégories : texture fine (argileuse), moyenne (sablo-argileuse) et grossière (sableuse, sablo limoneuse). L'établissement des cartes de textures des sols par le Système d'Information Géographique (SIG) a permis de montrer, pour 16 puits de quatre nappes (exceptés ceux de la nappe Ain Zayen Thmed), que la concentration des nitrates est fortement influencée par la texture du sol (Fig. 6). En effet, les teneurs les plus faibles, se situant entre 7 et 19 mg/l, ont été observées dans les sites à texture fine (P47 de la nappe Oumlagsab et P859, P687 de la nappe Harich) étant donné leur forte microporosité capable de retenir en partie les nitrates dans le sol. Les teneurs moyennes, variant de 22 à 30 mg/l, ont été notées au niveau des sites à texture moyenne (P917, P940 et P760 de la nappe Harich ; P80, P33 et P39 de la nappe Oumlagsab et P76 de la nappe Alaarich). Par contre les concentrations les plus élevées, allant de 44 à 54 mg/l, ont été enregistrées dans les sites à texture grossière (P22, P33, P38 et P42 de la nappe Chereyaa). Ces derniers possèdent une grande macroporosité qui permet de libérer plus d'éléments dissous comme les nitrates qui seront logés dans la nappe.

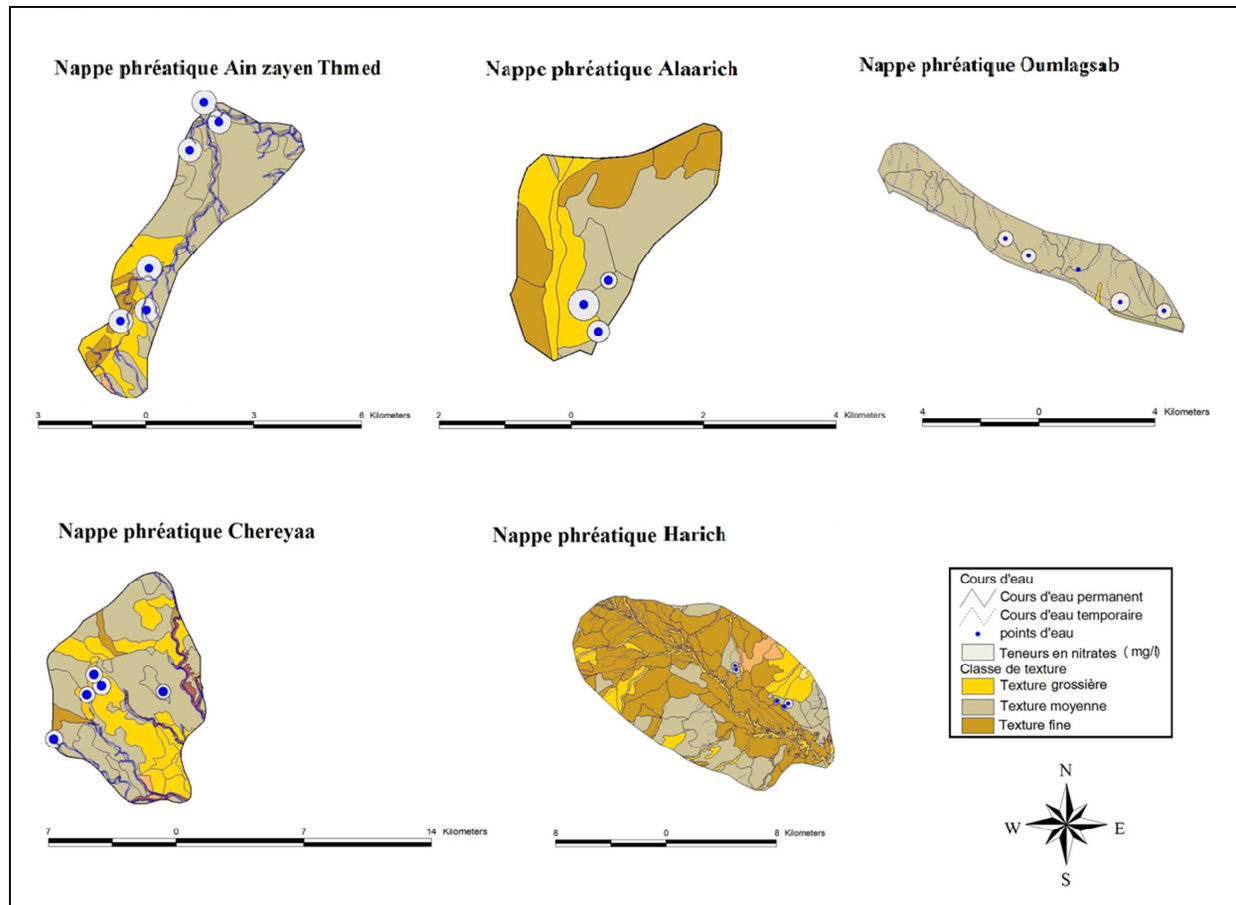


Fig. 6. Répartition des teneurs en nitrates en fonction de la texture du sol

3.4 EFFET DES APPORTS AZOTÉS SUR LES TENEURS EN NITRATES

Les résultats de l'enquête ont révélé une certaine concordance entre les nitrates se trouvant dans les eaux des puits surveillés et les apports d'engrais azotés (Fig. 7).

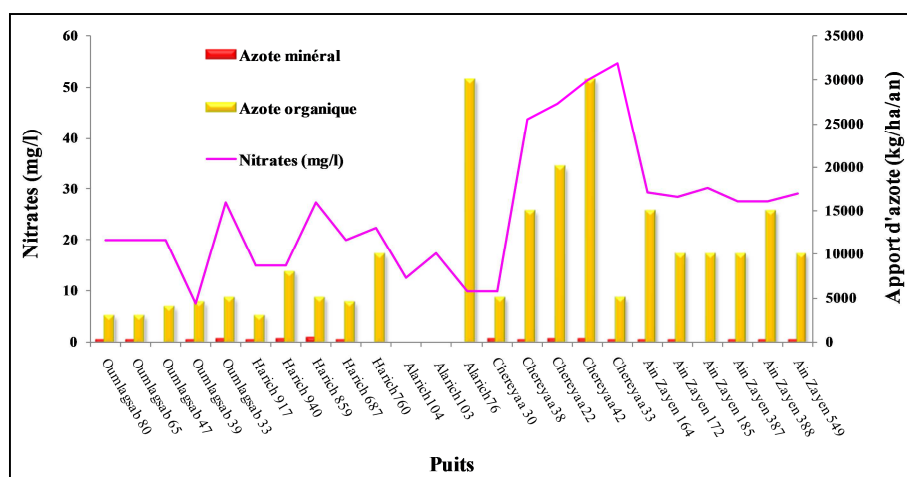


Fig. 7. Impact d'apport d'azote sur les teneurs en nitrates

Les teneurs sont d'autant plus élevées que les doses d'azote appliquées sont importantes. D'ailleurs, la pollution des nappes causée par le lessivage d'importantes quantités d'engrais azotés vers les eaux souterraines est largement appuyée

par les travaux de [12], [13] et [14]. En outre, un écart important entre l'azote minéral et organique pratiqués a été noté. Les agriculteurs appliquent des quantités annuelles énormes de fumier d'environ 30 000 kg/ha/an comparativement à celles de l'azote minéral variant de 150 à 450 kg/ha/an. De plus, l'analyse des données de l'occupation des sols durant la période 1999-2013 ont permis de révéler en partie une relation cultures-nitrates. Les sols occupés par des cultures horticoles (pomme de terre, culture maraichère, légume à feuille) ont tendance à lessiver des quantités élevées en nitrates. Par contre, pour les parcelles arboricoles (pommier, amandier, pistachier, etc.) les teneurs en nitrates sont plus faibles.

3.5 EFFET DU MODE D'IRRIGATION SUR LES TENEURS EN NITRATES

Le mode d'irrigation couplé à d'autres facteurs du milieu physique notamment les caractéristiques hydrogéologiques du sol, ainsi que le niveau de la nappe par rapport à la surface du sol peuvent limiter ou accentuer l'entraînement des polluants nitriques vers les nappes [15]. Les systèmes d'irrigation adoptés par les exploitants des puits de surface considérés par la présente étude sont le gravitaire employé pour les cultures arboricoles (pommier, figuier, amandier, pistachier, etc.); l'aspersion pour les cultures fourragères et le goutte à goutte pour l'olivier, les cultures arboricoles et maraichères. Cependant, le système d'irrigation le plus répandu au voisinage des points de surveillance est le gravitaire.

Les résultats présentés dans le Tableau 1 ont permis de révéler qu'en absence d'un système d'irrigation ou en appliquant le goutte-à-goutte, les risques de lessivage des nitrates sont faibles et les teneurs n'ont pas dépassé 41 mg/l. Par contre l'aspersion peut être un facteur de pollution des eaux souterraines mais de façon moindre que l'irrigation de surface. Au droit des parcelles utilisant cette technique, les nitrates présents dans l'eau atteignent 60 mg/l. En irrigation gravitaire, la teneur en nitrates est deux fois plus élevée qu'en goutte à goutte surtout en présence d'un sol à texture grossière tel est le cas de la nappe Chereyaa où la concentration a atteint 78 mg/l. En effet, mise à part la forte hétérogénéité de répartition de l'eau et des fertilisants apportés, le gravitaire induit des pertes importantes par drainage profond et favorise l'entraînement des nitrates et la pollution des ressources hydriques souterraines.

Tableau 1. Systèmes d'irrigation et concentration moyenne en nitrates des points de surveillance

Nappe	Système d'irrigation	Concentration moyenne (mg/l)
Oumlagsab	Gravitaire	25 – 34
Alaarich	Pas de système d'irrigation	25 – 27
Harich	Gravitaire	36 – 51
Chereyaa	Aspersion classique	56 à 60
	Gravitaire	53 - 78
Ain Zayen Thmed	Goutte à goutte	33 – 41
	Aspersion classique	42 - 43

4 CONCLUSION

Bien que les nitrates soient naturellement présents dans certaines eaux souterraines, les fortes concentrations sont généralement le résultat indirect des activités humaines dont l'incidence peut se faire sentir à long terme. L'analyse des tendances temporelles des concentrations nitriques observées sur 17 ans a montré une forte dégradation de la qualité des eaux des puits entre 1996 et 2003 avec des teneurs excessives atteignant pour certains cas ; des valeurs trois à quatre fois la limite de potabilité. Depuis 2003, une forte diminution a été notée, et la valeur seuil de potabilité est respectée. Les tendances observées peuvent être attribuées aux variations du taux d'intensification agricole liées aux facteurs sociaux-économiques de la région. A ceci, s'ajoutent les mauvaises pratiques de la gestion agricole adoptées par les agriculteurs avec la prédominance de l'irrigation gravitaire et l'épandage des quantités importantes d'engrais pour un meilleur rendement. Ces pratiques s'éloignent largement des mesures conservatrices et préservatives des ressources déjà rares. L'impact de la texture du sol, contrairement à la pluviométrie et à la piézométrie, a pu être mis en évidence. La nature grossière du sol peut favoriser le lessivage des nitrates et accentuer le processus de pollution. A l'égard de la piézométrie, il ya lieu de souligner également que les relevés des teneurs en nitrates n'intéressent qu'un nombre réduit de puits ne permettant pas d'établir la carte piézométrique de chaque nappe. De ce fait, l'installation d'un réseau de piézomètres de plus forte densité pourrait remplacer le réseau de puits existant, pour pouvoir distinguer les zones les plus vulnérables à l'infiltration des nitrates en fonction du sens d'écoulement, qui présente le vecteur de transport des nitrates dans les eaux souterraines.

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Integration of ICT in Teacher Education

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ABSTRACT: Globalization and advancement in technology are driving changes in the social, technological, economical, environmental and political landscapes at such a pace and magnitude that is too great and too multiple to ignore. Teachers are expected to facilitate learning and making it useful and meaningful to the individual learner by providing knowledge and skills. Innovative technologies are providing teachers with new possibilities but at the same time placing more demands on teachers to learn how to use these technologies in their teachings and prepare students with the knowledge and skills they need in the 21st century. ICT has great potential for enhancing teaching and learning outcomes. This would in turn depend on the kind of training that the teacher has undergone. ICT teacher training should therefore be considered as continuing process, with the need of continuing support.

KEYWORDS: Globalization, technology, Innovative, ICT (information and communication technology).

INTRODUCTION

The world of technology is expanding at a mind boggling speed and encompassing almost every walk of life. The countries which are completely assimilating the advanced information technology in their education, commerce, defense, economics and social systems are emerging as dominant players in this world. Globally, the educational systems are under great pressure to adopt innovative methodologies and to integrate new “Information and Communication Technologies” in teaching and learning. The adoption of ICT is no longer a means for sustaining competitive advantage but an essential weapon for the survival of any institution. ICT integration in institutions is perceived as a necessity and if the educational institutions want their students to leave the institution as confident individuals capable of using technologies creatively and productively, they have to promote NCIT's in their educational process.

TRENDS

The first ICT trends used in educational system include, videos shown on televisions, text downloaded from the internet and animation and graphical presentations with tools as Microsoft PowerPoint. Modern ICT trends in education include distance learning open source, social networking, mobile learning etc. Thus the future educational system will no longer be regarded as classroom and book bound but rather as interactive and fun through technology. The latest technology trend worldwide is virtual education. Developing countries like India, China, Thailand etc are also following this trend but with very few institutions which are providing complete environment for virtual education. There are many institutions which are providing a complementary or a supplementary environment.

EDUSAT

The Indian satellite for education is a path breaking effort in the concept of telecommunication in India. Satellites are establishing the connectivity between urban educational institutions with adequate infrastructure imparting quality

education to a large number of rural and semi-urban educational institutions that lack the necessary infrastructure and faculty.

AIMS AND OBJECTIVES OF ICT IMPLEMENTATION IN EDUCATION

- To implement the principle of lifelong learning.
- To promote equal opportunity to obtain education and information
- To develop a system of collecting and disseminating educational information.
- To promote technology literacy of all citizens, especially for students.
- To promote quality distance education.
- To promote culture of learning at school.
- To support schools in sharing experience and information with others.

TECHNOLOGY RICH STUDENT-CENTERED CLASSROOM VERSUS CONVENTIONAL CLASSROOM

Technology is generating student-centered, learning-based classrooms where students do not consume and retain the facts and figures diffused by their teachers but they also get opportunity to ask questions via e-mails or discussion forums and join other students in understanding the course content. The teacher acts as a facilitator and resource person just as a catalyst and helps students to promote their individual learning. Students can access lectures, demonstrations on demand via internet, can ask or receive answers to their questions. They can learn at their own pace without feeling the pressure to keep up with other students. Using computer programs and multimedia programs a single teacher can exercise many more resources and methods within one classroom.

There are many changes observed in technology rich student-centered classroom from traditional classroom:

- Coaching occurs rather than lecture.
- There is a shift from whole class to small group instructions.
- Students are more actively engaged.
- Collaboration is fostered (when they work on limited number of computers in small groups and help each other) and competition is lessened.
- Students develop higher order thinking skills and are able to handle more complex assignments.
- Students have wealth of knowledge open to them.
- There is an integration of both visual and verbal thinking instead of the privacy of verbal thinking.

New information and communication technologies have brought many new challenges and opportunities for the educational system and the educators and they need to come to terms with these new challenges and take full advantage of the opportunities. For this the teachers should have the competence to integrate the emerging technologies and digital content with all their operations. It is of immense importance for today's teacher to have the knowledge of successful integration of ICT into his/her subject area to make learning successful. Exposure to ICT during the pre-service has gained much importance as it can help in increasing the willingness to integrate technology for classroom teaching.

TRAINING PROGRAMS

Institutions around the world are stepping towards providing ICT literacy to teacher-trainees by integrating ICT in teacher training programs. The following are the four primary approaches.

1. **DEVELOPMENT OF ICT SKILLS:** To develop ICT skills the pupil-teachers are given knowledge of ICT in general. They are made skillful in using ICT in their day to day life. They are provided with knowledge about various software, hardware and their use in their profession.
2. **STUDY OF METHODS AND ACTIVITIES OF TEACHING THROUGH ICT:** ICT aided teaching approach emphasizes on integration of ICT skills in respective subjects. Teachers design lessons and activities that centre on the use of ICT tools that will foster the attainment of learning outcomes. The teachers who have gone through such type of training at pre-service level are more confident and more understanding concerning the implementation of technology.
3. **SUBJECT-SPECIFIED APPROACH:** Under subject specified approach student-teachers learn to use their ICT skills in their subject area. Teachers are not only exposed to new and innovative ways of learning but also provided with a practical understanding as to how teaching and learning with ICT is different from its conventional counterpart.

4. **PRACTICE DRIVEN APPROACH:** In this approach the students are exposed to practical work-places. They are expected to design their lessons and assignments etc using ICT tools and implementing and managing these according to ICT facilities provided at their work place.

ICT COMPETENCIES IN TEACHER-TRAINERS

For the successful implementation of ICT in teacher-education, the teacher training curriculum implies the competencies for teachers, which are as follows:

- **Positive attitude towards ICT:** teacher should act as a role model for pre-service trainees and in-service teachers. He should encourage technology integration among the trainees.
- **Understanding of the educational potential of ICT:** The teacher should be an active and competent user of telecommunication services and internet as an instruction and teachers to use digital resources to get answers to their questions.
- **Ability to use ICT effectively in the Curriculum:** The teacher should help the institution in the implementation of technology plans of the institution and should plan, design and demonstrate the use of multimedia applications for instructional use.
- **Ability to manage ICT in classroom:** The teacher should be able to handle hardware and software and should have in-depth knowledge of instructional theories so that he can appropriately apply ICT into his/her classroom teaching.
- **Ability to evaluate ICT use:** The teacher should be able to evaluate ICT use in terms of student learning.
- **Technical Capabilities:** Training teachers to benefit from ICT's is essential for effective integration of ICTs in teaching. Not many teachers, including those who are using ICT, have a comprehensive knowledge of the wide range of its tools and resources. Therefore extensive on-going exposure to ICT for selecting the appropriate tools for their specific purpose is essential to enhance the effectiveness of teaching-learning.

Teacher inexperience and skill deficiencies are often important factors in creating barriers in communicating and disseminating content, because, at times, there is a great disconnect between student knowledge and use of ICTs and the knowledge and abilities of the teacher using them.

BENEFITS OF ICT-INTEGRATION ON TEACHER TRAINERS AND STUDENT TEACHERS

- They become self learners.
- They are exposed to a world of knowledge and so get updated.
- Problem-based learning skills are developed.
- It enables sustainable professional development.
- It enables the diffusion of knowledge to large masses.
- It develops higher order of thinking skills.
- It gives a feeling of empowerment to them (as they are aware of recent methodologies)

CONCLUSION

I conclude by saying that reliance on technology may go beyond expectations, but no technology can ever replace a teacher from its classroom. Role of teacher has changed from knowledge disseminator to instructor or facilitator, classroom environment has changed from teacher-centered, lecture-based to student-centered, learner-based but teacher was, is and will remain a pivot on which the educational system revolves.

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Synthesis and Characterization of Nitrogen-Doped TiO₂/WO₃ Nano-Composite Material and its Photocatalytic Activity for Photo-degradation of Phenol Red in Aqueous Solution

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ABSTRACT: Crystal form of N-TiO₂/WO₃ Nano-Composite material was prepared from urea, commercial TiO₂ and WO₃ by simple solid phase reaction followed by calcinations at a temperature of 400 °C for four hours at each step. The as-synthesized photocatalyst was characterized using XRD and Uv-Visible diffuse reflectance spectra. It was found that the absorption edge of N-TiO₂/WO₃ was well extended to visible light. Dark experiment has been done to know the degree of photodegradation of adsorption of PR over the studied photocatalyst under non-irradiation. The result obtained was for photocatalytic degradation of adsorbed PR was only about 6.32%. The as-synthesized photocatalyst was highly active under visible irradiation (93.87%) than under UV irradiations (75.74%). This may be due to the fact that the absorption edge of the modified TiO₂ particle shifts to visible light range.

KEYWORDS: Advanced oxidation processes, degradation, visible and UV radiations.

1 INTRODUCTION

Nowadays Environmental pollution is proposed to be the greatest problem that chemical scientists will face in the 21st century and an increasing number of scientists are looking for new systems to solve this problem [1]. Even if chemical industries make products with much beneficial usage; they do also have negative impacts on human health and the environment. They release hazardous, calcitrant and toxic chemical substances such as phenolic compounds, high molecular weight polymeric surfactants, herbicides and pesticides from industrial wastewater effluent which are well known to be not easily biodegradable [2]. These effects have become major concern within the international community because of the environmental issues addressed by the Environmental Protection Agency (EPA) to prevent pollution and contamination of groundwater and surface waters [3]. Traditionally, industrial wastewater treatments for these effluents include different techniques such as biological treatment, reverse osmosis and activated carbon adsorption. These techniques often utilize potentially hazardous or polluting materials and even most of them are non-biodegradable.

Therefore, the development of an effective treatment technique that can convert pollutants into non-toxic or less harmful materials is highly required. In recent years, there has been the emergence of voluminous literatures on the development of novel effective photocatalytic processes for the treatment of industrial wastewater effluents and municipal wastes that contain toxic and recalcitrant pollutants. Photocatalysis is among the rapidly evolving and efficient technologies for purification of water. With this approach, harmful organic compounds are broken down in the presence of catalyst and ultraviolet (UV) irradiation without generating secondary harmful pollutants [4]. Semiconductors such as TiO₂, Fe₂O₃, ZnO, ZnS and WO₃ have been known to possess Photocatalytic character [5]. Among them, titanium dioxide has been extensively studied throughout the world and considered as reference photocatalyst in the degradation of organic pollutants, sewage treatment, air purification and disinfection due to its superior photocatalytic performance, non-selective degradation of various organics, deep mineralization rate, and low cost, inert and non-toxic properties [6]. However, the wide band of TiO₂ (anatase of 3.2 eV, rutile of 3.0 eV) limits the absorption wavelength less than 387 nm, which is only 3–5% of the sunlight energy and holds back the practical applications [7]. In addition, the high rate of electron–hole recombination on the surface

and in the bulk phase of the catalysts and the low photoelectric conversion efficiency hamper the practical applications of TiO₂ as photo catalytic materials.

Therefore, doping TiO₂ with some transition-metal elements such as Co and Cu was used as the initial approach to shift the optical response of TiO₂ from the UV band to the visible band [8]. But even these metal-doped TiO₂ materials suffered from thermal instability and low-quantum efficiency because of increased carrier trapping after doping or require expensive facilities in the ion implantation case [9]. In contrast, better visible optical response of TiO₂ could be achieved by using nonmetal doping [10]. Kinds of nonmetal elements, including phosphorus, carbon, chlorine, and bromine were found to be capable of making doped TiO₂ respond to visible light [11].

Therefore, the proposed project was aimed at studying the Synthesis and Characterization of Nitrogen-Doped TiO₂/WO₃ Nano-Composite material and its photocatalytic efficiency for photo-degradation of phenol Red in aqueous solution under visible and uv radiation.

2 MATERIALS AND METHODS

2.1 EXPERIMENTAL SITE

The synthesis of Nitrogen-Doped TiO₂/WO₃ Nano-Composite material ,the degradation experiments and part of the characterization of the as-synthesized photocatalysts (Uv-Vis) were carried out at Haramaya University Research Laboratory (HURL). XRD characterization was done in Addis Ababa Ethiopia Geological Survey Laboratory.

2.2 EQUIPMENT AND APPARATUS

The equipment and apparatus used in this study were: UV/vis spectrophotometer (Gullen kamp model SP 62), X-ray diffraction (Bruker D8 Advance XRD, AXS GMBH, Karlsruhe, West Germany X-ray defractometre), glass reactor, , tungsten lamp (TORCH 40W) as visible light source, Uv lamp (254 nm) as Uv-light source , air (oxygen) pumper, , furnace, centrifuge, magnetic stirrer

2.3 CHEMICALS AND REAGENTS

In this study the following chemicals were used: commercial titanium dioxide (TiO₂) (scientific park, N.Y,U.S.A.), tungsten trioxide(WO₃) (MW 231.84 gmol⁻¹, SD fine chemicals, 99%), Phenol red (C₁₉H₁₄O₅S) (MW. 354.38 g/mol. 1, BLULUX), Ethanol (CH₃CH₂OH) (MW. 58.03 g mol⁻¹, Park scientific, 99.8), Urea (MW 60.06 gmol⁻¹, extra pure BLULUX)), 0.1M NaOH (MW. 40 g mol⁻¹ Assay: 98%) and 0.1M H₂SO₄ (MW. 98.08 g mol⁻¹ Assay: 98%). All were analytical grade and used with no further purification.

2.4 EXPERIMENTAL METHODS

2.4.1 PREPARATION OF PHOTOCATALYSTS

2.4.1.1 PREPARATION OF N-DOPED TiO₂

20 g of TiO₂ and 60 g of urea (TiO₂: urea = 1:3) were mixed and transferred to a mortar and well crushed using pestle. The obtained powder was then calcined at 400oC for four hours for solid phase reaction [3].

2.4.1.2 PREPARATION OF N-DOPED TiO₂/WO₃ NANO-COMPOSITE MATERIAL

10 g of N-TiO₂, which was synthesized in section 3.4.1.1.was mixed with 0.75 g of WO₃ using 1:1 (v/v) of water and ethanol as solvent. This mixture was subjected to heating at a temperature of 110°C for drying. After cooling to room temperature, it was subjected to calcinations temperature of 400oC for 4 hours [3].

2.4.2 CHARACTERIZATION METHODS

The as-synthesized composite photocatalyst was characterized using XRD and Uv-Vis spectrophotometer. The crystal phase and crystallite size of the entire obtained composite was measured by Bruker D8 Advance XRD, AXS GMBH, Karlsruhe,

West Germany X-ray diffractometer. The sample was measured in the angular range (2θ) of 40-640 at a scan rate of 0.020 min⁻¹ using Cu K α radiation ($\lambda = 0.154056$ nm) operating at 40 kV and 40 mA accelerated voltage and applied current respectively. A UV-visible spectrophotometer (Gallen kamp model SP 62) was used to obtain the optical absorbance spectra of the sample.

2.4.3 PHOTOCATALYTIC DEGRADATION EXPERIMENT

Photocatalytic degradation of phenol red was carried out in a reactor tube made of glass with an effective volume of 500 ml and having an internal diameter of 8 cm with provision for air purging during photocatalysis and an outlet for the collection of samples from the reactor.

A known amount of the synthesized photocatalyst and 250 ml of PR (50 ppm) was taken in a reactor tube with a capacity of 500 ml and the suspension was stirred in dark for one hour in each experiment to obtain adsorption equilibrium before illumination of the reactor. Prior to illumination of the sample by visible or by UV, air (oxygen) was purged using hand purge into the solution in order to have homogeneous composition. During the reaction, the solution was maintained at room temperature and the distance of the lamp from the solution was kept to 9 cm and its light intensity was recorded to be 8.25mW/cm². 10ml of the sample was withdrawn each time at 20 minutes time interval for over the irradiation time of 3 hours. The suspension was centrifuged at 3500 rpm in order to settle down the catalyst particles at the bottom of the test tube before analysis. The absorbance of the clear solution was measured at a λ max of 432 nm for quantitative analysis using optimum amounts of catalysts and pH values.

To check whether the PR is easily degradable or not blank experiment (without addition of any catalyst) has also been done. Photocatalytic degradation experiment was conducted using the as-synthesized photocatalysts (N-doped TiO₂/WO₃ nano-composite material).

2.4.3.1 COMPARISON OF THE EFFICIENCY OF THE ASSYNTHESIZED PHOTOCATALYSTS UNDER VISIBLE AND UV RADIATIONS

EFFECT OF VARYING AMOUNT OF CATALYST ON THE PHOTODEGRADATION OF PHENOL RED

To evaluate the effect of the as-synthesized catalyst (N-doped TiO₂/WO₃ nano-composite material on the degradation of phenol red under UV and visible light; the experiment was carried out by taking optimal amount of catalyst 0.45 g and pH of 3 [16] and other conditions were also kept constant throughout the experiment). The percentage degradation was the calculated.

3 RESULTS AND DISCUSSION

3.1 CHARACTERIZATION OF THE PHOTOCATALYSTS

A fine powder of N-TiO₂/WO₃ was obtained following the above procedures and was characterized as follows.

3.1.1 X-RAY DIFFRACTION (XRD)

Calcinations of the sample at 400°C for 4 hours brings transformation of the composite photocatalyst phase from amorphous to anatase as the XRD spectra shows maximum peak at average angle of 25.59° for N-TiO₂/WO₃. There are also minor peaks at around 38°, 48°, 54° and 55° for the anatase phase. Similar result has been reported by other researchers for N-TiO₂ [2]. For WO₃ peaks at 130, 180 and 190 are observed. The XRD pattern of the as-synthesized sample shows only anatase form of TiO₂ and monoclinic form of WO₃ indicating that WO₃ is well incorporated into TiO₂. As an XRD spectroscopic technique mimic about the structure of crystals, it can be confirmed from (Appendix Figure 1) that the crystallographic shape of the as-synthesized anatase is tetragonal, as studied by many scholars. This is because calcinations of TiO₂ at 400°C for 4 hrs lead to the formation of anatase which is tetragonal [13]. As can be confirmed from the XRD spectra of the sample, the incorporation of the impurities into the crystal lattice of TiO₂ doesn't alter its crystal structure. The average crystallite size of the as-synthesized catalyst was estimated using Debye Scherrer equation which is given as:

$$d = \frac{\kappa \lambda}{\beta \cos \theta} \quad (3.1)$$

Where, d is crystallite size in nanometer K is shape factor constant, which is 0.9, β is the full width at half maximum in radians, λ is the wave length of the X-ray and θ is the Bragg angle.

Therefore the average crystallite size of the photocatalyst (N-TiO₂/WO₃) was calculated based on Dubye Scherer equation at 2 θ (degree) value of 25.59 and β (radian) value of 0.0133 and found to be approximately 10.61 nm. As shown in Figure1, throughout the crystal of N-TiO₂/WO₃ appears to have no other phase other than anatase phase of TiO₂ and the monoclinic phase of WO₃. There was no particular peak resulted from nitrogen impurity in the composite catalyst (N-TiO₂/WO₃). This may be due to the uniform distribution of nitrogen possibly in the form of atom within the as-synthesized material [14].

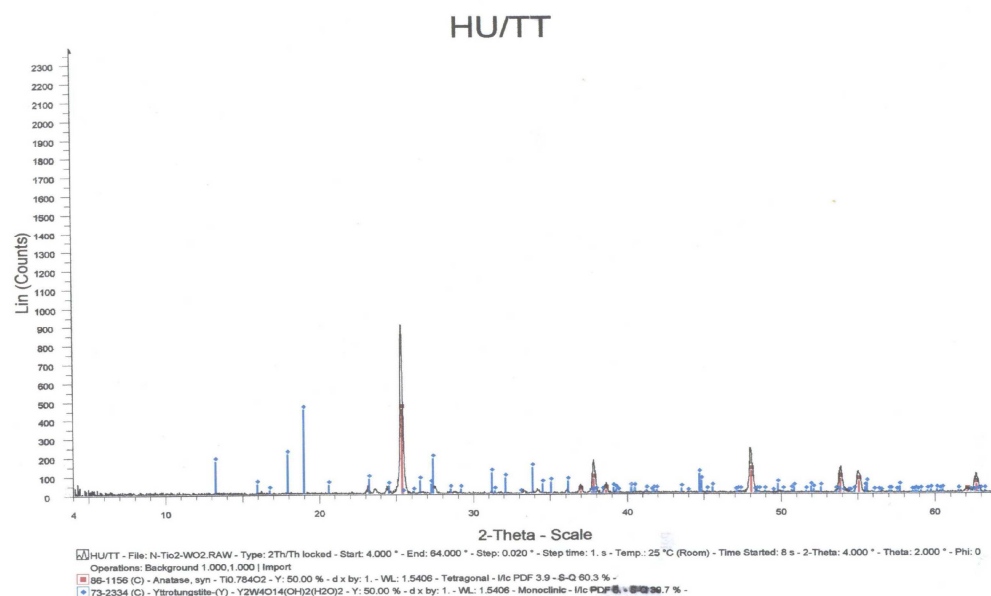


Figure1: XRD pattern of N-TiO₂/WO₃

3.1.2 UV/VIS DIFFUSE ABSORBANCE

The Uv-Visible diffuse reflectance spectrum of the prepared N-TiO₂/WO₃ nano-composite material is given in Figure 2. The diffuse absorbance is found to be at λ max of 538 nm and almost similar result was reported. But the UV-Visible diffuse reflectance spectrum of the calcined TiO₂ was reported to be at λ max of 397 nm [9]. From this measurement it can be seen that the absorption edge of N-TiO₂/WO₃ has shifted to the visible side compared to the non-doped calcined TiO₂. This indicates that in the Uv-vis diffuse reflectance of NTiO₂/WO₃, the absorption edge of the calcined TiO₂ can extend from 397 nm to 538 nm. This may be due to band narrowing of the calcined TiO₂ upon doping N and coupling it with WO₃.

Accordingly the bang gap energy of the as-synthesized photocatalyst can be calculated by the following equation: E_g (eV) = 1240/ λ Where, E_g is band gap energy in electron volts and λ is the wavelength (nm) at the intercept of tangent line to the x-axis. Thus from Equation (3.2), the absorption edge of N-TiO₂/WO₃, can be calculated and was found to be 2.30 eV.

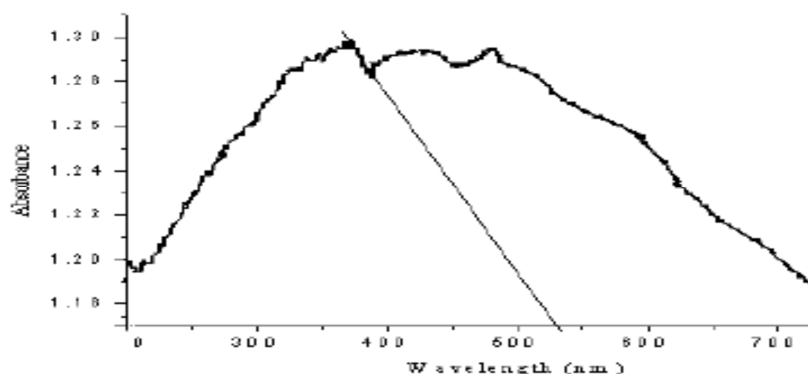


Figure.2. Uv- Visible absorbance of N-TiO₂/WO₃

3.2 PHOTOCATALYTIC ACTIVITY OF THE PHOTOCATALYST

To test the photocatalytic efficiency of the prepared nano-materials, photocatalytic degradation of PR was carried out both under UV and visible irradiations as well as in dark. The percentage degradation of PR was measured at every 20 minutes interval for over 3 hours. The percent degradation was calculated for each case using the following equation.

Degradation (%) = $[A_0 - A_t / A_0] \times 100$ Where, A_0 is the initial absorbance of the solution, A_t is the absorbance of the solution at time t in minutes

3.2.1 COMPARISON OF THE EFFICIENCY OF THE ASSYNTHEZIZED PHOTOCATALYSTS UNDER VISIBLE AND UV RADIATIONS

EFFECT OF VARYING AMOUNT OF CATALYST ON THE PHOTO-DEGRADATION OF PHENOL RED

Since there are various dyes which are degraded when exposed to direct UV or visible light in a short period of time even without the presence of catalyst, initial investigation ("blank" experiment without addition of any photocatalyst on to the solution of PR) was done in order to determine whether the PR solution is resistant to degradation under UV and Visible irradiation or not. However, insignificant changes were observed for the duration of 180 minutes (< 1%) both under UV and Visible light sources. This showed that the organic compound in the solution was very stable and do not have self-destruct mechanism even if it was irradiated under UV or visible light for 3 hours [15].

Dark experiment has also been done to know the degree of photodegradation of adsorption of PR over the studied photocatalyst under non-irradiation. The result obtained was for photocatalytic degradation of adsorbed PR was only about 6.32%.

The as-synthesized photocatalyst was highly active under visible irradiation (93.87%) than under UV irradiations (75.74%). This may be due to the fact that the absorption edge of the modified TiO₂ particle shifts to visible light range [5]. This may be because of the presence of substitutional Nitrogen atoms in the TiO₂ matrix enhanced the absorption in the visible band and then led to a corresponding photocatalytic activity. This may be due to that nitrogen doping could reduce the band gap of TiO₂ and improve its photocatalytic activity in the visible light region [2].

4 CONCLUSION

In this piece of work, a nano-crystalline modified anatase TiO₂ photocatalyst (N-TiO₂/WO₃) initiated from commercial TiO₂ has been synthesized in order to have efficient TiO₂ based photocatalyst that works in visible light.

Therefore, it is important to dope catalysts and prepare in composite form in order to harvest solar radiation/visible radiation.

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An Analysis of Self-esteem between Destitute and Non-destitute women

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ABSTRACT: The present study was conducted to explore the relationship of self-esteem destitute and non-destitute women (N = 60). Urdu translation of Self-Esteem Scale (Hudson, 1982), comprised of 25 items, was used to measure self-esteem. It was hypothesized that self-esteem of the destitute women will be lower than non-destitute women. Results indicated that destitute women have lower self-esteem than non-destitute women. Results regarding education indicate that in over all groups, women whose education is up to matriculation have lower self-esteem than those whose education is greater than matriculation. Another demographic which marital status, no differences have been resulted in overall sample of married and unmarried women on Self-esteem Scale. Another demographic was age on Self-Esteem Scale adolescents have low-esteem than the adults in overall sample.

KEYWORDS: self-esteem, destitution.

1 INTRODUCTION

1.1 SELF-ESTEEM

The concept of self is very deep rooted and strongly held within us since childhood. Psychologists have always focused on the concept of self, exploring different attributes of self, e.g. self-growth, self-efficacy, self-actualization etc. But, most widely investigated aspects of self are self-concept and self-esteem. Former case is the “cognitive” component and latter case is the “affective” part of the self (Purkey, 1988).

Self-esteem is an important component of personality, which refers to how we feel about the self or how we value ourselves. It is the individual’s private feeling that is derived from one’s perception and appraisals of different attributes of the self.

The self esteem is the evaluative component of the self concept. It is a function of the distance between the ideal self and the perceived self. When the perceived self matches the ideal self, self esteem is relatively high. Low self esteem occurs when the perceived self is significantly lower than the ideal self. Since the distance between the ideal and perceived self constantly varies depending on task and social feedback, self esteem is a dynamic component of the self concept and it is always in a state of change and development.

Self-esteem is an important component of personality, which refers to how we feel about the self or how we value ourselves. It is the individual’s private feeling that is derived from one’s perception and appraisals of different attributes of

the self. Self-esteem is person's global orientation towards the self (Brown, 1993), which plays an important role in his psychological life. Moreover self-esteem is a very significant and critical aspect of the self (Harter, 1993).

Self-esteem is a very personal experience for an individual. In this experience he evaluates different aspects of life. The nature of self-evaluation has profound effect on a man's thinking processes, emotions, desires, values and goals and it is single most significant key to his behavior. Nature and degree of his self-esteem and standards by which he judges himself help in understanding a man psychologically (Browden, 1969).

According to Branden (1987), self-esteem has two integrated aspects: it entails a sense of personal efficacy and a sense of personal worth. It is integrated sum of self –confidence and self-respect. It is the conviction that one is competent to live and worthy of living.

However, self-esteem is continually modified and validated throughout the life span, by interaction with family and friends. Self esteem is direct function of positive and negative past, present, and future experiences (Tashakhai, Thompson, Wade, & Valente, 1990).

Researches show that people with low self-esteem experience negative emotion like stress, depression, anxiety, and maladjustment more commonly than people with high self-esteem (Cutrona, 1982; Goswick & Jones, 1981; Leary, 1983; Taylor & Brown, 1988). Individuals with high level of self-esteem are said to feel confident in their capabilities and those with low self-esteem are said to feel inadequate, helpless and inferior and as a result these feelings create negative conditions (Pearlin, Lieberman, Menaghan, & Mullan, 1981).

For Rafai (1999) self-esteem is a personality construct, which referred to the individual's feeling about the self, and indicative of the value placed over one's self.

According to the Rice (1987) that self-esteem has been called the "survival of the soul". It is the ingredient, which gives dignity to human existence. It grows out of human interaction in which the self is considered important to someone.

The person whose self-esteem is high feels worthy and important and views himself or herself as a competent person who can live appropriately and happily in one's life. He or she feels capable, adequate, and effective to deal with the demands of life and think himself or herself a likeable person who can enjoy healthy relationship with other people. An individual of high self-esteem shows more resilience in the times of despair. On the contrary the person whose self-esteem is low, feels less regard for self, lack confidence and decisiveness. The person with low self-esteem is vulnerable to feel shattered and may become easily frustrated in difficult life situation. He or she tends to loose courage while facing diversities of life (Rafai, 1999).

According to the definition given by Cybersynce (2001), self-esteem is "how much a person likes, accepts, and respects himself overall as a person". Erickson (1962) refers to self-esteem as the individual self- perceived consistent individuality.

Branden (1987) said, "self-esteem is the experience of being competent to cope with the basic challenges of life and of being worthy of happiness". Another aspect of our evaluations depend heavily upon the way we believe we compare to others whose skills, abilities, and talents are similar to our own. In our daily life we keep evaluating ourselves with reference to other people and if these judgments and evaluations are not up to our expectations we tend to desire an urgent need of gaining and maintaining a satisfying level of self-esteem (Mettee & Riskin, 1974).

Nathaniel (as cited in Khalil.A, 1999) said that need of maintaining positive evaluation of one's self is vitally important. To the extent that men who lack self-esteem feel driven to fake it and may create illusion of self-esteem and a strong and desperate sense that to face the universe without self-esteem is to stand naked, disarmed, and delivered to destruction.

According to Nathaniel (as cited in Khalil.A, 1999) self-esteem has two integrated aspects. It entails a sense of personal efficacy and a sense of personal worth. It is the integrated sum of self-confidence and self-respect, it is the conviction that one is competent to live and worthy of living.

Self-esteem is not a value, which, once achieved, is maintained effortlessly and automatically thereafter. Self-esteem can increase or decrease with passage of different stages of life and as in the case of every value of a living organism, action and constant effort is necessary not only to gain it, but also to keep it Nathaniel (as cited in Khalil.A,1999) I.

The scope of a person's productive ambition reflects not only the range of his intelligence, but most crucially, the degree of his self-esteem. The higher the level of a man's self-esteem, the higher the goals he sets for himself and the more demanding the challenges he tend to seek .That means self-esteem is influenced significantly by the comparison we make of ourselves to others, by our personal aspirations and by feedback we receive from others. It is greatly affected by both

interpersonal and intra-psychic factors. People will go to great lengths to protect their self-esteem, since it is the foundation on which entire personality superstructure resides (Branden, 1987).

According to Spitz (1993), self-esteem is a positive or negative way of evaluating one's values, feelings, attitudes and beliefs, fears and desires and strengths and weaknesses.

The nature of self-evaluation has profound effects on the man's thinking processes, emotions, desires, values and goals and is the single most significant key to his behavior. Nature and degree of his self-esteem and standards by which he judges himself help in understanding a man psychologically (Mackner, 1969).

People strive for self-esteem because high self-esteem promotes positive affect by buffering the person against stress and other negative emotions and by enhancing personal adjustment, where as low self-esteem is associated with depression anxiety and maladjustment (Spitz, 1993).

Research studies have shown the level of self-esteem to be of particular importance in determining an individual's receptivity to others. It has been reported that persons of low self-esteem often experience difficulty in recognizing affectionate or accepting overtures even when they are being offered. A person convinced of his own lack of worth expects social validation of his own adverse self-views and tends to interpret behavior of others in terms of his own expectations (as cited in Horrocks, 1976).

Self-esteem is to be distinguished from related constructs such as self-confidence or self-efficacy, which refers to the beliefs about one's abilities and wherewithal to obtain desired outcomes Bandura (as cited in Leary, M.R., 1983).

1.2 TYPES OF SELF-ESTEEM

Korman (as cited in Toor, A., 2000) suggests three types of self-esteem:

Chronic self esteem: It is defined as a relatively persistent personality trait or dispositional state that occurs consistently across various situations;

Task-specific self esteem: It can be defined as one's self perception of his/her competence concerning a particular task or job; and socially-influenced self esteem, which is a function of the expectations of others. Chronic self-esteem is the result of past experience and focuses on one's competencies. An individual's confidence in his/her competencies directs the individual into situations, which will require the use of those competencies. Task-specific self-esteem is the result of feedback, which comes directly from observation of the results of one's efforts;

Socially-influenced self esteem: It results from communication or feedback from reference group members or society as a whole, concerning the value of an identity and the individual's ability to meet the expectations of the reference group and/or society as a whole.

1.3 ASPECTS OF ASPECTS OF SELF-ESTEEM

Damon (1983) suggests, that self-esteem is closely related to self-concept and self-efficacy. When the children perceive their worth, their abilities, their accomplishments, do they view themselves positively or negatively? Everyone needs to feel loved, liked, accepted, valued, capable and competent. How children feel about themselves is their self-esteem. It is their liking and respect for themselves.

According to O'Malley and Bachman (1983), studies that report very high stability in self-esteem over adolescence are likely tapping the individual's baseline self-esteem, which is unlikely to change dramatically over time. This may be because the determinants of baseline self-esteem are themselves relatively stable factors such as social class: middle-class adolescence have higher self-esteem than do less affluent peers. Sex: boys have higher self-esteem than girls. Birth-order: oldest and only children have higher self-esteem. Academic ability: more able adolescents have higher self-esteem.

Actual Verses Ideal Self: Jersild, (1963) describes the *actual self* by maintaining that the young person regards as his actual self when he has ideas and attitudes about "what he really is like". When questioned he can describe himself in detail as he thinks he is.

The sum total of a person's view of what he wishes he were or think he ought to be, as distinguished from what he is, is generally called the *ideal-self*. It involves aspiration he is vigorously striving to attain, or hopes dimly some day to realize (Jersild, 1963). According to Handle (1987), with the onset of puberty most young people begin to make a thorough assessment of themselves, comparing not only their body parts but also their motor-skills, intellectual abilities, talents and

social skills with those of their peers and their ideals. As a consequence, they are preoccupied with attempting to reconcile their selves as they perceive them with their ideal selves. By late adolescence, they may have managed to sort themselves out-to determine what they can most effectively be and to integrate their goals into their ideal selves.

Maslow (as cited in Zuberi.t,2003) studied the esteem needs, and he reported the way that self-esteem is related to process of becoming a self-actualizing person. According to him all people have a need or desire for a stable, firmly based, sense of self-regard or self-concept, and they need the esteem for themselves and from others. According to (Harter,1993), discrepancy between one's expectations or ideal self, and the perception of one's actual adequacy have a major effect on self-esteem.

Self-esteem has two interrelated aspects; it entails a sense of personal efficacy and a sense of personal worth. It is the integrated sum of self-confidence and self-respect. It is the conviction that one is competent to live and worthy of living (Branden, 1969). The most material and visible part of the self is the 'self' that is the physical body. This being the case, it is not surprising to find a considerable amount of evidence to suggest that one's appearance is an important determiner of self-esteem, in both men and women (Adams, 1973). Individual experiences his desire for self-esteem as an urgent imperative, as a basic need, whether he identifies the issue explicitly or not, he cannot escape the feeling that his estimate of himself is of life and death importance. No one can be indifferent to the question of how he judges himself; his nature does not allow man this option. So intensely does a man feel the need of positive view of himself, that he may invade, repress, distort his judgments, disintegrate his mind-in order to avoid coming face to face with facts that would affect his self-appraisal adversely (Branden, 1969). He further added that this need of maintaining positive evaluation of one's self is vitally important. To the extent that men who lack self-esteem feel driven to fake it and may create the illusion of self-esteem and a strong and desperate sense to face the universe without self-esteem is to stand naked, disarmed, and delivered to destruction.

1.4 HIGH SELF-ESTEEM

Genuine high self-esteem people are thought to have genuinely favorable feelings of self-worth, whereas *defensive* high self-esteem people are thought to harbor inner negative self-feelings that they are unwilling to admit, due to high needs for social approval. Because they are unwilling to admit their weaknesses, they may appear to have high self-esteem. Defensive high self-esteem people usually are distinguished from genuine high self-esteem people on the basis of their greater agreement with statements that cast people in a positive light but probably are not true called "socially desirable responding".

Because of their greater needs for social approval, "defensively high [self-esteem people] ought to do more than react to success or failure; they ought to engage in active attempts to change their public definition after failure, to gain approval when possible, and to structure social situations to maximize self-enhancement possibilities". "On the other hand, a more genuine high self-esteem person should be less concerned to avoid or repudiate failure, since failure is not particularly threatening".

After a failure experience, defensive high self-esteem people described themselves to others in an extremely positive manner (presumably as a way to garner approval). The same did not occur among genuine high self-esteem people, who apparently had little need to compensate for the failure by altering their self-descriptions. These findings are important because they represent clear support for the assertion those individuals who score high on a self-esteem scale are not all the same.

Children whose families become homeless undergo significant physical changes and changes in lifestyle. They must leave their homes, including most belongings, neighborhood friends, schools. Sometime they must also leave a second parent or other relatives. Routines are disrupted and new routines are difficult to establish. The effects of these type of events on the children's development are not yet well understood; however emotional deprivation and social isolation, typically imposed on homeless children, are thought to lead to insecure attachments to others, or self-esteem, aggressive behaviors and dysfunctional personality development Coopersmith; Harlow & Harlow; Harlow & Suomi(as cited in DiBiase.R ,Waddal.s,1995).

1.5 LOW SELF-ESTEEM

Another perspective has emerged recently that characterizes people with low self-esteem as cautious and uncertain (rather than highly maladjusted) individuals whose behavioral styles are geared toward minimizing exposure of their deficiencies (Baumeister et al. 1989). Proponents of this latter viewpoint assert that the self-evaluations and self-concepts of

low self-esteem people are characterized more by uncertainty, confusion, and neutrality than by negativity (Baumeister 1993) and that low self-esteem people embrace their positive self-aspects and engage in some forms of self-protection and self-enhancement when they feel safe to do so. These findings suggest that people with low self-esteem are not necessarily miserable people who loathe and despise themselves and who inevitably engage in self-destructive behaviors. Finally, low self-esteem is implicated in a number of psychological disorders that lead people to seek psychotherapy and other mental health services (Leary, 1995).

Which of these two views better characterizes low self-esteem is currently a major point of contention among researchers who study self-esteem. It may be noteworthy that most of the research that has supported the "cautious and uncertain" view of self-esteem has involved college students. Whereas most of the research that has supported the "self-loathing and maladaptive" view of self-esteem has involved children, adolescents, or "special" populations (e.g., substance abusers, juvenile delinquents, psychotherapy clients). Perhaps the low self-esteem people who reach college take on qualities and utilize strategies that differentiate them from other people with low self-esteem. Alternatively, it may be that only a subset of people with very low self-esteem suffers from extreme self-loathing and maladaptive behavior patterns.

Numerous investigations describe the runaway as insecure, depressed, unhappy and impulsive (Benalcaser, 1982), with emotional problems, low self-esteem and an unmanageable personal life.

Homeless adolescents often suffer from severe, anxiety and depression, poor health and nutrition and low self-esteem.

1.6 DESTITUTION

Destitution is a physical, social and psychological state in which individual finds himself/herself detached from the normal links of social, economic and emotional support. Destitute women are homeless without any resources and any person to look after them. In Pakistan's social perspective destitution is supposed to be a problem of women. Women are accustomed to a physical, social, economic and emotional dependency. When this dependency is not extended to a woman, she feels helpless and lost and gets the label of destitute.

Apparently it looks as if it is a personal problem of a woman who has lost support in the society. But a personal problem becomes a community problem or social problem if it affects at an appreciable number of people or its causes are rooted not only in the individual but also in the social environment.

It is interesting to note that Pakistani society has certain socioeconomic conditions which provide a very ripe ground for the emergence of this phenomenon. The traditional status of women in our society expects a woman to remain economically and emotionally dependent.

The support which she gets in the patriarchic society provides her an apparently comfortable and easy life. But the 'strings' of this support are solely in the hands of man. He can withdraw it whenever he desires; and the woman is left without any capability of leading an independent life. She is not accustomed to earn her own living and to make the decisions for herself. When she is deprived of these facilities she feels miserable. Destitution is a "a state without friends, money or prospects" (Webster, 2002).

Bahr (1973) argued that destitution occurs as a process of disaffiliation i.e., a process of increasing detachment from traditional institutions and social roles. Women have become the fastest growing segment of the homeless population (Brannigan & Caputo, 1993). Many of the researches are available to answer, why a person leaves home and prefer to live in the shelter home or destitute home. Studies have also tried to examine the effects of destitution (Roberts, 1982; Stiffman, 1980). Destitution is a problem for woman; it is also a strategy for escaping violence. There is growing literature that presents homeless people as victims or sick and that have contributed to the politicization of destitution as a social problem (as cited in Shinn Knickman, Weitzman; 1991).

The incidents of young girls fleeing from home are increasing day by day. Young girls take extreme step of abandoning their family and home safety. The reason for their revolt is ignored and taken for granted by the society. It is revealed that most of such women who flee from their homes are brought to Edhi Welfare Center or Dar-ul-Aman by the police or by the people they approach for help.

There are three categories of homeless person: runaway who leave home without a parent's or guardian's permissions; homeless person who have left home with the knowledge and consent of parents and guardians; and shelter home or destitute home kids, who have adopted to shelter home or destitute home life largely through illegal activities (National Network of Runaway Youth Services, 1985).

Individual problems of homeless people differ sharply from an analysis of structural determinants of destitution in poverty and loss of affordable housing. McChensey (1990) has offered a useful analogy to help us understand the difference: Destitution, she says, is like a game of musical chairs. The players are low income household. The chairs are the housing units they can afford. If there are more low-income households than affordable housing units, some household will be left homeless when the music stops. Thus they do not cause destitution. Rather they determine vulnerability to destitution in a tight housing market. In the musical chair analogy, individual problem determine only which players will be left standing when the music stops (as cited in Shinn, 1992).

1.7 REASONS OF DESTITUTION

Home is a place where one feels to be protected from all outside threats. It is a place of satisfaction for the people living in. Leaving one's home, parents or family is an extreme step taken by a person in our society What makes them to do so is an unexplored question, but some of the reason mentioned by them are as follows (Pota, 1993).

Family Violence: One of the important reason for forsaking home is family violence. Domestic violence is far widespread across all classes in our culture .It ranges from slapping , hitting, and kicking to murder. A study of Woman's Division, suggests that domestic violence takes place approximately 80 percent of the household in the country. Incidences of stove burning are being increasingly reported in the press. During 1998, 282 burn cases of woman were reported in Punjab. Of these 65 percent died of their injuries. Data collected from two hospitals of Rawalpindi and Islamabad over a period of three years since 1994 reveal 739 cases of burn victims. The official figure for murder of woman during 1998 was 1,974; majority of them were victims of their own relatives-husbands, brothers, fathers and in-laws (Zia & Bari, 1999).

Forced/Unmatched Marriages: In our society particularly in rural areas, parents often arrange marriages of their children (especially for girls) without asking for their consent or considering relevant attributes of a suitable match. Most of the girls accept it even if they do not like the match; some of them do not. If they talk to their parents about it, parents either does not pay any heed to it or react even bitterly. If the issue is of emotional relevance to the girls, they may elope out of rebelliousness.

Fantasy World: Some youngsters inspired by the novels and films create a world of fantasy for themselves in which they imagine themselves as prince/princess or hero/heroine. On the contrary they find a lot of discrepancy in the world of their fantasy and the real environment around them. This discrepancy is increased if the individual belongs to lower socioeconomic class. In their disappointment they try to realize this fantasy and leave their homes they rather want to get each and every thing that look glamorous in their media.

Suppressed or Poor Family Environment: Many parents in our society have an autocratic style of dealing with their children. Unfortunately the girls are given differential treatment in health, education, love, and care as compared to the boys, and also are the target of unduly restrictions. This type of family environment induces rebellious attitude in young girls and whenever they found an opportunity they leave their homes. According to Johnson and Carter (1980) a poor home environment is the central reason for leaving home, typically runaways report conflict with parents, alienation from them, rejection and hostile control, lack of warmth, affection and parental support, problematic marital relationship with much internal conflict and family disorganization.

Step Father or Step Mother: Those children whose parents remarry feel uncomfortable with the new relationship due to the lack of proper care and love. In our society most of the time children are maltreated by their stepparents. In extreme cases the step children are physically or sexually abused along with verbal and emotional abuse. The worst sufferers are the girls who are totally dependent upon their parents and have little freedom to express themselves, when the situation becomes too threatening and intolerable for them, they runaway from the situation to escape the torment and the torture.

Lack of Proper Guidance: A young girl may not have a close relationship in the family and surroundings to seek advice and if he/she has, there is no understanding of their point of view. The girl may have some emotional or other problems for which she does not find any solutions. In this state of ignorance and lack of proper guidance, she may take wrong step .Poor self-esteem and other issues related to mental and emotional health can be a factor. They may think to quit home environment where they don't seek proper guidance and being immature they can't differentiate between good or evil.

Sensitive Nature: Some parents prefer the male child on the female just because he is a "boy" and ignore the needs of their daughters. Discriminatory and biased attitude of parents towards their children on the basis of gender can also trigger her to leave home. Every child's emotional needs are different and if not fulfilled appropriately, produce feelings of insecurity and worthlessness. Some children are of sensitive nature and they demand parent's special attention. A routine scolding from parents may invoke the idea that they are not wanted by their parents so it s better to go away from them (Pota, 1993).

1.8 DAR-UL-AMAN: SHELTER HOME FOR DESTITUTE WOMAN

This is a scheme which aims at protecting woman deprived of family support due to one reason or another. It is a matter of common knowledge that, woman who become destitute due to death or desertion of her husband, are compelled either to beg or lead immoral life and become a burden on society.

There is a category of woman who are kidnapped from their home or forced to live immoral lives. This scheme envisages protecting and rehabilitating destitute woman either through marriage or domestic industrial training. This scheme helps such unfortunate woman to find shelter and also their way to normal and regular life, to the extent that it is acceptable to their relatives and the community they have come from. The Dar-ul-Aman is a government agency and therefore, operates under legal rules

1.9 RATIONALE AND OBJECTIVES OF THE STUDY

A lot of researches have been carried out on the self-esteem regarding the normal population. But I was interested in the destitute population for the research. I wanted to study how the destitute women perceive themselves, their abilities, their attributes, how they perceive themselves in the time of despair, how their mind undergoes the process of life with her natural and real social, economic and physical environment. Destitute women are at very sensitive edge of either losing their self-concept and self-esteem or they may be get strengthened.

In our society especially, it is very difficult to survive without home, resources, money or relatives. Society does not accept the woman who have taken an action of leaving home or who is helpless or deprived.

I was interested to search out the difference how the environment effects a normal woman and a destitute woman, how debilitating, devastatingly destitution effects the psyche of the woman especially on the growing young females and the woman with children. Destitute woman undergoes episodes of social isolation, emotional expression, and emotional deprivation.

Most of destitute women are those who have left their homes deliberately, I was interested to see how she exercise her rights and either it is their right or a crime as our society think so. How the other people feel, think and behave with a destitute woman, especially in Dar-ul-Aman how people treat them. So the objectives of my study are as follows;

- (1) To explore the effects of destitution on self-esteem.
- (2) To check the association of the demographic variables with the destitution.
- (3) To compare the destitute and non-destitute women regarding self-esteem

2 METHODOLOGY

2.1 SELF-ESTEEM SCALE (SES)

The Self-Esteem Scale was developed by Hudson (1982). The scale consisted of 25 items having categories in the form of 5-point rating scale. Where "strongly disagree", was given a value "1", "disagree" a value "2", "do not know", a value "3", "agree", a value "4" and "strongly agree" a value "5". The alpha co-efficient of the original scale was - .91. the original Self-Esteem Scale was translated by the researcher and the supervisor for the present study in order to check the meaningfulness and comprehensiveness of the scale. The original Self-Esteem Scale was given to the students of M.Phil and was asked to translate all the items of the scale in simple Urdu language. Final selection of the items was made with the help of Supervisor, which convey the exact meanings of the original items. The score of the subject is an aggregate of the categories check on all items. The possible score range is 25 to 125. the positive items of the self-Esteem Scale (i.e., item nos. 3, 4, 6, 7, 14, 15, 18, 21, 22, 23, 24) are scored in reverse order. So that subject's choice of '5'. The negative items are scored in normal manner. Hence a high score on SES indicates self-esteem problems.

2.2 SAMPLE

The sample consisted of 60 women, out of them 30 were destitute and 30 were non-destitute. Sample of the destitute women was taken from Dar-ul-Aman Multan, and DG Khan city through purposive and convenient sampling. Those women were selected who are there at the time of data collection and who volunteered to participate. A purposive sample of non-

destitute woman was taken from Bahawalpur. The age of both samples ranges from 17 to 40 years. Demographic data sheet included instruction and their name, age, education and marital status.

2.3 PROCEDURE

Sample of the destitute woman was contacted in Dar-ul-Aman after seeking prior permission from Dar-ul-Aman, and Crisis Center authorities. They were briefed about the purpose of the research. After seeking the permission report was established with the sample and they were ensured that information taken from them will remain confidential. They were requested to give their answers as honestly and accurately as they could and not leave any statement unanswered. Two scales, Self-Esteem Scale and Self-Concept Scale were administered individually, both scale were in Urdu version. They were encouraged to ask for any ambiguity prior to attempting the questionnaires. Illiterate sample was facilitated by verbalizing the questions of the scale in Punjabi language which they easily comprehend, so I completed the procedure of data collection. At the end of the seeking information, I thanked all the women, authorities and staff at these places.

3 HYPOTHESIS OF THE STUDY

- Self-esteem of the destitute women will be lower than non-destitute women.
- Educated and highly educated will have high self-esteem than non-educated and less educated.
- Educated and highly educated will have high self-esteem than non-educated and less educated in the group of destitute women.
- Educated and highly educated will have high self-esteem than non-educated and less educated in the group of non- destitute women
- Unmarried woman will have high self-esteem than married woman.
- Unmarried woman will have high self-esteem than married woman in destitute group.
- Unmarried woman will have high self-esteem than married woman in non-destitute group.
- Adolescents will have high self-esteem than adults.
- Adolescents will have high self-esteem than adults in destitute group.
- Adolescents will have high self-esteem than adults in non-destitute group.

4 RESULTS AND DISCUSSION

Table 1. Mean, standard deviation, and t-value of destitute and non-destitute on Self-Esteem Scale (N = 60)

Groups	N	M	SD	T	P
Destitute women	30	65.89	14.62	.700	.487
Non-Destitute women	30	63.17	15.26		

df = 58

Table no. 2 shows that difference between destitute and non-destitute women on the Self-Concept Scale are non-significant ($t = .700$, $df = 58$, $p = n.s$). These findings indicate that there is not much difference in the two groups in terms of their self-concept. The results imply that destitute women have lower self-esteem than non-destitute women.

Table 2. Mean, standard deviation, and t-value on self-esteem of up to matriculation educated and greater than matriculation women (N = 60)

Education	N	M	SD	T
Up to Matriculation	29	68.83	15.81	2.244
> Matriculation	31	60.48	12.93	

$*p < .05$, $df = 58$

Table no.3 shows significant difference on the scores of self-esteem of women educated up to matriculation and greater than matriculation ($t = 2.244$, $df = 58$, $p < .05$). These findings indicate that there is significant difference in the two groups in terms of their self-esteem, which implies that women educated up to matriculation have lower self-esteem than the women educated greater than matriculation.

Table 3. Mean, standard deviation, and t-value on the self-esteem of women educated up to matriculation and greater than matriculation in the group of destitute women (N = 30)

Education	N	M	SD	t	P
Up to Matriculation	20	70.15	13.80	2.459	
> Matriculation	10	57.30	12.82		

df = 28

Table no.4 shows significant difference on the scores of self-esteem of women educated up to matriculation and greater than matriculation in destitute women ($t = 2.459$, $df = 28$, $p < .05$). These findings indicate that there is significant difference within destitute group in terms of self-esteem, which implies that within the destitute sample women educated up to matriculation have lower self-esteem than the women educated greater than matriculation.

Table 4. Mean, standard deviation, and t-value on the self-esteem of women educated up to matriculation and greater than matriculation in the group of non-destitute women (N = 30)

Education	N	M	SD	T	P
Up to Matriculation	9	65.89	20.21	.633	.532
> Matriculation	21	62.00	13.01		

df = 28

Table no.5 shows that difference within non-destitute group of women educated up to matriculation and greater than matriculation on self-esteem are non-significant ($t = .633$, $df = 28$, $p = n.s$). These findings indicate that there is non-significant difference within non-destitute group in terms of self-esteem. Which implies that within the non-destitute sample women educated up to matriculation have lower self-esteem than the women educated greater than matriculation.

Table 5. Mean, standard deviation, and t-value on the self-esteem of married and un-married women (N = 60)

Marital Status	N	M	SD	t	P
Married	40	64.62	15.67	.079	
Un-Married	20	64.30	13.54		

df = 58

Table no.9 shows that difference between married and unmarried on their score of self-esteem is non-significant ($t = .079$, $df = 58$, $p = .937$). These findings indicate that there is non-significant difference of married and unmarried women, in terms of their self-esteem. These results imply that no differences have been found on self-esteem between married and unmarried women in overall sample.

Table 6. Mean, standard deviation, and t-value on the self-esteem of married and un-married women in destitute group (N = 30)

Marital Status	N	M	SD	t	P
Married	23	65.91	14.21	.031	.976
Un-Married	7	65.71	17.10		

df = 28

Table no.10 shows that difference between married and unmarried destitute women on self-esteem is non-significant ($t = .031$, $df = 28$, $p = .976$). These findings indicate that there is no difference in married and unmarried destitute women in terms of self-esteem. Results imply that within destitute sample married and unmarried women have equal level of self-esteem.

Table 7. Mean, standard deviation, and t-value on the self-esteem of married and un-married women in non-destitute group (N = 30)

Marital Status	N	M	SD	t	P
Married	17	62.88	17.75	-.115	.909
Un-Married	13	63.54	17.93		

df = 28

Table no.11 shows that difference between married and unmarried non-destitute women on self-esteem is non-significant ($t = -.115$, $df = 28$, $p = .909$). These findings indicate that there is not much difference in married and unmarried non-destitute women in terms of self-esteem. These findings imply that within non-destitute sample married women have slightly higher self-esteem than unmarried women.

Table 8. Mean, standard deviation, and t-value on the self-esteem of up to 21 year women and greater than 21 years (N = 60)

Age	n	M	SD	t	P
Upto 21 years	18	69.22	13.62	1.626	.109
> 21 years	42	62.50	15.09		

df = 58

Table no.5 shows that difference between the women up to 21 years and greater than 21 years on their scores on self-esteem is non-significant ($t = 1.626$, $df = 58$, $p = .109$). These findings indicate that there is not much difference of women up to 21 years and greater than 21 years in terms of self-esteem. These results imply that women up to 21 years have lower self-esteem than women greater than 21 years of age in overall sample.

Table 9. Mean, standard deviation, and t-value on the self-esteem of upto 21 year women and greater than 21 years in destitutes (N = 30)

Age	n	M	SD	t	P
Upto 21 years	13	71.54	14.10	1.945	
> 21 years	17	61.53	13.87		

df = 28

Table no.16 shows significant difference on the scores of self-esteem of women upto 21 years and greater than 21 years in destitute women ($t = 1.945$, $df = 28$, $p < .05$). These findings indicate that there is significant difference between women up

to 21 years and greater than 21 years in destitute women in terms of self-esteem. Results imply that within destitute sample women up to 21 years have lower self-esteem than women greater than 21 years of age.

Table 10. Mean, standard deviation, and t-value on the self-esteem of upto 21 year women and greater than 21 years in non-destitute women (N = 30)

Age	<i>N</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>P</i>
Upto 21 years	5	63.20	11.39	.005	.996
> 21 years	25	63.16	16.11		
<i>df</i> = 28					

Table no.17 shows that difference between the women up to 21 years and greater than 21 years in non-destitute group on self-esteem is non-significant ($t = .005$, $df = 28$, $p = .96$). These findings indicate that there is no difference between women up to 21 years and greater than 21 years in non-destitute group in terms of self-esteem. Results imply that within non-destitute sample women up to 21 years and women greater than 21 years of age have similar level of self-esteem.

5 CONCLUSION

The present study was carried out to investigate the level of self-esteem among destitute and non-destitute women. To achieve the purpose Urdu translation of Self-Esteem Scale (Hudson, 1982) was used to measure the self-esteem level.

It was hypothesized that destitute women will have lower self-esteem than non-destitute women. Results indicate that destitute women have higher self-concept than non-destitute women.

Most possible reason could be that most of the destitute women were those who had willingly left their home. They claimed during data collection that it is their right to live a life according to their own will choice and freedom. Nobody easily leaves the home especially woman in our society for whom most suitable, safe place is her home how can she wish to leave home unless and until she is compelled by certain factors. If their rights, freedom will be violated, they even any person can not bear it.

During data collection it was observed that destitute women reacted very defensively and they become touchy some negative items. But non-destitute women does not reacted like that, they remain calm and cool.

Perhaps there might be difference in their approach towards life, a destitute woman prefers herself, her rights as a woman. Whereas the other non-destitute who is living with family normally, she is exercising her rights already and prefers more to her family, her values and the society.

There is possibility that destitute women realize themselves low, inferior and as a reaction she perceives herself as she is very right as these women claimed they are struggling for their rights.

Results indicated that destitute women have lower self-esteem than non-destitute. There is possibility that non-destitute woman are more adjusted in social structure, they have better relationships with people with high conformity, persuasion, low cognitive dissonance and healthy social comparison. Whereas the destitute woman is detached from her social, physical, economic environment and have no healthy social comparison, have negative emotions like anxiety, depression and are maladjusted.

Self-esteem is not a value rather it keeps on changing. There might be the reason that destitute women are mostly in Dar-ul-Aman or shelter homes, she experiences as frequently being devalued, unappreciated and low sense of personal efficacy and worth.

There is possibility that destitute women have less exposure as compare to non-destitute. She can't exercise her potentials capabilities and can't think about high achievements. Even most of the destitute were illiterate, how can they come up with high self-esteem as self-esteem is a function of past, present and future experiences. Non-destitute women during data collection seemed to be competent, capable and happy in their lives.

Then it was hypothesized that overall women in total sample, who are educated up to matriculation will have lower self-esteem than the women who are educated from matriculation to M.Phil.

This hypothesis was accepted as far as self-esteem is concerned. There is possibility that women educated up to matriculation have less exposure, her thinking, rationality, might not developed as of educated women. As highly educated women might have more diversity of exposure, her thinking might be more rational, logical and reality based and she might have exercised her capabilities, potentials more productively as compared to woman who is up to matriculation.

Some are the results of non-destitute women.

Within group comparison of destitute, these results also indicate that up to matriculation have lower self-esteem as compared to those who education is great than matriculation. The reasons for these results are same as above. Women who are educated up to matriculation may not be exercised practically their potentials and capabilities.

Overall results over marital status indicate that there is no difference on self-esteem of married and unmarried women. Perhaps marital status does not affect the self-esteem of women. Some are the results of within group comparison of destitute women.

Where as within the group comparison in non-destitute sample, married women have higher self-esteem than unmarried, perhaps the experience exposure of a non-destitute, married women increase after marriage, and she may come to know about her capabilities, potentials more fully than an unmarried woman.

According to results adolescents (up to 21 years) have lower self-esteem than the adults (> 21 years), hypothesis about this domain was refuted as I had hypothesized vice a versa. There is possibility that adults have practically excised their potentials, capabilities and plan their standards and goals and when they reach out these goals, they judge themselves more effectively than adolescent.

Same are the results of within group comparison of destitute sample on self-esteem which indicate that adults have high self-esteem than adolescents, where as no differences have been found according to the results of group comparison of non-destitute sample regarding age on self-esteem.

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Diversité morfo génétique de *Oxalis pes-caprae*, L. au Péninsule du Cap Bon de la Tunisie

[Morpho genetic diversity of *Oxalis pes-caprae* L. in the Cap Bon Peninsula of Tunisia]

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RESUME: L'*Oxalis pes-caprae*, L. qui se multiplie essentiellement par voie végétative (rhizome et bulbe), est une plante invasive riche en métabolites secondaires et qui a envahie tous les terrains en Afrique du Nord et particulièrement en Tunisie. En vue d'exploiter la diversité génétique des ressources végétales en général, nous avons pensé à étudier la diversité génétique de cette espèce et d'exploiter les métabolites secondaires qu'elle en contient. Dans cette étude limitée à la zone de la Péninsule du Cap Bon de la Tunisie, nous avons montré que cette espèce pourrait se multiplier par voie sexuée et contribuer à sa diversité génétique. Les résultats obtenus ont montré une grande diversité de pigmentation qui a été confirmée par l'étude moléculaire. L'utilisation des inters simples séquences répétées (ISSR) a montré que les accessions du Cap Bon peuvent être classées en quatre groupes homogènes différents.

MOTS-CLEFS: Oxalis, ISSR, diversité, morphologique, moléculaire.

1 INTRODUCTION

Durant ces dernières décennies, les travaux de recherches ont été orientés vers l'exploitation des ressources végétales spontanées, riches en métabolites secondaires, en produits pharmaceutiques, et/ou en produits cosmétiques, etc.... Pour avoir une idée de la diversité des espèces spontanées, l'étude menée par certains auteurs Maghrébins en (2003) [1] dans une région limitée à Wergla (Algérie) ont inventorié trente sept (37) espèces appartenant à vingt familles dont les plus importantes sont les Composées, les Graminées, les Chenopodiacees et les Labiées. De même, les travaux de Nabli (1989) cités par El-Hamrouni, (2001) [2] sur la flore spontanée de la Tunisie ont inventorié 2162 espèces réparties en 115 familles et en 742 genres. Parmi ces espèces 80% d'entre elles existent sur l'ensemble du territoire national et 929 se rencontrent au Cap Bon.

Parmi ces études, certaines ont été focalisées tout particulièrement sur le genre *Oxalis* qui comporte plusieurs espèces dont la plus abondante est *Oxalis pes-caprae* et *Oxalis corniculata* mais aussi d'autres sous espèces ou des hybrides difficilement distinguables des espèces déjà connues ont été décrits.

L'*Oxalis pes-caprae* L. anciennement nommée *Oxalis cernua* Thunb est une espèce originaire de l'Afrique du Sud. Elle a colonisé différentes régions du monde à climat de type méditerranéen. En Afrique du Nord, elle a été citée dans différentes synthèses sur la flore adventice du Maroc occidental et central [3]; [4] et [5]) et également, durant les années 30 en Tunisie par Chabrolin (http://bibdigital.rjb.csic.es/Imágenes/P0063_10/P0063_10_0434.pdf).

Dans son habitat naturel (Afrique du Sud), les plantes d'*O. pes-caprae* présentent différents niveaux de ploïdie: diploïdes ($2n = 2x = 14$) ou tétraploïdes ($2n = 4x = 28$) [6]; [7]. Les espèces pentaploïdes ($2n = 5x = 35$) sont rares et stériles et donc leur reproduction est essentiellement asexuée [6].

En Tunisie, l'*Oxalis pes-caprae* est la plus dominante. C'est une plante à petites fleurs jaunes (une ou deux par pédoncule) en fascicule ombelliforme de couleur jaune [8]. Elle est utilisée en culinaire, notamment fraîche dans les salades, ou comme additifs avec les viandes grillées ou cuites. Ses fleurs sont utilisées en teintureries traditionnelles, ce qui constitue un enjeu économique important à l'avenir.

Vu son importance économique, écologique et sociale, l'étude de la diversité génétique de cette espèce est maintenant d'une importance primordiale. Selon Baril, (2001) [9], l'intérêt de la caractérisation moléculaire de la biodiversité de n'importe quelle espèce apparaît dans tous les domaines de la génétique végétale: taxonomie, gestion des ressources génétiques, amélioration des plantes et enfin, inscription et protection variétale.

C'est dans ce cadre que se situe ce travail, qui a pour objectif de caractériser la diversité génétique des différentes accessions d'*Oxalis* au Cap Bon (péninsule située au Nord-Est de la Tunisie) sur le plan morphologique et moléculaire et voir si cette espèce se multiplie uniquement par voie végétative ou, au contraire, la voie sexuée est aussi possible et dans quelle mesure elle contribue à la diversité de cette espèce.

2 MATÉRIEL & MÉTHODES

2.1 MATÉRIEL VÉGÉTAL UTILISÉ

L'espèce utilisée dans cette étude est l'*Oxalis pes-caprae* L. C'est une herbe à fleurs en fascicule ombelliforme de couleur jaune. Ses feuilles, longuement pétiolées, sont toutes disposées en rosette dense, à 3 folioles en forme de cœur. Les fruits sont des capsules cylindriques oblongues, mais ne se forment que rarement [10].

2.2 COLLECTE ET DESCRIPTION DES ÉCHANTILLONS

Nous avons collecté les différentes accessions d'*Oxalis* étudiées dans différentes régions du Cap Bon (Tunisie) et dont les localités sont mentionnées ci-dessous :

A1) Soliman; **A2)** Mrayssa ; **A3)** Takelsa ; **A4)** Sidi Daoud ; **A5)** Saheb Jebel; **A6)** Hawarya; **A7)** Grombalia; **A8)** Bou Argoub; **A9)** Bir Bouragba; **A10)** Hammamet; **A11)** Nabeul; **A12)** Beni Khiar; **A13)** Korba; **A14)** Menzel Horr; **A15)** Menzel Temim; **A16)** Tazarka; **A17)** Kelibya; **A18)** Menzel Bou Zelfa; **A19)** Beni Khalled.

Les échantillons collectés ont été ramenés au Laboratoire où ils ont été décrits sur le plan morphologique (longueur du pédoncule, degré de pigmentation des feuilles) et broyés pour en extraire l'ADN pour l'étude moléculaire.

2.3 RÉALISATION DE POLLINISATION ARTIFICIELLE

Il s'agit dans ce type d'expérience, de castrer la fleur (éliminer les étamines), et empêcher toute action d'agents pollinisateurs susceptibles de provoquer la fécondation. Ceci a été fait par ensachage des fleurs castrées dans des sacs en papier spécial percés de nombreux petits pores pendant quelques jours. Après cette phase, nous avons apporté des grains de pollen étranger que nous avons déposé sur le gynécée des fleurs, nous les avons ensachés et après 10 jours, nous avons observé les résultats obtenus.

2.4 EXTRACTION ET QUANTIFICATION DE L'ADN TOTAL

Afin de minimiser le temps d'exposition du matériel végétal à la température ambiante, et éviter ainsi la dégradation de l'ADN, le mortier et le pilon sont trempés dans l'azote liquide. Un échantillon de 1g de matière végétale de chaque accession est broyé dans ce mortier, en présence d'azote liquide, jusqu'à l'obtention d'une poudre très fine.

Chaque broyat (chaque accession) est transféré dans un tube de 2 ml, auquel nous avons ajouté 900µl de tampon d'extraction (2% CTAB, 20 Mm EDTA; 1,44 mM Tris HCl à pH 8) et 9 µl de β-mercaptoéthanol). Tous les tubes sont, par la suite, incubés à 65°C pendant 30 min avec des agitations périodiques toutes les 5min. Après un repos de 4 à 5 min, 900 µl de chloroforme: isoamylalcool (24:1 v/v) ont été ajoutés. Le mélange a été agité manuellement pendant 15 min afin de maintenir l'émulsion, puis il a subi une centrifugation pendant 10 min à 13000 tr/min, à température de 4°C.

A la fin de cette centrifugation, la phase aqueuse a été gardée, et les acides nucléiques qui en font partie, ont été précipités en ajoutant un volume égal d'isopropanol. Ensuite, une deuxième centrifugation a été réalisée dans les mêmes conditions, pendant 10 min. Le surnageant est éliminé, et le culot d'ADN obtenu est lavé avec 500 µl d'éthanol (70%).

Au terme de ce lavage (centrifugation), le surnageant est éliminé et les tubes sont séchés à l'air libre pendant une heure. Le culot est par la suite dissout dans 100 µl de TE (Tampon de re-suspension: Tris HCl 10mM à pH 8, EDTA 1 mM à pH 8).

L'élimination des ARN a été réalisée en ajoutant à chaque tube 2 µl de RNase (1 µg/ml), et nous avons incubé les tubes à 37°C pendant 2 heures. Ensuite, nous avons ajouté à chaque tube 300µl de chloroforme alcool iso amylique avant de les centrifuger pendant 10min à 13000 tpm.

Le surnageant récupéré a reçu 0.1volume (20 µl) d'acétate de sodium (3M, pH 5.2) et 2 volumes (400 µl) d'éthanol. L'ensemble étant mis à -80°C pendant 10 min, centrifugé pendant 10 min à 13000 tpm et le culot est récupéré. Ce dernier a été lavé à l'alcool à 70%, séché et dissout dans 100 µl de TE

L'estimation de la quantité d'ADN a été réalisée en faisant migrer les ADN des différentes accessions sur gel d'agarose à 0.8% contenant du Bromure d'Ethidium (BET) et leur visualisation sous UV.

2.5 APPLICATION DU PROTOCOLE ISSR (INTER SIMPLE SEQUENCE REPEAT)

Les inters séquences simples répétées (ISSR) est une technique moléculaire basée sur la PCR et qui est hautement reproductible, en raison de l'ancrage de ses amorces à leurs fins et aussi en raison de leur longueur. Elles ont été largement utilisées pour révéler le polymorphisme inter variétal [11]. Cette technique a été utilisée par Malice (2009)[12] pour révéler la diversité génétique et la structure de *Oxalis tuberosa* Mol de la Bolivie.

2.5.1 LES AMORCES ISSR

Les amorces (ISSR) représentées dans le tableau 1 sont des amorces testées sur *Oxalis tuberosa*. Nous les avons utilisé sur *Oxalis pes-caprae* puisqu'il appartient au même genre (*Oxalis*).

Tableau 1: Liste des amorces testées avec leurs températures d'hybridation.

Amorce	Séquence 5'→3'	Références	T _m (°C)	T _a (°C)
1	BDB-(ACA) ₅	Mc Gregor <i>et al.</i> 2000	50	-
2	DD-(CCA) ₅	Mc Gregor <i>et al.</i> 2000	56	52
3	DHB-(CGA) ₅	Mc Gregor <i>et al.</i> 2000	58	53
4	VHV-(GT) ₇ -G	Mc Gregor <i>et al.</i> 2000	56	51
5	DBD-(AC) ₇	Mc Gregor <i>et al.</i> 2000	50	-
6	BDB-(CAC) ₅	Prevost and wilkinson 1998	60	55
7	(AG) ₈ -YT	Prevost and wilkinson 1998	52	47
8	(GA) ₈ -YC	Prevost and wilkinson 1998	56	51
9	(AC) ₈ -G	Prevost and wilkinson 1998	52	47
10	(AC) ₈ -YG	Prevost and wilkinson 1998	56	51
11	(AG) ₈ -T	Prevost and wilkinson 1998	50	50
12	(GA) ₈ -A	Prevost and wilkinson 1998	50	50
13	(GA) ₈ -C	Joshi <i>et al.</i> 2000	52	50
14	(GATG) ₄ -C	Joshi <i>et al.</i> 2000	52	-
15	VHV-(GTG) ₅	Joshi <i>et al.</i> 2000	60	-
16	DDC-(CAC) ₅	Joshi <i>et al.</i> 2000	60	55
17	(GT) ₈ -C	Joshi <i>et al.</i> 2000	52	
18	(GT) ₈ -YC	Joshi <i>et al.</i> 2000	56	47
19	(TG) ₈ -A	Joshi <i>et al.</i> 2000	50	-
20	(CA) ₈ -G	Pasqualone <i>et al.</i> 2000	52	-
21	(CCA) ₈ -YA	Pasqualone <i>et al.</i> 2000	52	49
22	(GACA) ₄	Pasqualone <i>et al.</i> 2000	48	49

B= G ou T ou C; D= G ou A ou T; H= A ou T ou C, V= G ou A ou C

2.5.2 MILIEU RÉACTIONNEL D'AMPLIFICATION PAR PCR

Après avoir déterminé les concentrations optimales de tous les composants de la réaction (PCR), nous avons préparé un milieu réactionnel contenant le tampon PCR, le $MgCl_2$, les dNTPs, l'amorce, l'ADN, la Taq polymérase et l'eau ultra pure (Tableau 2). L'application de la technique ISSR aux accessions d'*Oxalis* du Cap Bon, a été réalisée en testant toutes les amorces indiquées dans le tableau 1, ensuite, seules les amorces qui ont donné des bandes reproductibles et polymorphes ont été retenues pour l'étude du polymorphisme moléculaire.

L'analyse ISSR a été réalisée en utilisant 25 ng d'ADN des différentes accessions d'*Oxalis*, et 8 amorces ISSR (tableau 2).

Tableau 2: Le mélange réactionnel pour l'amplification de l'ADN par PCR.

Composant	Concentration	Volume prélevé (μl)
ADN	25 ng/μl	0,5
Go Taq Buffer (γ compris $MgCl_2$)	5 X	5
$MgCl_2$ (25 mM)	2 mM	2
dNTP (2 mM)	200 μM	2,5
Amorce (100 μM)	2,5 μM	0,625
Go Taq polymérase (Promega)	5 U/μl	0,2

Le volume final de la réaction est ajusté à 25 μl par l'eau ultra-pure. Les milieux réactionnels contenus dans les tubes PCR sont placés dans un thermocycleur (Biometra Uno II). L'amplification PCR est effectuée selon un programme composé d'une pré-dénaturation à 94°C pendant 3 min, suivie de 35 cycles comportant chacun une étape de dénaturation à 94°C pendant 1min, une étape d'hybridation à T_a pendant 1min, et une étape d'élongation à 72 °C pendant 2 min. La dernière étape de la réaction d'amplification consiste en une extension finale à 72 °C pendant 2 min.

2.6 ANALYSES STATISTIQUES

Les résultats de l'amplification ISSR sont lus sur les photos des gels, et seules les bandes nettes et visibles ont été comptées. Les profils électrophorétiques sont transformés en matrices binaires portant en lignes les accessions testées, et en colonnes, les marqueurs générés par les différentes amorces ISSR. Nous avons attribué le score 1 pour la présence de bandes, et le score 0 pour l'absence de bandes.

La matrice des données obtenues, a été analysée par le programme Treecon for Windows (version 1.3b) selon la méthode UPGMA (Unweight Pair Group Method with Arithmetic Average) de Nei, (1978) [13], ce qui a permis d'avoir un dendrogramme de dissimilarité et une matrice des distances génétiques.

3 RÉSULTATS ET DISCUSSION

3.1 RÉALISATION DES CROISEMENTS INTRA ACCESSIONS

Pour confirmer que l'*Oxalis* a un mode de reproduction sexué, nous avons réalisé une simple expérience consistant à faire un croisement artificiel entre une plante mère, dont on a castré la fleur, et le pollen d'une autre fleur provenant d'une autre accession d'*Oxalis*. Le résultat est l'obtention d'une capsule contenant 2 graines de semence qui pourraient être disséminées et contribuer à la diversification génétique de l'*Oxalis* (photo 1).



Photo 1: Graine d'*Oxalis* après fécondation

Ce résultat obtenu est conforme à celui qui a été observé depuis for longtemps par Chabrolin (http://bibdigital.rjb.csic.es/Imagenes/P0063_10/P0063_10_0434.pdf), professeur à l'Ecole Coloniale d'Agriculture (ECA: actuellement nommée: Institut National Agronomique de Tunisie: INAT), détaché au service botanique et agronomique de Tunisie (SBAT: actuellement nommé Institut National de la Recherche Agronomique de Tunisie: INRAT). Cet ancien enseignant-chercheur a mentionné en 1933 et 1934 que, «*dans les peuplements d'Oxalis de la région de Tunis, les graines de cette plante ont été régulièrement trouvées*». Il a ajouté que «*cette fructification d'Oxalis paraît être un fait régulier dans la région de Tunis, bien qu'elle passe en général inaperçue*».

Nos résultats ainsi que les constatations ci-haut indiquées confirment que l'*Oxalis* pourrait se multiplier aussi par voie sexuée, ce qui pourrait expliquer la diversité génétique obtenue puisque la fécondation sexuée pourrait être réalisée soit par autogamie soit par allogamie, par des pollens transportés par les insectes ou le vent.

3.2 OBSERVATIONS SUR LA VARIABILITÉ MORPHOLOGIQUE DES OXALIS

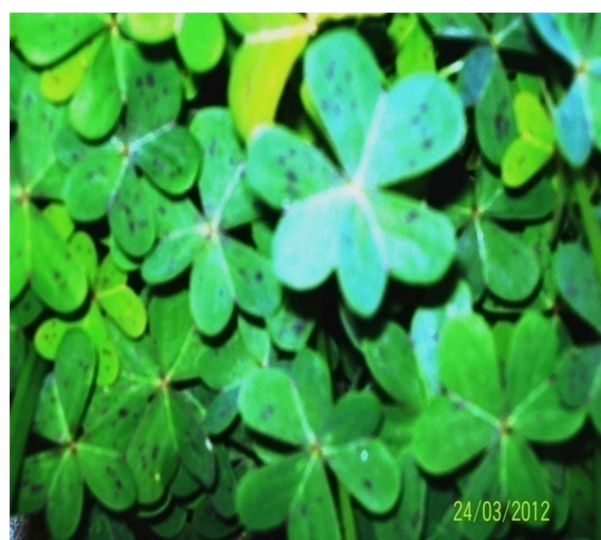
A coté des croisements que nous avons réalisés entre accessions, nous avons aussi effectué des observations sur l'aspect morphologique (longueur des pétioles et pigmentation des feuilles) dans les différentes régions du Cap Bon (photos 2). Ces observations ont montré une grande diversité de pigmentation au niveau des feuilles de l'*Oxalis* allant de zéro pigmentation jusqu'à une couverture totale des feuilles (feuilles pourpres).



A : feuilles sans pigmentations



B : feuilles avec pigmentation légère



C : feuilles avec pigmentation plus accentuée



D : feuilles avec pigmentations encore plus intenses



E : Pigmentations couvrant la totalité des feuilles



Photo 2: Variabilité de la pigmentation des feuilles d'*Oxalis pes-caprea*

Une autre hypothèse pourrait expliquer la grande variabilité de l'*Oxalis* dans la région du Cap Bon de la Tunisie est l'effet humain. En effet, cette région est particulièrement riche en pépinière de plantes florales. Les fleuristes de cette région font souvent recours à l'amendement de leurs sols qui présentent rarement une composition idéale. Les substrats apportés de différentes régions pourraient porter des bulbes d'une région à une autre, ce qui expliquerait la variabilité d'*Oxalis* entre les différentes régions.

3.3 CARACTÉRISATION MOLÉCULAIRE DES ACCESSIONS D'*Oxalis*

Les profils ISSR obtenus (figure 1) ont permis de réaliser la matrice de dissimilarité génétique entre les différents échantillons d'*Oxalis*. Cette matrice nous a permis de réaliser le dendrogramme de dissimilarité génétique en utilisant le logiciel Treecon for Windows version 1.3.b. Les constructions phylogénétiques ont été basées sur la méthode UPGMA (Unweighted Pair Group Method with Arithmetic Average). L'analyse de cette matrice montre que les coefficients de dissimilarité génétique varient de 0,2 à 0,941, avec une moyenne de 0,793 (Tableau 3)

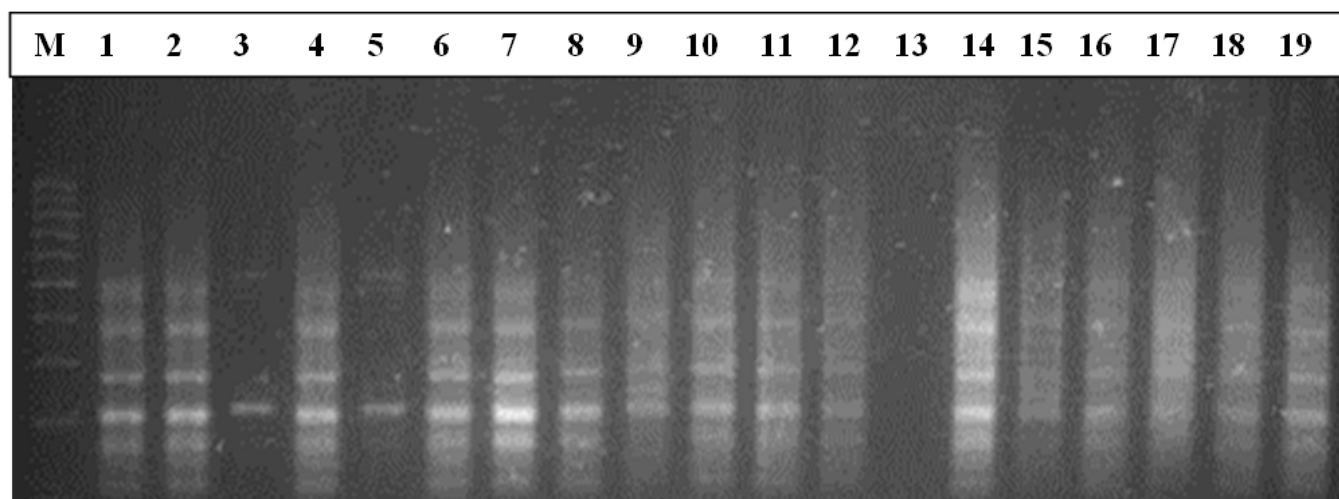


Figure 1: Un exemple de profil électrophorétique d'*Oxalis* du Cap Bon obtenu par l'amorce (GA)8-A.

Légende: 1 Soliman; 2 Mrysa ; 3 Takelsa; 4 Sidi Daoud; 5 Saheb Jebel; 6 Hawarya; 7 Grombalia; 8 Bou Argoub; 9 Bir Bouragba; 10 Hammamet; 11 Nabeul; 12 Beni Khia; 13 Korba; 14 Menzel Horr; 15 Menzel Temim; 16 Tazarka; 17 Kelibya; 18 Menzel Bou Zelfa; 19 Beni Khalled.

Tableau 3: Matrice de dissimilarité génétique entre les échantillons d'Oxalis du Cap Bon, estimée selon la formule de Nei, (1978) [13], basée sur les marqueurs ISSR.

A 1	0																		
A 2	7	0																	
A 3	81	83	0																
A 4	16	8	81	0															
A 5	57	56	67	58	0														
A 6	14	6	82	2	59	0													
A 7	10	10	82	8	54	7	0												
A 8	16	9	89	11	63	9	9	0											
A 9	27	25	85	28	64	26	22	21	0										
A 10	19	14	88	17	65	15	18	17	27	0									
A 11	12	15	81	21	68	19	15	14	25	17	0								
A 12	17	16	89	25	66	23	19	18	32	11	18	0							
A 13	75	78	71	82	54	82	76	84	71	83	82	83	0						
A 14	24	23	88	22	69	20	20	16	33	15	19	13	94	0					
A 15	39	36	75	40	67	37	37	35	29	38	32	40	68	37	0				
A 16	23	19	89	18	71	16	19	12	25	17	18	16	89	10	32	0			
A 17	23	21	85	17	76	15	19	21	21	24	21	32	79	26	29	18	0		
A 18	17	12	83	15	71	13	16	12	21	8	11	16	83	13	32	12	19	0	
A 19	20	15	80	7	56	9	12	18	29	14	25	22	81	19	37	19	18	15	0
	A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	A 10	A 11	A 12	A 13	A 14	A 15	A 16	A 17	A 18	A 19

Légende: A1) Soliman; A2) Mraysa ; A3) Takelsa ; A4) Sidi Daoud ; A5) Saheb Jebel; A6) Hawarya; A7) Grombalia; A8) Bou Argoub; A9) Bir Bouragba; A10) Hammamet; A11) Nabeul; A12) Beni Khia; A13) Korba; A14) Menzel Horr; A15) Menzel Temim; A16) Tazarka; A17) Kelibya; A18) Menzel Bou Zelfa; A19) Beni Khaled.

Le dendrogramme obtenu à partir des échantillons d'Oxalis du Cap Bon (Figure 2) montre clairement 4 groupes plus ou moins séparés:

- **G1** subdivisé en 3 sous groupes: **SG1** constitué de A15 et **SG2** constitué de A9 et A17 alors que le **SG3** est constitué de A4, A6, A7, A19, A8, A1, A2, A11, A14, A16, A12, A10 et A18,;
- **G2** constitué d'A3;
- **G3** constitué d'A5;
- **G4** constitué d'A13.

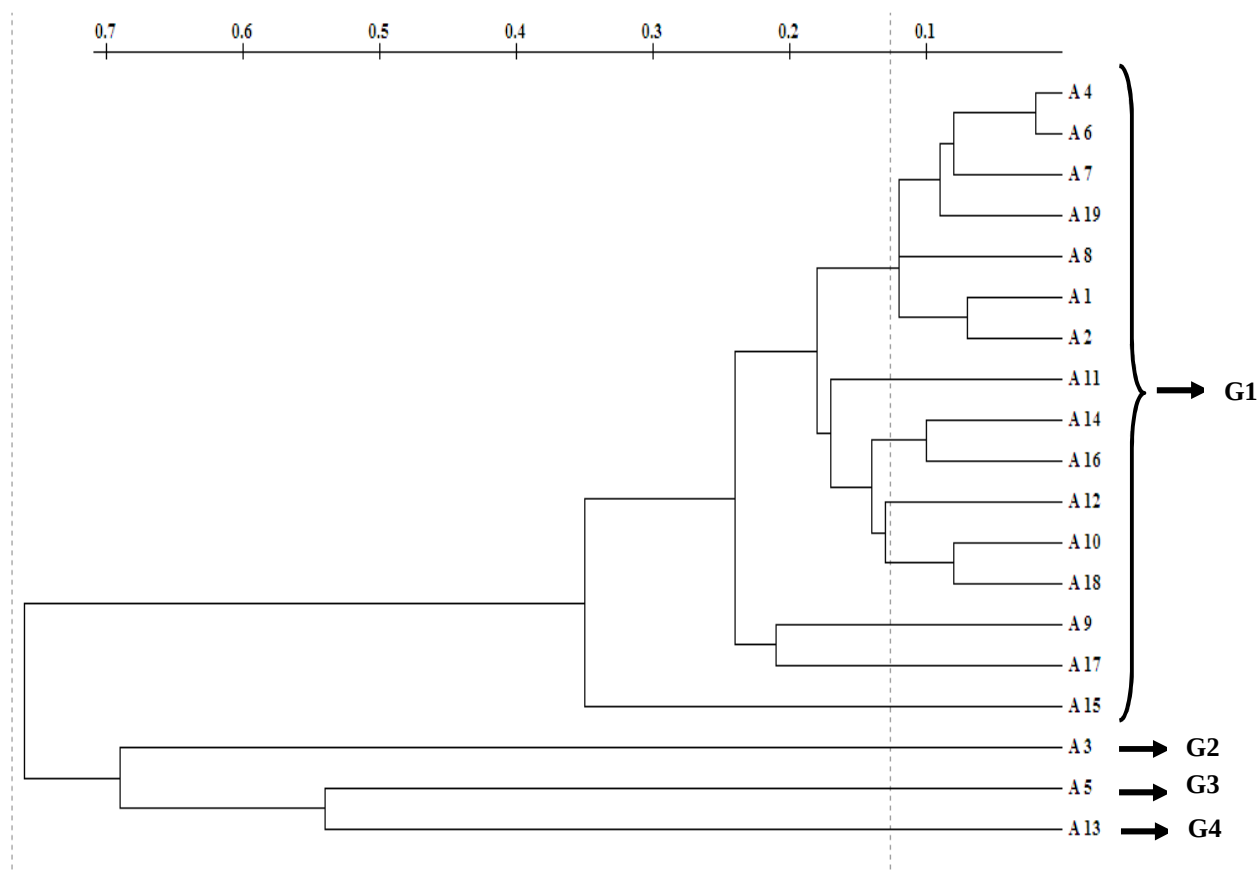


Figure 2: Dendrogramme regroupant les échantillons d'*Oxalis* du Cap Bon, établi par les marqueurs ISSR et la méthode UPGMA à partir de la matrice dissimilarité.

Légende: **A1)** Soliman; **A2)** Ferme Mrayssa ; **A3)** Takelsa ; **A4)** Sidi Daoud ; **A5)** Saheb Jebel; **A6)** Hawarya; **A7)** Gromballia; **A8)** Bou Argoub; **A9)** Bir Bouragba; **A10)** Hammamet; **A11)** Nabeul; **A12)** Beni Khiar; **A13)** Korba; **A14)** Menzel Horr; **A15)** Menzel Temim; **A16)** Tazarka; **A17)** Kelibya; **A18)** Menzel Bou Zelfa; **A19)** Beni Khalled.

Par ailleurs, les dissimilarités les plus faibles ont été observées entre les échantillons suivants (A2-A6 et A6-A4, avec des coefficients de dissimilarité de 6 et 2% respectivement), ce qui traduit une forte ressemblance entre elles. Par contre, les dissimilarités les plus élevées ont été observées entre les échantillons (A3-A8; A3-A16; A13-A16 et A13-A14 avec des coefficients de dissimilarité de 89; 89; 89 et 94% respectivement).

3.4 DISCUSSION DE L'ASPECT MOLÉCULAIRE

Les amorces ISSR ancrées en 5' ou en 3' reposent sur un certain degré de connaissance au niveau des séquences puisqu'elles amplifient des séquences intermicrosatellites. Cette technique a l'avantage particulier, d'être plus reproductibles, à cause des séquences d'amorces ancrées et plus longues utilisées que celle d'autres méthodes telles que la RAPD. Pour assurer une netteté des bandes amplifiées, nous étions contraints d'utiliser une concentration d'amorces de 2,5 μ M, contrairement à ce que [14] ont utilisé en travaillant sur *Oxalis tuberosa* Mol. où ils ont mentionné qu'une concentration de 0,4 μ M est suffisante pour la réaction PCR.

En testant les amorces, nous avons obtenu une première classe d'amorces ne générant aucune amplification. Cela pourrait être expliqué par l'absence totale de complémentarité entre les ADN matrices et les amorces utilisées et/ou par l'éloignement des sites d'hybridation. La deuxième classe d'amorces a généré des bandes, ce qui explique clairement que les ADN ayant généré des bandes sont les ADN présentant des sites d'hybridation rapprochés, et que les amorces pointent l'une vers l'autre. Dans ce cas, des produits d'amplification de tailles variables sont alors générés.

Quoiqu'il en soit, les résultats obtenus montrent clairement l'intérêt de l'utilisation de cette technique pour la caractérisation moléculaire des échantillons d'*Oxalis* étudiés. L'analyse des profils électrophorétiques montre que le nombre

de fragments amplifiés varie en fonction de l'amorce et de l'accession. Pour une même amorce, le nombre de bandes polymorphes générées est différent d'une accession à une autre mais, dans certains cas, avec un profil de migration similaire, donc, le taux du polymorphisme révélé est étroitement lié à l'amorce. A ce sujet, plusieurs auteurs signalent l'existence d'une relation entre le degré du polymorphisme et la séquence des amorces ([15]; [16]). L'exploitation de ces marqueurs moléculaires moyennant des analyses statistiques appropriées, a permis de construire l'arbre phylogénique. L'analyse de cet arbre montre que les échantillons du Cap Bon sont répartis en 4 groupes

Les amorces ISSR utilisées dans ce travail sont ancrées et donc, ne permettent pas d'amplifications non spécifiques et de ce fait, (i) sont efficaces malgré qu'elles engendrent des groupes inférieurs à ceux engendrés par d'autres méthodes telles que la RAPD (travail non publié) (ii) les *Oxalis* sont relativement diversifiés si bien que, même dans une région géographiquement limitée telle que le Cap Bon, jusqu'à 4 groupes distincts sont présents. (iii) la diversité des groupes obtenue serait due à la pollinisation parfois allogames qui pourrait se produire entre accessions et donc contrairement à ce que certains auteurs pensent, l'*Oxalis* ne se multiplie pas uniquement par bulbes ou par rhizomes, mais aussi un pourcentage non négligeable est généré par voie sexuée. Cette conclusion est basée sur les résultats de nos expériences et sur ceux d'autres travaux réalisés aussi bien sur le plan de la biologie florale que sur le plan moléculaire. En effet, les travaux de [17] ont prouvé que la biologie florale de l'*Oxalis* montre 3 cas possibles: un cas où l'autogamie est impossible vue la position des étamines courtes par rapport au stigmate haut, un cas où l'autopollinisation est très possible car le stigmate est situé en dessous des étamines et un cas intermédiaire où l'autogamie et l'allogamie sont tous les deux possibles.

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Caractérisation des schistes sombres du bassin de Tafilalet

[Characterization of dark shales of basin Tafilalet]

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ABSTRACT: The origin of the dark coloration in some Paleozoic shales in Tafilalet Basin was the subject of along geological debate. Is it due to the richness of organic matter? The abundance of dark minerals? Or both of them? This paper consists to characterize some dark shales dating from Paleozoic of the Eastern Anti-Atlas of Morocco. The Thermogravimetric and differential thermalanalysis, X-ray diffraction and scanning electron microscope are experimental tools that have been used in this study. The results of these analyze show that dark shales of Tafilalet basin are rick on organic matter. This study may be useful in oil field exploration.

KEYWORDS: Black shale, organic matter, Basin of Tafilalet, porosity, Mineralogy.

RESUME: L'origine de la coloration sombre de certains schistes paléozoïquesde Bassin de Tafilalet, était le sujet d'un long débat géologique.Celaest-ildû à la richesseen matière organique? A l'abondance des minéraux sombres? Ou les deux à la fois?

L'objectif de ce travail est de caractériser quelques schistes noirs de Paléozoïque provenant de l'Anti-Atlas Oriental du Maroc. L'analyse Thermogravimétrique et Thermique différentielle, la Diffraction des Rayons X, et le Microscope Electronique à Balayage sont des outils expérimentaux qui ont été employé pour réaliser cette étude. Les résultats de ces analyses ont montré que les schistes sombres de Tafilalet sont riches en matière organique. Cette étude pourra être utile dans le domaine de l'exploration pétrolière.

MOTS-CLEFS: Schiste noir, Matière organique, Bassin de Tafilalet, porosité, Minéralogie.

1 INTRODUCTION

Du Cambrien inférieur au Dévonien les schistes marins sont très fréquents au Maroc en raison de la position distale du pays sur le plateau du Gondwana Paléozoïque [1]. Dans l'Anti-Atlas Oriental, les schistes sombres sont souvent de couleur grise foncée à noire, quand c'est inaltéré, en partie due à la présence de matière organique, cependant dans le bassin de Tafilalet, les schistes sombres de Paléozoïque ne reflètent pas forcément la richesse en matières organique, la couleur sombre peut également être produite par des composés sulfurés microcristallines telles que la Pyrite (FeS) indicative de conditions diagénétiques anoxiques et d'autres minéraux noirs tels que les oxydes de Manganèse, issus des processus biologiques comme le métabolisme bactérien appelé Chemolithotrophie qui indique des conditions sous-oxyques [2], [3], [4].

La série sédimentaire Paléozoïque de l'Anti-Atlas Orientale atteint 8 km d'épaisseur à l'Ouest et décroît jusqu'à 4 km à l'Est, la puissance de la couverture décroît également vers le nord. Sur la bordure nord-ouest de la boutonnière du Saharo,

les sédiments Paléozoïques sont masqués par le bassin Cénozoïque de Ouarzazate. Au nord de l'Ougnat, ce sont les roches Crétacées qui recouvrent une partie du Paléozoïque dans la partie Nord-Est du Tafilalt. Toute la série Paléozoïque est dominée par des sédiments déposés dans un environnement de mer peu profonde [5].

A Tafilalet les carbonates ont été le sujet de plusieurs études, cependant, très peu sont les recherches qui se sont intéressées à l'étude des Schistes.

Caractérisés par leur couleur sombre, les schistes des périodes Ordovicien supérieur-Silurien et Silurien-Dévonien de l'Atlas Oriental sont marqués par des Graptolites, des Orthocères et des Crinoïdes planctoniques [6], [7]. Les variations climatiques ont permis un changement de la sédimentologie dans le bassin de Tafilalet, de la fin de l'Ordovicien supérieur au Frasnien moyen. La sédimentation détritique devient graduellement carbonatée, permettant ainsi des dépôts des calcaires massifs intercalés par des schistes sombres. Caractéristique d'un environnement pauvre en oxygène [8].

L'objectif de ce travail est la caractérisation physicochimique des schistes sombres de Tafilalet afin d'en déduire la composition organique et minéralogique, et par conséquent l'intérêt que pourra présenter ce bassin dans le domaine de l'exploration pétrolière.

2 MATERIEL ET METHODES

2.1 LA ZONE D'ÉTUDE

Le secteur d'étude est situé dans la partie Est de l'Anti-Atlas Oriental (figure 1). Il est limité à l'Est par la Hamada de Guir, au Sud par celle de Kem Kem, à l'Ouest par la cuvette du Tazzarine et s'ennuie au Nord sous les bassins crétacés et tertiaires d'Errachidia-Boudenib et de Ouarzazate.

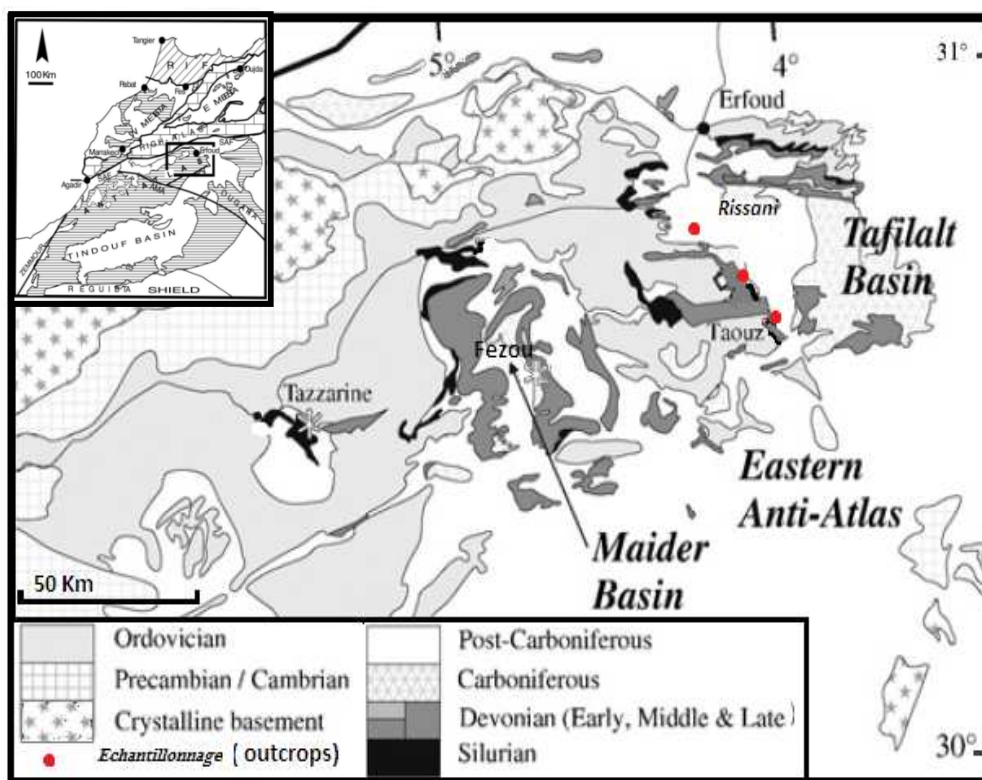


Figure 1. Schéma géologique montrant la couverture sédimentaire du Bassin de Tafilalet-Maïder et les lieux d'échantillonnage.

2.2 APPROCHE MÉTHODIQUE

Des échantillons de schistes sombres paléozoïques datés de l'Ordovicien, Silurien et Dévonien ont été récupérés (figure 2) afin de réaliser une série des analyses pour caractériser les propriétés physicochimiques de ces matériaux.

Les matériaux ont été observés par microscope optique de type **Nikon**, pour une description générale et la recherche des microfossiles. L'analyse minéralogique par diffraction des rayons X a été effectuée par un diffractomètre à poudre **Siemens**.

D500 à anticathode de nickel ($\lambda K\alpha = 1,5406 \text{ \AA}$), couplé à un micro-ordinateur qui permet un pilotage automatique de la rotation du goniomètre ainsi que l'acquisition et le traitement des données. La puissance utilisée est de 30KV et l'intensité est de 20 mA.

Dans le but de quantifier les espèces minérales et/ou organiques potentiellement présentes dans la matrice d'étude, des analyses thermogravimétriques ATG, des analyses thermiques différentielles ATD et des analyses par perte au feu ont été réalisées. Les observations ont été centrées sur la gamme de températures comprises entre 180 et 560 °C, le domaine de combustion de la matière organique.

La méthode (ATD) consiste à mesurer la différence de température ΔT entre l'échantillon à étudier et un échantillon de référence inerte, tous deux soumis aux mêmes conditions. Cette différence est liée à la quantité de chaleur dégagée ou absorbée par le matériau étudié. On enregistre ainsi ΔT en fonction de la température. Ceci permet de détecter des pics de transformations endothermiques et exothermiques. L'appareil utilisé est de type **Linseis L62 ATD**, il permet de travailler dans un intervalle de température allant de 25°C à 1250 °C. La vitesse de chauffage que nous avons adopté est de 10°C/mn. L'échantillon de référence étant l'Alumine.

Des observations par Microscope Electronique à Balayage (MEB) ont été réalisées sur des fragments de 0,5 cm de diamètre pour la détermination minéralogique et la caractérisation texturale ou morphologique des matériaux, Le MEB peut également fournir une analyse minéralogique (dispersion d'énergie spectrométrie : EDS), ainsi que des images rétrodiffusées sur des échantillons prélevés. L'appareil utilisé dans cette étude est un microscope de type **Philips XL-30**, fonctionnant sous une tension de 20KV.

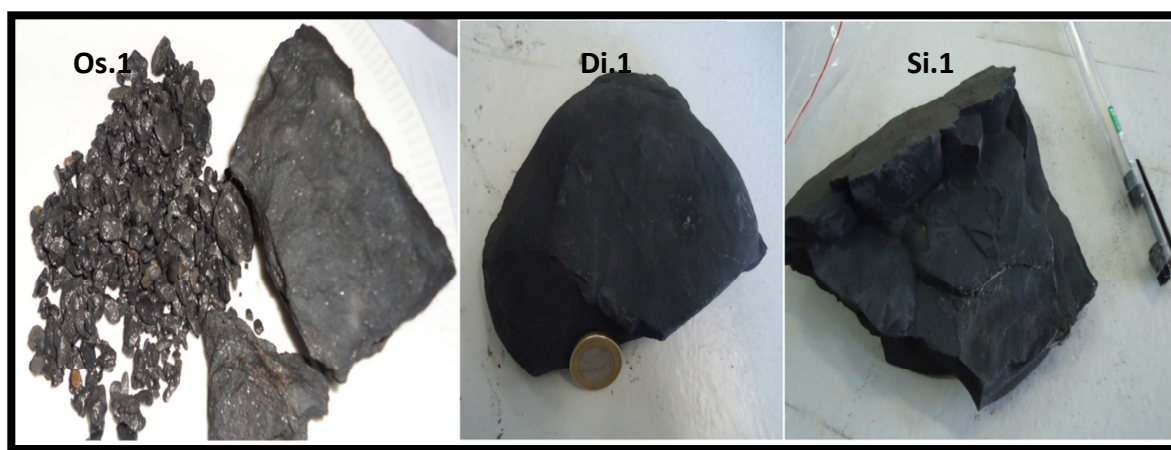


Figure 2. Les schistes paléozoïques de Bassin de Tafilalet.

Os.1 : Schiste Ordovicien, **Di.1** : schiste marneux du Dévonien, **Si.1** : Schiste Silurien inférieur

3 RESULTATS

L'observation des matériaux par microscope optique (Tableau 1) montre dans les plans perpendiculaires au sens de litage des schistes Siluriens, un aspect stratifié et des textures plutôt isotropes. Sur le plan de la granulométrie, ces schistes sont généralement grainstone ou des silts fins à ciment siliceux, on note aussi la présence des fossiles du genre Graptolites, des oxydes de Fer et des framboïdes de Pyrite piégés dans les plans de la stratification, le test acide est négatif.

Pour les schistes du Dévonien, ils présentent une texture généralement wackstone à mudstone rarement grainstone à ciment calcaireux, quelques traces des tiges de crinoïdes sont opérés, la stratification n'est pas toujours claire, et présente dans certains échantillons des structures de bioturbations, le test acide est positif.

Quant aux schistes Ordoviciens, ils sont durs, très micacés à grains de Quartz fins et arrondis bien granoclassés, ciment argileux à hématites, le test acide est négatif.

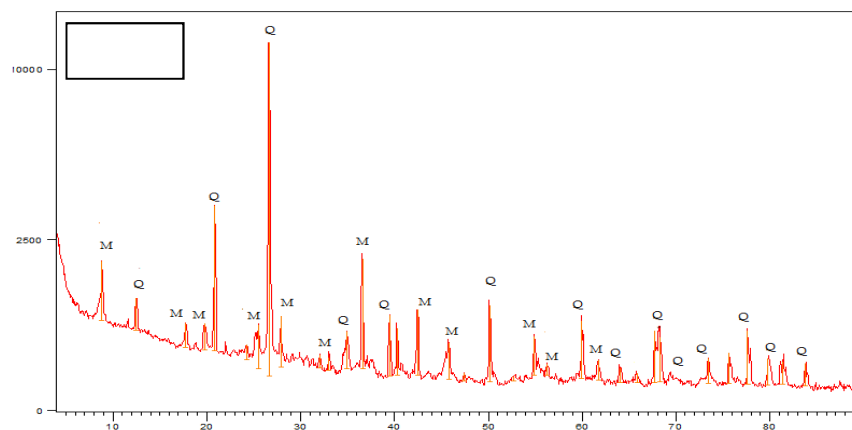
Tableau 1 : Description lithologique des schistes sombres de Tafilalet avec coordonnées, âges et formations géologiques

Echantillon	Coordonnées	Âge / Périodes	Description Lithologique	Groupe / Formation géologique
Os.1	N 30'49 19 W 05'39 08	Ordovicien Supérieur (Katien)	Gris foncé à Noire, dure, pas de fissures visibles, pyriteux, Micacé. traces de Feldspath. Test acide négatif.	Groupe de Ktaoua
Si.1	N 31'09 58 W 5' 01 11	Silurien moyen (Wenlock)	Silt Noire, non plastique, friable, graptolitique, fissuration visible. Test acide négatif.	Formation de Tamaghrouit
Di.1	N 31'12 35 W 4' 18 58	Dévonien inférieur (Emsien)	Noire, peu plastique, moyennement dure à friable, Test acide positif, trace d'Oxyde de fer.	Formation de Saheb El Rasse

3.1 LES SCHISTES ORDOVICIENS

3.1.1 ANALYSE MINÉRALOGIQUES

Le diffractogramme de L'échantillon (**Os.1**) nous montre une phase argileuse représentée par la muscovite ($K Al_2 Si_3 Al O_{10} (OH)_2$), et une phase non argileuse représentée par du Qz détritique (SiO_2). Ce schiste est constitué seulement par deux minéraux clairs, le Quartz et le Muscovite (figure 3). La couleur noire de ce schiste est donc due, fort probable, à la présence de la matière organique.

Figure 3. Spectre DRX de l'échantillon (**Os.1**) sur poudre (Angle 2θ)

Q : Quartz, M: Muscovite

3.1.2 ANALYSES THERMOGRAVIMÉTRIQUES ET THERMIQUE DIFFÉRENTIELLES ATD/ATG

Le thermogramme ATD-ATG (Figure 4) des poudres crues du schiste **Os.1** présente :

- Entre 50°C et 260°C, trois pics endothermiques associés à une première perte de poids. Ces pics sont attribués à la perte d'eau libre et adsorbée.
- Un pic exothermique à 350°C lié à la désagrégation de la pyrite et l'augmentation du soufre lié à la matière organique [9].
- Entre 260°C et 850°C, on observe une série de pics exothermiques liés à des pertes de 5% de la masse total de l'échantillon. Ces pertes sont dues à la décomposition de la matière organique [10].
- Vers 500°C de faibles crochets endothermiques caractérisant la présence du quartz.
- De faibles pics endothermiques au voisinage de 850°- 900° indiquant la destruction du mica de type muscovite, qui constitue avec l'eau et le potassium, le minéral de l'illite [11].

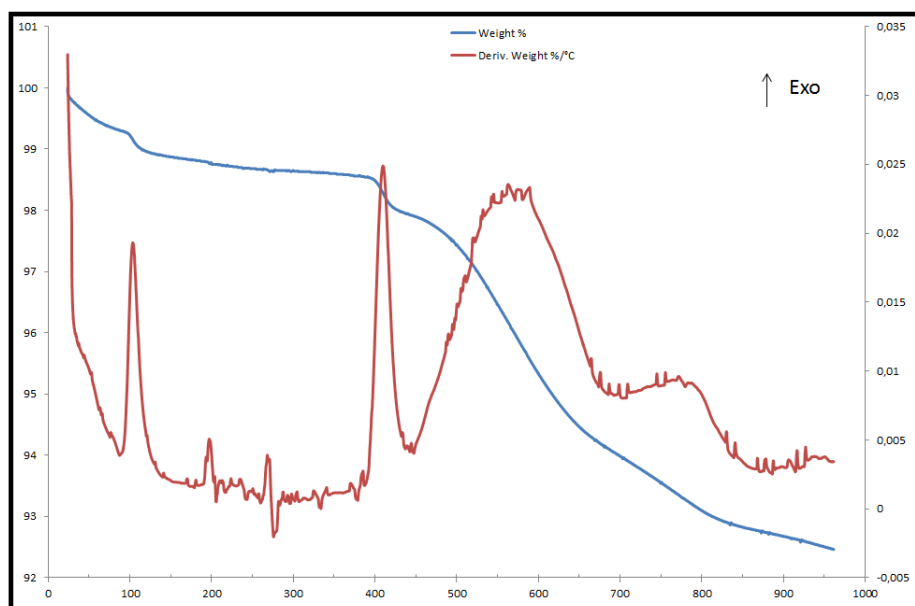


Figure 4. Thermogrammes ATD-ATG des poudres crues du schiste (Os.1).

3.1.3 OBSERVATION PAR MICROSCOPE ELECTRONIQUE A BALAYAGE

Le MEB dévoile d'importantes données organiques, minéralogiques et texturales (Figure 5).

Sur le plan textural le schiste (**Os.1**) présente trois types de porosités :

- Une porosité organique qui se trouve à l'intérieur de la matière organique (Figure 5: C), cette porosité de diamètre qui varie entre 10 à 20 μm . Une étude antérieure a montré que dans certains schistes organiques, cette porosité varie de 2 à 50 nm [12].
- Une porosité intragranulaire d'ordre nanométrique qui se localise entre les grains et les minéraux constituant le matériau.
- Une porosité fissurale qui reste difficile à détecter à cause de la matrice argileuse dense. Ce type de porosité se localise autour des pores organiques.

Minéralogiquement, on a pu mettre en évidence de la muscovite (Figure 5 : B et C) qui se présente souvent en grandes paillettes (60 à 100 μm), par contre les grains de quartz, souvent de petites tailles, sont difficile à repérer et restent couverts par la matrice et/ou la matière organique.

Du point de vu organique, et grâce à la technique d'extraction de l'élément de carbone, on a pu observer des tissus organiques de 100 μm de diamètre. En effet, le spectre EDS (figure 5 : C') a montré un pourcentage de carbone organique de l'ordre de 4.85%, cette valeur confirme le pourcentage donné par les Analyses Thermogravimétriques et Thermique différentielles (5%).

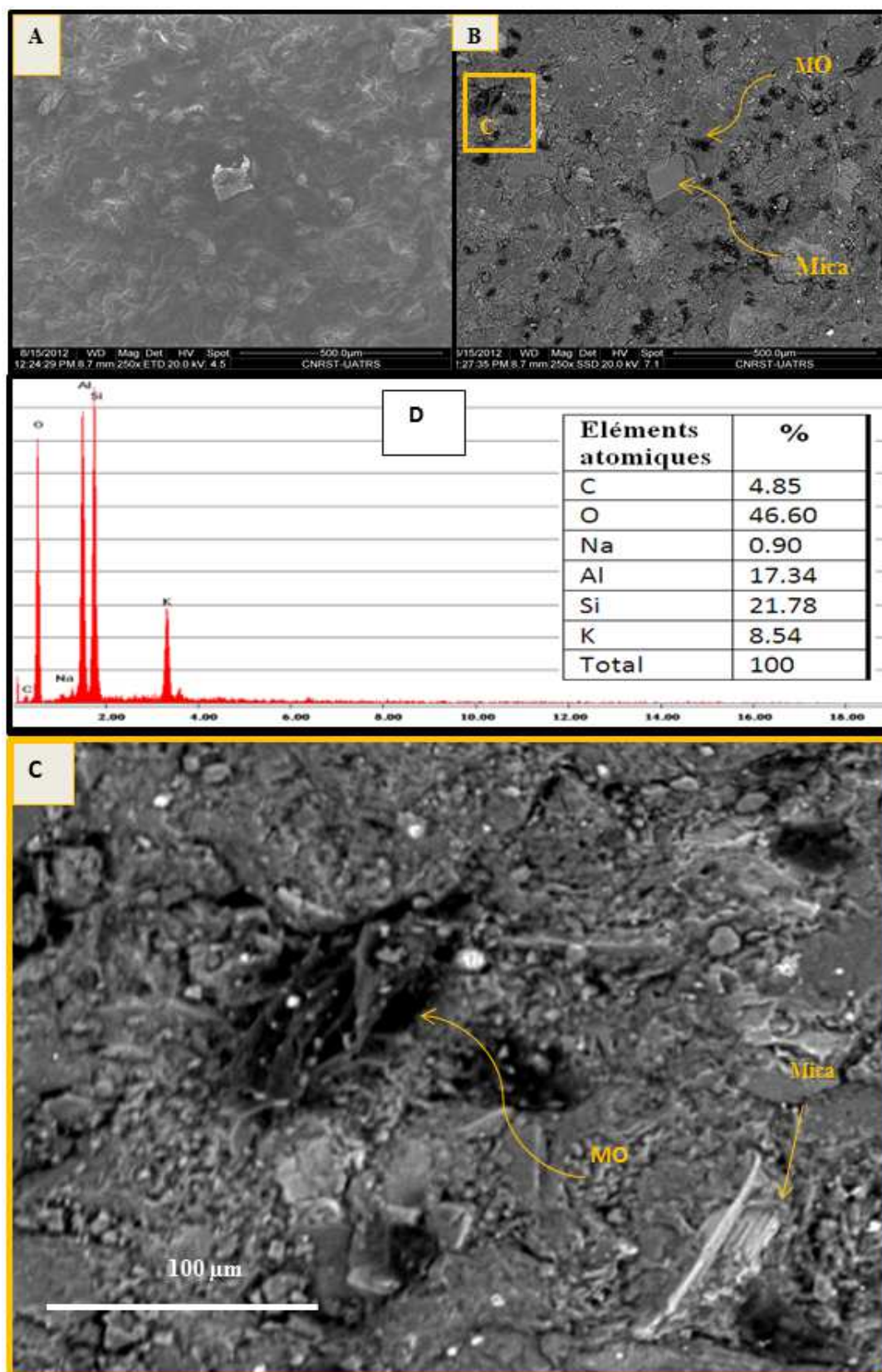


Figure 5. Images du MEB de l'échantillon (Os.1).

A : Vue d'ensemble d'une surface fraîche, B: Extrapolation du carbone organique. C : Tissu Organique, D : Spectres EDS associés à la vue B.

3.2 LES SCHISTES SILURIENS

3.2.1 ANALYSES MINÉRALOGIQUES

Le diffractogramme de (**Si.1**) identifie une phase argileuse représentée par de l'illite, déterminée par un ensemble de pics entre 10 et 15 Å. D'autres phases non argileuses telles les oxydes de Fer présentés ici sous forme de Goethite ($\text{Fe}^{+3}\text{O}(\text{OH})$) et le Quartz y sont aussi présent, à noter que le quartz est le minéral le plus abondant dans ce matériau. Cette composition minéralogique fait de ce matériau une argile non gonflante vis-à-vis de l'eau (Figure 6).

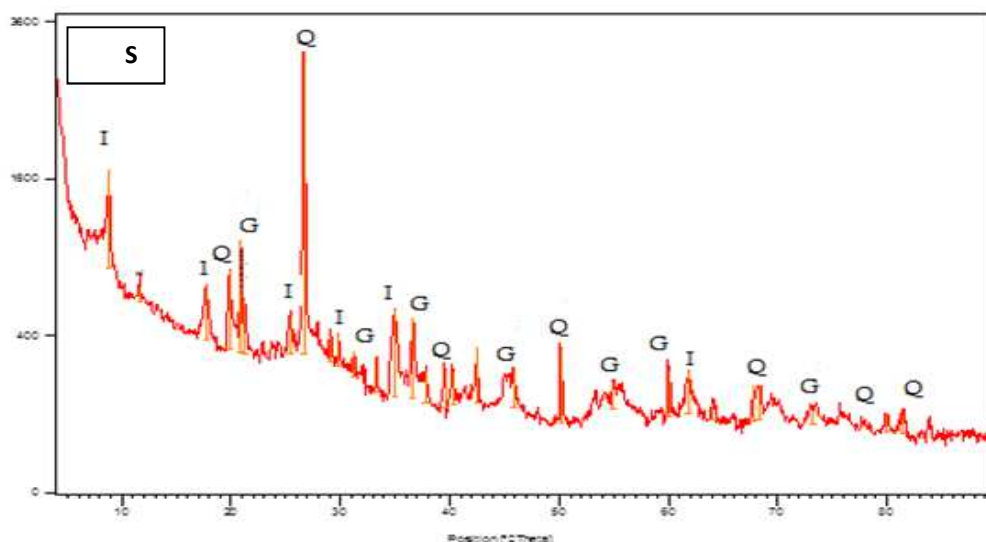


Figure 6. Spectre DRX de l'échantillon (**Si.1**) sur poudre, (Angle 2θ)

I: illite, Q: quartz, G: goethite.

3.2.2 ANALYSES THERMOGRAVIMÉTRIQUES ET THERMIQUE DIFFÉRENTIELLES ATD/ATG

Le thermogramme ATD-ATG (Figure 7) des poudres crues du schiste (**Si.1**) présente :

- Trois pics endothermiques associés à une première perte de poids entre 50°C et 200°C. Ces pics sont attribués à la perte d'eau libre et adsorbée.
- Un pic débutant à 400°C caractéristique de l'élimination de l'eau de constitution résultant de la libération des hydroxydes appartenant au réseau de l'illite.
- Entre 180 et 560 °C, des pics exothermiques liés à des pertes de 7% de la masse total de l'échantillon, due à la décomposition de la matière organique.
- Un pic endothermique vers 92°C et un autre exothermique vers 300°C mettent en évidence la présence de la goethite.
- Vers 500°C un faible crochet endothermique qui est caractéristique de la présence du quartz.
- De faibles pics endothermiques au voisinage de 850°- 900° indiquant la destruction du mica de type muscovite, qui constitue avec l'eau et le potassium, le minéral de l'illite [11].

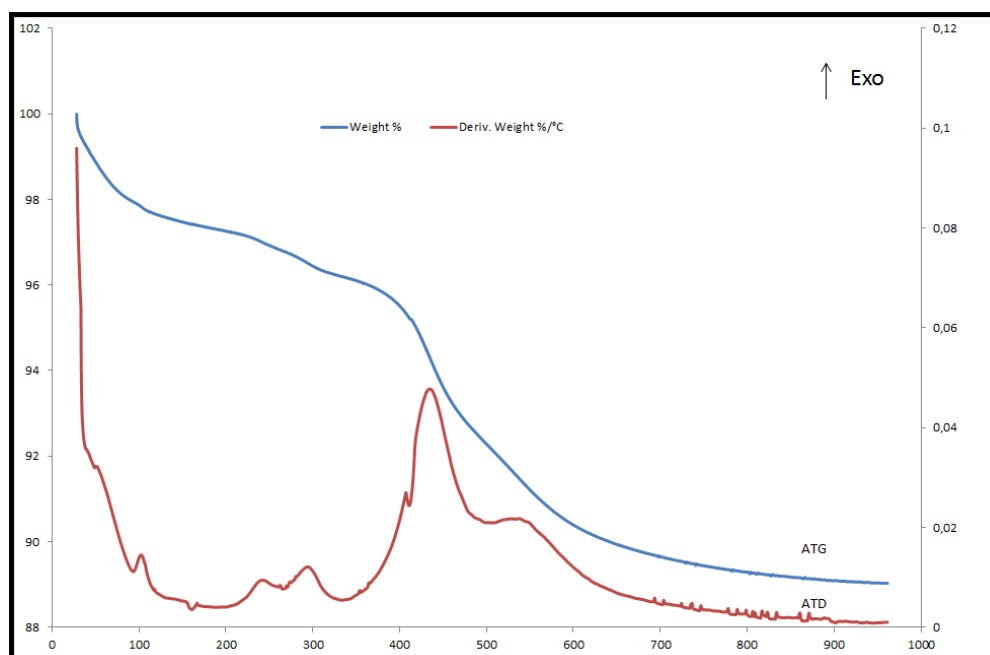


Figure 7. Thermogrammes ATD-ATG des poudres crues du schiste (Si.1).

3.2.3 OBSERVATION PAR MICROSCOPE ÉLECTRONIQUE

L'Observation par le MEB nous a permis de dévoiler les données suivantes (Figure 8):

Structuralement on note trois types de porosité :

- Une porosité intragranulaire, qui se localise entre les grains et prend différentes tailles nanométriques à micrométriques.
- Une porosité fissurale démontré par des lignes sombres (Figure 8 : D).
- Une porosité lamellaire entre les feuillets des schistes.

La plupart des échantillons de Silurien ont une matrice constituée principalement par des particules argileuses (plaquettes d'Argiles) comme le prouve les données des analyses DRX et EDS. La taille de ces plaquettes est comprise entre 10 et 25 μm , assemblées avec un ciment siliceux. Des minéraux non argileux (possible Pyrite) de petites tailles pouvant être parfois moulés dans la matrice sous forme de petits glomérules (figures 8 : B).

Le pourcentage des éléments atomiques obtenue par le spectre EDS (figure 8 : C) montre une valeur de 7% du carbone organique, cette valeur est compatible avec celle donnée par les Analyses Thermogravimétriques et Thermique différentielles (figure 7).

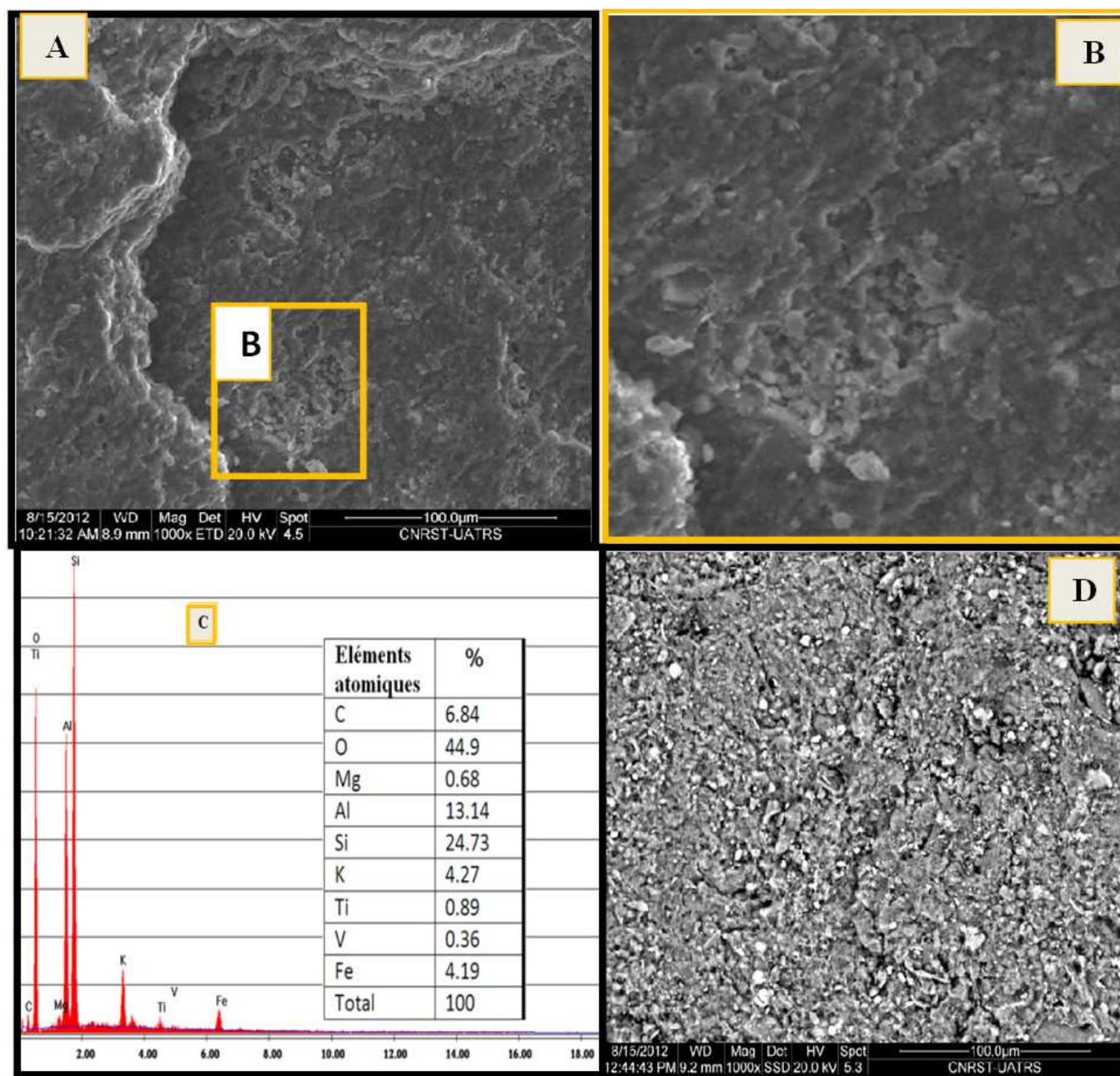


Figure 8. Images par MEB de l'échantillon (Si.1).

A: Vu d'une Surface fraîche, montrant : B: Porosité intragranulaire, C : Spectres EDS associés à la vue B, D : Extrapolation de la porosité de la vue A.

3.3 LES SCHISTES DÉVONIENS

3.3.1 ANALYSES MINÉRALOGIQUES

Le diffractogramme de l'échantillon **Di.1** (figure 9) présente une phase argileuse caractérisée par la présence de la muscovite (de raie $3,1\text{\AA}$ et $3,5\text{\AA}$) et du Clinocllore $(\text{Mg, Fe})_6(\text{Si, Al})_4\text{O}_{10}(\text{OH})_8$, tous les deux représentent la partie phylliteuse de ce matériau. La phase non argileuse est représentée par le quartz de raie caractéristique ($3,34\text{\AA}$), et la calcite **Ca** (CO_3).

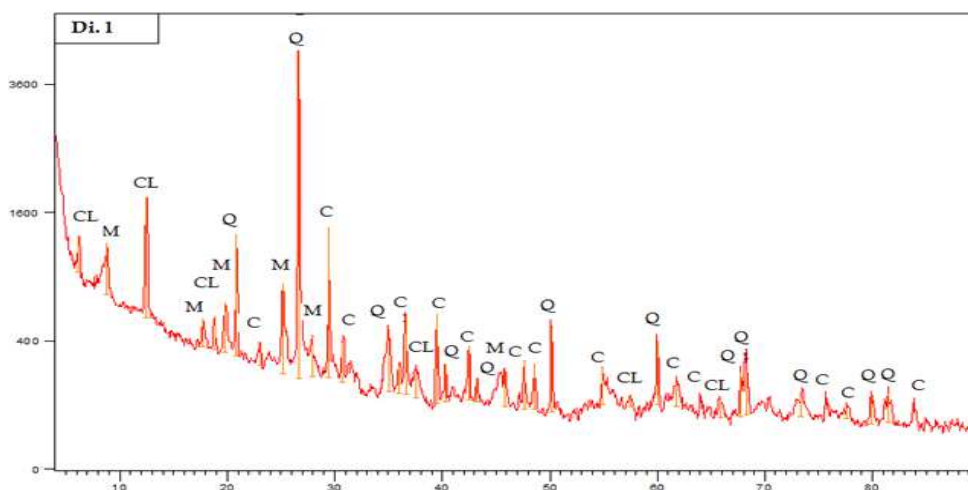


Figure 9 .Spectre DRX de l'échantillon (Di.1) sur poudre.(Angle 2θ)

Q : Quartz, C: Calcite, M: Muscovite, Cl: Clinocllore.

3.3.2 ANALYSES THERMOGRAVIMETRIQUES ET THERMIQUE DIFFERENTIELLES ATD/ATG

Le thermogramme ATD-ATG (Figure 10) des poudres crues du schiste **Di.1** présente :

- Trois pics endothermiques associés à une première perte de poids entre 50°C et 200°C. Ces pics sont attribués à la perte d'eau libre et adsorbée.
- Entre 150°C et 800°C on observe une série de pics (de très petits amplitudes) exothermiques liés à des pertes de 8% de la masse totale de l'échantillon, et qui correspondent à la décomposition des composés organiques.
- Vers 535°C, un faible crochet endothermique caractéristique de la présence du quartz.
- Un pic endothermique 800°C caractéristique de la décarbonatation de la calcite.
- Un pic exothermique à 837°C correspond à la transformation du clinocllore en olivine.
- Un accident endothermique situé entre 800 et 900°C, lié à la déshydroxylation de la muscovite (qui se transforme graduellement en orthose entre 1000 et 1140°C).

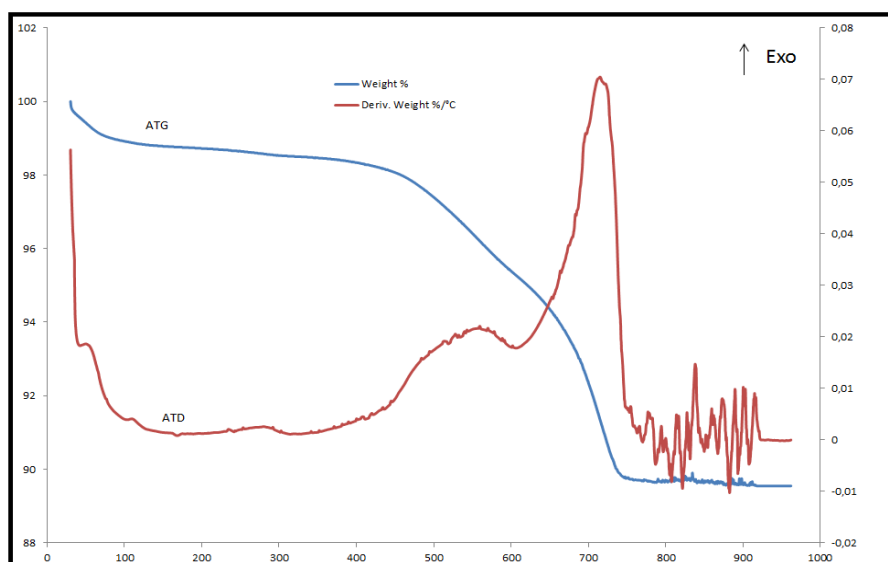


Figure 10. Thermogramme ATD-ATG des poudres crues du schiste (Di.1).

3.3.3 OBSERVATION PAR MICROSCOPE ÉLECTRONIQUE

La texture du schiste **Di.1** (figure 11) est un peu identique à celui observé dans les schistes **Os.1** et **Si.1**, c'est-à-dire ; une porosité intragranulaire, une porosité fissurale et une porosité lamellaire, mais avec un degré moins important. Ceci est dû à l'homogénéité minéralogique qui rend les liaisons intercrystallines plus fortes dans cet échantillon carbonaté.

Les plages de silice sont intimement imbriquées dans la matrice carbonatée, les grains de quartz sont rarement détectés, de même les minéraux argileux tel le clinocllore et la muscovite sont difficilement repérable, ceci est confirmé par les pourcentages faibles des éléments d'Aluminium, Silicium et potassium, obtenu par spectre d'analyses à la sonde EDS (Figure 11: C).

En outre, le pourcentage du carbone organique (**3.74%**) montré par la sonde EDS, n'est pas compatible avec le pourcentage de la matière organique (**8%**) déduit à partir des analyses Thermogravimétriques et Thermique différentielles ATD/ATG.

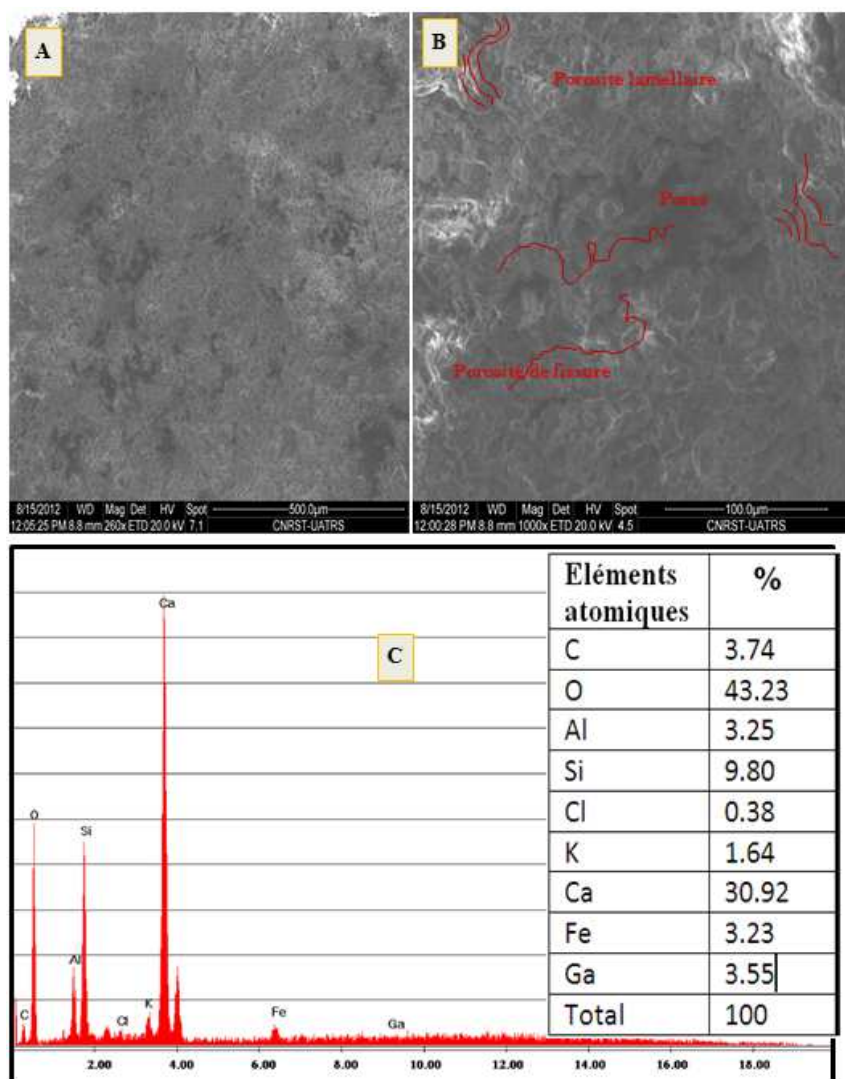


Figure 11. Images par MEB de l'échantillon (Di.1).

A : Vu d'une surface perpendiculaire au sens de litage, **B** : Porosité lamellaire et porosité de fissure, **C** : Spectre EDS associés à la vue A.

4 DISCUSSION

L'observation de l'intervalle thermique [180°C - 600°C], domaine de la combustion de la matière organique des courbes ATD/ATG, montre par des pics exothermiques l'existence de la matière organique qui peut aller jusqu'à 8% de la masse total de la roche. Cette matière organique se trouve piégée dans différents types de porosité, fissurales, intragranulaires et lamellaires, observées par le microscope électronique à balayage MEB.

Minéralogiquement, les schistes sombres paléozoïque de Tafilalet sont généralement constitués par des phases argileuses représentées par de l'illite, de la Muscovite et du Clinocllore. Les phases non argileuses sont formés par le quartz, la goethite et la Calcite.

L'élément du Manganèse n'a pas été détecté dans les schistes étudiés. Cependant, des études antérieures ont rapporté l'existence des oxydes de Manganèse, issus d'un métabolisme bactérien appelé Chemolithotrophie [13], [14] sur certains facies carbonatés dans le même bassin.

Selon les pourcentages de l'élément du Carbone Organique donné par les spectres EDS, il paraît que les schistes de Bassin de Tafilalet datés de l'Ordovicien supérieur et du Silurien inférieur sont plus organiques que les schistes du Dévonien inférieur.

5 CONCLUSION

La caractérisation physico-chimique des schistes sombres paléozoïques de Tafilalet par les analyses Thermogravimétrique et Thermique différentielle, la Diffraction des Rayons X, et le Microscope Electronique à Balayage, montre que les schistes argileux de l'Ordovicien supérieur et du Silurien inférieur peuvent présenter un grand intérêt pétrolier, vu leur teneur non négligeable en carbone organique (jusqu'à 7%).

Les schistes calcaireux du Dévonien inférieur sont relativement moins riches en carbone organique (3%).

CONFLIT D'INTÉRÊTS

Aucun.

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EFFECTS OF SAWMILL WASTES IN RESIDENTIAL AREAS OF OGBESE AND AKURE TOWNSHIPS, ONDO STATE, NIGERIA

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ABSTRACT: This research examines the volume of waste generated by sawmill industries vis-à-vis the management method adopted by sawmills and the prevailing diseases in the study areas and proffer appropriate solutions that is expected to improve the residential environment and make it more aesthetic and therefore improve the health of the people. The study made use of both primary and secondary data. The primary data were collected through the administration of structured questionnaire which was administered on household-heads within 1-kilometer radius of the selected sawmill industries. The second, which was administered on the sawmill operators, examined the waste management practices and safety health measures adopted by the saw millers. The third set of questionnaire was administered on Town Planning Authorities, covering the location of the sawmill industries. Random systematic sampling method was employed to select the residents within the two study areas. Statistical Package for Social Sciences (SPSS) was used for data processing. Analysis of data was carried out using descriptive and inferential statistics. The findings of this research clearly reveal the locations of sawmill industries in the study areas, the volume of waste generated by each sawmill industry including the various modes of waste disposal practices adopted. It also reveals the various ways by which sawmill wastes can be put into use and went further to expose the various environmental and health problems pose by the operation of sawmill industries. Finally, relevant recommendations were made to find solution to the various problems pointed out by the researcher.

KEYWORDS: Log, Wood, Safety, Health, Pollution, Industries.

1 INTRODUCTION

Sawmill is a primary wood processing industry which has since its inception continued to make significant contribution to the economic development of not only Nigeria, but the world at large.

The Sawmill is presently a notable employer of labour in the countries where it exists. Sawmill Industries provide about 2% of the world's overall gross domestic product (GDP). [1]. In developing countries like Nigeria, the Sawmill Industries currently contribute an average of about 2.7% of G.D.P. which keeps on increasing at a faster rate [2]. Sawmill has continued to service other wood based industries locally and internationally.

Sawmill thus represents an important economic force for development, particularly in those developing countries with substantial endowment of forest resources like Nigeria.

In Nigeria majority of the sawmill industries are located in the wood producing rain forest areas of Nigeria. The largest concentration of sawmills are in Lagos, Ekiti, Osun, Cross river, Ondo, Oyo, Imo, Edo, Delta and Ogun State, together, they account for over 90% of the saw milling activities in the country [3].

Saw mill by its nature generates a lot of wastes such as; saw dusts, wood off cuts, wood backs, plain shavings, wood rejects, etc. As the demands for wood and its products increase, the volume of wastes being generated cannot but increase. In the absence of proper disposal methods, these wastes are burnt in the open air. Hence, one of the greatest environmental

problems facing the industry today is how to properly dispose the waste generated daily by the ever increasing activities of the sawmill industries.

Waste generation is a concomitant aspect of living; it cannot be eliminated but can only be managed, [4]. The problems posed by these wastes are many. They degrade the urban environment, reduce its aesthetic value, produce offensive odours during the rains and pollute the air with smoke when the wastes are burnt uncontrollably. They also constitute health hazards when they are not timely disposed. They become breeding places for worms and insects. They also pose bad working environment for those working in the area, due to accumulation of wastes over a period of time most especially during raining season.

In view of this, the researcher critically consider the works of past scholars on similar problems such as that of Aina, [5] which deals mainly on sawmill waste utilization for energy generation,[6] Dosunmu and Ajayi wrote on problem and management of sawmill waste in Lagos, [7] Lucas wrote on ways of improving Lumber recovery from a live-sawn log in sawmills, among others, realizing that none as actually consider the effects of Sawmill waste on the adjoining residents. In-view of this, this research is out to fill the vacuums created by enlighten the residents and other members of the public on the danger inherent in living close to sawmill industries.

2 METHODOLOGY

Structured questionnaires were used to obtain the relevant data from the residents, the saw millers, and Area Town Planning Offices for Akure North and Akure South Local Government, while interview guides was employed to obtain data from village heads, health workers, in addition some photographs of scenery of interest were snapped by the researcher and coupled with personal observations. The waste disposal method, health safety measures, income of respondents, distance between respondents houses and sawmill among others are gotten with the aid of questionnaires.

Random Systematic sampling methods was employed to select the residents within the two study areas. In Akure, the existing Sawmill Industries were identified in five (5) operating corridors. These are Ado, Oda, Idanre, Ondo Roads and Road Block. These were used as the basis for selection of residential areas and respondents. Ogbese is divided into two by river Ogbese, the first part is known as Ayede Ogbese and the second Oke-Odo Ogbese.

House count was conducted within one-kilometer radius from each sawmill, a distance indicated by Ministry of Health, Ondo State as health critical distance to sawmill industry [8]. This was achieved with the use of Google earth at a low resolution. Twenty-five percent (25%) of the houses in each of the Identified sawmill industrial corridors were selected using random systematic sampling method. one house hold head was picked in the selected residential buildings for the administration of the questionnaire. Twenty five percent (25%) of the sawmill industry in the study areas were randomly selected for investigation.

Table 1: Questionnaire Distributed to Respondents in the Study Areas (Akure & Ogbese)

S/N	Industrial Corridors	Houses in Industrial Corridors	25% of the Houses	Questionnaire Distributed	Questionnaire Returned	% Recovered
AKURE						
1.	Ado Road	192	48	48	46	95.8
2.	Oda Road	121	30.2	30	30	100
3.	Oke-Aro	200	50	50	49	98
4.	Ondo Road	186	46.3	46	39	84.8
5	Road Block	150	37.5	38	30	78.9
Sub-Total	5	848.8	212	212	194	91.5
OGBESE						
6.	Ayede	352	88	88	78	88.6
7.	Oke-Odo	96	24	24	17	85.0
Sub-Total	2	448	112	112	95	84.8
Ground Total	7	1,296.8	324	324	289	89.2

Source: Author's Research Design, 2014

Finally, drawing on the concept of homogenous population and given the assumption that the socio-economic indicators of each of the households are nearly the same, [9] one (1) household-head was randomly picked in each of the selected residential buildings for the administration of the household questionnaire. The total sampled size of 324 was considered adequate for the study within the seven identified sawmill industrial corridors, boiling down to an average of 46 persons per corridor.

Modes of operation in sawmill industries are similar as they make use of the same type of machines. Due to this, an average of twenty one point four percent (21.4%) of the sawmill industries in the study areas were randomly selected to represent the sample size for the sawmill industries investigated

Table 2: Sampled Sawmills in the Study Areas (Akure and Ogbese)

S/N	Industrial Corridors	Total No. of Sawmill	Average Numbers/Names of Selected 21.4% of Sawmill Industries		% Sampled
1	Ado Road	4	1	Australia Sawmill	25
2	Oda Road	2	1	Elemon sawmill	50
3	Idanre Road	4	1	Musayayi I sawmill	25
4	Ondo Road	28	3	Jebe Sawmill, Olukayode Sawmill, Ojuenimala Sawmill	14.3
5	Road Block	15	2	Oyo Sawmill, Austin sawmill	13.3
Sub-Total	5	53	8		
OGBESE					
6	Ayede	17	2	J-Eze Okoli Sawmill, Unifous Sawmill	11.7
7	Oke-Odo	11	1	Eje Jesu Sawmill	10.5
Sub-Total	2	28	3		
Ground Total	7	81	11		21.4

Source: Author's Research Design, 2014

Statistical Package for Social Sciences (SPSS) 16th Version was used for data processing. Analysis of data was carried out using descriptive and inferential statistics. The descriptive method utilizes tables, charts and pictorial illustrations. The inferential approach utilizes the chi-square analysis in testing the formulated research hypotheses.

Secondary data was obtained from relevant textbooks, journals, conference and seminar papers, relevant maps, internet, and dissertation/thesis. Other areas where relevant data was derived include the Environmental Office at Akure North and Akure South Local Government Council, Local Government Secretariat and the offices of the Agricultural Development Project (ADP), the Basic Health Centre at Ayede Ogbese was also visited. Information such as the prevalent diseases was gotten from the Basic Health Centre at Ogbese. The maps used for this research were from the ministry of works at Akure North Local Government Area. The average number of logs worked on per day by each sawmill were gotten from Ondo State Ministry of Forest Department among others.

3 FINDINGS

The findings from this study shows that a sizeable proportion of the population at Ogbese were mostly low income earners and the responses received revealed that poverty is prevalent amongst the people, going by estimation of high density average occupancy rates of 12 persons per room, [10]. The per capital income of majority of the people (54.6%) and (66.3%) Akure and Ogbese respectively was very low, an indication of socio economic status below the poverty line; going by the United Nation's declaration which approximates absolute poverty to mean living below \$1 per day while relative poverty is living below \$2 per day, [11].

Table 3: Respondents level of Income (% in Parenthesis)

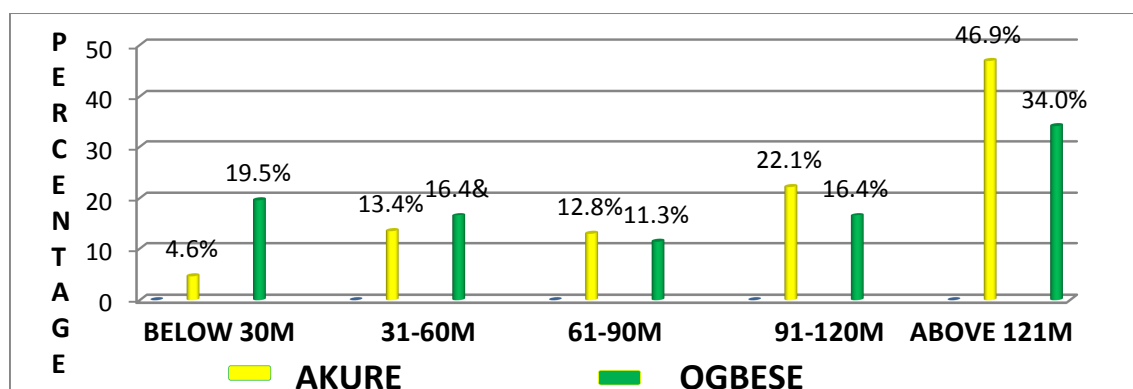
Annual Income (N)	Akure	Ogbese	Total	%
	No. of Respondents	No. of Respondents		
Below 100, 000	106 (54.6%)	63 (66.3%)	169	58.4
100, 001-300, 000	59 (30.4%)	26 (27.4%)	85	29.4
300, 001-500, 000	22 (11.3%)	4 (4.2%)	26	8.9
500, 001 and Above	7 (3.6%)	2 (2.1%)	9	3.1
Total	194 (100%)	95 (100%)	289	100

Source: Author's Field Work, 2014

This situation no doubt affects the people's standard of living, their ability to demand for housing and their requirement for other services.

3.1 DISTANCE BETWEEN RESPONDENTS HOUSES AND SAWMILL INDUSTRIES

The findings revealed 24.1% of the sampled residents live within a distance less than 30 meters to sawmill industries as against the 30 meters buffer space standard required in the National Building Code of Nigeria.



Source: Author's Field Work, 2014

It is also sad to know that most Sawmill Industries in Ogbese are sited within residential buildings thereby exposing the residents to the various environmental effects generated by the Sawmill activities in this area.



Fig. 1: View of a Residential Building sharing boundary with a Sawmill At Roadblock

This is an example of residential building whose distance within sawmill industry is less than 30 meters, this building is highly polluted and has social, economic and health costs to Residents. The high level of pollution and its attendant impact on residents questions the tenets of Zoning.

Source: Author's Field Survey (2014).

3.2 QUALITY OF LIFE AND HEALTH STATUS

The ultimate aim of this sub-section is to know the level of exposure of individuals to disease pathogens and the corresponding effects on their health status as a result of exposure to sawmill Waste within their neighbourhood. The disease pathogens are something like bacterium and virus that can cause disease. These disease pathogens are transmitted through air and water; through common insects and pests; through physical contact with physical materials like wall or dusty ground; and even through human beings.

The Distance within Sawmill industry and Residence (DSIR) was correlated with Frequency of Environmentally Induced Diseases (FEID) the distance within residential building and Sawmill Industry form the variables which were correlated with each of the FEID in order for relationship to be ascertained. The selected variables are:

Distance within Sawmill industry and Residence (DSIR)	Frequency of Environmentally Induced Diseases (FEID)
Less than 30 meters	Frequency of Cough
31-60 meters	Frequency of Catarrh
61-90 meters	Frequency of skin Infection
91-120 meters	Frequency of Malaria
121 meters and above	Frequency of dysentery
	Frequency of typhoid
	Frequency of Worms
	Frequency of Acute Diarrhea
	Frequency of Body weakness
	Frequency of measles
	Frequency of Tuberculosis
	Frequency of Sleeplessness

The decision of whether to accept the null hypothesis and reject alternate hypothesis or otherwise is based on the value of the asymptotic significant value of the chi-square statistics. If value is less than a particular critical limit, then the statistic is significant at that critical limit.

Table 4: Distances within Residential Buildings and Sawmill Industries and Prevalent Diseases

Diseases	Chi-squared (X^2) value	Asymptotic significance	Remarks
FCOUGH	34.208	.001**	Reject null
FCATARRH	79.876	.000**	Reject null
FSKINFECT	38.578	.000**	Reject null
FMALAR	194.087	.000**	Reject null
FDYSENT	79.429	.000**	Reject null
FTYPHOID	27.512	.001**	Reject null
FWORMS	15.712	.401	Accept null
FACDIARR	28.090	.000**	Reject null
FBDWEAK	8.574	.199	Accept null
FMEASL	14.975	.092	Accept null
FTUBER	21.944	.038*	Partial
FSLEEP	36.550	.000**	Reject null

Source: Author's Field Work, 2014.

* $p \leq 0.05$. i.e., X^2 is significant at 0.05 alpha level, ** $p \leq 0.01$. i.e., X^2 is significant at 0.01 alpha level

From the data analysis shown in Table 4, at critical limits of 1% and 5%, the null hypothesis was rejected for eight (8) variables implying that;

"Distances within residential building and sawmill dose significantly affect the prevalent diseases in the study areas"

The variables concerned are; FCOUGH (Frequency of cough), FCATARRH (Frequency of catarrh), FSKINFECT (frequency of skin infection), FMALAR (Frequency of malaria), FDYSENT (Frequency of dysentery), FTYPHOID (Frequency of typhoid), FACDIARR (Frequency of Acute Diarrhea), FSLEEP (Frequency of Frequency of Sleeplessness).

Contrariwise, the null hypothesis was accepted for three variables at both 1% and 5% critical limits implying that;

"Distances within residential building and sawmill dose not significantly affect the prevalent diseases in the study areas"

In this case the concerned variables are; FWORMS (Frequency of worms), FBDWEAK (Frequency of body weakness) and FMEASL (Frequency of measles).

And lastly, only one variable have the partial status and the variable is FTUBER (Frequency of tuberculosis). The null hypothesis is accepted at 1% critical limit but rejected at 5% critical limit.

3.3 MODE OF WASTE DISPOSAL IN SAWMILL INDUSTRIES IN THE STUDY AREA

Table 5 shows the various methods of waste disposal practices in the sawmill industries in the study areas, and the result shows that none of the sawmill industries in both study areas recycle their waste.

Table 5: Waste Management Practices by Sawmill Industries in the study area

Mode of disposal	Akure		Ogbese	
		Percentage %		Percentage %
Re-use	NA	NA	NA	NA
Burnt	6	75	3	100
Open space dumping	8	100	3	100
Organized collection	3	37	NA	NA

Source: Author's Field Work, 2014.

3.4 WASTE GENERATED BY SAWMILL INDUSTRIES IN THE STUDY AREAS

There are 28 sawmill industries in Ogbese while we have 53 sawmill industries in Akure. Each of the mills has at least one sawing machine and some have as many as three machines. A minimum of 10 logs are being sawn per day per mill (i.e. 9,150 logs per week of six working days). Neal estimated the waste of wood industries to be one third of the total weight of wood being processed, [12], [13]. The minimum girth (or diameter) of the log that can be fell and brought to the study areas for processing is 1.126m. [14].

1. Volumes of each of the logs, before conversion was carried out each day, were obtained using Newton's formula.

$$V_1 = \pi (db^2 + 4dm^2 + ds^2) L / 24$$

Where,

V_1 = volume of log (m^3)

db = diameter at the large end of log

dm = diameter at midpoint of log

ds = diameter at small end of the log

L = Log length (m)

π = 3.142 or 22/7

Therefore, a particular log of wood with the following parameters

db = 6 ft1.829m

dm = 5 ft.....1.524m

ds = 4 ft.....1.219m

$$V_1 = 3.142 [(1.829)^2 + 4(1.524)^2 + (1.219)^2] \times 3.658 / 24$$

$$= 3.142 [14.307] 0.1524$$

$$\text{Volume of log} = 6.760m^3$$

Using mathematical method of differentiation and keeping dm^2 constant, the lumber of highest volume that can be obtained is of the dimension 12 by 1 by 1

2. Total Volume of various dimension of lumbers obtained per day from timbers in 1 above is obtained using:

$$V_2 = [L \times B \times H]n$$

Where,

V_2 = Volume of sawn lumbers (m^3)

L = Length (mm)

B = Breath (mm)

H = Thickness (mm)

n = Total number of lumbers obtained.

Therefore: L = 12.....(3.658m)

B = 1.....(0.304m)

H = 1.....(0.304m)

Therefore:

$$V_2 = 3.658 \times 0.304 \times 0.304$$

$$= 0.338m^3$$

Note: this is just for a single number generated. According to the standard wood data book, a log of such measurement should produce approximately 12 pieces of lumber with the above dimension.

Total volume of lumbers = $0.338 \times N$

Where $N = 12$

$$V_2 = 0.338 \times 12$$

$$V_2 = 4.056m^3$$

3. The total volume of wood waste generated per day from the conversion of timbers to lumbers is estimated using:

$$V_w = V_1 - V_2$$

Where,

V_w = volume of waste (m^3)

V_1 = Volume of round logs before conversion (m^3)

V_2 = Volume of lumbers obtained after conversion (m^3).

Therefore:

$$V_w = 6.760 - 4.056$$

$$V_w = 2.704m^3$$

4. The percentage waste is therefore calculated using the formula

$$\% \text{ waste} = \frac{V_w}{V_1} \times \frac{100}{1}$$

Therefore:

$$= \frac{2.704}{6.760} \times \frac{100}{1}$$

$$V_w = 40\%$$

The volume of waste is 40% of the total volume of log converted to lumber.

In a day, sawmills in Akure converts a minimum of 1,022 logs of wood which generates approximately 408.8 tons of waste, and this will equally amount to about 2445.2 tons of waste per week. While in Ogbese sawmills converts a minimum of 503 logs of wood per day which will also generates approximately 201.2 tons of waste and 1207.2 tons of waste per week. This is enormous for a town that can hardly cope with its domestic waste. It is therefore, not surprising that these waste accumulate year after year with propensity to increase as the demand for wood increases.

TABLE 6: Logs Converted in each Sawmill in the Study Areas

S/NO	INDUSTRIAL CORRIDORS	AVERAGE NUMBER OF LOGS CONVERTED/DAY	AVERAGE NUMBER OF LOGS CONVERTED/WEEK	AVERAGE VOLUME OF WASTE GENERATED/DAY (M^3)	AVERAGE VOLUME OF WASTE GENERATED/WEEK (M^3)
AKURE					
1	ONDO ROAD	579	3474	231.6	1389.6
2	ROAD BLOCK	254	1524	101.6	602.4
3	ADO ROAD	70	420	28	168
4	OKE-ARO	78	468	31.2	187.2
5	ODA ROAD	41	246	16.4	98.4
OGBESE					
6	AYADE OGBESE	340	2040	136	816
7	OKE-ODO OGBESE	163	978	65.2	391.2
TOTAL		1525	9150	610	6660

Source: Ondo State Forestry Department (2013); Updated by the Researcher.

The sawmill industries presently incinerate some of these wastes as a way of getting read of the huge waste accumulated within her vicinity. The burning is carried out as crudely as possible, thereby introducing air pollution into the already polluted environment.



Fig. 2: Accumulated Waste in the Sawmill Industry in Ogbese

with unorganized waste dump such as this; the sawdust, wood shavings, wood off-cuts and even the logs yet to be converted provide a good environment for the breeding of worms, rodents, insects such as flies, crickets, bees, beetles, mosquitoes etc. this of cause is responsible for the prevalence of malaria that is caused by mosquitoes which is prevalent in the study area.

Source: Author's Field Survey (2014).

3.5 DIRECT OBSERVATION

Based on direct observation, one could see that exposure to hazardous conditions reduced with distance from the sawmill industries. Field findings also revealed in Ogbese, all residents located in the North-East zone are affected by sawmill pollution especially air pollution as the South-West wind blows across the Sawmills and unfortunately majority of the sawmill industries in Ogbese are located in the South-West zone of Ogbese.

Findings reveal that there is an existing Master Plan for Akure while that of Ogbese could not be established. It was assumed that Ogbese has no Master Plan, this could be linked with the reasons while sawmills are sited within residential areas and half-hazards. Though Akure has a Master Plan, it was noticed that there has been a deviation from the existing Master Plan.

4 RECOMMENDATION

Inadequate environmental management attached to the diverse and complex activities within the Urban Centre is resulting into environmental problems that are threatening the dwellers, [15]. These include the haphazard locations of industries and emissions of hydrocarbon and poisonous gases that are depleting the ozone layer as well as causing climate change and global warming. In other to ameliorate these problems the following recommendations are made;

4.1 IMPROVE CONVERSION METHOD

The research shows that averagely, 1,525 logs were worked on daily in the study areas which generate averagely about 610m³ of waste per day. However the quantity of wood waste generated can be reduced with improved conversion method.

4.2 USE OF CONVEYOR BELT

The study confirm that about 40 - 50% of logs converted in sawmills comes out as waste. This means that equal volume of sawn timber or log derived is regarded as wastes which comes out in form of sawdust, chips, slabs, edgings, trim-ends, off-cuts, shavings, peeler cores, veneer, etc. in-view of this the use of conveyor belt to collect the waste is necessary in order not to hinder the sawmilling, plywood and veneer processes.

4.3 UTILIZING THE WASTES

The waste yield from the sawmill industry is about one third of the whole of the material involved. The fundamental difficulties in utilizing this waste is the economics of collecting adequate quality of waste to justify the installation of an additional processing plants that can utilize the waste.

Sawmill Wastes as Fuel:- it can be used to produce banquet fuel for cooking. Sawmill wastes are highly combustible, most especially if they are dry. The most combustible wood fuel is charcoal and followed closely (in descending order) by dry soft wood material (e. g. sawdust pellets, planer shavings etc.)

Chip / Particle Board:- Another way of utilizing wood waste is in the manufacture of chipboard or wood-particle board. Sawdusts and wood off-cuts can be separated from other waste at source. The wood off-cuts and rejects are crushed to make chips and mixed in turn with sawdust. Binders, such as resins, are used as to bind the particles together. The mixture is then poured into appropriate moulds to form any desired board size.

Litters:- Wood wastes could be used as litters for animals. Since they are easily available, affordable and disposable, it could serve as better alternatives most especially in the poultry.

Soil Conditioner:- Wood wastes compost, mulch and soil conditioners are useful in Nigeria and sub-Sahara Africa. The wood wastes can have a good use in this area.

4.4 MAKING THE INDUSTRIES PAY (POLLUTER PAY PRINCIPLE)

The society will be better off, if the polluter is held liable for the losses he imposed on others. Because of self-interest, he will not want to adjust his activity but if we measure the gains and the losses involved using a measure common to both (i.e. money). Those who gain receive benefits, for which they are willing to pay, while those who lose suffer a cost, which they would receive as compensation, [16].

4.5 INCENTIVES BY THE GOVERNMENT

Government can help the industries by providing certain incentives. Since the volume of waste generated is enormous, and the industries are more concerned with their economic activities, the government can offer to cart away the wastes to land fill sites and incinerators at subsidized rates. Government can also encourage cottage industries that will utilize the wastes. This will empower the people economically and create jobs as well.

4.6 RELOCATION

It is recommended that the sawmill industries should be relocated if there should exist a friendly and inviting residential area, there should be a buffer between them. This is due to the fact that the two land uses cannot complement each other rather they contradict each other because residential land use cannot be used alongside with industrial land use due to the heavy pollution discharge from the industry (Sawmill)

5 CONCLUSION

All over the world, corporations locates their polluting factories, toxic dumps, and other dangerous projects close to people who are most oppressed by poverty and low status; worst still they are deprived of basic infrastructure. Low income earners constitute a significant percentage of population for whom physical developments plans are made; however, more often than not they become victims of the costs (burdens and hazards) of proposed and or implemented land use(s). Poverty is one of the greatest problems militating against development in the high density areas as poverty simply connotes deprivation. Unlike medium and low density areas, high density population live in substandard houses, lack basic infrastructure and amenities especially good roads, health care facilities and potable water amongst others. This explain the reason while Ogbese is most hit by the negative impact of the operation of sawmill industries in the two study areas examined.

To a large extent, cases of environmental discrimination remain traceable to the negligence and or ineptitude of professionals charged with the responsibility of ensuring that people have effective, efficient and unrestricted access to a safe, healthy and functional environment. Ideally sawmill industries are not supposed to be sited within residential areas rather they auth to be localize in a given zone probably outskirt the residential areas.

Finally, sawmill wastes such as wood off-cuts, sawdust, back peels etcetera are not all hazardous in term of all of its economics importance. Only it should be probably managed in other not to arm man and is environment. In addition to this, sawdust has a limitless range of uses in society. For example its uses as source of fuel, in making asbestos, veneers, mosquito coil, and others makes it an important waste product in environment..

It was discovered that lack of representation and participation in the key decision making processes, political interference, poor funding of physical planning establishments, dearth of technical personnel and working equipment as well as a near absence of easy-access information and technical assistance contribute to the inability of physical planners to curb Indiscriminate sitting of industries in minority and low-income communities.

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To ascertain the contribution of the microcredit institutions in women poverty alleviation in Tanzania: The case of Kinondoni municipality, Dar es Salaam, Tanzania

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ABSTRACT: This paper aimed at ascertaining and examining the contribution of micro-credit institutions to women poverty alleviation and the following specific objectives formed important part of this study; to identify the factors attracting women to join credit services, to examine conditions used by micro-credit institutions in financing women credit borrowers, to examine the effects of credit to women borrowers in poverty alleviation, to identify the challenges facing women credit borrowers in acquiring credit and finally to identify the strategies taken to overcome challenges facing women credit borrowers in acquiring credits. The target population for this study was women credit borrowers. The study constituted a sample size of 40 respondents obtained through probability and non probability sampling. Case study design approach was employed during study. Questionnaires, interview, focus group discussion, documentary review and observations were used during data collection. The study findings showed that micro-credit institutions have great impacts and contributed to improve standard of living of many women credit borrowers and poverty alleviation at household level. The conditions, procedures, and terms used by micro credit institutions in providing credits to women credit borrowers hinder the micro-credit initiative to serve as an essential strategy for poverty alleviation. This paper concludes and recommends that despite of prevailing large number of micro credit institutions and organizations that provide financial assistance to women in poverty alleviation still difficult loan conditions like collateral, unfriendly repayment schedules, higher interest rates continue to hinder and limit participation of many women.

KEYWORDS: Micro-credit institution, women poverty, poverty alleviation.

1 INTRODUCTION AND BACKGROUND

Women increasingly comprise a large portion of the poor across the world. They are more disadvantaged group than men, and they are perceived as more in need of financial assistance to strengthen their role in the society. It should be noted that women play a great role in the development of the national economies and improving the living standards of individual households. Their participation in formal and informal sectors of the economy has been substantial and increasing in most countries in the world (World Bank, 2001).

The incidence of poverty in the third world countries is higher among women than men. Pearson, 1992 asserts that there is substantial evidence that women have constantly lost out in the development process in these countries. The reason for such feature is that economic, social and cultural factors in the Third World have combined to produce a situation in which most development efforts have tended to discount the potential social and economic contribution of women and hence fail to mobilize and benefit from women as a vital human resource (South Commission, 1990).

In Africa, women perform the most crucial work, that 80% of the women are participating in farming but they are marginalized economically (UNICEF, 1989). During the pre-colonial era, the most important role of women in defining their entire life was portrayed as bearing and bringing up a children (Chilton, 1984). The Women World Conference in Beijing established initiatives in the enhancement of women legal capacity, economic empowerment, poverty alleviation, women

education, training and employment, political empowerment and inclusion of women in decision making. In realizing this, the governments of Tanzania since 1991, established a financial reforms in order to create an effective and efficient financial system which will be able to support women so as to enable them to break away from poverty. The reforms focused on the government commitment to permit banking institutions to operate on a commercial basis, making their business and management decisions on the free from outside intervention within the prudential supervision. The principal elements of financial reforms established included liberalization of interest rates, elimination of administrative credit allocation, strengthening the Central Bank of Tanzania in regulating and supervising financial institutions, restructuring of state owned financial institutions and allowing the entry of local and private banks for development of credit and savings.

The emergence of micro finance institutions has stimulated micro credit services to poor people and women in particular to have access to micro loans for the purpose of rising their standards of living and struggle towards poverty alleviation and improving their economic status in Tanzania. Before establishment of micro credit institutions, the large number of women were creating their own jobs in small business using their own low income generated from their own savings, relatives and rotating schemes so called "upatu" (Berger, 1989). where by women were increasingly engaged in some economic activities in their homesteads and they gathered capital through rotating and saving credit schemes.

The development process between men and women shows that, the only small percentage of women attend their development activities as men. According to Micro Credit Summit Campaign 2001 Report, 14.2 million of poorest women in the world now have access to financial services through specialized micro finance institutions (MFIs), Banks, NGOs, and other non-bank financial institutions. Yunus (1984) argued that people who lives in developing countries might improve their standards by becoming micro entrepreneurs and the financial institutions should support their initiatives with the small loans, since micro credit can serve as anti-poverty tool (NSGRP Report, 2003). The examples of micro finance institutions that involving in provision of credit to the poor and low income individuals in Tanzania, especially women includes commercial Banks, Non-Government Organizations (NGOs), and Cooperative Societies like SACCOS.

2 RESEARCH METHODOLOGY

2.1 RESEARCH DESIGN

This study used both qualitative and quantitative data employing probability and non probability sampling techniques in determining the sample size. Interview, questionnaires; focus group discussion, documentary reviews, and observation were used to generate primary and secondary data to facilitate generalizations and conclusions about the phenomenon under study or enquiry.

2.2 STUDY AREA

The study was conducted at Kinondoni Municipality in Dar es Salaam and involved two credit institutions operate credit activities which are PRIDE Tanzania and WANAMA SACCOS. The reasons for choosing this area were firstly Kinondoni Municipality hosts a lot of credit institutions and also hosts a lot of petty business activities so the researcher wanted to ascertain whether the increase of credit institutions and credit scheme in general goes parallel with the poverty alleviation to those credit borrowers particularly women. Second reason is that these credit institutions was accessible and agreed this study to be conducted in their premises, also the area was convenient to the researcher since researcher was residing within Kinondoni Municipality since the area was cost effective as it reduced some unnecessary costs during the data collection.

2.3 GEOGRAPHICAL AND POPULATION DESCRIPTION OF KINONDONI MUNICIPALITY

Kinondoni District is a one of three districts in Dar es Salaam which is located in northern part of Dar es Salaam city, the other being Temeke located to the southeast and Ilala. To the east is bordered by Indian Ocean and to the north and west bordered by the Coastal Region. According to Tanzania Population and Housing Census 2012 shows that population of Kinondoni is 1775049, among them 860802 are males and 914247 are females. The area of Kinondoni Municipal is about 531 square kilometers. The original inhabitants of kinondoni were Zaramo, and Ndengereko, but due to urbanization the municipal have become multi ethnic. It also involves the following wards; Bunju, Goba, Kawe, Kibamba, Kigogo, Kijitonyama, Sinza, Kimara, Kinondoni, Kunduchi, Mabibo, Magomeni and other of Makuburi, Makumbusho, Makurumla, Manzese, Mbezi, Mburahati, Mbwi, Mikocheni, Msasani, Mwananyamala, Mzimuni, Ndugumbi, Tandale and Ubungu.

2.4 EMPLOYMENT AND ECONOMIC ACTIVITIES

It is estimated that about 360,000 residents of Kinondoni Municipality are employed in both private and public sectors. Out of these, 95% are employed in private sector while the rest 5% are employed in the public sectors. Working forces of 200,000 people in Kinondoni Municipality are self-employed in various activities for the attainment of their dairy needs for their wellbeing. The majority of the residents are involved in petty business, fisheries, livestock keeping and agriculture including horticulture. Only 3% of the working force is engaged in subsistence agriculture in the peripheral urban areas. There are no big farms, in most cases the farms ranges from 2.5 to 6 acres. Others make small gardens around their homes in which various vegetables and root crops like cassava and potatoes for family foods are grown. Kinondoni Municipality profile (2010).

2.5 SAMPLE AND SAMPLING PROCEDURES

Probability and non probability sampling represented by both random and purposive sampling respectively were applied in determining the sample size suitable for the study.purposive sampling was used in selecting key informants from the administrative officials in the microcredit institutions and community development officers in the municipality council.

2.5.1 TARGET POPULATION

The target population for this study was women credit borrowers in Kinondoni municipality. Moreover, the major concern for choosing this group was due to real situation of poverty among them and the growing consensus that, large portion of women have joined credit services in various micro finance institutions so as to get away from poverty, thus it was important to assess how these credit institutions have enabled women particularly to get away from poverty.

2.5.2 SAMPLE SIZE

This study constituted a sample size of 40 respondents where 37 was women credit borrowers both from PRIDE Tanzania and WANAMA SACCOS cooperative based institutions, 2 credit officers one from PRIDE Tanzania and other from WANAMA SACCOS, furthermore it involved executive director from Tanzania Women Bank as stipulated in table 3.1 below

Table 2.1 Distribution of Respondents

Category of Respondents	Frequency	Percentage (%)
Women credit borrowers	37	92.5
Credit officers	2	5
Tanzania Women Bank	1	2.5
Total	40	100

Source: Research findings, 2013

2.5.3 SAMPLING TECHNIQUES AND PROCEDURES

This study included both qualitative and quantitative methods of data collection, where by probability and non probability sampling was used to select sample size from the sample unit. The sample unit for this study was women credit borrowers and credit institutions in kinondoni municipality. Furthermore, the inclusion and exclusion criteria were applied where; the study included women credit borrowers and credit officers but excluded other credit borrowers like males and other poor and low income people in kinondoni municipality.

2.6 DATA COLLECTION METHODS AND INSTRUMENTS

The study employed different methods of data collection where by both primary and secondary data were collected. Primary data are those which are fresh or the data which are collected for the first time, while secondary data are those which have already collected by someone else and which have already passed through the statistical process (Kothari, 2004).The data were collected by the following methods.

2.6.1 QUESTIONNAIRES

Both closed and Open- ended questionnaires were used to elicit responses from credit borrowers who are able to read and credit officers. In ensuring high responses and reliability of data, the researcher translated some questionnaires into our national language which is “Kiswahili” for the women credit borrowers and this reduced language difficulties during data collection and the questionnaires for credit officers remain in English language.

2.6.2 OBSERVATION METHOD

The researcher observed the real situation during his visit to where they run their business. The researcher visited members of WANAMA SACCOS in their small grinding meals industries and other clients from PRIDE Tanzania. The method aimed at looking if the credits taken are used to establish and develop the entrepreneurial activities.

2.6.3 FOCUS GROUP DISCUSSION

This method used in data collection because the technique is so flexible that allowed facilitator to explore reliable information and encouraged participation among participants. In this method the researcher made some discussions with women credit borrowers. This method was used to make verification of data obtained from questionnaires since the discussions provided a lot of information from the respondents.

2.6.4 INTERVIEW

Interviews were used to collect various data from women credit borrowers, thus the method made easy collection of data from the respondents as it allowed flexibility, greater freedom and addition of supplement questions. In this method the same prepared questions were asked to all respondents particularly those who were not able to read and write so as to get different or confirm answers of the same question to all respondents.

2.6.5 DOCUMENTARY REVIEW METHOD

The method used to gather information during the study where it involved the reading of various published academic documents, private research reports, credit scheme journals, NGO’s reports and the reports from various credit institutions. The method also involved read of some text books, website materials, newspapers, this method helped researcher to get insight from the past researches related to the study.

3 DATA ANALYSIS, FINDINGS, AND DISCUSSION

3.1 INTRODUCTION

The data analysis and presentation was done using tables and charts, where both qualitative and quantitative data were compiled and analyzed using excel thereby producing frequency tables and charts whose computed results were useful to conclusions and findings .This part therefore deals with the presentation and analysis of data obtained from the study of the contribution of micro credit institutions to women poverty alleviation in Tanzania-the case study of Kinondoni Municipality, it also shows characteristics of respondents or the studied population, who were interviewed, observed documentation and involved those who were given questionnaires during the research. The data presentation is organized according to the research objectives and research questions guiding this study.

3.2 RESPONDENTS SEX

Table 2.1 depicts 38 (95%) of the respondents were women, who constituted of women credit borrowers, and Tanzania Women Bank Director. The circumstances that drove the researcher to select women is because of their poverty and being marginalized economically, as it has been stipulated, also 2 (5%) credit officers were both males.

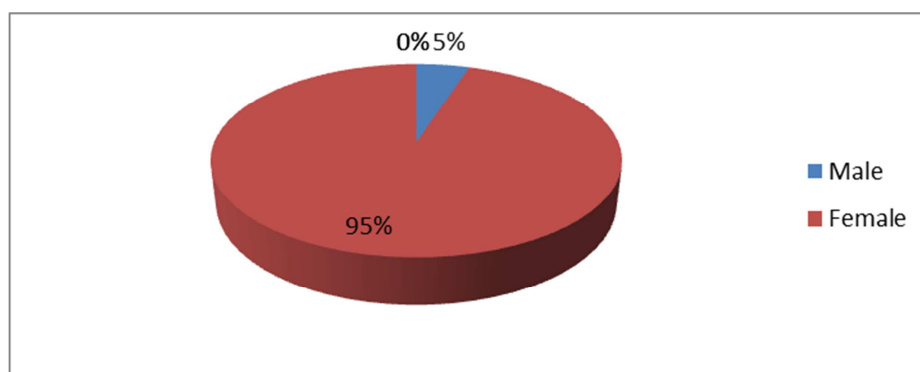


Figure 3.2 Respondent's Sex

Source: Research findings, 2013

3.2.1 RESPONDENTS AGE

Table 3.2 Respondents age range

Age range (Years)	Frequency	Percentage (%)
15 - 30	14	35
30 - 45	20	50
45 and above	6	15
Total	40	100

Source: Research findings, 2013

The finding from table 4.2 indicates that, the number of respondents at age of 15 – 30 comprised of 14 (35%) of all respondents under the study, 30- 45 consisted of 20 which is equal 50% of the all respondents and 45 years and above constituted 6 (15%) of the total respondents. From the table above, large number of credit borrowers their age range appeared to be in between 30 – 45, this is to say that the younger people between fourteen to thirty years and those above forty five years are not much involved in seeking credit while the age between thirty to forty five years involved in acquiring credit.

3.2.2 MARITAL STATUS OF RESPONDENTS

Table 3.3 Marital Status of Respondents

Marital Status	Frequency	Percentage (%)
Married	21	52.5
Not Married	13	32.5
Widow	6	15
Total	40	100

Source: Research findings, 2013

The table above shows marital status of respondents included in the study where, 21(52.5%) of all respondents were married, 13 (32.5%) were not married, and 6 (15%) were widows. This indicates that, large percentage of respondents join credit institutions are married than those not married and widows, they said a reason for a large percentage of married respondents is that, they have number of dependents in their families.

3.2.3 EDUCATION LEVEL OF RESPONDENTS

Table 3.4 Education Level of Respondents

Education Level	Frequency	Percentage (%)
Primary	24	60
Secondary	8	20
Certificate	5	12.5
Diploma	-	-
Degree and above	3	7.5
Total	40	100

Source: Research findings, 2013

Table 3.4 indicates education level of respondents where 24 (60%) of all respondents had primary education, 8 (20%), had secondary level of education, certificate level included 5 (12.5%), for both women credit borrowers and non credit borrowers, no any respondents who had diploma, and only 3(7.5%) had degree level and above and these were 2 credit officers and one Executive director of Tanzania Women Bank. The table above indicates that large percentage of women credit borrowers have primary education, hence they said education is crucial factor for poverty alleviation.

3.3 DISCUSSION OF FINDINGS

This study aimed at ascertaining the contribution of micro credit institutions to women poverty alleviation as follows

3.3.1 FACTORS THAT ATTRACTED WOMEN CREDIT BORROWERS TO JOIN CREDIT INSTITUTIONS

During the research women credit borrowers stated that poverty was a major factor that motivated them to join credit institutions since they had low income which could not support their family needs thus they joined credit services so that to settle their problems and improve their living standards, also low capital for their business motivated them to join credit institutions so as to increase capital. But the attention of researcher was also to know the factors that stimulated women credit borrowers to join particular credit institution. Table 4.5 summarizes results of their answers.

Table 3.5 Factors Attracted Women Credit to join Credit Institutions

Category	Frequency	Percentage (%)
Minimal interest rate	24	60
Business training	10	25
Accessibility	6	15
Total	40	100

Source: Research findings, 2013

Table 2.5 above indicates that, minimum interest rate is a most significant factor attracted women credit borrowers to join credit scheme as it covered 60% of the respondents followed by business training 25% while accessibility was last ranked as it covered 15% of the respondents and this is specifically respondents from the SACCOS replied, the accomplishment of these percentage become by the inclusion of two credit officers and TWB Executive director.

3.3.2 CONDITIONS USED BY MICRO CREDIT INSTITUTIONS IN FINANCING WOMEN BORROWERS

Women credit borrowers were asked to indicate the conditions for getting loans and also credit officers were asked to give conditions they use in providing credit to their clients. The aim of this was to get into insight if the conditions for getting loans are favorable or not favorable for them. The respondents from all credit institutions that means both women credit borrowers and credit officers said that in order for the clients to get loan must have collateral first particularly this should be a fixed assets, and other conditions like group lending, attending of business training as illustrated in table 3.6 below:-

Table 3.6 Conditions Used by Micro Finance Institutions to Provide Loans to Women

Conditions for loan	Frequency	Percentage (%)
Collateral	25	62.5
Group lending	8	20
Attend training	3	7.5
Others	4	10
Total	40	100

Source: Research findings 2013

The table above indicates that, the majority of respondents said a collateral is most important condition required for getting loan as it covered 62.5% and the collateral should be greater than the amount of loan borrowed, 20% said that in order to get loan borrowers should be in group of 5 – 15 members through group lending system who are familiar to each other but in some credit institutions required that group members to relatives in hope that family formation are more likely to have a higher repayment rate, 7.5% reported that attending of business training , and 10% articulated other conditions like being a legal member of particular institution and specifically was found in SACCOS, inspection of business premises, age of 18 years and above, sponsors who can take up an obligation once clients fail to repay the loans, business license.

3.3.3 THE EFFECTS OF CREDIT TO WOMEN CREDIT BORROWERS IN POVERTY ALLEVIATION

Table 3.7 Effects of Credits to Women Poverty Alleviation

Effects of Credits	Frequency	Percentage (%)
Establishment of business	17	42.5
Business expansion	10	25
To meet family needs	08	20
Building houses	03	7.5
Others	02	05
Total	40	100

Source: Research findings, 2013

Table 3.7 shows credits have great impacts in poverty reduction to women as indicated above, where 42.5% respondents from both PRIDE and WANAMA SACCOS interviewed, responded through questionnaires and discussions made between researcher and them said that credit have helped to initiate business activities which they could not be able to establish before joining credit scheme, they went further to say now they are doing business such as food vending, tailoring, hair dressing saloon, selling clothes, and other from WANAMA have established small grinding meals industries and through those business their level of income has increased.

Respondents covered 25% both from all these two institutions said that, before joining credit institutions the capital for their business was small and they were not able to extend their business activities, but now credit institutions created ability to them to increase capital for their business by being able to seek loans something which has contributed to the improvement and expansion of their business.

20% of all respondents said that credit have helped to meet their basic family needs, they said loans obtained from various institutions through establishment of entrepreneur activities have raised their ability to meet several family needs such as foods, clothes, shelter and paying school fees for their dependents on time, while 7.5% said loans has helped them to buy plots for building houses and others have built better houses and 5% have benefited much through business training provided by these institutions and hence have improved their skills and capacity.

3.3.4 CHALLENGES AND PROBLEMS FACING WOMEN CREDIT BORROWERS IN ACQUIRING CREDIT

Under this section, the researcher was interested to know if there are any challenges and problems that women borrowers face in acquiring credits, from the process of taking it until repay back period. The researcher came into understanding that women credit borrowers are facing several challenges and problems in acquiring credit. The percentage

descriptions of responses from respondents for the challenges and problems facing them when they are seeking loans from various credit institutions have been analyzed and described in table 3.8 below

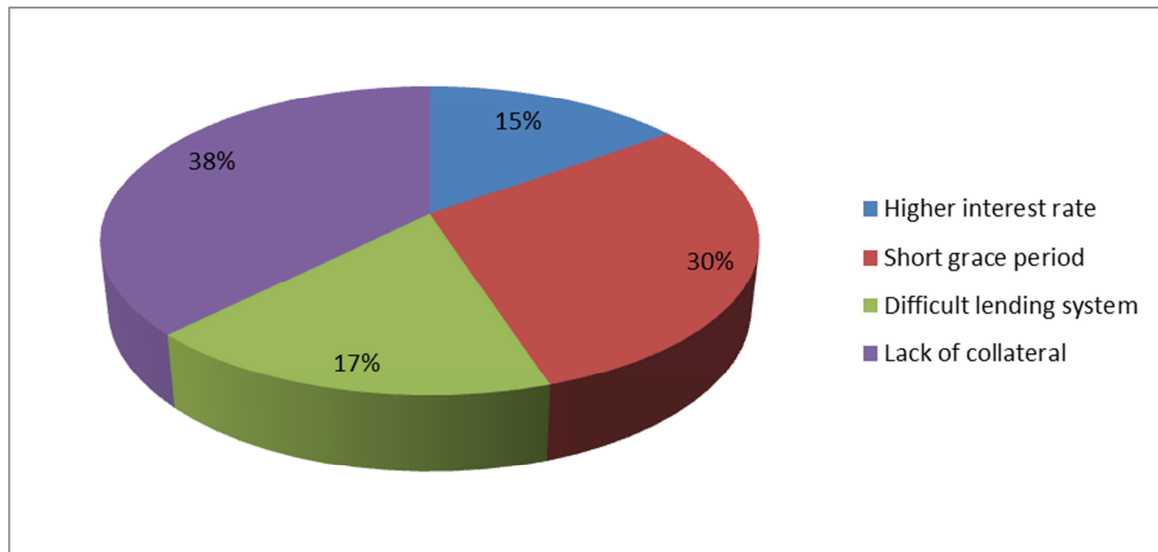


Figure 3.8 Challenges Facing Women Credit borrowers in Acquiring Credits

Source: Research findings, 2013

38% reported to have problem of getting collaterals. This also was mentioned among the problems that face women borrowers. Following the actual situation of life, not all members had valuable assets which could serve as collaterals. It is a great challenge among women for getting loans because if a loan seeker does not have collateral then she is disqualified for getting loans. Lack of collateral has been reported as among the factor that contributing to poor and backward state of women as the late Mwalimu Nyerere articulated that *"lack of property right limits women's efforts to undertake development projects in villages and towns"* (1968). 30% of the respondents reported that short grace period is also a great challenge for loan repayment. The loan repayment schedule from SACCOS and PRIDE reported to be on weekly basis. Generally they said that time allocated for loan repayment is too short for a borrowers to start business, gain profit and use part of the profit to repay the loan. Due to that some respondents reported to end up using the loan itself for repayment because the time fixed for loan repayment does not give borrowers a loophole for starting business and generate profit which will facilitate smooth repayment of such loan, since when a borrowers fail to pay on time fixed by a particular institution the borrowers face difficulties including the confiscation of clients belonging and properties such as houses and other fixed assets important for the life of person.

17% of the respondents reported to have difficult lending system. They mentioned group loan lending system to be difficult running business activities and paying back the loan. Respondents said that some other institutions regards group lending as a condition for getting loans thus in order to get loans the seekers must form a group ranging from 05 – 15 members. This system become an obstacle for them in poverty alleviation when a member fails to pay back a loan within agreed time or disappears with a loan. Some women clients from PRIDE complained that, when this happen, the rest of members are arrested and locked-up until they pay for defaulter. They went further and said credit institutions also apply other measures for defaulter of the credit such as taking collateral kept and sell them in order to cover for loan repayment, or take to court or arrest their guarantor.

15% of the respondents said that higher interest rate fixed by credit institutions is also a problem. They complained that, these institutions have high interest rate to the extent that some women decided to give up and withdraw from credit institutions since what they earned is only ended up in paying back the loan. Through observation and review of several documents the credit institution under this study charging higher amount of interest rate up to 36%. The statement provided by PRIDE Manager shown that PRIDE interest rate was 4% per month for group lending and 3% per month for individual lending and 36% per annum, and in case of WANAMA SACCOS the interest rate covers 1.5% per month for individual lending and 18% per annum, credit borrower from this institution said this interest rate is affordable but the challenge is that one should have saving account as a principle from which she can be granted a loan twice or three times of the saving amount this affect most of the women credit borrowers.

3.3.5 STRATEGIES TAKEN TO OVERCOME CHALLENGES AND PROBLEMS FACING WOMEN IN ACQUIRING CREDIT

The attention of the researcher was to know if there are any strategies that have been taken to overcome these challenges and problems that facing women credit borrowers.

Tanzania Women Bank Executive director said that the bank took several efforts to ensure that loans services is improved by making frequent review of the conditions for getting loans to the clients so as to build capacity and increase the number of women joining credit services, also bringing services closer to the people, this by making expansion and opening of other branches such as kariakoo branch and increase more accessibility of the bank and services to the people.

Provision of frequent business training particularly to women credit borrowers. Lack of business training and entrepreneur skills in running business activities is a one among the challenge that lead to the failure of loan repayment. In case of PRIDE the attending of training is a necessary condition for getting loans, how this become a strategies to overcome challenges in getting loans because some other women fail to repay back the loans hence training has been put so as to enable them to acquire skills in running business and reduce a problem of loan repayment failure.

4 CONCLUSION AND RECOMMENDATIONS

4.1 CONCLUSION

The study findings confirm that microcredit has a significant impact on family and socio-economic well being through its influence on the pattern of household income and consumption. But making it available to women does not automatically mean can drive women from poverty. Other interventions like entrepreneurial skills training, planning and financial management and bookkeeping skills are also of paramount importance .In light of the findings it can be concluded that despite of the prevailing of large number of micro credit institutions and organizations that provide assistance to women in poverty alleviation still difficult loan conditions like collateral, unfriendly repayment schedules, higher interest rates on the side of micro credit institutions, having saving account in some other institutions, lack of frequent and reliable entrepreneurial skills that can build their capacity in management of loans and running their business activities, lack of reliable and friendly business premises make credit services play little role to achieve the forecasted positive changes of raising economic status to women credit borrowers.

4.2 RECOMMENDATIONS

Women lack property rights and they also lack adequate knowledge on existing credit facilities. This part provides suggestions and way forward to the government and credit institutions on how can make credit services to women be a poverty alleviation factor.

4.2.1 RECOMMENDATIONS TO WOMEN CREDIT BORROWERS, MICROCREDIT INSTITUTIONS AND GOVERNMENT

Women credit borrowers should join credit services when they have profitable business so as to reduce the burden finding repayment from other sources. Moreover, proper enterprise management skills and usage of fund should be given higher consideration. The entrepreneurship education should be intensified by stakeholders and microcredit lending institutions in particular. Furthermore the microcredit institutions should provide highly affordable loans. Repayment schedule should also be reviewed to at least on monthly basis to all credit institutions to allow the credit borrowers use the loans to do business and generate profit. Weekly repayment schedule is too tightening to the credit borrowers to use the loan profitably. **Government** should revise micro finance policies and regulatory framework that are not in favour of credit borrowers or credit institutions. However, the Government and NGOs still need to facilitate and conduct training on production of quality products and marketing skills, sensitize and enabling women to participate in National and International Trade Fairs.

4.2.2 AREAS FOR FURTHER RESEARCH

This study recommends that connected to this topic in this paper the following areas are worthy for further research;

- Exploring and gauging the role of the societal culture and traditions as a facilitator or inhibitor of unleashing women potential in poverty alleviation process,

- Find out and recommend a harmonizing model or curriculum for entrepreneurship education and training and ;
- Analysis of the viability of the existing entrepreneurship policy and alignment with gender empowerment policy in Tanzanian situation.

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Assessment of factors responsible for the performance failure in public secondary schools in Tanzania: The case of Kinondoni district, Dar es Salaam, Tanzania

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ABSTRACT: This paper identified and assessed factors responsible for failure in the public schools in the year 2013. The findings confirm that during the past five years, Tanzania has experienced alarming student failure rates in the public schools in particular. This paper revealed that most of the public schools have acute shortages of text books as well as laboratory equipment, incompetent and unmotivated teachers and also heavily lacking sound learning infrastructure. This study, due to financial and time constraints, adopted a case study design to strengthen investigation and therefore chose to use kinondoni district. A sample of 50 respondents was drawn and created by the use of both simple random sampling (to obtain 30 students), and purposive sampling (to get 10 parents/households, 5 head teachers, and 5 district education officers). Questionnaires, interviews, focus group discussions, observation, and review of existing education reports were employed to collect data. Data analysis was done through excel software. The study concludes and recommends the government should improve work environment by attractive salaries, better treatment of teachers, and provision of sound learning equipment and infrastructure, total subsidisation of the public schools education service delivery and ensuring effective management of this vital sector to the socio-economic development of this nation.

KEYWORDS: education policy, public schools, student performance.

1 INTRODUCTION AND BACKGROUND

Throughout the world the education factor is highly linked with the socio-economic development of any given nation (Sadker, 1995; Kuleana, 1999). Tanzania like any other thriving nation has been at the forefront stage armed with Tanzania development vision 2025, Millenium development goals, and National strategy for growth and reduction of poverty (NSGRP) to embark on efforts and various programs aiming at promoting educational excellences among its communities and groups (TETPO, 1995; Athumani, 1995). However, the results of these efforts seem not to tally with expectations since over the years it continues to witness and experience mass failure at lower levels of education i.e. the primary and secondary schools which further suggests few candidates get chances to proceed with tertiary education level (Suleman and Rakesh, 2004).

This study was strongly motivated by the public secondary schools mass failure performance and therefore undertook investigative enquiry upon a target population of head teachers in schools, students, parents and district education officers, with a view to identify, and assess the factors responsible for the failure contrary to national expectations and goals in the education system. Lack of sound learning equipment and infrastructure, lack of quality and shortage of teachers and presence of low motivated teachers has been strongly and repeatedly mentioned as being the core factor that drives students and public schools performance into failure score (Chediell, Sekwao, and Kirumba, 2000). This is vividly reflected and substantiated in the education sector performance evaluation reports of both SEDP I, SEDP II, and ESDP.

The Secondary Education Development Programme II (SEDP II) happens to be a continuation of SEDP I, which was implemented between 2004 and 2009, building on the national goals of secondary education provision. The programme

vision, as reflected in the Education Sector Development Programme (ESDP) 2008 - 2017 document, is meant to continue to have upgraded and coherently planned, managed and monitored education sector, secondary education sub-sector inclusive, that will develop human capital in order to boost economic growth and eliminate poverty. As in SEDP I, the changes, reforms and interventions reflected in the SEDP II were meant to continue to improve learning outputs and outcomes through teacher capability improvements and promotion of teaching and learning environments. These improvements would lead to increased achievement and competencies of learners and teachers, which in turn would also reflect efficient and effective output/outcome of secondary education (Chediel, Sekwao, and Kirumba, 2000).

Overall, the objectives of SEDP I were to improve access with equity, quality, management and delivery of secondary education in Tanzania. The review of SEDP I implementation has shown that the Programme was most successful in improving access and equity. The number of secondary schools has been more than tripled between 2004 and 2009 to serve different underserved communities and so has the number of enrollees. Despite these successes, there have been a number of challenges, including the following:

1. Poor performance in secondary education examinations, with most students getting marginal pass of Division IV or failing completely.
2. Acute shortages of teachers, especially in the sciences and mathematics, with many students not able to do these subjects at all.
3. Asymmetrical deployment of teachers of required, whereby urban areas have an advantage in recruiting more and better teachers compared to rural community secondary schools, most of which have an acute shortages of teachers.

It was the purpose of this study to expore and measure the responsibility borne by the above factors on the education sector performance. In doing so, the following has been studied and assessed accordingly:

- To find out government efforts in improving education performance in public secondary school
- To examine challenges faced by public secondary school
- To suggest and /or recommend solutions to alleviate failure in public secondary schools.

2 RESEARCH DESIGN AND METHODOLOGY

2.1 INTRODUCTION

This section presents the research methodology followed in the study. It describes the research design; study area, the sampling techniques as well as tools used in collecting data and information (Kothari, 2004; Kombo, and Tromp, 2006).

2.2 RESEARCH DESIGN

The study adopts a case study design so as to strengthen the depth of investigation of the population under enquiry (Kothari, 2004; Kombo, and Tromp, 2006). Kinondoni District is being used in this study to represent the case since it is manageable and realizable within the present research financial and time constraints.

2.3 SAMPLE AND SAMPLING PROCEDURE

Sampling is the process of selecting a number of individual or object from population such that the selected group contains element representative of the characteristic found in the entire group. Probability sampling is the main sampling method in which the researcher applied. It was not easy to study the population as whole and so probability sampling (simple random sampling) and non-probability sampling (purposive sampling) was used in the study.

In probability sampling random sampling was selected and the researcher use lottery system to get 30 students in threes schools of which ten students from each school where units was given numbers written on the uniform piece of paper then put them in the container mixed thoroughly and take out the required sample in random manner from the container.

In non-probability sampling purposive sampling was used to get specific respondents, this was used to get 10 parents from the household who only has children in secondary school, district education officer (DEO) and head from selected secondary schools who was selected purposively to provide relevant information.

2.3.1 SAMPLE SIZE

Sample refers to the number of respondent, was used to select in the study in order to provide required information (Kothari, 2004). The researcher was use the sample size of 50 respondents, where by the researcher was grouped the respondent into the following groups such as 30 students, 5 head teachers, 10 parents and 5 district education officers

Table 2.3.1 Shows the distribution of respondents

S/N	Categories of respondent	Number of Respondents	Percentage
1	Head teacher	5	10
2	District education officer	5	10
3	Parents	10	20
4	Students	30	60
	Total	50	100

Source: Research Design, 2013

2.3.2 DATA COLLECTION METHODS

The study employed different methods so as to collect the accurate and required data in the study i.e questionnaires, interview, focus group discussions, observations and review of existing documents. These methods enable the researcher to obtain the needed information and data. Both primary and secondary data were obtained. Primary data are those data which are collected afresh and for the first time and therefore happen to be original in character (Kothari, 2004; Kombo, and Tromp, 2006), while secondary data are those data which have already been collected by someone else and which have already passed through previous process (Kothari, 2004).

Questionnaires

The list of questions for questionnaire was set for each heads of secondary schools, students and other respondents. They conceded of both closed and open ended questions. The use of questionnaire is more advantageous because it involves several respondents who answer a set of questions at once and also give respondents a greater feeling of privacy and minimizes interview bias.

This method was used to parents, students from different secondary schools, head teachers and also district education officer. This was used to collect data from respondents for the study because it help the researcher to gather much information from various people; so far the researcher was able to collect information about the respondent's personal characteristics and environment which is often a greater value in interpreting results.

Interview

Face to face interview was conducted in which respondents were asked questions to elicit information and data that describe answers to the main question under investigation such as to reveal why failure and what should be done to curb the situation in long term perspectives and permanent remedy

Observation

Observation is a method of data collection where by information obtained without asking the respondents. The information was obtained by looking or investigating effectiveness of the schools administrative system. The method enabled a researcher to visit places where and how Government make effort for the development of the schools in Kinondoni municipal.

Focus group discussion method

This method was conducted among the groups of students with the view of knowing the factor responsible for failure in public schools to their side, and what is should be done to reduce failure.

Documentary review/review of existing reports

This is the technique of collecting information from the data which have already been collected by someone else or other agencies. In this method a researcher utilizes secondary data by looking information that was taken from Kinondoni municipal documents. For example documents from news papers, internet, magazine, reports and other publication.

2.3.3 DATA PROCESSING, ANALYSIS AND PRESENTATION

Data processing

The collected data was edited and examined to detect errors and omissions before coding them so as to make them amenable for analysis.

Data analysis and presentation

The collected data were analyzed and presented by excel graphs, charts and tables as well as documentation. Thus the percentage and totals according to categories of respondents were done by using excel software.

The term analysis refers to the computation of certain measures along with searching for patterns of relationship that exist among data-groups, therefore the data collected was presented in term of tables and pie charts so as to help the reader understand them clearly.

3 DATA ANALYSIS, PRESENTATION AND INTERPRETATION

3.1 INTRODUCTION

This section is designed specifically to present data collected in the field as well as interpretation and analysis so as to enable the whole concept of the study and research to be understood clearly for uptake purpose and usefulness. The presentation and analysis has been done according to the research questions and hence the specific objectives.

The major objective of this study was to assess the factors responsible for failure in public schools. In order to capture the reality of the above objective, the research questions were advanced. The first question aimed at finding Government efforts in improving education performance. The second question aimed at finding out the challenges facing public secondary schools. Lastly the third question identified the strategies done by the government to remove or curb the failure in public secondary schools.

This study sought to assess the factors responsible for failure in public secondary schools in Kinondoni District. The researcher interviewed 45 respondents constituting a success rate of 90 percent achieved from a sample of 50 respondents categorized in four groups as follows: 30 students, 5 head teachers, 10 parents and 5 district education officers.

3.2 RESPONDENTS CHARACTERISTICS DISTRIBUTION

The study also composed of different sex respondents that are male and female from interview, questionnaire and focused group discussion which are the methods of data collection in order to reduce the biases so as to promote the equality to both male and female in information collected.

3.2.1 RESPONDENTS BY AGE GROUPS DISTRIBUTION

The study involved respondents of different age groups distribution this aimed to eliminating the age biasing in responses. The below table shows the respondents in terms of their age groups.

Table 3.2.1 Respondents by age groups

Age	Sample size	Cumulative frequency	Percentage
14-30	15	15	31.25
31-40	20	35	41.66
41-50	15	50	27.08
Total	50	50	100

Source: research findings, 2013.

It can be observed that from age between 14-30 of 15. Respondents which is 31.25% from secondary school and other from household, Age between 31-40 of 20, respondents which is 41.66%, from District education officers and head teacher as well age between 41-50 respondents which is 27.08% from parent.

3.2.2 RESPONDENTS BY LEVEL OF EDUCATION

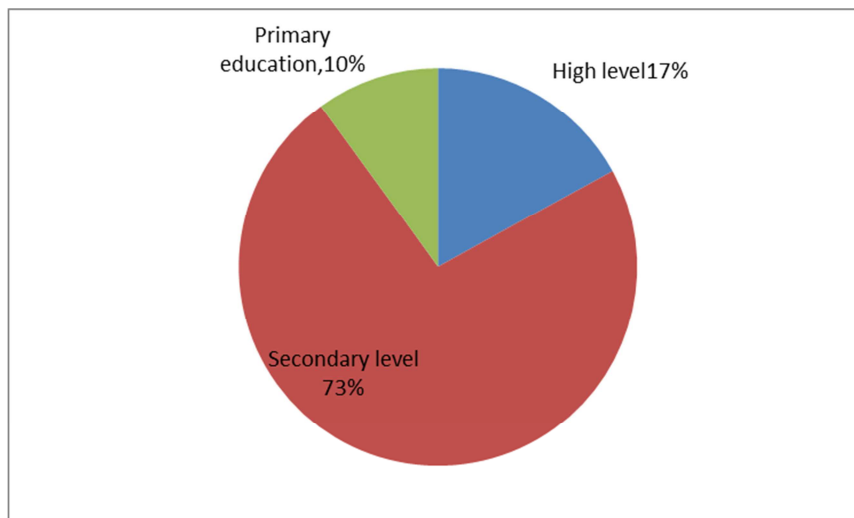


Figure 3.2.2 Respondents by the level of education (17% High level, 73% secondary level, 10% primary education)

Source: Research findings, 2013

3.3 RESPONSES TO RESEARCH QUESTIONS

3.3.1 RESEARCH QUESTION ONE

What are the efforts of the government in improving education performance in public secondary schools?

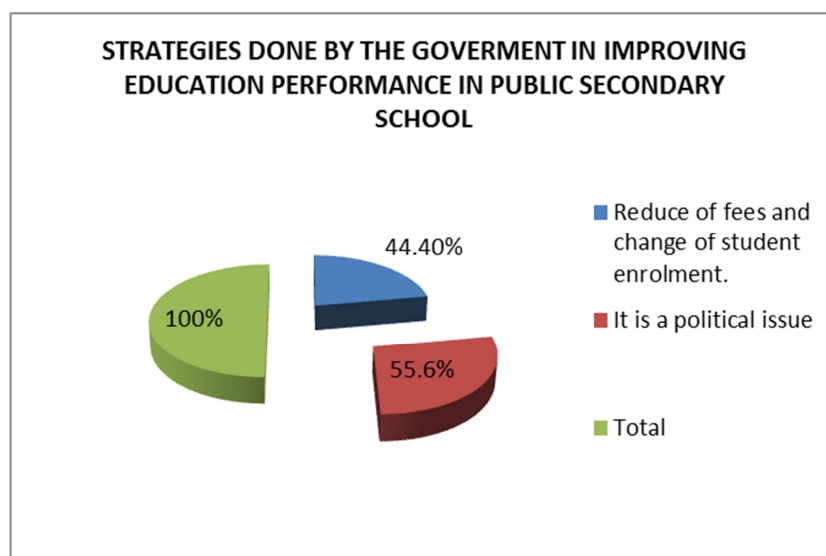


Figure 3.3.1 Shows the effort done by the government in improving education performance in kinondon municipal.

Source: Research findings, 2013

In order to answer the above question the respondents who were interviewed by 44.4% they said the Reduce of the school fees and change the of students enrollment, there was contribution in education performance around their places from the government while the remaining percent which accounts 55.5% of the respondents said no there are no any contribution from the government.

INTERPRETATION

During the field work through interview and focused group discussion Documentary Example files of the Mabibo secondary school sum of education officer and parent through their respondents by all, what are the efforts of the government in improving education performance in public secondary schools?

REDUCE OF SCHOOL FEES AND CHANGE THE OF STUDENTS ENROLLMENT

This question were asked to 5 key respondents who are head of school teachers and district education officer. This is 44.4% of all respondents and they commented that yes there is the relationship between lowering of secondary school fees and Enrollment where by for the two schools which were Mabibo secondary schools shows how the enrollment increased compared to the time before the lowering of of school fees and the remained three schools which started after the lowering of school fees that are Mburaati secondary schools shows how the enrollment increased year after year because of the low fee. The head teacher at Mabibo secondary school commented that the enrolment increased about 20% in the year 2005 when the fee was lowered as shown in the table below , where th head teacher of Mburiati secondary school has commented that the enrolment rate increase 90% and they enrol 200 student in form one each year.

Table 3.2 Shows the number of enrolment at Mabibo secondary school three years before and three years after the lowering of school fees.

Years	Number of enrolment	percentage	Cummulative percentage
1999	130	10.2%	10.2%
2000	114	8.9%	19.1%
2001	120	9.4%	28.5%
2002	200	15.6%	44.1%
2003	218	17.0%	61.1%
2004	230	18.0%	79.1%
2005	267	20.9%	100%
Total	1279	100	100

Source: Research findings, 2013

Respondents has commented that the issue of lowering secondary school fees by the government on january 2005 was a political issue because it was the year of general election in Tanzania and so they lowered the fees inorder that when it comes to the election the rulling part could get many vote from the citizens.

Respondents commented that lowering of school fees decreases child labour because many children from the poor families, orphans get the access to secondary education and they escape the issue of going in the streets to find jobs so as to get money to pay for their fees as it was before the reduction of school fees.

Respondents has commented that the lowering of school fees lead to the poor quality education because the government does not provide enough aids to the schools so that they can operate well where they are saying that there is lack of teaching and learning materials which made parents to find for private tuitions for their childrens. Also they commented on its effect on high enrolment rate, and lack of teachers where the study have shown that parents and students believe that the most important factor determining the effectiveness of a school is the existence of teachers who are able to use interactive method and maintain an active learning environment. So school with poorly trained teachers are unpopular and higher pay school attract qualified teachers.

3.3.2 RESEARCH QUESTION TWO

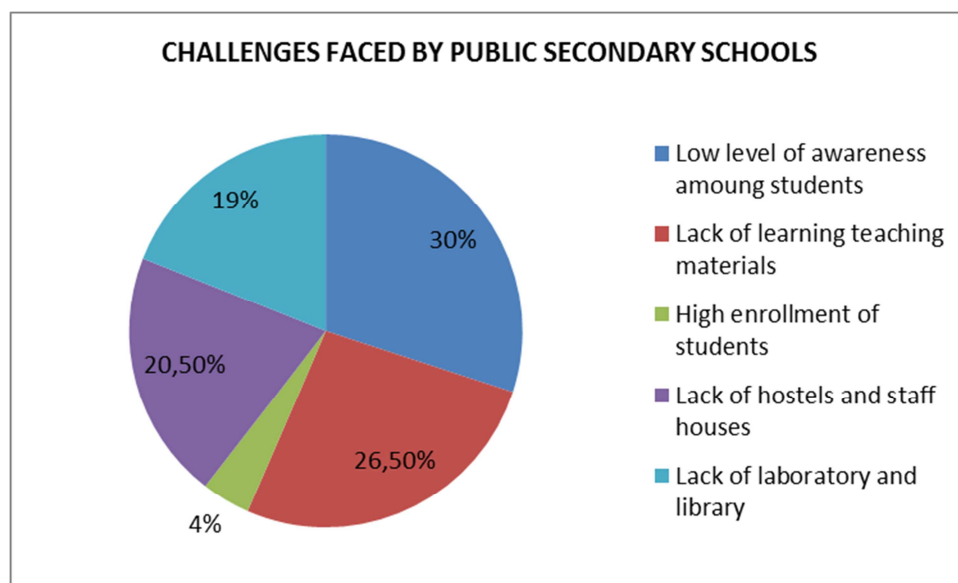


Figure 3.3.2 Shows the Challenges faced by public secondary schools effort in kinondon municipal.

Source: Research findings, 2013

INTERPRETATION

From the above figure, during the field work through interview and focused group discussion to the Mabibo secondary school sum of education officer and parent through their respondents by all, they respond to the question challenges faced by public secondary schools.

Low level of awareness among students

Interviewed teachers, students, parents and district education officer are saying that most of students are not aware of what they are doing at school and when asked them that why are they at school you will find them saying because the fee is low without ambitions about what next after my studies. This implies that most of students are not caring enough to what they have to do in school which lead to the poor performance among them.

Lack of learning and teaching materials

In improving education the government of Tanzania the researcher found that lack of learning and teaching material are among the factor which lead poor performance in public secondary because it lowered the fees but still it does not provide these schools with learning and teaching materials. For head of schools which the researcher has visited commented that one book is shared by many students in the class and so the situation is very difficult for students to learn also for the teachers to teach therefore it becomes an obstacle to a good performance.

High enrollment of students

Interviewed head of school teachers, district education officer and students has commented that big population among these community schools is an obstacle to the students performance. The interviewed teachers commented that since the lowering of school fees the student enrollment increased compared to the school facilities such as classrooms, tables, chairs, teachers and the like, they also commented that one teacher attend three classes per day due to large number of students (World bank, 2009). So high enrollment also becomes an obstacle to better students performance in these schools because its increase does not associate with many other factors such as increase of teachers, infrastructure and teaching and learning materials (World bank, 2009).

Lack of hostels and staff houses

The respondents has argued that due to the lowering of school fees many have get an access to secondary education therefore others are from far and they have to find for places to stay and find a way on how they will stay which make them to use much of the time to find food and other staffs which will enable them to stay far from their home and this takes student time for studying instead which can affect their performance. Also they have argued about teachers having no places to stay around the school environment where they are living far from their working environment which simetimes cost them and being absent to the work for some days, so for the teacher absenteeism affect the students performance.

Lack of laboratory and library

Respondents has argued that government schools can not afford to build laboratories and libraries because the fees which has been lowered is not enough for them because even though it is low still there are students who are finishing school without finishing the fee and since the government does not provide these schools with enough grants to operate.

3.3.3 RESEACH QUESTION THREE

What should be done so as to reduce failure in public secondary schools?

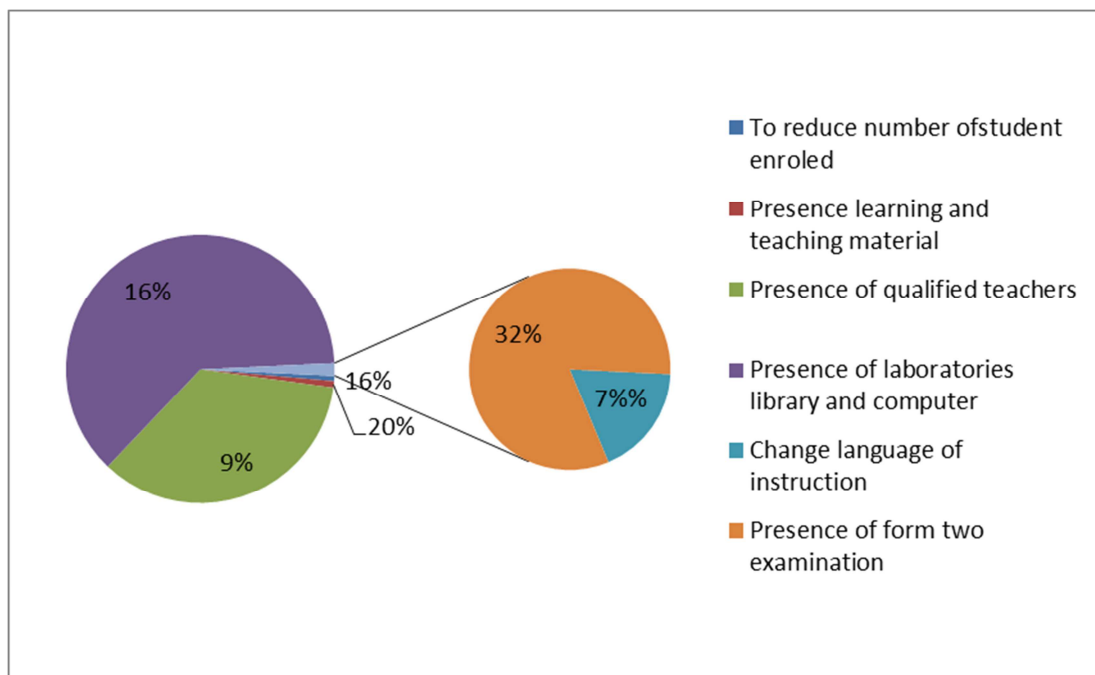


Figure 3.3.3 Things to be done to reduce failure in public secondary schools.

Source: Research findings, 2013

INTERPRETATION

From the above figure, during the field work through Interview, Observation and focused group discussion to the Mabibo secondary school, Mburiati secondary school, Umoja secondary school sum of education officer and parent through their respondents by all, they respond to the question. What should be done so as to reduce failure in public secondary schools?

To reduce number of students enroled

The lowering of school fees succeeded in expanding secondary education access to urban students, but there is serious problem of overcrowded schools, about 18 respondents which is equal to 9% of all respondents has commented on the alleviation of big number of enroled students in schools which does not match with the infrastructures available to these schools.

Presence of learning and teaching material

Efforts towards improving teaching and learning materials in schools for quality education attainment is needed more because the study has revealed that government financing of capitation grants to public secondary schools for the purchase of learning materials is not provided satisfactory and disbursed effectively. About 5% of the respondents has commented that increasing learning and teaching materials is a way to improve quality education especially in public schools.

Presence of qualified teachers

Interviewed respondent has argued that they believe the most important factor that determine the effectiveness of school is the existence of teachers who are able to use interactive methods and maintain an active learning environment and so schools with poorly trained and qualified teachers can not provide quality education. Therefore respondents were calling on the presence of qualified teachers as a way to provide quality education.

Presence of laboratories, library and computer

These are things which can promote a student to be updated with issues concerning their studies therefore absence of them in schools can make the education students are getting not quality therefore 5% of the respondents commented that government schools must have Library computer.

Change language of instruction

The respondents has commented that if the students in secondary schools were using kiswahili as their language of instruction they were performing very well because they know well kiswahili than the english language which is used to teach all subjects except kiswahili subject itself.

Presence of form two examination

Respondents commented that since the removal of national examination to the form two level students have been perform badly due to the fact that many are many are continuing with form three and four without having the passes required which will make them end up failing in form four national examination whereby they will not continue to advanced level studies.

4 CONCLUSION AND RECOMMENDATIONS

4.1 INTRODUCTION

This section presents conclusion and recommendation; conclusions are given in accordance with research questions tested. Recommendations carry the possible solutions of factors responsible for failure of public secondary schools with reference to Kinondoni Municipal.

4.2 CONCLUSION

This paper revealed that, although the government had increased the students' enrolment by lowering the school fees, the quality of the teaching-learning environment has been impeded. This was in poor availability of teaching-learning facilities, increase of failure and supportive services, low quality learners entrants into secondary school education and lack of motivational strategies to teachers and students. Yet, others were the failure of the government to provide appropriate support and stimulate adequate community participation. The study noted that the community perceptions towards the lowering of school fees implementation as a process to attain quality education was negative.

4.3 RECOMMENDATIONS

This paper calls to the government and District Educational Officers in particular to align their efforts towards motivating the teachers and improving teaching-learning and working environment in schools for quality education. Furthermore, this paper recommends further studies to be done in other regions in rural and urban areas to establish a comparable pattern and trend. The Government in collaboration with Non-governmental organizations/private sector should review and formulate sound policies and strategies for empowering the citizens economically so as to have parents with income power to finance children's education. More education to sensitize over importance of education is still needed to urban and rural in particular.

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Incentives in Zimbabwe's education system: Cure or curse?

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ABSTRACT: During the years 2005 to 2008, Zimbabwe plunged into an economic depression. Many social and economic systems were severely shaken, while others crumbled. The education sector was not spared. Many schools closed as teachers left their jobs for the informal sector while others crossed the borders in search of greener pastures. It was against this background that some parents mooted the idea of incentivising teachers as a way of retaining and motivating them. Many teachers were given financial incentives, while in a few cases, incentives were paid in kind. With incentives, some semblance of sanity returned to the education sector. Unfortunately, a few years down the line, the issue of incentives courted so much controversy, poisoning relations amongst stakeholders, especially between parents and teachers. This study assessed how incentives were administered and why they spoiled relations amongst stakeholders. This qualitative study made use of the survey research design where data were collected through questionnaires and interviews from teachers and parents in Chipinge district of Zimbabwe. The study recommended that incentives should be upheld, but the incentive scheme needed to be revisited in order to benefit all stakeholders in the education system.

KEYWORDS: Incentive schemes, teachers' incentives, teacher motivation, parents- teachers' relations, Zimbabwean education system.

1 BACKGROUND OF THE STUDY

Zimbabwe witnessed a severe economic depression between 2005 and 2008. The education sector was severely shaken. A number of schools closed as teachers left either for greener pastures in neighbouring countries or to undertake self-jobs which were rather more rewarding. According to Chagonda (2010), a number of teachers migrated to other countries notably South Africa, Botswana, Zambia, Mozambique, Namibia, Britain, Australia and America. It was estimated that between 2000 and 2008, around 45000 teachers had left Zimbabwe (Chagonda, 2010).

According to *The Educated Horizon* (2013), between 2004 and 2008 teachers' strikes increased, as teachers were clamouring for better salaries and improved working conditions, which the government failed to provide. Work stoppages and teacher-flights into the diaspora resulted in closure of some schools where over 90 percent of students in Zimbabwe were not attending school by October 2008 (*The Educated Horizon*, 2013). Teachers who remained behind were busy engaging in informal activities to earn a living since their salaries had been reduced to rubble (Share, October 2011). As a result, there was no meaningful teaching and learning taking place.

In order to arrest the situation, some parents mooted the idea of giving their children's teachers incentive allowances. According to Adedeji and Olaniyan (2011), the provision of financial incentives to teachers in Sub-Saharan Africa is not uncommon. However, the Zimbabwean scenario was peculiar in that the incentives were paid by parents and guardians of the school children and not by the government. The incentives were either in cash (Rands, Meticals, US Dollars or the British Pound Sterling) or in kind (mealie-meal, maize, chicken, goats, cooking oil or bars of soap). The Ministry of Education, Sport,

Art and Culture also bought the idea. Through Circular Minute 10/2009, the Ministry of Education proposed that 10 percent of school levies could be appropriated as teachers' incentives, and 5 percent as incentives for non-teaching staff. However, this was to be done with the blessing and approval of the School Development Committee in the case of council and mission schools, and the School Development Association, in the case of government schools. This was the basis upon which the incentive scheme was premised.

1.1 STATEMENT OF THE PROBLEM

Incentive schemes came as a blessing to the waning fortunes of the education system in Zimbabwe. Teachers returned to work and meaningful teaching-learning resumed. Regardless of this, a number of stakeholders raised their voices against the system. Parents cried foul, claiming incentivising teachers was the responsibility of the Civil Service Commission, the body that employs teachers and other government workers. Teachers clashed with school heads and the School Development Association/ Committee (SDA or SDC) as well as with non-teaching staff over the local incentive scheme. The study sought to find out how incentives were administered and why they poisoned relations amongst stakeholders, despite their turning around the waned fortunes of the education system in Zimbabwe.

1.2 OBJECTIVES OF THE STUDY

- To establish the nature of local incentive schemes in schools.
- To assess how the incentive scheme was administered.
- To analyse parents' perceptions of the teachers' incentive schemes.
- To assess why the incentive scheme poisoned relations amongst stakeholders in the education system.

1.3 SIGNIFICANCE OF THE STUDY

According to Chireshe and Shumba (2011), very little research, notably by Nhundu (1999), and Chireshe and Mapfumo (2003), has been done in the area of teachers' motivation in Zimbabwe. This study is thus important as it seeks to plug a glaring gap in the area of motivation in general, and teachers' motivation in particular. Since the area of study is almost virgin, the research will contribute immensely to the body of knowledge in educational management, thus laying the basis for future and further research on incentive schemes and their place in motivation of workers. The study will be an eye-opener to a number of organizations, particularly on planning, implementation, control and evaluation of incentive schemes. Organizations which are set to benefit from such a study include schools that are currently engaging in incentive schemes, schools which are planning to introduce such schemes as well as other public and private organisations.

1.4 DELIMITATIONS OF THE STUDY

The research was carried out on secondary schools in Chipinge, a district in Manicaland province of Zimbabwe. Stakeholders in this study refer to teachers, school heads, members of the SDC or SDA, and parents. The study covered the period 2009 to 2013. Incentives in this study refer to monetary and/ or non-monetary incentives introduced in schools in Zimbabwe following the economic slump of 2008.

2 LITERATURE REVIEW

2.1 INCENTIVES AND MOTIVATION

According to Chireshe and Shumba (2011), incentives are external measures that are designed and established to influence motivation and behaviour of individuals, groups or organizations. The incentive theory of motivation emerged in the 1940s and 1950s (Franzoi, 2011). It advances the fact that people are pulled towards certain behaviours as a result of the incentives they would get in return for their efforts (Bernstein, 2011 and Cherry, 2012). They further argue that a person's behavior is motivated by the pull of external goals like recognition, rewards and money. Hockenburb and Hockenburb (2003) view money as an excellent example of external rewards. Another proponent of the incentive theory of motivation is Franzoi (2011) who holds that the value of incentives depends on the worker's circumstances and that the value of incentives changes over time.

2.2 THE RISE OF TEACHER INCENTIVES IN ZIMBABWE

Between 2005 and 2008, a number of teachers left their jobs and either skipped the border or joined the informal sector to make ends meet (Chagonda, 2010). It is estimated that between 2000 and 2008 around 45000 teachers had left the country for greener pastures (Chagonda, 2010). According to Chireshe and Shumba (2011), David Coltart, the then Minister of Education, admitted that Zimbabwe lost more than 20 000 teachers to its neighbours between 2007 and 2008 alone, due to poor remuneration in addition to unattractive work locations, unprofessional treatment of teachers, arbitrary teacher deployment systems, lack of professional development opportunities, political harassment and political victimisation.

According to *The Educated Horizon* (2013), while teachers earned Z\$30 billion (about US\$15 in October 2008), teachers across the Limpopo river (South Africa) earned R8000 (about US\$800). As a result of this development, a number of teachers left the country to ply their trade in countries like South Africa. A number of schools thus closed. *The Educated Horizon* (2013) holds that by October 2008, over 90 percent of students in Zimbabwe were not attending school as many schools had closed. According to Share (October, 2011) teachers who remained behind were busy engaging in informal activities to earn a living since their salaries had been reduced to rubble. As a result, there was no meaningful teaching and learning to talk about.

To support the point above, one notes that there was a fall in Ordinary level pass rates for the years 2005 to 2008. According to *The Educated Horizon* (2013), in 2005 the pass rate was 12 percent, 14, 2 percent in 2006; then 9,85 percent in 2007; 14,44 percent in 2008, and then rose to 19,33 percent in 2009 when sanity in the education system was slowly creeping back. The sudden rise in pass rate between 2008 and 2009 coincided with the introduction of incentives, making many stakeholders believe that there was a strong correlation between the introduction of incentives and improved pass rates.

2.3 THE IMPORTANCE OF TEACHER INCENTIVES

According to McKim and Hughart (2005) incentive schemes are motivational programmes designed to encourage commitment to increasing productivity. Share (November, 2013) holds that parents and guardians have been paying incentives to motivate teachers in Zimbabwe. Share further argues that for parents, incentives were not an end in themselves, but they are a tool to curb laziness, absenteeism and the brain-drain and at the same time to increase productivity. Ssendagire, as quoted by Chireshe and Shumba (2011) holds that a motivated teacher leads to motivated students, and hence, good performance.

Teacher incentives are linked to teacher retention. In Zimbabwe like in most parts of the world, there is a shortage of teachers, since many teachers leave the profession for greener pastures. According to Share (October 2011), over 300 rural and satellite schools in Zimbabwe's 10 provinces were in 2012 manned by unqualified teachers. Although teachers' training colleges were churning out graduates year after year, it was discovered that trained teachers were shunning filling vacant posts because of poor conditions of service, with some preferring to venture into the informal sector as entrepreneurs or skipping the borders to try their luck in foreign lands. In 2012, there were 13 000 vacant teaching posts in Zimbabwe (Share, November 2013). The situation was worse in the Midlands, Mashonaland Central, Matabeleland South and Matabeleland North. This made teacher- retention programmes like incentive schemes a very noble cause.

2.4 IMPLEMENTATION OF INCENTIVES IN SCHOOLS

According to Circular Minute No. 10 of 2009 and Share (November, 2013), incentives were a creation by the government, where the Ministry of Education, Sport Art and Culture proposed that, with approval of parents through the SDC or SDA, 10 percent of school levies could be offered as teachers' incentives, while 5 percent would be given to non-teaching staff. As noted by Nyawo, in many cases, there was no formula used in distributing incentives, as it was arbitrarily set by school heads and the school governing bodies (Share, November, 2013). This led to chaos in the administration of the scheme among stakeholders. Thus, this study sought to assess administration of the incentive scheme and how it poisoned relations amongst stakeholders.

3 MATERIAL AND METHODS

In this study, simple random sampling was used to select 10 secondary schools from the 33 secondary schools in Chipinge district, making a sample size of 30.3 % percent. Thirty teachers (3 from each of the 10 schools) were selected using simple random sampling and were asked to fill questionnaires. Purposive sampling was used to select interviewees who included 10

school heads (one from each of the 10 selected schools), 10 members of the SDC/ SDA (one from each of the 10 schools). Purposive sampling was also used to select 20 parents who responded to questionnaires. This sampling technique was chosen because it helped the researcher to select only those informants adjudged to be knowledgeable about the data sought (Kumar, 2010). Data were coded and categorised into themes and sub-themes. Thereafter data were analysed through thematic content analysis. Descriptive statistics, namely numbers, frequencies and percentages were also used in analysing data.

4 RESULTS

4.1 THE NATURE OF TEACHER INCENTIVE SCHEMES

Teacher incentive schemes in Chipinge district differed from school to school in terms of type (monetary or non-monetary), amounts paid to teachers and frequency of payment. Table 1 below shows this data more succinctly.

Table 1: Incentive figures and frequency of payment

School	A	B	C	D	E	F	G	H	I
Amount (US\$)	160	150	165	200	150	10	100	50	10
Frequency of payment	Termly	Monthly	Monthly	Monthly	Termly	Monthly	Termly	Termly	Termly
Average per month (US\$)	40	150	165	200	37.50	10	25	12.50	2.50

Most schools (90 percent) had monetary incentives, which were paid in United States dollars. Only one school (10 percent) used non-monetary incentives, which comprised of 10 kilogrammes of mealie-meal per teacher per term. While 4 schools paid teachers monthly incentives, 5 paid them at the end of the school term. The monetary incentives differed remarkably amongst schools as it ranged from a minimum of US\$2.50 to a maximum of US\$200 per month.

4.2 IMPLEMENTATION OF TEACHER INCENTIVE SCHEMES

Many schools adopted the scheme since they saw it as a panacea to problems that were bedeviling their schools. For school heads, incentive schemes were as a result of the government circular that authorised such provisions. For the majority of parents (80 percent), incentives were meant to motivate teachers so as to improve school pass rates. As a result, 80 percent of secondary schools in Chipinge district introduced incentive schemes between 2009 and 2010. Only 2 schools introduced them afterwards, that was, in 2011 and 2012.

It was the implementation phase of the incentive scheme that torched some storm. According to the government incentives' circular, parents could give 10 percent of school levies to teachers as incentives. However, this rule of thumb was not respected, either deliberately or unwillingly. According to 60 percent of school heads, schools many times failed to raise enough money to run the schools as well as to raise money for incentives. This was especially caused by parents who at times failed to pay fees on time or totally failed to do so.

Heads of schools expressed that they faced challenges as outlined in Table 2 in implementing incentive schemes.

Table 2: Problems facing school heads in implementing the incentive scheme

Response	Frequency	Percentage
Meeting incentive payment deadlines	2	20
False and unfounded accusations of embezzlement of funds	3	30
Parents demanding the immediate scrapping of incentives	1	10
Lack of adequate financial resources	3	30
No problems in implementing the incentive scheme	1	10
Total	10	100

Meeting the incentive payment deadline was a thorn in the flesh for two school heads. They expressed that under normal circumstances, incentives were payable on the last working day of the month or the last working day of the term. Unfortunately, some parents failed to pay fees on time, resulting in schools failing to deliver their promise to teachers. When this happened, teachers complained and in some cases downed tools. When the same defaulting parents realised this, they accused the school heads of embezzling school funds.

In extreme cases, some parents completely failed to pay school fees. One school head revealed that parents owed the school about US\$32 000 in fees arrears. The situation was compounded by the Basic Education Assistance Module, a programme whereby government paid the fees for poor and disadvantaged students. In many cases, government failed to own up. To make matters worse, the government instructed school heads against expelling fee-defaulting students. The government allowed such students even to write public examinations. Thus, in many cases, rural day secondary schools failed to make ends meet, let alone deliver on their incentive obligations to teachers.

The implementation phase was also complicated by some parents who unprocedurally called for the scrapping of incentives. All school heads interviewed revealed that incentives were adopted when parents and the SDC voted for them. They argued that at first, parents voted for the adoption of incentives at a Parents Assembly meeting. Thereafter, parents' representatives, the SDC voted annually on whether to continue or discontinue the scheme. All school heads claimed that members of the SDC annually approved the continuation of the scheme. Unfortunately, a small group of parents, some of them socially and politically-influential, mobilised other parents and viciously attacked school heads for holding on to incentives, despite the fact that the SDC approved the scheme.

Incentive money was normally paid to teachers by the school bursar in small khaki envelopes. However, at one boarding school, the money was paid to teachers through respective teachers' bank accounts. The head of the school claimed that they had since shifted incentive pay day from the last day of the month and made it coincide with teachers' government pay days. The school head claimed that they had adopted that system for security reasons, as well as for teachers' convenience.

In implementing payment of incentives, it was noted that at some schools, heads deducted some money from teachers' incentives for absenteeism and bunking of lessons. Twenty percent of school heads supported this move claiming that it made teachers more responsible, and at the same time it made schools meet parents' expectations, that of increased pass rates for their children. This contributed to sour relations between teachers and their school heads.

4.3 PARENTS AND TEACHERS' PERCEPTIONS ABOUT INCENTIVE SCHEMES

Parents had conflicting views as regards their perception of incentives. While 35 percent of parents saw incentives as motivational tools, 45 percent of them saw them as the gateway to good pass rates while 20 percent of parents perceived them as bad. Probably, parents' stance for adjudging incentives as bad emanated from their belief that remuneration of teachers was not their responsibility. Ninety percent of parents claimed that it was not their responsibility to assist teachers' employer, the government, to improve teachers' working conditions. It was not surprising that the same number of parents clamoured for the scrapping of incentives.

Some 40 percent of parents felt that it was government duty to pay teachers as well as to cater for their welfare. Thus, they felt short-changed by the issue of incentive schemes. Twenty percent of parents claimed that incentives were supposed to be removed because school heads were embezzling school funds. Another 20 percent of parents felt that teachers were being pampered as if they were the only government workers. Parents felt that there was no need to do more for teachers while the rest of civil servants did not have incentives. Fifteen percent of parents argued that incentives were supposed to be scrapped because parents were generally poor. It should be noted that some 20 percent of parents who participated in this study were unemployed, while 5 percent were pensioners. This implied that some parents were generally ill-equipped to pay teachers' incentives.

Five percent of parents held that incentives were supposed to be removed because parents' ambassadors, the SDC, neglected representing parents' interests in school matters. Instead, the SDC now sided with teachers as they also benefitted from incentive schemes either directly through sitting allowances or through some uncouth means.

The issue that incentives were fairly low was also expressed by teachers. Only six out of 30 teachers claimed that the incentives that they were getting were adequate. This stemmed from the fact that some schools were giving teachers incentives of US\$10 per term or a bucket of maize, worth US\$10 per term.

Although 75 percent of SDC members agreed that the financial position of most parents was not impressive, they argued that the amount charged for incentives was reasonably low and that it was set with the financial status of parents in mind. As

one SDC member argued, the figure was low for rural day secondary schools while it was higher for boarding and urban schools where children of affluent parents enrolled.

Some parents held that incentives made a lot of sense around 2009 to 2010 when teachers' salaries were very low. During that period, teachers' salaries ranged between US\$100 and US\$250. Now that salaries were around US\$400, 10 percent of parents claimed that such salaries no longer warranted supplementation. However, a number of school heads disagreed with parents here. Seven school heads (70 percent) held that although salaries had significantly improved, incentives were supposed to continue until such a time that salaries were above the Poverty Datum Line, which according to one school head, was in early 2014 pegged at US\$502 per month. The school heads' argument was that removing incentives at this juncture was akin to winding the clock back to the pre-2009 era.

It was surprising to note that all members of the SDC claimed that incentives were administered in a transparent manner. However, 40 percent of teachers also took a swipe against school heads and members of the SDC, accusing them of short-changing teachers and at times administering the scheme in an untransparent manner. Two reasons were advanced to explain such shoddy deals and these were dispensing different incentive figures to different teachers at the same school as well as deducting some money for alleged absenteeism. They claimed the money deducted from errant teachers only found its way into administrators' pockets.

While parents largely disapproved incentives, teachers, school heads and members of the SDC vehemently supported the scheme as well as its continuation. Twenty-four teachers (80 percent) held that incentives made them work harder. They saw incentives as motivating, thus the link between incentives and increased productivity. Thus, for such teachers, incentives were good, a claim made by 80 percent of teachers versus 25 percent of parents, 70 percent of SDC members and 70 percent of school heads. The 7 school heads who also claimed that incentives were motivational pointed out to a marked decrease in teacher transfers and absenteeism. Two school heads also pointed out that out of 15 teachers at their schools who were due to go for vacation leave, only one went on leave during the past three years. Senior teachers who were eligible for promotion as deputy school heads and education officers were also shunning the offer, implying that they were a lot happier at their schools.

4.4 STAKEHOLDER RELATIONS

Relations between parents and teachers were largely bad and so were relations between teachers and school heads as well as members of the SDC. Fifty percent of teachers claimed that their relations with parents were bad, 40 percent claimed that their relations with parents were good and 10 percent were undecided. This contrasted with 55 percent of parents who held the view that incentives made relations between stakeholders bad. This showed that parents felt more hard-pressed by incentives than teachers who seemed to have down-played the impact on stakeholder relations because they were beneficiaries of the scheme.

Parents were not happy about the scheme for a number of reasons. Table 3 below shows their main bone of contention, which resulted in strained relations.

Table 3: Parents' reasons for bad relations with teachers

Reasons	Frequency	Percentage
Heads and teachers were now very arrogant	8	40
Pass rates did not improve significantly	4	20
Children chased from school for failing to raise money for incentives despite paying tuition fees	5	25
Teachers were milking the poor and helpless parents	3	15
Total	20	100

Forty percent of parents claimed that their relations with teachers were bad because teachers and school heads were now very arrogant. This arrogance, parents alleged, emanated from the fact that teachers were now treated as a special breed of humanity, unlike what the case was with other professionals. Teachers who received about US\$200 as incentives ended up richer than the average man on the street, and therefore were easily seen as arrogant. This resulted in them becoming unique; buying fancy cars, building houses and generally becoming socially untouchables, as one parent claimed.

It seemed parents brought the issue of arrogance as an excuse. The fact that teachers bought houses and cars cannot be sufficient condition for arrogance. Teachers, like any other professionals, should be able to live decent lives, which include buying or owning houses and cars, among other niceties.

Another bone of contention was the fact that teachers chased away children for parents' failure to pay money for incentives, despite paying tuition fees in full. Parents saw this as extortion and felt such treatment was unfair.

Chasing away students for parents' failure to pay school fees coupled with some teachers resorting to excessive beer-drinking because they had more disposable income, resulted in low pass rates. Some 20 percent of parents argued that since the introduction of incentives, pass rates at some schools had not improved.

Three parents (15 percent) claimed that they now did not see eye to eye with teachers because teachers were undeservingly milking them. It should be noted that some parents who took part in this study were unemployed and others were pensioners. It thus did not augur well for such parents to understand why they had to subsidise a government-employed and government-earning teacher. Teachers also had a bone to chew with their school heads, as well as with chairpersons of the SDCs. Fifty percent of teachers expressed that they were not happy with the manner incentives were administered at their schools.

In small rural day secondary schools, evidence showed that although incentives were supposed to be paid at the end of every month or term, their payment was dependent on the availability of money. If no such money was available, incentives would not be paid. There were no arrear payments. For 5 percent of teachers, this was a bone of contention with their school heads. In some schools, late payment of incentive money was an issue. Fifteen percent of teachers argued that school heads deliberately paid them later than scheduled just to frustrate them. One teacher gave the example of the November 2013 incentives which were paid in February 2014, when the incentives could have made much difference had they been paid during the festive season.

Interviews with two school heads revealed that monetary deductions were effected for absenteeism and bunking of lessons. However, 25 percent of teachers did not take this lightly as they claimed that sometimes deductions were unwarranted and that at times, no clear deduction formula was used or that some teachers' money was never deducted because of their close links to administrators. This reason shared a lot in common with allegations by 3 teachers (15 percent) that while all teachers were said to be equal, some teachers were more equal than others. This stemmed from the issue that some teachers got more money than others.

Teachers who were paid as little as US\$10 per month or per term as incentives claimed that they had for long unsuccessfully bargained for an incentive increment. However, they claimed that their school heads, who had numerous other benefits, as well as their over-stayed SDCs denied them of such. Thus, 15 percent of teachers did not agree with their school heads and SDC members because they did not want to raise the incentive figure to the same levels as those of fellow teachers in neighbouring schools. Such teachers allegedly ended up claiming that school heads and SDC members had formed cartels to sideline teachers as well as to milk parents.

This brought into spotlight the role of the SDC in the school system. As discovered in this research, the SDC seems to be distant from the parents that they purportedly represent, and were more inclined towards teachers, or school heads to be more precise. This study revealed that members of the SDC largely saw incentives as good, incentive figures as reasonable and even approved the continuation of incentives year in and year out. All this seemed to contradict the views and wishes of parents, who elected members of the SDC.

5 DISCUSSION

5.1 THE NATURE OF INCENTIVE SCHEMES

Incentives differed from school to school. While most schools paid monetary incentives, some few schools paid them in kind using basic food stuffs and goods. The use of basic items like sugar, mealie-meal, soap and cooking oil was common during the pre-2009 era when basic items were scarce in Zimbabwe. During that period, barter trade was common as the Zimbabwe dollar had been eroded by inflation. According to Chagonda (2010), inflation peaked at 231 million percent in 2008. During that period, even rentals were paid using basic goods. When dollarisation was adopted, most schools preferred to use the United States dollar. The only school that chose to pay non-monetary incentives, using mealie-meal or maize, was a rural-based and poor school. According to the SDC member of the school, most parents there were farmers and their major source of livelihood was agriculturally-based.

The amount of money paid to teachers as incentives was guided by the government circular which stated that up to 10 percent of school levies could be given to teachers as incentives. In actual fact, the incentive figure differed in line with the financial capability of parents or guardians of individual schools. This confirmed Nyawo's claim that there was no clear formula in the way schools distributed incentives (Share, November 2013). In boarding, mission and urban schools, the incentive figure was higher than that of teachers at rural council day schools. As a result, it was discovered that teacher incentives in the same district ranged from as little as \$2.50 per month and as much as \$200 per month.

5.2 IMPLEMENTATION OF INCENTIVES

Various scholars stated different reasons for undertaking incentive schemes. For McKinney (2000) incentives were for staff retention, while for McKim and Hughart (2005) incentives were meant to increase productivity and for Share (November 2013) they were meant to curb laziness and absenteeism among teachers. In Zimbabwean scenario, all factors stated above applied since the country was smarting out of the economic depression, when staff mobility and attrition rates were high and when teacher motivation was on its lowest ebb due to low salaries and deplorable working conditions. Thus, the introduction of incentives spread like veld fire, beginning in 2009. With the introduction of dollarisation in February 2009 (Chagonda, 2010), teachers (like the rest of the civil servants) were paid a flat US\$100. Schools that introduced incentives got the best teachers. Failure to put in place retention measures like the incentive schemes resulted in some schools going for long periods without qualified teachers. As noted by Share (2013), over 300 rural and satellite schools in Zimbabwe's 10 provinces were manned by unqualified teachers in 2012. Nevertheless, some schools never introduced incentives, confirming Dokora's (Minister of Primary and Secondary Education) assertion that only about 38 percent of schools in the country had introduced incentive schemes by 2013 (Share, October 2013).

5.3 STAKEHOLDER RELATIONS

Although parents initially supported the issue of teacher incentives, they vehemently campaigned against it starting around 2012. Many parents claimed that they were poor and could not continue propping the government in motivating their workers. Ndlovu of the Zimbabwe Teachers' Association argued that sometimes parents faced difficulties in raising fees to the point of selling fruits to raise the money (Wedzel, 2011). Although parents struggled to pay the incentives, they did so grudgingly. According to Wedzel (2011), parents paid incentive money so that their children would not be victimised, but regarded incentives as a form of extortion. This poisoned relations between teachers and parents.

Failure by parents to pay school fees from where incentives were obtained had a chain reaction. When parents failed to pay school fees, teachers accused school heads of embezzling school funds. While teachers' accusations were at times uncalled for, the fact that some school heads misappropriated school funds, with or without conniving with the SDC, remained true. Nyawo of Teachers' Union of Zimbabwe said school heads as well as the SDC's had become corrupt and connived to steal levies, thus, shortchanging teachers in the process (Share, November 2013). Share (2012) reported that the head of one former Group A school in Masvingo was assaulted by parents and pupils over a misunderstanding about incentives. In another incident, the head of a secondary school near Chaka Business Centre in the Midlands Province committed suicide after quarrelling with parents over the alleged abuse of money meant for teachers' incentives (The Herald: 31 October 2013). Parents claimed that they paid \$10 monthly towards teachers' incentives, but teachers never received the money as the school head allegedly converted it to his own use. The fact that some school heads were clandestinely benefitting from the incentive schemes was highlighted by Nyawo, the president of the Teachers' Union of Zimbabwe, who claimed that a number of school heads refused taking up promotional posts because they were getting attractive incentive perks at their respective schools (Share, October 2011).

Relations between teachers and school heads were also bad because some school heads treated their teachers differently. Share (November 2013) argued that some teachers got incentives during school holidays while others did not and at the same time some teachers had their incentives deducted for alleged lateness or absenteeism.

Matters were worsened by the rather ambivalent character of the SDCs. It was not clear whether they still represented other parents or they had other interests to serve. Share (November 2013) noted that a number of SDC chairpersons had very close relations with school heads and they also had overstayed in their positions. In this study, SDC members had served on average 5 years, although they agreed the norm was two years. This raised eyebrows giving the impression that SDC members were clandestinely benefitting from the incentive schemes.

6 CONCLUSION

The issue of incentives is hotly-contested. While it is not new in education or in industry and commerce, it has been peculiar in Zimbabwe as it were parents, and not the government, who paid them. Incentives proved to be the magic wand for with their adoption, normalcy once again dawned in the education sector. As advanced by *The Educated Horizon* (2013), over 90 percent of school-going children were out of school by October 2008. Due to the introduction of incentives, schools which had closed re-opened, teachers who had absconded, returned to their schools and pass rates began to go up. Unfortunately, the issue of incentives made relations amongst stakeholders bad. It pitted teachers against parents, teachers against school heads, teachers against SDC members, leaving one wondering whether or not the incentive scheme was a cure to Zimbabwe's education system or it was a curse which sought to destroy the system from within.

7 RECOMMENDATIONS

7.1 INCENTIVES SHOULD BE UPHELD

Evidence obtained in the research suggested that incentives motivated teachers. Once teachers were motivated, they were bound to work more industriously and diligently and thus benefit students and parents in the process. In this regard, incentives should be upheld until such a time that the government could afford to motivate its workers on its own.

7.2 INCENTIVE FIGURES SHOULD BE WITHIN THE REACH OF THE AVERAGE PARENT

Schools and SDC's should genuinely review downwards incentives which parents felt were exorbitant. Attention should be focused on the average parents' financial capability. Setting incentive figures based on the capability of a few but very rich parents, place untold suffering on the majority of parents who are not well-off.

7.3 TEACHERS SHOULD BE RESPONSIBLE

Teachers needed to play their part. As argued in this study, parents initially recommended the payment of incentives to teachers so that their children would truly benefit academically. However, some parents pointed out in the discussion that at some schools, pass rates had remained low and that some teachers had become drunkards as they have more money to spend. As the saying goes, a good turn deserves another, teachers need to really work hard and make sure that pass rates go up in order to justify the incentives they got.

7.4 THERE IS NEED TO RE-VISIT AND RE-DEFINE THE ROLE OF THE SDC

There is need for the Ministry of Primary and Secondary Education to assist parents by educating the SDCs about their role in the school system. Workshops should be held where members of the SDC are taught their responsibilities and terms of references. This will enable members of the SDC to execute their duties in a more responsible manner and from a more informed position.

7.5 TRANSPARENCY AND ACCOUNTABILITY SHOULD BE THE GUIDING PRINCIPLES IN PAYING INCENTIVES

Once SDC's are put under check, issues of accountability and transparency are naturally catered for. SDC's which are seen as closer to parents are more likely to be viewed as transparent and devoid of corruption. In a similar vein, there is need to improve financial accountability and financial reporting system within schools. Bursars, heads and SDC's should have clean hands and should desist from concealing financial transactions, whether good or bad, from teachers. Once teachers know the true financial position of the school, they are more likely to bear with the school head during times that the school's finances are in the red.

7.6 THE EMPLOYER SHOULD PLAY HIS PART

The government should not sit back and relax and leave everything in the hands of parents. Incentives were introduced in 2009 when the government was heavily weighed down with a plethora of economic challenges. Five years down the line, the government should take a more proactive role in improving the working conditions of its workers. Thus, parents may have to be excused from paying incentives, if and only if teachers' salary and working conditions are improved. This includes the payment of a Poverty Datum Line-related salary and decent transport and housing allowances.

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Dollarisation, Exit Illegal Informal Dealers: How the Adoption of the Multi-currency System hit the Illegal Informal Sector in Zimbabwe

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ABSTRACT: Between 2005 and 2008, Zimbabwe experienced one of her worst economic depressions since attaining independence in 1980. The Zimbabwean dollar was rendered valueless, basic goods disappeared from the shelves, salaries were reduced to rubbles and a number of companies closed. In the midst of this economic malaise, a group of self-styled illegal informal businesspeople rose to prominence. They replaced almost anything that was formal and dictated life in almost all spheres. All this happened at the mercy of the ordinary law-abiding citizens. The government of Zimbabwe tried every trick in the bag to contain these illegal informal activities, for example, by controlling prices, arresting unlicensed informal traders, limiting daily bank withdrawals and licensing trade in foreign currency. All these efforts were unsuccessful. With the dawn of dollarisation in February 2009, the illegal informal sector was swiftly swept off its pedestal. This study envisaged to assess the exploits of the illegal informal traders and how dollarisation hit them right in the face and lastly it assessed their post-dollarisation survival strategies. This qualitative study was informed through use of semi-structured interviews and personal observation. A sample of illegal informal traders was purposely selected from the town of Chipinge in Manicaland province of Zimbabwe.

KEYWORDS: Dollarisation, economic depression, illegal informal sector, profiteering, survival skills.

1 BACKGROUND OF THE STUDY

Zimbabwe's economic fortunes experienced an all-time low between 2005 and 2008. Statistics showed a general downward trend in the fortunes of a once promising economy. For example, annual Gross Domestic Product fell from US\$7billion (1980) to US\$5.7 billion (2000), US\$5 billion (2005) to US\$3.2 billion (2008) (Makochehanwa: 2009). During the same period, the economy experienced negative growth rate from 3.9 % (1980), -7.3 % (2000), -4.0% (2005) and -14.1% (2008) (Makochehanwa: 2009). Kairiza (2012) also provided inflation statistics as 47% (1998), 599% (2003), 7982% (2007) and 231.1 million percent (July 2008). Makochehanwa (2009) holds that inflation at the end of 2008 was 489 billion percent! Zimbabweans were reduced to paupers with the unemployment rate pegged at 90% in December 2008 (Kairiza (2012). In an economy where the highest denomination was by December 2008 a Z\$100 trillion, a teacher's monthly salary of Z\$30 billion was equivalent to US\$15 (Chagonda: 2010). The exchange rate in December 2008 stood as US\$1: Z\$350 000 (official rate) and Z\$500 trillion (parallel market rate) (*The Zimbabwean*: 2013). Basic foodstuffs disappeared from shelves as black market trade flourished. Foreign currency was hard to come by as everyone jostled to get hold of the treasured "green back" (US dollar), the South African Rand or the Botswana Pula. Life was just dull, uncertain and unbearable.

In the midst of these socio-economic throes rose a cliché of self-styled illegal informal traders, commonly referred to as *makoronyera* in contemporary street lingo in Zimbabwe. *Makoronyera* in the small border town of Chipinge made a name for themselves since they had numerous advantages at their disposal. Firstly, Chipinge town lies on the border with

Mozambique. The Zimbabwe-Mozambique border is not efficiently manned by immigration authorities as is the case with borders with countries like Botswana and South Africa. This made the border prone to illicit deals by unscrupulous illegal traders. Secondly, Chipinge lies about 80 kilometres from Chiadzwa diamond mines. Before 2009, illegal mining was the order of the day at the Chiadzwa- Marange diamond mines. Thousands of Zimbabweans engaged in open cast mining, where many a fortune from the illegal venture. This provided the platform from where *makoronyera* pounced with vigour and tenacity.

As observed by Kafuramika (2010), informal businesspeople resorted to short-term, grab and run opportunistic entrepreneurial skills of customer identification, market segmentation and niche carving. As the formal market became more and more inefficient in responding to demand-supply fluctuations, the informal sector thrived, making informal businesspeople instantly wealthy overnight. The case study of Chipinge in this study is a microcosm of several other unscrupulous infamous spots in the country where illicit activities seemed to go on unchecked and almost, with impunity. Some of these centres were the Ximex Mall and Roadport in Harare, Fort Street in Bulawayo and Bahardur Centre in Gweru (Gono: 2008). There was so much speculation in Zimbabwe resulting in Gono, the then Governor of the Reserve Bank, labeling the Zimbabwean economy in 2007 as the 'Casino Economy' (Gono: 2008).

1.1 PROBLEM STATEMENT

In February 2009, the Government of Zimbabwe adopted the multi-currency system (Chagonda: 2010). The country dollarised as it adopted the use of the United States dollar, the South African Rand, the Batswana Pula and the British Pound. The Zimbabwe dollar which had been hardest-hit by inflation was officially abandoned in April 2009 (Gukurume: 2010). This development came as a great relief to millions of Zimbabweans who had great hopes of a return to economic and financial sanity. Inflation was put under check. According to Gukurume (2010) and Kairiza (2012), inflation decreased from 231 million percent in December 2008 to 3 percent in February 2009. Economic stability once again dawned on Zimbabwe, as basic commodities once again were on the shelves and with stable prices (Chagonda: 2010). While everyone seemed to be in celebratory mode, a handful of self-styled illegal informal businesspeople were in deep mourning. This study sought to assess why and how dollarisation easily managed to swiftly sweep illegal informal traders off the pedestal, a cliché which seemed firmly established. *Township Vibes* (2008) claimed that the illegal informal sector was so quick and efficient that one could mistake it for official economic system.

1.2 PURPOSE OF THE STUDY

This study traced how the illegal informal sector eked out a living in the midst of poverty and how dollarisation brought all this to a halt. This aim was addressed under the following objectives;

- To assess factors leading to the rise of the illegal informal sector in Zimbabwe.
- To trace the speculative and illegal activities that the illegal informal sector engaged in.
- To assess reasons why dollarisation swiftly swept off the illegal informal sector.
- To assess the post-dollarisation survival strategies of the illegal informal traders.

1.3 SIGNIFICANCE OF THE STUDY

A research of this scope helps monetary and fiscal policy makers to come up with legislation, education programs and action plans aimed at capacity building and strengthening capabilities of the financial and economic sector. It also enables a fundamental reappraisal of entrepreneurship in the light of the formal and informal systems and its impact on the economy. This helps the government to plan timely and accordingly. Lastly, this study will help entrepreneurs to choose long-term and sustainable development careers as opposed to short-term and unsustainable projects that are detrimental to them and the country in the long run.

1.4 DELIMITATIONS

This study traced the activities of the illegal informal businesspeople and as such, it excludes the activities of informal businesspeople who engaged in legal business dealings. The *makoronyera* under spotlight in this study were the illegal informal businesspeople of Chipinge, a town in Manicaland province of Zimbabwe. Business deals by *makoronyera* are labeled as illegal because they were not licensed by the government.

2 MATERIALS AND METHODS

This qualitative study made use of the survey research design. This design was chosen because it is a good instrument for acquiring information about characteristics, opinions, attitudes or experiences of people (Babbie and Mouton: 2001). Data were generated through semi-structured face-to-face interviews with 17 former illegal informal traders, who were purposively selected in the town of Chipinge. The interview was chosen as a research instrument because it has a high response rate, it gives the researcher room to probe and it can also be configured to generate various types of information (Kumar: 2010). Data were also collected through personal observation, especially on post-dollarisation survival strategies by the former illegal informal traders. Secondary sources, namely journal articles, books and online sources were also used firstly to provide information on literature review and secondly to help triangulate findings from primary research. Data were coded and categorised into themes and sub-themes. Thereafter data were analysed through thematic content analysis. Descriptive statistics, namely numbers, frequencies and percentages were also used in analysing data.

3 FINDINGS AND DISCUSSION

Seventeen respondents were interviewed. Of them 12 were men and 5 were women. Their ages were as follows; two were between 15 and 20 years, ten were between 21 and 30 and five were between 31 and 43 years. This shows that it was mainly the productive age of the population which was involved in such illegal deals in a bid to earn a living.

The majority of the *makoronyera* interviewed held that even though they specialised in a one activity, they still engaged in other activities on a “part-time basis”. This confirms the rationale that in business, it is not safe to put all one’s eggs in one basket. Thus, while 12 *makoronyera* engaged in foreign currency exchange, they also engaged in “money burning” and the sale of imported illicit brews. Three *makoronyera* specialised in the buying and selling of fuel on the black market. Two of the five women in the study engaged in illegal imports of basic food stuffs from neighbouring countries like South Africa and Botswana.

While the name *makoronyera* has been loosely used to refer to all hoodlums in this study, these illegal informal traders were better known by other names in line with their areas of specialisation. Those involved in money changing were coined *mamanichenja* (money changers). Those involved in money burning were coined *vanamabhena* (the burners) or *ndimbandimba* (bulky). Women involved in foreign currency exchange were dubbed *Mapostori* (Apostles) in line with the white regalia they adorned for identification purposes. Women who imported cooking oil, sugar, soap and other basic foodstuffs were dubbed *Vanamai Messinah*. They were so named after Messinah, a town in South Africa, which is close to the South Africa- Zimbabwe border, where most basic foodstuffs were procured by Zimbabweans for resale back home.

3.1 ECONOMIC ACTIVITIES THAT THE ILLEGAL INFORMAL TRADERS ENGAGED IN

The major pre-occupation by the illegal informal traders included foreign currency exchange, ‘burning’ money, illegal sale of fuel and basic food stuffs and the unlicensed sale of banned potent liquor. Table 1 shows the economic activities that the illegal informal traders engaged in.

Table 1: Economic activities that the illegal informal traders engaged in (n = 17)

Group	Pseudonym	Activity	Number
Foreign currency exchangers	Mamanichenja	Sale of foreign currency	4
Money ‘burners’	VanaMabhena	Exchange of hard currency for Zimbabwe dollars using the RTG system	5
Potent drink pushers	Ndimbandimba/ makoronyera	Sale of unlicensed potent liquor imported from Mozambique	3
Black market fuel dealers	Madhiziri	Illegal sale of fuel on the black market	3
Unlicensed basic goods importers	VanaMai Messinah	Sale of unlicensed imported basic goods on the parallel market	2
Total			17

3.1.1 FOREIGN CURRENCY EXCHANGE

Four illegal informal businesspeople specialised in foreign currency exchange. They bought US dollars, Mozambican Meticals, Botswana Pula and the South African Rand and resold them at higher rates. Capital flight was commonplace. The little foreign currency anyone had soon found its way outside the borders of the country where basic goods could be obtained. While banks did not have the hard currency, the informal businesspeople had it. A number of factors contributed to scarcity of foreign currency in Zimbabwe between 2005 and 2008.

Firstly, the Land Redistribution Programme which was started in 2000 resulted in very low agricultural production. Zimbabwe is an agro-based economy, meaning to say a fall in agricultural produce and subsequently, exports, resulted in very little foreign currency inflows. The European Union imposed sanctions on Zimbabwe in 2002. This resulted in massive loss of markets for Zimbabwe, be it for agricultural produce, mineral exports or finished and semi-finished goods. Lastly, the little foreign currency reserves in the country got depleted as they were used to buy basic imports like food, spare parts, machinery and other basic goods which could no longer be obtained locally.

Given the scenario that foreign currency could not be obtained from banks, where the exchange rate was reasonable, it flooded the parallel market where the exchange rate was very high. Many explanations have been given to explain the source of the foreign currency. Two respondents argued that they procured it from the illegal sale of diamonds at Chiadzwa. It should be noted that most valuable products were by 2007 sold in foreign currency. One respondent allegedly claimed that they obtained the foreign currency from senior government officials. During the money-printing madness era, it was common to find agents with loads of trunks of the newly printed currency at the borders where they would use it to buy foreign currency weeks before the new currency was officially launched in the country. Yet another respondent claimed that they obtained the foreign currency from the basic goods they sold. Once they sold something in Rands, they “burnt” the Rands into trillions of Zimbabwe dollars from where they exchanged it for more Rands.

3.1.2 MONEY ‘BURNING’

The majority of informants engaged in money transfer business. Five informants (29 percent) perfected the art of transferring hard currency for Zimbabwean dollars through the bank system. Illegal traders bought hard currency from members of the public using Zimbabwe dollars. However, the transaction was paid for through bank transfer by the buyer to the seller. The Real Transfer Gross Settlement (RTGS) system came as a great relief to Zimbabweans as cash was no longer forthcoming from banks as people wanted. People began to buy goods from shops using RTGS. Even school fees were now paid through RTGS. With trillions of Zimbabwean dollars in their accounts, sellers could now afford to buy goods from suppliers through the RTGS system. They could also afford to pay for school fees, without handling the physical money.

According to one respondent, many “burners” and their customers who engaged in the deal during its inception made a fortune. He gave the example of a man who bought a 25 tonne-load of building material after having burnt only US\$500. Many companies during early 2008 still honored the Zimbabwe dollar. The government also compelled them to honour the Zimbabwe dollar, and failure to do so could result in serious legal reprimand. A number of the respondents claimed to have bought both movable and immovable properties during this era. They also expressed that their lifestyle changed overnight and some transferred their children to boarding and private schools. Remember, a term’s boarding fee of Z\$500 billion could be catered for by “burning” just US\$20!

The system soon attracted many people until such a time that money burning was not only the talk of town, but also the major pre-occupation. As one *goronyera*, (singular form for *makoronyera*) put it, “You had to be in it. It was either you were a ‘burner’ or a ‘burnwa’”. Burner referred to the one who bought the hard currency in return and paid for it using bank transfers of worthless Zimbabwe dollars. “Burnwa” referred to the one who was burnt, remember this individual would have exchanged some hard currency in return for worthless trillions of Zimbabwe dollars. When the government of Zimbabwe discovered that the system was now grossly abused, it abolished the RTGS system and replaced it by the cheque system. However, by this time, many bank account holders had balances they could hardly name. Some had trillions, others quintillions and others sexillions. This money has remained frozen in people’s accounts to this day.

3.1.3 SALE OF FUEL ON THE BLACK MARKET

Three informants (18 percent) engaged in the sale of fuel on the black market. Fuel was one of the scarcest product on the market in Zimbabwe by 2008. It was almost absurd for one to look for fuel at the gas station. The only time fuel was available at the gas stations, long and winding queues were the order of the day. One could spend up to 12 hours to be served. Thus, even if fuel was available there, people preferred to look for fuel “kumagamu” (at the gum trees), where one

could access the precious liquid within minutes. According to *The Living Zimbabwe* (2013), even renowned organisations like the Harare City Council in 2005 admitted that they were buying fuel on the black market, for them to keep going.

Makoronyera who specialised in fuel deals, also known as “Madhiziri”(diesel) gave various theories pertaining to the source of the fuel. Two of them claimed that they obtained the fuel from “magonyeti”. Magonyeti is a Zimbabwean coinage for haulage trucks. Haulage trucks that came into the country came with drums of fuel as reserve for their consumption. They were allowed this quota into the country as it was a known fact that Zimbabwe was dry. Haulage truck drivers sold this fuel at very low prices to their clients. One had to simply wave down an approaching haulage truck using a 20 litre container, and the deal would begin, said one *madhiziri*. They in turn sold the fuel in foreign currency and at exorbitant prices to desperate motorists.

One illegal informal trader, who operated on a medium scale basis, claimed that he obtained the fuel from neighbouring countries. He imported the product in large drums. Although unlicensed importation of fuel was prohibited, he and his peers bribed immigration officials, in order to bring the product home. According to one *madhiziri*, one 120 litre drum of petrol could fetch a profit of US\$200. Under normal circumstances, he used to import 5 drums at a go. Before 2008, retailers could not sell their products in foreign currency. In late 2008, companies had to apply for authorisation to sell in foreign currency. Before such authorisation, licensed fuel dealers officially imported fuel, but went on to sell it on the black market, where they made handsome profits. They engaged the services of various *madhiziri* who repackaged the product in smaller quantities which was sold at *kumagamu*. A whole 5000 litre consignment of fuel could be sold this way!

3.1.4 IMPORTATION OF ILLICIT BREWS

Three illegal informal traders specialized in the sale of the banned and potent liquor procured from neighbouring Mozambique. As companies folded and closed or restricted operations, the beer industry was not spared. Clear beer became very scarce. A market niche was therefore born for the unscrupulous *makoronyera*, who seemed ever alert to new opportunities. Liquor imports from Mozambique included Zed, Lawidzani and Knock out. These spirits had been blacklisted by the Government of Zimbabwe for they were deadly, as their alcohol volume was said to be above the authorized maximum of 40 percent. Two respondents confessed seeing two imbibers collapsing and dying after taking these potent drinks.

The greatest market for the Lawidzani was the Chiadzwa diamond fields. As one respondent put it, Lawidzani was like water to *magweja* (illegal male diamond miners) and *magwejelini* (female miners). Since illegal miners made a fortune from their trade, they many times had the money to buy such spirits and in large quantities. The spirits were mainly obtained from Espungabera, a Mozambican town about 40 kilometres from Chipinge. After skipping the border through undesignated points, the spirits were mainly shipped to Chiadzwa overnight when there were no police roadblocks.

3.1.5 ILLEGAL IMPORTS OF BASIC FOODSTUFFS

Two women in this study specialised in the unlicensed importation of basic products. They imported cooking oil, sugar, soap, flour, rice and even bread from neighbouring countries, which they then sold in Zimbabwe at exorbitant prices, and in foreign currency. Although some products were obtained from Mozambique and Botswana, the bulk of them came from Messina, South Africa. This resulted in women engaging in this trade being labeled *Vanamai Messinah* (women of Messina).

Vanamai Messinah replaced retail chains like TM and OK in importance. While large supermarket chains lined their shelves with tissue paper and Protector condoms, these women who operated small shops or from their homes had everything that an average consumer would want. They formed syndicates with bus drivers and conductors. Bus crews assisted them in evading immigration authorities and formalities. This enabled them to bring into the country large quantities of goods which they sold at high profit margins. One woman confessed that even immigration and police officers joined and assisted them in return for some kickbacks. Muzvidziwa (2005) observed that in many cases, it is women who engaged in cross-border trade as a means to earn a living. He however, bemoaned incidences of corruption involving women and immigration authorities, some of which could be attributed to sexual favours.

3.2 THE EFFECTS OF DOLLARISATION ON THE ILLEGAL INFORMAL DEALERS

In the midst of such economic mess that the country dollarised in February 2009 (Chagonda: 2010). According to Schuler (2005), dollarisation is a situation whereby a country has no locally issued currency and officially uses the currencies of other

countries and the currency need not necessarily be the United States dollar. According to Mutengezanwa et al (2012), the advantages of dollarisation include financial and monetary integration, low inflation, lower interest rates, reduced transaction costs, economic integration, sound financial system and economic policy credibility. Nonetheless, for the illegal informal dealers, these advantages translated into disadvantages as with dollarisation, liquidity challenges and deflation and some other unfavourables, began to set in.

Dollarisation was a slap in the face for most *makoronyera*. Dollarisation meant that every transaction was now officially done in foreign currency. Even salaries of government workers were from February 2009 paid in foreign currency. People began to open foreign currency accounts. This meant everybody had foreign currency and *makoronyeras'* world was doomed. All but one illegal informal dealers' businesses collapsed. When this happened, *makoronyera* were left exposed. The table below shows how different illegal informal traders responded to the harsh effects of dollarisation.

Table 2: How different illegal informal traders responded to the harsh effects of dollarisation (n = 17)

Response	Frequency	Percentage
Returned to their formal jobs	5	29
Sold cars to make ends meet	2	12
Moved from low to high density lodgings	1	6
Failed to pay house mortgages	1	6
Divorced	1	6
Went to teachers' college	2	12
Became hopeless vagabonds	2	12
Became commuter omnibus driver	1	6
Became commuter omnibus conductor	1	6
Business expanded and boomed	1	6
Total	17	100

One *goronyera* who was caught by dollarisation in the middle of a housing mortgage deal failed to honour his payments and the house was gone. He had paid US\$4000 deposit for a house in Gaza in Chipinge and hoped to pay the balance of US\$2000 after two or three escapades. Thus, when dollarisation dawned, he failed to raise the balance and the deal was reversed. One other *goronyera* soon found the going tough. He had to move from his Low Density lodgings to a 2-roomed house in Gaza high density suburb. He also withdrew his two students from Chipinge Primary School (a former Group A School) to Matione Primary School in Gaza high density suburb. Two informants sold their cars to make ends meet. One of them claimed that he had two children at Midlands State University, both of them in their final years. Thus, when dollarisation reversed his lucrative trade, he failed to raise money for university tuition. Thus, he had to sell his cars at giveaway prices in order to raise university fees for his children.

For many, the flamboyant lifestyle was a thing of the past. Even the bellies that had earned them the name *ndimbandimba* (bulky) were soon flat. One *goronyera* who pursued a lavish lifestyle, marrying three women during the height of the economic recession soon found out that true love was not hinged on earthly riches. Two years after dollarisation, his two younger wives abandoned him as he could not afford to continue spoiling them.

As argued by Chagonda (2010), people who participated in money exchange and burning exercise included professionals who had abandoned their jobs for the lucrative trade. When dollarisation proved that it was there to stay, many reached for their wardrobes and cabinets for their certificates, diplomas and degrees and started to look for formal employment. The Government of Zimbabwe extended an amnesty to those professionals who had unceremoniously left to rejoin the public service. A number of teachers, nurses, university lecturers and agricultural officers, to mention a few, rejoined the public service. Between February 2009 and May 2010, the Government of Zimbabwe only paid its workers a flat US\$100, which was later raised to US\$150 in 2011, regardless of grade or rank. For the former *makoronyera*, this was a better deal as their empire had collapsed. Five of the former *makoronyera* contacted in this study returned to their professional jobs, 4 of them as teachers and 1 as a nurse.

Those who had no formal and professional qualifications found the going tougher. Two of them went to Mutare Teachers' College from where they have since graduated as qualified teachers. Another illegal informal dealer became a commuter omnibus driver while another one became a bus conductor. It was rather sad to note that the 2 former *makoronyera* lost all hope with life and had transformed into real vagabonds. They now survived by hook and crook as they were now *Vanasesere* (unqualified people who take up any job on offer). Such jobs include loading goods on bus carriers, maintaining

grounds, hedges and lawns, fetching water, fetching firewood, doing some gardening work and selling airtime, to mention a few.

For one *Mai Messinah*, dollarisation came as blessing for after self-introspection, she discovered who she really was. After the dawn of dollarisation, her business, like those of her peers, nose-dived to an all-time low. However, she quickly adjusted. She built proper structures and went on to license her retail shop. Through hard work and sacrifice, her business has expanded. She now boasts of three retail shops in Chipinge and several flea market stalls.

4 CONCLUSION

During the period 2005 to 2008, a handful of Zimbabweans distinguished themselves as the well-to-do when millions were languishing in poverty. They engaged in a number of illegal activities and even established structures parallel to those of government. For four years, fiscal and monetary authorities in the country tried every trick in the bag to contain the illegal informal traders, but without success. They seemed to have lost the battle until February 2009 when dollarisation was adopted. Unscrupulous dealers soon found themselves out of business. Without being compelled to fall in line, they adjusted on their own and many of them reverted back to the formal system. Unfortunately, some of them failed to adjust and as such, transformed into real destitutes.

5 RECOMMENDATIONS

The study proposes the following recommendations:

- Illegal activities do not pay, especially in the long run. Thus, people should learn to live honest lives where they pursue legal careers. Economies should instill in people a work ethic which highlights that there are no short cuts to success in life.
- Economic rot in society is self-destructive. This study has shown that some illegal informal traders had lost hope with life and had become real vagabonds. While another informant divorced, another lost a house. *The Zimbabwean* (2008) also highlights that the whole speculation process further destroyed the economy as most of the money in people's bank accounts was artificial.
- When faced with economic challenges, the government should put in place robust, long-term and effective macro-economic measures. For example, it should desist from controlling the economy and let free market forces operate. Price controls by the government of Zimbabwe resulted in hoarding of basic goods, a rise in price of basic goods and subsequently, shortages of these basic goods on the market.
- The government of Zimbabwe should end its isolationist stance and improve relations with the international community, monetary institutions and donor agencies. Such agencies can be of great assistance in times of crisis.

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AN EXPLORATION OF THE INFLUENCE OF PERSONALITY TRAITS ON SUICIDE IDEATION AND ATTEMPTS IN PUBLIC SECONDARY SCHOOL STUDENTS IN KENYA

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ABSTRACT: The present study was prompted by the observation that there was very high prevalence of suicide ideation and attempts among students in secondary schools in Kenya. The objective of the study was to explore the influence of personality traits on suicide ideation and attempts among learners in public secondary school students in Kenya. The target population comprised of the students population (5940), Guidance and Counseling teachers (29), teachers (289) and the sub county educational officers (8). Overall, the sampled respondents were 300 covering all the categories of the study comprising 260 students, 8 sub county educational officers and 28 class teachers and 4 heads of Guidance and Counseling. The data collection instruments comprised of questionnaires and interviews schedules. The instruments were piloted and tested for reliability at 0.7 reliability coefficients while validity was established by seeking assistance of supervisors and other experts. The collected data was analyzed using thematic analysis for qualitative data while quantitative data was analyzed using both descriptive and inferential statistics like frequency tables and the regression model. The findings established that the study components comprising personality. The findings from the regression analysis yielded the value of $R=0.848$ which means the variation in the number of suicide ideations and attempts are explained by the study components. Further, the computed value of $R^2=0.72$ demonstrates a strong positive relationship of the study variables and the incidences of suicide ideation and attempts in Kenya.

The study recommends the establishment and strengthening of Guidance and Counseling programmes, training guidance and counseling teachers to reach out to the students, fostering life skills among the students to cope with the day to day challenges, enhancing the co-curricular activities to keep the students busy and change of behavior attitudes among the students.

KEYWORDS: Personality Traits, Suicide, suicide ideation, suicide attempts, pervasiveness, Guidance and Counselling (G&C).

1 INTRODUCTION

The incidence of suicide is attributable to many causes. In recent times, the relationship between HIV/AIDS and Suicide has become an area of concern and has been noted in several epidemiologic studies. Numerous case reports support the trend of increased suicide risk in persons infected with HIV/AIDS and are attributable to a variety of medical, neurotic, psychiatric factors which contribute to the death of a HIV/AIDS patient. For instance, a 27 year-old man committed suicide two years after he received a diagnosis of AIDS. On 24th August 2010, another student of a university in Kenya attempted to commit suicide after she found out she was living with HIV (New Vision 2011). Ma-zok (1988) observed that the association between HIV/AIDS and the risk of suicide was found to be increased thirty-six fold. Further, a study by Cote & colleagues (2005) noted that there is a 7.4 fold higher risk for suicide among men with AIDS compared to that of the general population.

The causes of suicide ideations and attempts are also attributable to psychosocial causes among the students which inter alia include personality circumstances, family settings, schools setting and societal environment all which bring stress. In regard to stress, it is instructive to note that the borderline between stress and depression is fairly thin with some literature using the terms interchangeably. The apparent link points to the direction that stress degenerates into depression. Stress is

mainly a psychological manifestation of some discontent and denial tendencies. Stress related suicidal attempts could be attributed to a prospective escape from situations that seemed impossible to deal with or to get relief from bad thoughts or feelings. Some feelings of being unwanted, unloved, victimized or being a burden to others can contribute to the increase of suicidal thoughts. Suicide could be interpreted as a "cry for help" and attention or an expression of despair and wish to escape rather than a genuine reason to die (Kandels, 1991).

Closely related to stress is depression, which refers to a state of low mood and aversion to activity, it is also an extreme case of stress. It is externally epitomized by sadness, helplessness and hopelessness among students. Feelings of hopeless and/or helplessness are shared among those who are clinically depressed. They are also some of the most frustrating feelings that depressed individuals' experience. Research on the cognitive theory of depression has shown that people who are depressed struggle with feelings of hopelessness and helplessness more so than people who are not depressed (Sacco & Beck, 1995). A sense of hopelessness reflects a negative view of the *future*. This includes expectations of personal dissatisfaction, failure, and a continuation of pain and difficulty-- a belief that nothing will get better. Emotional state of helplessness reflects a negative view of the *self*. Depressed individuals view themselves more negatively, their egoism suffers, and they have little or no self-confidence. They do not believe they have any control or that they can help themselves to feel better. They may have an urge to give up and think, "What's the use?"

2 STATEMENT OF THE PROBLEM

At least 100,000 adolescents die by suicide every year and among youngsters aged 15 to 24 years, suicide is the third cause of death. Moreover, the real number of suicides is higher than the statistics show and suicide in adolescence is often underestimated (Newsbulletin, 2012). According to UNICEF (2011), depression is the single largest contributor to the global burden of disease for people aged 15–19 and suicide is one of the three leading causes of mortality among people aged 15–35 years. Globally, an estimated 71,000 adolescents commit suicide annually, while up to 40 times as many make suicide attempts (UNICEF, 2011).

In a study on Prevalence and Correlates of Suicidal Ideation Among Students in sub-Saharan Africa, which included Kenya, Palmier (2011) found that with a large percentage of the population in many sub-Saharan countries being under the age of 18, the prevalence of suicidal ideation and the rate of deaths attributed to suicide will continue to be a serious public health concern unless contributing factors are established and proper programs aimed at suicide prevention are implemented. To further underscore the importance of the study area, Staff (2008) observed that each suicide leaves an average of 6 intimately affected by the death either as a spouse, parent, significant other or sibling.

3 PURPOSE OF THE STUDY

The purpose of this study was to explore the influence of personality traits on suicide ideation and attempts in public secondary school students in Kenya

4 OBJECTIVE OF THE STUDY

The study sought to accomplish the following objective:

To explore the influence of personality traits on suicide ideation and attempts in public secondary school students in Kenya.

5 LITERATURE REVIEW

It is important to ground on the risk factors associated to the personality characteristics of an individual. McLean, Maxwell, Platt, Harris, & Jepson (2008) in a study to describe and assess current knowledge regarding the societal and cultural factors associated with increased incidence of suicide found out that a wide range of personality traits is implicated in higher risk of suicide, including hopelessness, neuroticism, extroversion, impulsivity, aggression, anger, irritability, hostility, and anxiety. In addition, they assert that there may be increased suicide risk associated with particular individual/personality factors including hopelessness, neuroticism, extroversion, impulsivity, aggression, anger, irritability, hostility, and anxiety; attention deficit hyperactivity disorder (ADHD) and low problem-solving skills (McLean *et al.* 2008).

Adolescence is a critical phase in life and has its influence on suicide ideation and attempts. Davidson & Linnoila (1991) observe that it is a phase is characterized by emotional, physical, psychological and social dynamics that seemingly defy

natural law. It is a phase marooned in erratic up and downs in both biological and social setting of a teenage (Davidson & Linnoila, 1991). Scientifically, it is attributable to the gradual release of chemicals in the brain called neurotransmitters that triggers systemic imbalance in the lifestyle of teenagers. The resultant view of life that emanates from this state may and regrettably so, lead to suicide ideation (Davidson & Linnoila, 1991).

A survey by the biennial Youth Risk Behavior Survey (YRBS) data for adolescents found out that during the preceding 12 months, 28.6% of high school students had felt so sad or hopeless almost every day for the last two weeks in a row that they stopped doing some usual activities, 16.9% of students had seriously considered attempting suicide, 8.5% of students had already attempted suicide on or more times and 2.9% of students nationwide had made a suicide attempt that had to be treated by a doctor or nurse (Grunbaum *et al.* 2004). According to Grunbaum *et al.* (2004), adolescents suffer from a feeling of loss for the childhood they must leave behind and undergo an arduous period of adjustment to their new adult identity and yet the society alienates them by denying them their rights, responsibilities and privileges of adulthood. They are no longer children yet they are not accorded adult privileges to express their sexuality and hold a place in the work force (Davidson & Linnoila, 1991). One cognitive explanation for suicide suggest that when adolescence lack adequate problem-solving skills and face stress provoking problems, they develop an attitude of hopelessness and attempt suicide as they see no other alternative. Holmes (1991) describes these cognitive processes as rigid where adolescents decide on suicide as a solution to their problems and they will not consider other solutions. Adolescents are faced with many challenges that can culminate into suicide.

6 RESEARCH METHODOLOGY

In achieving the objective of the study, the researchers used the mixed research method which is an approach of inquiry that combines both qualitative and quantitative forms. The two approaches are used so that the overall strength of the study is greater than either qualitative or quantitative research as stated by Creswell & Clark (2007). Qualitative design employed in this study was phenomenology. The objective of qualitative phenomenological research is to describe a "lived experience" of a phenomenon. "Investigators search for essentials, invariant structure (or essence) or the central underlying meaning of the experience and emphasize the intentionality of consciousness where experiences contain both the outward appearance and inward consciousness based on memory, image and meaning" (Creswell, 1998). The design allowed the researchers to carry out an in-depth focus on the meaning of suicidal ideation and attempts in area of study. It was also used to explore the phenomena of suicide and to capture individual thoughts, feelings experiences or interpretation of meaning and process.

Previous research has shown that hopelessness was related to adolescent suicidal ideation. Several studies found that there was a significant relationship between hopelessness and suicidality, Cukrowicz, Rutter and Warman (2004). Hopelessness was found to be the strongest of cognitive variables in concurrent association with suicidal ideation (Stewart, 2005). Researchers also reported that hopelessness was the best predictor of suicidal ideation in students and adolescents experiencing bipolar disorder Hallfors (2006), Hallfors (2006), and Smith (2006).

7 RESEARCH FINDINGS

7.1 PERSONALITY TRAITS ON SUICIDE IDEATION AND ATTEMPTS

Under this variable, the study sought to establish the influence of personality characteristics on suicide ideation and attempts in public secondary schools. The variable was operationalized into hopelessness, resentment, withdrawal, low esteem, adolescence crisis and loneliness which were measured using the likert scale.

7.2 RATINGS OF HOPELESSNESS ON SUICIDE IDEATION AND ATTEMPT

On the objective of personality trait on suicide ideation and attempt hopelessness was a variable of interest to the researchers. The study showed that the major cause of suicide ideation and attempts was hopelessness. The findings established that 52% strongly agreed that they experienced hopelessness in their lives while 20% moderately agreed. A cumulative rating of 72% implies that this was a general phenomenon in the lives of the respondents. In relation to gender the ratings were 54.4% among the boys and 45.6% among girls. This idea was confirmed by the teachers in the focused group discussions and interview guide for the G&C teachers who observed that students experience periods of hopelessness in their lives.

In this study the indicators of hopelessness as a personality trait were worry, fearfulness, headaches, disturbed sleeping patterns and thoughts of suicide. Suicidal ideation symptoms may include unintentional weight loss, feeling helpless, feeling alone, excessive fatigue, low self-esteem, presence of consistent excessively talkative, intent on previously dormant goals, feel like one's mind is racing. The onset of symptoms like these with an inability to get rid of or cope with their effects, a possible form of psychological inflexibility, is one possible trait associated with suicidal ideation. They may also cause psychological distress, which is another symptom associated with suicidal ideation. Symptoms like these related with psychological inflexibility, recurring patterns, or psychological distress may in some cases lead to the onset of suicidal ideation. Other possible symptoms and warning signs include hopelessness, insomnia, depression, severe anxiety impaired, concentration, psychomotor agitation and panic attack, (Valensein et al 2012).

This concurs with Shneidman (1996) that the common emotion in suicide is hopelessness and helplessness where a pervasive sense of hopelessness defined in terms of pessimistic expectations about the future is even more important than other forms of negative emotion such as depression in predicting suicidal behavior. The suicidal student is convinced that absolutely nothing can be done to improve his or her situation, no one can help.

Table 1: Rating of hopelessness among boys and girls in percentage

Indicators	Boys	Girls
Worry	65	35
Fearfulness	45	55
Disturbed sleep patterns	59	41
Headaches	51	49
Thoughts of suicide	52	48
Mean	54.4	45.6

7.3 RATINGS OF RESENTMENT ON SUICIDE IDEATION AND ATTEMPTS

Based on the relationship of personality trait and suicide ideation and attempts, resentment was rated second. According to the researcher, the indicators for resentment were rejection, depression, being confused and angry. Unrealistic academic, social, or family expectations can create a strong sense of rejection and can lead to deep disappointment. The findings were that of 52.8% of boys and 47.2% of the girls experienced resentment. Results from the focused group discussions and the interview schedule gave emphasizes of the same. They were anonymous on the students' feelings of rejection, depression, being confused and angry when things went wrong at school or at home. This is also confirmed by <http://www.mentalhealthamerica.net/conditions/depression-teens> that many young people feel that life is not fair or that things "never go their way." They feel "stressed out" and confused. To make matters worse, teens are bombarded by conflicting messages from parents, friends and society.

Today's teens see more of what life has to offer both good and bad on television, at school, in magazines and on the internet. The argument is that sometimes teens feel so depressed that they consider ending their lives. The study shows that suicide attempts among young people may be based on long-standing problems triggered by a specific event. Suicidal adolescents may view a temporary situation as a permanent condition. Feelings of anger and resentment combined with exaggerated guilt can lead to impulsive, self-destructive acts.

Table 2: Indicators of resentment in percentages

Indicators	Gender		Total
	Boys	Girls	
Rejection	44	56	100
Anger	58	42	100
Confusion	48	52	100
Disappointment	54	46	100
Sadness	60	40	100
Mean	52.8	47.2	

7.4 RATINGS OF DEPRESSION ON SUICIDE IDEATION AND ATTEMPTS

On the personality trait of depression the researchers were mainly concerned with feelings of sadness, insomnia, self-injury, frequent tearfulness and disinterest in class work as indicators of the trait. Findings indicate that 45% boys and 55% girls experience depression. The interview schedule from the sub county educational officers confirmed that the issue of depression has become common in the district. The heads of G&C commented that a number of students are depressed due to situations that they are unable to cope with from home and school. Research indicates that teens with depression may socialize less because prolonged feeling of sadness is accompanied by loss of concentration and isolation. Depression will lead to loneliness because a depressed person loves isolation (which of course breeds lonesome feelings). In a similar vein, loneliness also leads to depression because one may feel sad and depressed when lonesome feelings persist, Joiner (2010).

Table 2: Indicators of depression in percentage

Indicators	Gender		Total
	Boys	Girls	
Sadness	41	59	100
Insomnia	46	54	100
Self-injury	48	52	100
Frequent tearfulness	47	53	100
Disinterest in classwork	43	57	100
Mean	45	55	

7.5 RATINGS OF SELF-ESTEEM ON SUICIDE IDEATION AND ATTEMPTS

Self-esteem reflects the evaluative component of self-concept. Indicators of self-esteem were feelings of self-worth, self-acceptance, self-respect, worthwhileness and competence. Ratings on self-esteem accounted for 57.6% for boys and 42.4% for girls. The study shows that girls suffer from low self-esteem therefore being more vulnerable to suicidal ideation and attempts. The focus group discussion from the teachers lamented that many students suffer from low self-esteem especially girls and it affects their level of concentration and participation in class and even co-curricular activities. Many girls are overwhelmed by the issue of imaginary audience. People with high self-esteem tend to be satisfied with their lives and hold a positive attitude toward themselves. They display a genuine sense of self-acceptance, self-worth, and self-respect (Rosenberg, 1985).

In contrast, people with low self-esteem evaluate the self as unworthy and incompetent. Thus, self-esteem can have a profound influence on a person's cognitions, emotions, and responses to stressful life events. The adolescent with low self-esteem may see life as not worth living and may perceive everyday stressors as overwhelming. Low self-esteem has been found to be important in the prediction of suicidal ideation among high school students (Dukes and Lorch, 1989).

Table 3: Indicators of self-esteem in Percentage

Indicators	Gender		Total
	Boys	Girls	
Self- Worth	58	42	100
Self-acceptance	56	44	100
Self – respect	52	48	100
Worthiness	60	40	100
Competence	62	38	100
Mean	57.6	42.4	100

Self-esteem reflects the evaluative component of self-concept. Self-esteem refers to the global appraisal a person makes of his or her own value as a competent and worthwhile person. People with high self-esteem tend to be satisfied with their lives and hold a positive attitude toward themselves. They display a genuine sense of self-acceptance, self-worth, and self-respect (Rosenberg, 1985). In contrast, people with low self-esteem evaluate the self as unworthy and incompetent. Thus, self-esteem can have a profound influence on a person's cognitions, emotions, and responses to stressful life events. The

adolescent with low self-esteem may see life as not worth living and may perceive everyday stressors as overwhelming. Low self-esteem has been found to be important in the prediction of suicidal ideation among high school students (Dukes and Lorch, 1989). The presence and severity of suicidal ideation in adolescents with affective disorders has been related to low self-esteem (Brent et al., 1986). Low self-esteem is also implicated in suicide attempts made by adolescents (Kienhorst et al., 1990).

8 CONCLUSIONS AND RECOMMENDATIONS

Based on the results that were obtained the findings of the study unearthed the impact of psychosocial factors that perpetuate suicide ideation and attempts in public secondary schools in Kenya. The current trend requires intervention and the study recommends the following:-

Capacity building for the guidance and counseling departments; this should be geared to provision of the requisite support resources for the departments. An important input is their administrative empowerment to ensure the development of proactive programs and delivery systems which are not only deterrent but also have the capacity to drive the process to the root causes. The G&C staff should perhaps be granted reasonable discretion to explore the causes beyond the school environment.

Mainstream G&C into the school curriculum; this complements the capacity building of G&C. The importance of guidance and counseling studies in the normal school curriculum would potentially inculcate at an early age a positive behavioural culture and coping mechanisms in students through the delivery and imparting of quality knowledge and information on the pertinent causes of suicide and other negative behavioral tendencies. The importance of this approach is to bake ready-made adolescents who are well equipped with causes and remedies for any eventual symptoms, tendencies and occurrences. This correlates to White (2013) that school based screening is a strategy that is designed to increase detection and promote help seeking among potentially suicidal youth and given that the majority of young people spend a great deal of time at school, classroom or school wide approaches for identifying potentially suicidal adolescents have been increasingly recommended as important youth suicide prevention strategies

Enhance emphasis on co-curricular activities in school programs and the positive linkage to talent development. In the current school curriculum, most non-academic activities are considered peripheral and therefore attract little premium as they are labeled as non-core activities. Sports and other co-curricular activities are both recreational and potential career fronts. When well nurtured, sporting activities are deterrents to emotional imbalances that escalate to stress and the resultant social maladies. It is incumbent on the policy maker in the education system to recognition that career development can also be achieved through enhancement of the inherent talents in adolescents and can therefore be harnessed with the normal school curriculum. Indeed sports and art are currently very lucrative ventures world-wide.

Develop policy guidelines to address the social needs of the students; the devolved system of governance in the country provides the opportunity to formulate policies that address the unique socio-cultural environments of the schools within the counties without compromising the national identity. The success of such policies should involve wide consultations with the county stakeholders to ensure pooling together, broad coverage and accessibility. The roles of the communities, religious and corporate entities would provide the required synergy.

Management of identified cases; how well attempters are nurtured and mainstreamed back to their peers would doubtlessly have positive ramification on the control mechanisms and approaches fronted to address the menace. Most communities treat suicide attempters or families with suicide history as social outcasts without any meritorious analysis of the underlying causes. This calls for a mind shift and deliberate effort to demystify suicide and accord commensurate attention as given to other social vices bedeviling societies. This is in line with the observation by White (2013) that it is important to develop a locally coordinated, systematic service delivery response network that will ensure that youth at risk for suicide receive timely assessments, effective care, efficient follow up and careful monitoring.

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A RELATIONAL ANALYSIS OF FAMILY HISTORY CONTRIBUTION TO SUICIDE IDEATION AND ATTEMPTS IN PUBLIC SECONDARY SCHOOLS IN KENYA

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ABSTRACT: The present study was driven by high prevalence of suicide ideation and attempts among students in secondary schools in Kenya. The objective of the study was the relational analysis of the family history contribution on suicide ideation and attempts among learners in public secondary school students in Kenya. The study was based on mixed methodology using qualitative and quantitative research designs. The target population comprised of the students population (5940), Guidance and Counseling teachers (29), teachers (289) and the sub county educational officers (8). Overall, the sampled respondents were 300 covering all the categories of the study comprising 260 students, 8 sub county educational officers and 28 class teachers and 4 heads of Guidance and Counseling. The data collection instruments comprised of questionnaires and interviews schedules. The instruments were piloted and tested for reliability at 0.7 reliability coefficients while validity was established by seeking assistance of supervisors and other experts. The collected data was analyzed using thematic analysis for qualitative data while quantitative data was analyzed using both descriptive and inferential statistics like frequency tables and the regression model. The findings established that the study component of family history had a significant contribution to the frequency of suicide ideation and attempts in Kenya. The findings from the regression analysis yielded the value of $R=0.848$ which means the variation in the number of suicide ideations and attempts are explained by the study components. Further, the computed value of $R^2=0.72$ demonstrates a strong positive relationship of the study variables and the incidences of suicide ideation and attempts in Kenya. The study recommends the establishment and strengthening of Guidance and Counseling programmes, training guidance and counseling teachers to reach out to the students, fostering life skills among the students to cope with the day to day challenges, enhancing the co-curricular activities to keep the students busy and change of behavior attitudes among the students.

KEYWORDS: Family History, Suicide, suicide ideation, suicide attempts, pervasiveness, Guidance and Counselling (G&C), District Education Officer (DEO).

1 INTRODUCTION

Although data on suicide is not readily available in Kenya, evidence mainly from the print and electronic media show that the problem is on the rise (CIA, 2011). According to police records, there are more than two thousand suicides recorded cases each year (CIA, 2011). In more specific terms, the 2008 Kenya Police crime report indicated that in 2006, there were 362 suicide cases while in 2007, there were 221 and 266 in 2008 which translated to 20 suicides per month. The number could actually be higher and experts noted that not all cases are reported or documented (CIA, 2011).

Previous suicide attempts may lead to a much greater risk of making a future attempt while a family history of suicide attempts or completed suicide increases a future attempt. Another cause of suicide is the proximal risk factors that put someone at more immediate risk of a suicide attempt. Most people who commit suicide have a combination of the two. Distal risk factors are made of psychiatric diagnosis where depression, bipolar disorder, substance abuse disorders and personality disorders convey the greatest risk.

A previous suicide attempt makes the risk greater, including a family history of suicide attempts or completed suicide (Bearman & Moody, 2004). Proximal suicide risk factors include recent onset of suicidal thoughts where most suicidal thoughts occur within one year of first having suicidal thoughts. Feelings of hopelessness can be an immediate risk factor for suicide, having a suicide plan indicates that the plan is imminent. Many people have to be monitored for suicidality after a recent incarceration. This is in contagion by other recent suicides that includes a well-documented research on suicide either by a friend, peer or media figure, (Bearman & Moody, 2004).

2 STATEMENT OF THE PROBLEM

Reports of persons who have committed suicide in Kenya are alarming and not curved to specific age group (CIA, 2011). The dynamic psycho-social environments and the attendant challenges point to the possibility of a dramatic increase in suicidal behaviour in the coming decade. This is likely to be based on the perceived lifestyles, behavioural patterns, and economic wellbeing and in some instances psychological considerations. However, whether successful or unsuccessful, suicide affects people directly or indirectly and it is estimated that each suicide leaves an average of 6 people intimately affected by the death either as a spouse, parent, significant other or sibling (Staff, 2008). It is also estimated that 80 per cent of the home suicide scenes are cleaned up by a close friend, significant other or a family member and that 75% are likely to commit suicide later on in life (Staff, 2008).

The age bracket of the students in secondary schools lies squarely in the adolescence phase and instructively therefore require preview to cast an appreciation of the salient issues on focus. United Nations defines adolescents as individuals aged 10–19 and effectively referring to those in the second decade of their lives (UNICEF, 2011). Thus defining adolescence as the second decade of an individual's life makes it possible to collect age-based data for the purpose of analysing this transitional period and is in tandem with the scope of this study.

According an article entitled *Suicidal Behaviour in Adolescents* by IASP appearing in the *Newsbulletin for the period October/November 2012*, at least 100,000 adolescents die by suicide every year and among youngsters aged 15 to 24, suicide is the third cause of death. Moreover, the real number of suicides is higher than the statistics show and suicide in adolescence is often underestimated and that suicidal behaviour (fatal and non-fatal) in adolescents is often associated with a psychiatric disorder, and often unrecognized or untreated (Newsbulletin, 2012). The psychiatric disorder is known to run in families, where families with a history of it are more prone to it. This prompted the relational analysis of family history as a contributor to of suicide ideation and attempts among students in secondary schools in Kenya

3 PURPOSE OF THE STUDY

The purpose of the study was to establish the relational analysis of family history as a contributor to of suicide ideation and attempts among students in public secondary schools in Kenya.

4 RESEARCH OBJECTIVE

To establish the relational analysis of family history as a contributor to of suicide ideation and attempts among students in public secondary schools in Kenya

5 LITERATURE REVIEW

The family history of suicide is a key consideration in understanding the incidences of suicide ideation and attempts. Familial suicide can be a function of limitations and genetics. A family history of suicide is a significant risk factor in a young person. Young people tend to repeat the actions of those family members who are close to them. Biological relatives of a suicidal person are six times more likely to attempt or succeed in suicide than one of the adoptive relatives (Suicide Fact Sheet, 2006). Previous suicide attempts indicate that the youth who come from background dotted with suicide cases are potentially faced with great risk of future attempts.

Most people who attempt suicide do not complete suicide on a first attempt. Worse still those who later gain a history of repetitions have a significantly higher probability of committing suicide (Shaffer, 1988). More recent research by WHO proves that there are also indeed cases of depression and suicide on the continent, though there are few African countries that have data about suicidal behavior. This is because social-political, religious and cultural factors in some countries mean that suicide is still seen as a crime and can have negative consequences for the families of the deceased.

There are two major causes of suicide, those that make the person inclined either due to family background or the genetics of suicide and those that make his tendency evident including quarrel with parents, joblessness, divorce and other stressful events in life (Caplan, 1996). There is reliable evidence suggesting that genetic factors play an important role in predisposition to suicidal behavior. Research in the last three decades has concluded that there is a relationship between suicides, fierceness which in turn may lead to suicide attempts. An increasing number of molecular genetic studies have been carried out among cases involving suicidal behavior and the candidate genes thought to be related to suicide like serotonin transporters and serotonin receptors. Genetic factors seem to play a role in 30 per cent -50 per cent of cases with suicidal behavior (Brent, 2005).

6 RESEARCH METHODOLOGY

The researchers combined the Survey and Ex-post facto research designs. The researchers used the survey research design to collect information from a sample of individuals through their responses to questions. Survey research design proved to be an efficient method for systematically collecting data from the sample on personality traits, school set up and prevention programmes on suicide ideation and attempts.

Ex post facto study is a research design in which the investigation starts after the fact has occurred without interference from the researcher. This research design is appropriate in situations where it is not possible or acceptable to manipulate the characteristics of human participants (Cohen, Manion & Morison, 2000). The researcher used the research design because it was assumed that the psychosocial factors had already influenced the subjects on suicide ideation and attempt.

7 RESEARCH FINDINGS

7.1 FAMILY HISTORY ON SUICIDE IDEATION AND ATTEMPTS

This study variable sought to examine the influence of hereditary disposition, parental up-bringing and parental expectations on the pervasiveness of suicide ideation and attempts in public secondary schools in Kenya.

7.2 HEREDITARY DISPOSITION ON SUICIDE IDEATION AND ATTEMPTS

On establishing the contribution of family history on suicide ideation and attempts, 89% of the respondents indicated that they knew of a family member who had committed suicide which was a traceable hereditary indication of suicide being embedded in a family tree. 45% of the respondents agreed that they knew of a family member who committed suicide in the past while 55% disagreed. 62% of those who disagreed were girls while those 38% were boys. 52% of the respondents agreed that they feel there's a problem of suicide in the family line while 48% disagreed, out of those who agreed 32% were boys and 62% were girls.

This is consistent with Shaffer (1998) that the youth who came from a background dotted with suicide cases were potentially faced with greater risk of future attempts. This is reinforced by Brent (2005) that genetic factors seem to play a role in 30-50% of cases with suicidal behavior. The study showed that more girls attempted suicide but more boys died of suicide as explained by Shaffer (1999) that boys use lethal methods like guns and hanging while girls use less lethal methods, like consuming pesticide. The study also showed that Mathioya District had a high prevalence of suicide due increased substance abuse and lack of societal support.

On further analysis of the hereditary disposition based on gender and type of the school, the study confirmed that 35% of those who said that they knew a family member who had committed suicide were girls and 65% were boys. 42% of the respondents who said that they knew of a family member who had committed suicide were from mixed schools while 58% were from single schools.

Table 1: Hereditary disposition based on gender and type of school in percentage

Hereditary disposition	Gender		Type of school	
	Boys	Girls	Mixed	Single
	65%	35%	42%	58%

7.3 THE ROLE OF PARENTAL UPBRINGING ON SUICIDE IDEATION AND ATTEMPTS

The study sought to establish the role of parental upbringing on suicide ideation and attempts which established that high expectation on performance accounted for 22%, lack of basic needs 19%, conflict with parents 11%, poor communication 11%, marital conflict 8% and other causes accounting for 25%. Family problems including separation and divorce also contribute suicide attempts among the secondary students. This point was confirmed through the focused group discussions for teachers and interview guide schedule for G&C and DEOs where they cited aspects of poor upbringing as major contributors to suicide ideation and attempts. One head of G/C commented majority of our students are deprived of basic needs, the DEO also lamented that quite a number of students in the county come from broken families which can lead to lack of proper provision of their needs. These findings are consistent with Suicide Fact Sheet (2006) where 90% of suicidal teenagers believed their parents did not understand them.

The attempt to commit suicide is linked indirectly to protest or punish the parent. Some suicidal youth experience family trouble which leads them to doubt their self-worth and make them feel unwanted and misunderstood. Low levels of communication with parents can greatly enhance suicidal tendencies. The teachers in the focused group discussions confirmed that parental upbringing is a factor that contributes to suicide ideation and attempts in schools. They explained on the causes of suicide attempts among secondary school students in figure 4.

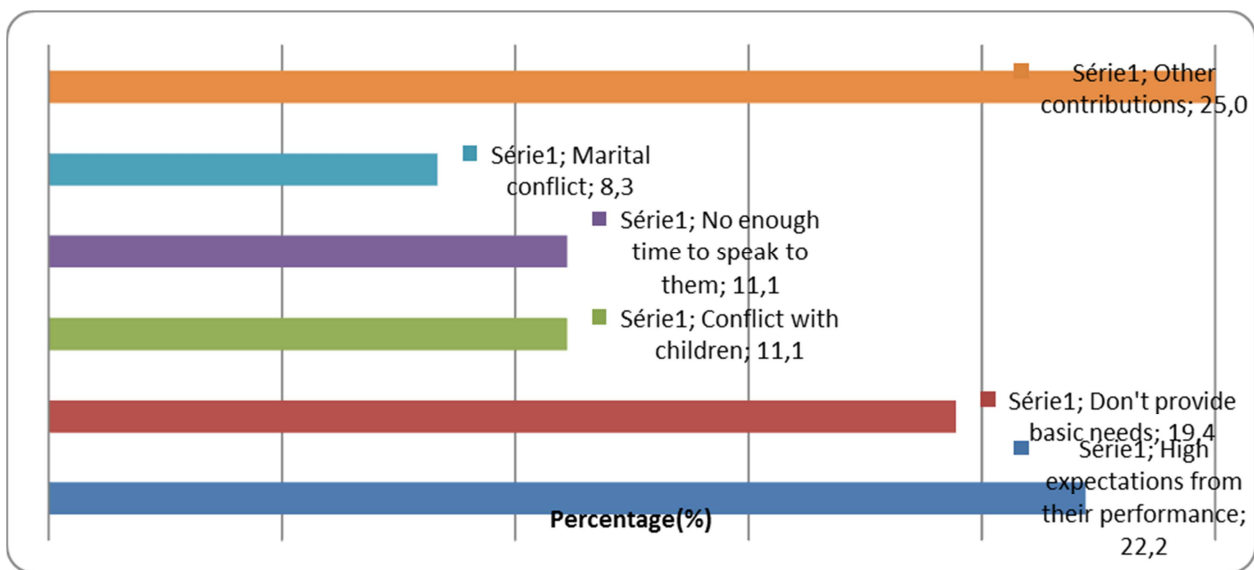


Figure 1: Bar graph on parental up-bringing

The study established that 44.8% of the boys and 52.8% of the girls felt that parental upbringing had a major role to play in suicidal ideation, 45% were in mixed schools while 55% were in single sex schools. This was confirmed by interview schedule from the heads of G&C that lack of proper parental upbringing could contribute to suicidal ideation and attempts.

Table 2: Parental upbringing on suicide ideation and attempts based gender and type of school in percentage

Role of parental upbringing based on gender in Mathiyo District	Gender		Type of school	
	Boys	Girls	Mixed	single
Marital conflict	46	44	40	60
Conflict with siblings	44	46	54	45
Lack of proper provision of basic needs	39	61	45	55
High expectation for parents	47	53	42	58
No enough time with parents	48	52	44	46
Mean	44.8	52.2	45	55

7.4 THE ROLE OF PARENTAL EXPECTATIONS IN SUICIDE IDEATION AND ATTEMPTS

High parental expectations may not necessarily be perceived as pressure but when students perceive such expectations as excessive or stressful, it becomes a pressure for them. The most obvious form of parental pressure reported is the verbal pressure from parents. Education is the main topic of conversation with their parents, who specifically stress the importance of getting good grades and getting into prestigious institutions, Tomiki (2001).

The study sought to find out how the respondents rated the parental expectation on the pervasiveness of suicide ideation and attempts. The study established that most of respondents (92%) indicated that parental expectations exerted enormous pressure towards suicide ideation and attempts in public secondary schools in Kenya. This fact was confirmed through the interview guide for G&C teachers who concurred with the fact that parental expectations contributed to suicidal ideation and attempts.

8 CONCLUSIONS AND RECOMMENDATIONS

In respect to family history and particular reference to parental up-bringing and performance expectations, it is important to undertake an early assessment of the child to establish the potential competences and aspirations. While education is considered as the superhighway to success, not all individuals hold the same capacity to pursue the prescribed career paths and any forced attempts would escalate into resistance, frustrations and retaliation just but to assert oneself. Broader considerations and evaluation of potential talents inherent in an adolescent may provide a more viable vent for success if assessed and discovered early. This would provide the requisite impetus for a parent and society to nurture the talent through school without undue pressure for unrealistic and unattainable expectations. The objective in this regard is to build internal and operational capacity of the child in readiness for the eventual tapping and commercialization of the assessed talent into lucrative careers and entrepreneurship.

In regard to prevention programs, the implication is that an enhancement of prevention programs would attain decent returns if and when proactive awareness campaigns together with the formulation and implementation of sound deterrent programs anchored on improved and conducive school and societal setting. It is instructive to highlight that a winning strategy to mitigate the prevalence of suicide ideation and attempts must jointly address the salient features of the family history factors. For instance, in instituting prevention programs such as in policy and awareness campaigns, the strategic options must address the negative family settings (such as curtailing the drug and substance networks), entrenching positive personality values to the individuals (such as economic empowerment of the youth) while at the same time addressing the mortal points in the school set ups (such as empowering the G&C programs, review of the school curricular programs).

It therefore means that the disposable remedial approaches are synergistic in nature and should be proactively designed if the desired results are to be achieved. Such prevention programs should not only be domiciled at the schools but instead should be an integrated approach ringed on the stakeholders (such as policy makers, schools, G&C, Community) for monitoring, continuity and sustainability. This is aptly pronounced by Boldt (1989) that human dignity is rooted in a good life, a sense of community, a positive self-worth and that human dignity is promoted when we provide these life conditions. Thus a prevention program must deliver premium value to the intended beneficiaries.

White (2013) further observes that many communities have opted to develop proactive protocols and policies that spell out the respective functions and responsibilities of each service delivery agency. Policies and procedures need to be in place to assist students evidencing suicidal behavior. It is recommended that these be contained in a crisis management handbook that also provides basic information about suicidal behavior, warning signs, suicidal contagion, suicidal prevention guidelines, and assessment tools for evaluating risk. Policies and procedures need to be in place to assist students evidencing suicidal behavior. It is recommended that these be contained in a crisis management handbook that also provides basic information about suicidal behavior, warning signs, suicidal contagion, suicidal prevention guidelines, and assessment tools for evaluating risk.

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Chemical composition and Antibacterial power of *Lavandula multifida* L. essential oil against multiresistant strains of *Escherichia coli*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* isolated in hospital

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ABSTRACT: Bacterial infectious diseases continue causing havoc while pharmaceutical firms produce less inhibitor against pathogens. In the frame of this anti infectious fight, we chose to work on *Lavandula multifida* L. (Lm) from Southern Morocco. Steam-distillation of the plant was done with Clevenger-type apparatus and Essential Oil (EO) obtained was analyzed by gas chromatography (GC) and mass spectrometry (MS). A phytochemical study of the species was also performed through standard qualitative reactions with specific reagents. Antibacterial activity of EO was first achieved through discs-diffusion tests against *Escherichia coli* (Ec0A, Ec0B), *Pseudomonas aeruginosa* (Psa0A, Psa0B) and *Klebsiella pneumoniae* (Kp0A, Kp0B). Then Minimal Inhibitory Concentrations (MIC) were determined by macrodilution method and Minimal Bactericidal Concentrations (MBC) were determined. Steam-distillation of the species yielded 2.01 ml of EO for 100g of dried matter and analyses revealed Phenol 2,3,5,6 tetramethyl as major component with 89.97%. Phytochemical tests proved the existence of polyphénols, triterpenes, sterols, mucilage and saponosids. Biological tests proved that this EO has a significant antibacterial power against the germs despite their resistance to Beta-lactamin, aminosid and polymyxin antibiotics. Extreme inhibition diameters were 37.3±4.4mm for Ec0B and 10.6±0.5mm for Psa0A. 0.6µl/ml was the MBC against Ec0A, 9.6µl/ml was the MBC obtained against Psa0A and Psa0B. This study, among the rare found about this species, confirms its utilization by local people to treat digestive and respiratory infections. Discovery of a chemotype is a good way to valorize the species. It could be easily isolated to serve as a model for new antibacterial drug.

KEYWORDS: Chemical study; *Lavandula multifida* L; Antibacterial Activity; Multiresistant Bacteria.

1 INTRODUCTION

Through generations, aromatic and medicinal plants have proved their benefits in human health management. These plants can be considered as a source of active principles since many of them had been the basis of drug manufacture. Among volatiles compounds, thymol isolated from *Thymus vulgaris* is well-known for its antimicrobial activity [1]. As volatile isolated compounds, essential oils which are a mixture of volatile compounds are used as complementary medicine. In this frame, essential oils from *Lavandula* genus are wide used by people and firms to provide well-being feeling and products.

Lavandula species are among the most used by Moroccan people. They have many activities such as anxiolytic, anti-inflammatory and antioxidant activities [2],[3],[4],[5].

Lavandula multifida L. is a Mediterranean native species wide spread in Morocco. It is used by local population to treat wounds, diabetes, cold, respiratory and digestive diseases [6],[7],[8],[9]. Additionally, *L.multifida* has hypoglycemic, hypolipidemic and antifungal virtues[10],[11],[12]. However, its essential oil has been little studied for antimicrobial ability since only two reports on Moroccan population of the species can be found[13],[14]. Thus, we focused our work on antibacterial activity of *L.multifida* essential oil from Moroccan arid region.

In this paper, we report chemical study (volatile and non volatile extracts) of the species then, we assess antibacterial power of *L.multifida*'s essential oil against gastrointestinal and respiratory tract pathogens *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* isolated from University Healthcare Centre of Fès (Morocco).

2 MATERIAL AND METHODS

2.1 PLANT MATERIAL AND EO EXTRACTION

The plant was collected after the flowering stage in the Anti Atlas region. The species was confirmed by Pr. Ibn Tatou at the scientific institute of Rabat.

The aerial parts of the plant were protected from sunlight and dried at room temperature for 13 days. EO from this part was obtained by steam distillation with Clevenger-type apparatus for two hours and half (2h30). The process was repeated three times for each sample of 100g. EO was dried with anhydrous sodium sulfate then stored in darkness at 4°C for further use.

2.2 EO ANALYSIS (GC AND GC/MS) AND COMPOUNDS IDENTIFICATION

Gas chromatography (GC) and mass spectrometry (MS) were used to study the chemical composition of the EO. We used a THERMO ELECTRON gas chromatograph: Trace GC Ultra equipped with DB-5 capillary column (5% phenyl-methyl-siloxan) (inner diameter 30m x 0.25mm, thickness: 0.25µm), flame ionization detector feed with H₂/Air gas and PVT (Programmed Vaporization Temperature) injector with split /splitless-mode. Split-mode injection is used (splitting ratio: 1/50 flow rate: 66mL/min) and injected volume is 1 µl sample of 10% EO solution in purified hexane. Nitrogen is the carrier gas at a flow rate of 1ml/min. The temperature rises from 50°C to 200°C at 4°C/min.

Mass spectrometry carried out with a gas chromatograph THERMO ELECTRON Trace MS System (THERMO ELECTRON: Trace GC Ultra; Polaris Q MS). Fragmentation is done by electronic impact 70eV intensity, capillary column DB-5MS (5% phenyl-methyl-siloxan) (30m x 0.25mm, 0.25µm). Temperature rises from 50 to 200°C at 4°C/min. Helium is the carrier gas at a flow rate of 1.5 mL/min. Split-mode injection is used with a splitting ratio of 1/70, flow ml/min. The apparatus is linked to a computer with NIST 98 mass spectra library.

The composition was reported as relative percentage of the total peak area.

To identify compounds, Kovats Indices were calculated by comparison with retention time of aliphatic hydrocarbons (C7-C40). Indices and each compound mass spectrum were compared to Adams reference [15] and NIST[16] mass spectra library.

2.3 PHYTOCHEMICAL SCREENING

Phytochemical study was achieved on aerial part of *L.multifida*. Dried sample of the plant was ground into fine powder. Specific extracts were prepared for each family of searched compounds. Extracts were obtained by extraction with solvents (ether and distilled water). This study is a set of qualitative tests based on standard colour and / or precipitation reactions. We used methodology described by Bruneton, Bidié et al. and Karumi et al. [2], [17], [18].

2.4 ANTIMICROBIAL ACTIVITY

2.4.1 BACTERIAL STRAINS

The set of six bacteria used for this study were isolated from University Healthcare Centre (Hassan II) of Fès. They were identified and coded as *Escherichia coli* (EcOA ESBL, EcOB), *Klebsiella pneumoniae* (KpOA ESBL, KpOB), multiresistant strains of

Pseudomonas aeruginosa (Ps0A, Ps0B). The antibiotic susceptibility profiles of the strains shown in table 1 are performed according to recommendations of French Microbiological society[19] and [20] EUCAST .

Table 1: Susceptibility test of bacterial strains to some antibiotics.^a

Test bacteria ATB ^b	Ec0A	Ec0B	Kp0A	Kp0B		Test bacteria ATB	Psa0A	Psa0B
Mel ₁₀ ^c	S	S	S	I		TIC ₇₅	R	R
CTX ₃₀	I	I	I	R		CT ₅₀	R	R
TIC ₇₅	S	S	R	R		CIP ₁₀	R	R
AX ₂₅	R	R	R	R		AK ₃₀	R	R
FOX ₃₀	I	S	I	I		IPM ₁₀	R	R
C ₃₀	R	S	S	S		CAZ ₃₀	R	R
CT ₅₀	S	S	S	S		PRL ₃₀	R	R
AMC ₃₀	R	R	R	R		SXT ₂₅	R	R

a. The result of the susceptibility test is presented as follow S: Susceptible, I: Intermediate, R: Resistant

b. Antibiotic (ATB) Meropenem (MEL), Cefotaxime (CTX), Ticarcillin (TIC), Amoxicillin (AX), Cefoxitin (FOX), Chloramphenicol (C), Colistin (CT), Amoxicillin+ clavulanate (AMC), Ciprofloxacin (CIP), Amikacin (AK), Imipenem (IPM), Ceftazidime (CAZ), Piperacillin (PRL), Trimethoprim+sulfamethoxazole (SXT).

c. Charge of antibiotic' Disc in µg

2.4.2 DISCS-DIFFUSION TESTS

Bacteria inocula (0.5 Mc Farlan) are prepared in ISS from 24h bacteria culture on Trypton Soya Agar (TSA). 90 mm-Petri dishes containing TSA medium are inoculated by inundation method. 6 mm diameter-sterile discs of filter paper loaded with 2µL of EO were placed in the centre of inoculated Petri dishes. EO's activity is assessed by measuring inhibition zone diameter in mm after 24 hours of incubation at 37°C. Isotonic saline sterile water (ISS) was used as negative control and 10µg antibiotic discs of Meropenem (Mel) and Ciprofloxacin (CIP) were used as positive control respectively for enterobacteria and *P. aeruginosa* strains.

Experiments are done at least three times.

2.4.3 MIC AND MBC

MIC is determined by macrodilution method in Brain Heart infusion broth. EO is diluted in DMSO to a concentration of 600µL/mL. Then two fold-dilutions are done over the range of 0.15µL/mL to 19.2µL/mL. Final volume of the tests-tubes is 4mL of liquid medium. The tubes were inoculated with 10⁵ CFU/mL [21], [22] and the different concentrations of the testing oil were added. The final concentration of DMSO in each tubes was <1.3%.

Tubes were incubated at 37°C for 24hours. The test was performed in duplicate. Several controls were used: culture medium plus DMSO without the extract, culture medium without DMSO and extract, culture medium with amoxicillin.

After MIC determination, 100µL of all the tubes without visible growth were spread on TSA and incubated for 24hours à 37°C. The MBC corresponds to the lowest concentration at which bacteria are killed.

3 RESULTS AND DISCUSSION

3.1 EXTRACTION YIELD

Steam distillation of 100g (dried matter) of Lm yields 2.01 mL of EO. This yield of 2.01% (mL/100g), is better than 0.7% found by Sellam et al[13] as yield with Moroccan sample from Errachidia. Benbelaid et al. [23] who worked on fresh aerial part of *L. multifida* from Tlemcen region in Algeria obtained 0.09%.

The yield obtained in our study is acceptable, but according to Costa et al. Danh et al. and Da Porto et al.[24],[25],[26], it would be 6 to 18 times higher by using supercritical fluid method instead of steam distillation. However, supercritical fluid process leads to a modification in EO' composition. Steam distillation seems to be the best process to have a good overview on plants volatile compounds [24].

3.2 CHEMICAL COMPOSITION OF EO

Analysis of EO by Gas chromatography and Mass spectrometry revealed 22 compounds representing 99.59% of total compounds (Table2). The five most important compounds which cover 96.91% are Durenol (Phenol 2,3,5,6 tetramethyl) (89.97%), caryophyllene oxide (2.43%), sphatulenol (1.83%), aromadendrene (1.68%) and carvacrol methyl ether (1%).

EO composition can be regrouped in monoterpenes (92.83%) and sesquiterpenes (6.48%). Chemical composition of this EO is different from those in the literature. Sellam et al.[13] in Moroccan population from Errachidia found 66.2% of carvacrol, p-cymene-8-ol (4.2%), caryophyllene oxide (2.7%), terpinolene (2.6%) while Douhri et al.[14] found in Moroccan population from Tetouan, carvacrol (47.62%), β -bisabolene (9%), linalool (7.42%), menthone (4.98%), caryophyllene (3.34%).

In Tunisia Chograni et al.[27] studied 11 samples of Lm' EOs and found 35 compounds. Carvacrol was the main one: 21.14 to 47.02%, then ester acrylic acid dodecanyl (8.96 to 14.06 %) and β -bisabolene (12.96 to 19%). Zuzarte et al.[12] worked on two samples of Lm from Portugal and found also that carvacrol (42.8 and 41.5%) was the main compound followed cis- β -ocimene (27.4 and 27%).

Our work reports for the first time the presence durenol (89.97%), in this species. It is also the first report of a so high percentage of a major component in *L.multifida*. Therefore, this compound can easily be isolated and purified for further studies. Furthermore, we notice that, all the works on *L.multifida* report phenol-type molecule as main compounds.

We chose to compare the chemical composition of our sample with other *Lavandula* species: EO of *L. Coronopifolia* is dominated by trans- β -ocimene (26.9%), carvacrol (18.5%), β -bisabolene (13.1%) and myrcene (7.5%)[28]. *Lavandula stoechas* EO is dominated by α - thujone, L-camphor and 1.8-cineole[29] (Sertkaya et al.,2010) or by camphor and fenchone [30].

In *L. angustifolia* OE, the most important compounds are linalool and linalyl acetate[25],[26],[31]. We notice that our OE's composition is different and chemical composition vary greatly in the same genus *Lavandula* and in the same species *Lavandula multifida* L. according to the region.

Table 2: Composition of *Lavandula multifida* L. Essential Oil from southern Morocco^d

Compounds	%	KI
α -pinène	0.03	939
β -pinène	0.03	979
δ -3 carène	0.09	1011
1,8 cineol	0.06	1031
Terpinolene	0.1	1088
<cis> thujone	0.36	1102
Camphor	0.37	1141
Cymen-8-ol<p>	0.04	1182
carvacrol methyl ether	1	1215
Durenol ^e	89.97	1361
Carvacrol acetate	0.78	1372
Total monoterpene	92.83	
Aromadendrene	1.68	1451
< α >patchoulene	0.14	1456
Viridiflorene	0.10	1496
Silfiperfolan-6- α -ol	0.04	1507
Coehene epoxide< α >	0.04	1574
Spathulenol	1.83	1578
Caryophyllene oxide	2.43	1583
Hinesol	0.23	1641
Total sesquiterpene	6.49	
Manool oxide	0.08	1987
Isomethyl- β -ionone	0.14	2070
Abietol dehydro	0.05	2368
others	0.31	

d. Compounds are listed in their elution order on DB-5 column. Kovats indices (KI) are relative to C7-C40 n-alkanes.

e. The compound was confirm by comparison of the spectrum with NIST mass spectra library

3.3 PHYTOCHEMICAL SCREENING

Phytochemical study showed abundance of polyphenols including tannins and flavonoids. The presence of flavonoids was manifested by the development of a pink-orange coloration that proved the existence of flavones. The presence of tannins was proved by a bluish coloration that specifies gallic tannins. Anthocyanes, leucoanthocyanes and catechic tannins were not found. The species also contains sterols, triterpenes mucilage and a small proportion of saponosids. The search of alkaloids led to a negative result (Table 3).

Table 3: Result of phytochemical study of *Lavandula multifida* L. from Southern Morocco

Chemical groups		Reagents or reaction name	Results
tannins	global	FeCl ₃	++ (Dark green color)
	catechic	Stiasny reagent	--- (red precipitate)
	gallic	Reaction with sodium acetate	++ (bleue coloration)
flavonoids	anthocyanes	Acido-basic reaction	---
	flavones	Cyanidin reaction	+ +(Pink-orange color)
	leucoanthocyanes	Cyanidin reaction without Mg shavings	---
alkaloids		- Valser - Mayer Reagent - Dragendorff Reagent	---
mucilage		precipitation Reaction	++(flake)
saponosids			+
Sterols et triterpenes		Liebermann Buchard Reaction	+ (Red ring and brownish violet color of the supernatant layer)

++ = abundant - = absent + = weak reaction

3.4 ANTIMICROBIAL ACTIVITY

3.4.1 ANTIBIOTICS SUSCEPTIBILITY TEST

The susceptibility tests to antibiotics (Table 2) proved that the strain Ec01 is resistant to Amoxicillin and Amoxicillin with clavulanate, it is also resistant to Chloramphenicol. Ec0A produces CTX-M ESBL.

Ec0B is resistant to Amoxicillin and Amoxicillin + clavulanate. This strain produces a chromosomal cephalosporinase.

Concerning *K.pneumoniae*'s strains, both are naturally resistant to Ticarcillin and amoxicillin (penicillin) thanks to a natural penicillase highly expressed. Kp0A is also CTX-M ESBL productive. While Kp0B produce a plasmid cephalosporin enzyme.

Pseudomonas strains Ps0A and Ps0B are naturally resistant to Trimethoprim associated with sulfamethoxazole. They are also resistant to colistin that is exceptional in *P. aeruginosa*'s strains. Both strains have developed resistant mechanism to Ticarcillin, Ciprofloxacin, Amikacin, Imipenem, Ceftazidime and Piperacillin. Thus *Pseudomonas* strains are resistant to Beta-lactamin, aminosid and polymixyn.

3.4.2 DISCS DIFFUSION TESTS

The discs diffusion tests with 2μL of EO have proved that the substance is active on all the strains. The lowest activities are obtained with Ps0A: 10.6±0.5mm and Ps0B:14.5±0.7.

The best activities are showed by 37.3±4.4 mm inhibition diameter zone against Ec0B and 36.3±2 mm against Kp0A.

Ec0A and Kp0B are averagely susceptible to EO, their inhibition diameters zones are respectively 28.6±1.5 and 24.5±4.9 mm (Table 4). These results seem to show that durenol lead to a better antibacterial activity compared to carvacrol since sellam et al. [13] found 17mm of inhibition against *E.coli* strains and 7.5mm against *P. aeruginosa* with 5μl of *L.multifida* EO dominated by Carvacrol(66.2%). The results of Douhri et al, [14] who found 9.5mm of inhibition against *E.coli* strains and no effect against *P. aeruginosa*, with an EO dominated by carvoacrol (47.62%) reinforce this hypothesis.

Our results are different from those of Benbelaid et al. [23] they proved that inhibition diameters are proportional to EO's quantity. In their work, for 2μl they obtain: 17mm for *Escherichia coli*, 13mm for *Klebsiella pneumoniae* and 7mm for *Pseudomonas aeruginosa*. It is only with 5μl that inhibition zone reached 22, 18 and 8 mm for the same bacterial strains.

We now compare this activity with other EOs. Mohammedi and Attik [32] worked on the same bacterial species with *Lavandula stoechas*, they found no effect on *P. Aeruginosa*. A weak activity was observed for *E .Coli* and *K. Pneumoniae* 8.19± 1.49mm and 5.88±0.57mm.

Lavandula stoechas is dominated by camphor, thujone and fenchone and the results show that *L. multifida* is more active than *Lavandula stoechas*. So the difference in EO composition even in the same genus leads to a significant difference in the activity. The remarkable activity of *L. multifida* is probably due to the presence of phenol-type molecule (Durenol) at a very high proportion. To strengthen this hypothesis we cite three thymus' EOs: *Thymus capitatus* with carvacrol chemotype, *Thymus ciliatus* with thymol chemotype and *Thymus algeriensis* with camphor.

In this study phenolic-rich EOs had similar activity and they were more active than camphor-rich EO [33],[34]. The second hypothesis is that caryophyllene oxide, known for his antibacterial activity at a low percentage could be responsible of the antibacterial activity. The last one is synergy between these two active compounds.

Table 4 : Antibacterial activity of *Lavandula multifida* L. essential oil through discs diffusion tests for *Escherichia coli* (Ec0A, Ec0B), *Pseudomonas aeruginosa* (Psa0A, Psa0B) and *Klebsiella pneumoniae* (Kp0A, Kp0B).

Test Bacteria	Ec0A	Ec0B	Kp0A	Kp0B	Psa0A	Psa0B
Lm' EO	28.6±1.5 [†]	37.3±4.4	36.3±2	24.5±4.9	10.6±0.5	14.5±0.7
Mel/CIP	24±0.2	34±0.5	22±0.5	17±03.	0±0	0±0

f. Diameters of inhibition zone are expressed in mm as means ± standard deviation of triplicate, (MEL) Meropenem, (CIP) Ciprofloxacin

3.4.3 MIC AND MBC DETERMINATION

MIC determination of EO, with a spectrum range from 0.15 to 19.2µL/mL, shows that Ec0A is the most susceptible strain. Its MIC is between 0.33 and 0.6µL/mL. The highest MIC is 4.8µl/ml obtained for Psa0B. The same MIC of 2.4µl/ml is observed for Psa0A and Kp0B (Table 5).

The lowest MBC is 0.6µL/mL for Ec0A and the highest is 9.6µL/mL for *Pseudomonas* Psa0A and Psa0B. The bactericidal concentrations can be ranged as follow Ec0A (0.6µl/ml) <Kp0A (1.2µl/ml) <Ec0B (2.4µL/mL) <Kp0B (4.8µL/mL) <Psa0A=Psa0B (9.6µL/mL).

Determination of MIC by macrodilution method shows that EO antimicrobial activity differs with strains as discs diffusion tests showed. Some strains are more susceptible than others. However, when comparing the two methods, we notice that the susceptibility of the strains is not ranged in the same order since the two methods differ in running conditions[35],[36].

The results proved that the species has a great potential to help fighting against microbial agents. The MIC determine here could be significantly reduced by purifying the bioactive compounds. On the one hand, if antimicrobial activity is due to durenol, thanks to the high percentage (89.97%), the compound could be easily purified and tested alone. It could be also easy to add radicals in the aim to improve its effectiveness and lower its MIC and MBC. On the other, if caryophyllene oxide (2.46%) is the antimicrobial agent, it means that the MIC and MBC can be very lower than those observed in this experiment.

Table 5: Minimal Inhibitory Concentration (MIC) and Minimal Bactericidal Concentration (MBC) of *Lavandula multifida* L. essential oil for *Escherichia coli* (Ec0A, Ec0B), *Pseudomonas aeruginosa* (Psa0A, Psa0B) and *Klebsiella pneumoniae* (Kp0A, Kp0B)g.

	Test bacteria					
	Ec0A	Ec0B	Kp0A	Kp0B	Psa0A	Psa0B
MIC (µL/mL)	0.6	1.2	1.2	2.4	2.4	4.8
MBC (µL/mL)	0.6	2.4	1.2	4.8	9.6	9.6

g. MIC and MBC are expressed in µL/mL. MIC is determined by macrodilution method

4 CONCLUSION

Lavandula multifida L. essential oil from southern Morocco possesses an antibacterial activity despite multiresistance of germs to antibiotics. This study among the rare found about this species confirms its utilization by local people to treat microbial infections. The discovery of durenol, as major component is a good way to valorize the species. It also seems to be the most effective compounds in this essential oil. This molecule could be easily isolated to serve as a model for pharmaceutical firms to produce new drug against resistant and non resistant bacteria.

ACKNOWLEDGMENT

Authors are grateful to administrations of Université Moulay Ismail and Université Mohammed Ibn Abdallah for providing facilities. Acknowledgments to the Moroccan Direction of Centre National de la recherche Scientifique et technique for Essential oil analysis. Sincere thanks to Ms Oumokhtar, Professor at Faculté de Médecine et de Pharmacie de Fès and her team for providing bacterial strains. Thanks also to Mr Ismael Koné for his help during writing.

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The Study of Mobile Guiding Course Construction Applied to Museum Printing Collections

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ABSTRACT: This study focuses on how to develop an effective online learning platform as a developing basis of digital learning materials for museum guiding course. A new learning mode of mobile guiding system will be proposed with example of the printing collections of National Science and Technology Museum. The museum digital resources will be converted into digital learning materials which can be used by the museum's volunteer tour guides through multimedia and mobile carrier. Such platform will be helpful for museum volunteer tour guide training and their self-growing. It will further provide museum visitors more autonomous learning environment.

KEYWORDS: Mobile learning, Museum learning, Volunteer tour guide training, online learning platform, instant information services

1 FOREWORD

The ubiquity of the Internet in recent years has caused an online learning boom that coupled with support from mobile devices has created a new model of education termed "mobile learning". This provides students a better online learning platform through wireless communication devices. The convenience and mobility of mobile devices has increased its application in various learning environments from on campus supporting curriculums and documenting observations to off campus in coop learning. The results of both have been confirmed through experimentation and this type of learning activity, especially in informal education institutions such as museums, is receiving more emphasis for application. The primary reason is how technological advancements have changed the physical operations and service aspects of museums and this is especially apparent in the use of information systems for exhibitions, collections, and guided tours. Through the use of mobile devices, communications between the museum collection and the audience becomes simpler and more effective. However, museums still face the important issue of consolidating digital resources on an electronic platform to provide an online learning community for autonomous learning.

The National Science and Technology Museum (NSTM) is Taiwan's first museum of applied sciences, encompassing themes such as telecommunications, biotechnology, and transportation. It possesses many classical collections from the technology industry but for the average audience, the content of these items are oftentimes more difficult to understand than historical artifacts and require in-depth guided tours for comprehension. This study attempts to propose a new mobile guiding course for museums to utilize their resources in establishing digital learning materials to conveniently train tour guides and provide museum visitors with a more autonomous learning environment.

2 RESEARCH PURPOSE

This study mainly utilizes case studies to achieve the purposes below:

1. Utilize new technology to convert the museum's traditional printing collections to digital learning materials.
2. Provide museum learners with a learning network and system to access learning materials.
3. Establish a common browsing platform and provide museum volunteers with a model for education training, provide instant information services with broad applications in the future to achieve the goal of autonomous learning.

3 DOCUMENTATION ANALYSIS

3.1 MOBILE LEARNING (M-LEARNING)

Mobile learning can be defined as: "A service or equipment used that is not limited by time and place that can provide digital information and learning materials to the student for the purpose of obtaining knowledge." [1]. Scholar Yang [2] defines mobile learning as learning that occurs at any time or place through the use of mobile devices; the device must display learning content and provide a means for two-way wireless communication. These definitions jointly point out the critical elements of mobile learning: mobile equipment, wireless communication, and digital content. In other words, mobile learning is using wireless communication services that allow students to use devices to conduct learning with digital content. Due to the mobile of characteristic devices, the student is not restricted by time or place. Using mobile communications technology, the student can use devices such as a PDA, mobile phone, e-book pack, and more to learn any place, any time.

Mobile learning, aside from having the features of "just-in-time learning", "self-directed learning", "life-long learning", and "training on-the-job", [3], it also carries six major characteristics [4]: the urgency of learning, aggressive obtaining of knowledge, mobility of the learning environment, interactivity during the learning process, contextualized learning activities, and overall integrity of teaching content. Wireless Internet applications are used to consolidate various sources of information to support the student in non-linear, multi-dimensional, and flexible learning and thinking. It is especially beneficial for highly complex learning content with little structure

The broad applications below can be determined with the application method and curriculum content design of mobile devices:

1. Presentation of text-aware mobile learning material: An example would be a software medium that is text-aware is used. This software is the study's own design and development, used to detect the user's mobile device type.
2. Utilize mobile devices to conduct coop learning: An example would be similar to Swedish University Vaxjo's C-Notes project that worked to supplement student learning and memory and encourage cooperative thinking; an application suitable for PDA equipment is used in conjunction with an external device called C-Pen to obtain and save critical information and concepts. [5]
3. Utilize mobile devices to supplement courses: An example would be usage in a course teaching about plant life in the campus. Students can document plants by taking pictures and then comparing the photographs to plant data in learning materials to confirm the type of plant and obtain related information .[6]
4. Utilize mobile devices and probes to conduct exploratory learning: An example would be elementary students in a Michigan elementary school that use the device ImagiProbe to connect to a PDA in order to gather data on water quality, which is then uploaded, to an online database. Long-term observation of the results is used to explore the changes in the environment [7].
5. Utilize GPS systems to conduct exploratory learning: For example, the historic preservation office of Illinois has developed a geographical information system of historical buildings and cultural resources. Historical sites with cultural significance are first input into a PDA for students to use GPS to locate these sites to update and maintain data [8].

3.2 MUSEUM APPLICATION OF MOBILE GUIDED TOURS

The diverse application of new technologies has changed how museums communicate with their visitors pivoting museums from an "education" orientation to a "learning" orientation. The importance and complexity of learning tools has also increased. Education in museums focuses on providing the visitor a true to life scenario or actual participation in activities to facilitate the learning of knowledge or skills; therefore, early tour methods consist of pamphlets, guided explanations, and listening devices which have evolved to the mobile devices of today [9][10]. The medium used in tours has evolved from still to interactive multimedia. Computer multimedia surely plays an important role in museum tours but

computers are cumbersome and not easily transported. Therefore, they have been replaced by light, mobile devices that are now used in museum tours [11][12]. Aside from being convenient to carry, mobile devices when used in conjunction with the tour system can offer the learner freedom in learning that is not restricted by time and space. Many studies explore the effect of mobile guided tours on museum exhibitions or exploratory learning [13][14][15] and results all point out that the use of mobile guided tours for exploratory learning shows results significant to standard museum personnel guided tours. The current application of personalized mobile digital tours is broad and when the personal device is consolidated with voice, infrared transfer, wireless communications, databases, and other technologies, functional expansion becomes even greater. Aside from museums and art galleries, this device can also see widespread use in seminars, guided city tours, and other topics [16]. If used in conjunction with RFID or Wi-Fi wireless signal positioning and surveys, it can provide a flexible guided tour and exploratory learning that will be beneficial for the conduct of educational training.

Tour guidance is an activity that is both transmissible and educational; positive effects produced by tour guidance can transform a monotonous museum into an enjoyable place of leisure for the public. Elaborate explanation through museum commentators, in combination with such technology, can be used to achieve the greatest of its value, and that is why mobile tour guidance is now broadly used. Digital devices possess powerful computing and storage capabilities and their high mobility marks their critical role for learning in museums. Many museums such as San Francisco's Exploratorium, Seattle's Experience Music Project, [17] and Taiwan's National Palace Museum and National Museum of History have all developed mobile tour systems. Most museum guided tour system designs focus on hardware with very little discussion about digital content or the exploration of educational training materials.

3.3 MUSEUM COLLECTIONS AND DIGITAL LEARNING MATERIALS DESIGN

More and more researchers feel that during a visit the visitor's attention should not only be on the cultural artifact, a stronger emphasis should also be placed on the exhibit's background history or cultural pulse. Through interpretation of the exhibit's cultural and historical background the visitor will have a deeper learning experience [18]. The visitor's prior knowledge is beneficial to the visitor's interpretation of the exhibit. Assuming the visitor's motives or attention span, long descriptive texts is not the optimal method of understanding an object. Yet, most tour guidance databases often use this method. In this aspect, the use of designing tour scenarios or through providing simulation software can achieve better results. [19]

There was a study in which researchers [20] focused on Chi Mei Museum's autumn harvest exhibit and designed an interactive museum mobile guided tour audio visual system in hopes of letting the general public understand the artistic meaning of the pieces. The study used Windows Phone, Flash, C#, full scene video and more to create a friendly interactive guided interface. QR Code technology was also used to store the contents of the collection in a back-end server and when mobile devices used the QuickMark software to scan the QR code, the information was returned wirelessly and the visitor would receive an interactive guided screen with pictures and text on their mobile device.

Another case is the "Discover NPM App" provided by the National Palace Museum [21]. This is Taiwan's first smartphone application with interactive functions with cultural artifacts. Through the use of this app, the public can experience the joy of holding cultural artifacts in their palms. The National Palace Museum chose 100 elite pieces most representative of their collection and created 20 interactive artifacts and 80 artifact introduction interfaces. The cultural artifact interaction used the many sensors on smartphones including touch, tilt, blowing, and more to display the various features of national treasures. The public used their smartphones to control and fully inspect the infamous "Jade Cabbage" and its' locust from all angles and learn about this classical artifact with diverse methods

From these case studies we can see that focusing on the creation of digital content with character is the way to fully express the characteristics of mobile devices to increase the value of mobile-guided tours. Here we can see the importance of digital learning materials.

4 CONSTRUCTING MOBILE TOUR GUIDANCE LEARNING MATERIALS – NATIONAL SCIENCE AND TECHNOLOGY MUSEUM (NSTM) PRINT COLLECTIONS AS EXAMPLE

The NSTM's collection is located in an opening storeroom and is displayed on open shelves including experience and maintenance work zones, marking it as the first viewable searchable collections in Taiwan. Of these, the collection volume for printing technology is the most complete as the museum's many years of digitizing their print collection has shown ample results. There is a massive amount of text, images, and video resources that provide learning through the audio-playback system. Content learning of the print collection has also become a training focus of volunteer tour guides. However the open collection, due to concerns of artifact preservation and safety, has been arranged on shelves. Therefore, it cannot compare

to the exhibition hall's interactive learning environment and is highly reliant on the in depth explanations from volunteers. As this is limited by manpower and training time, a new learning model is needed to supplement the learning of the print collection.

Mobile learning is the intersection of mobile technology and e-learning making learning possible at any time and place. This has become the training solution for the print collection and once an operation model is established, the wireless environment of the open collection can in the future also provide the audience with learning opportunities through their mobile phones using Wi-Fi. Learning materials of the print collection includes artifact content description along with multimedia designs to include technical activity learning materials, cultural story audio and video, technical principles, and printing digital collections e-books. The construction of learning materials and their applicable models are described below.

4.1 TEACHING PLAN CONTENT DEVELOPMENT

The mobile guided tour design for the museum visitation tour-learning plan is basically in two methods: audio-visual guidebook with visiting map design and scenario-based approach design. This study will combine the positive aspects of both and use an optimal learning interface and consolidated digital learning resources and introduce this to the autonomous learning area of the museum. An attempt to establish a mobile-guided tour learning platform and using the platform's generated QR-Code to present the museum's print collection then combine the display contents to make autonomous learning convenient. The advantages include knowledge transfer of specific themes in terms of collection knowledge and ease of training for volunteers.

As the design of this project's main focus is the training of volunteers guides for the museum's collections and future aspirations for applications in the exhibit for learning by the audience, the design of this project mainly consists of audio and visual learning materials for tour guidance supplemented by presentations and object research data. The digitizing of museum collection resources into learning content for the convenience of the repeated training of volunteers requires the considerations below:

1. The categorization of resources must be simple and adhere to user habits so that volunteers are willing to use this system to go online to learn and train at a whim.
2. Utilization of resources should be classified for the convenience of the student to observe and learn according to their abilities. Considerations must be given to which portions are suitable as learning materials for guided tours as material that is too difficult can lead to frustration while simple materials lack challenge and decrease the desire for autonomous learning.
3. The presentation of resources should be converted or organized which can not only help volunteers quickly take in the more difficult content of collections to increase tour skills and abilities but also increase the desire for autonomous learning to let museum collections become objects that talk and make learning more interesting.

4.2 CONSTRUCTION OF MOBILE TOUR GUIDANCE DIGITAL LEARNING MATERIALS

The structured system operations of the museum's print collection mobile learning materials are as described in Fig. 1.

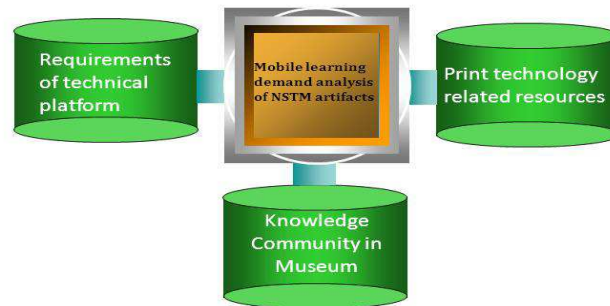


Fig. 1 Structure System Implementation of Print Collection Mobile Learning Materials

Once the demand for learning materials is proposed, aside from assessing viability of the technical platform, considerations must also be given to whether the print collection's related resources can support the content of the learning material; this includes aspects such as digital collection, storeroom resources, cooperating class activities and more to jointly form the knowledge contents of the digital collection to develop the museum's knowledge community. First the demand for mobile learning materials is analyzed and according to operational experience there are the requirements below:

(1) Help the volunteers of collection tours with training; establish example tutorials for each print artifact to help new volunteers to quickly understand the contents of the collection.

(2) Work with gifted volunteers to establish in-depth tour capabilities for special topics on print. Through the in-depth learning resources provided by the platform, knowledge of the museum's collections will deepen with supplementary data that further completes the knowledge base.

(3) Establish a social network with a print based theme and use the platform to share insights. Combining this with the examination measures for volunteers, learners can aggressively collect related content and share experiences. This will not only improve understanding of print topics, but can stimulate autonomous learning and start a beneficial cycle.

The mobile tour guidance learning platform's design principles include:

- The system's front end and management interface will be done through the web browser.
- Can automatically determine device (computer, iPhone, iPad, android mobile or tablet) and deliver their specific interface.
- Can add, delete, or edit various administrator groups including systems administrator, members, and more.
- Can directly browse content with an iPhone/iPad or other tablets including formats such as mp4, mp3, and PDF.
- Provide programmable playlists and maintenance methods such as add, update, delete and provide upload formats in the same field including: mp3, m4a, m4v, mp4, pdf, mov, avi, wmv, flx, m2ts, mts, dot, swf, epub.
- Once attachments are uploaded, the system will automatically produce a QR-Code matching the file to allow quick browsing using mobile phones.
- Content administrator and members can establish personal web pages and immediately produce mobile web pages.

4.3 DESIGN OF MOBILE DEVICE TOUR GUIDANCE TEACHING PLANS

To meet the needs of training volunteers, the design principles of the mobile device platform are as below:

1. Layout will be classified by the contents of the print collection.

- Adhere to practical operations and divide the video learning materials of each print artifact into videos of approximately 10 minutes in length for convenient mobile delivery and browsing.
- The system's interface is to be designed in a method that is simple to use and include the sections: channels, newest programs, featured area, and museum Facebook area (as in Fig. 2).



Fig. 2 Control interface design of the mobile tour guidance service platform

- Use podcast audio and video resource channel categorization so that users can quickly find learning materials relating to printing themes.
- Uploaded data automatically generates QR-Code image files.

For instance entering the system's letterpress printing technology artifact channel, the related artifact content will be displayed as in Fig. 3 and through the categorization of print programs; each program's videos will produce a QR-Code image file once uploaded to the system. The user can scan the QR-Code to retrieve that program's tour guidance audio and video learning materials to make the museum's online tour guidance learning simpler.



Fig.3 Print technology artifact section

5 CONCLUSION

The purpose of this study is to introduce the concept of autonomous learning for volunteers through the establishment of learning materials for museum tour guidance, and to achieve the goal of consolidating all of the museum's digital resources and learning materials to develop a mobile e-learning system that can provide various interactive learning activities to finally establish the museum's digital learning environment and further develop the museum's knowledge community.

From the case studies of digitizing learning materials of print collections we can see that applying mobile devices and service platforms for the purpose of training can be functional in transferring knowledge of artifacts. In the future this model of creating learning materials can be broadly used to develop other mobile learning systems for the museum's other exhibits. However, in terms of the effect of attracting autonomous learning in visitors, more exploration is required. This unnumbered section is used to identify people who have aided the authors in accomplishing the work presented and to acknowledge sources of funding.

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Performance Evaluation for the Age Dependent Face Recognition System

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ABSTRACT: Face recognition is the ability to establish a subject's identity based on facial characteristics. Face recognition has a wide range of applications, including Human-Computer-interaction, Driver's license, National ID, Passports, Voter registration, Security system, Personal device logon, Desktop logon, Information security, Database security, Internet access, CCTV control and Suspect tracking and investigation. A face recognition system based on the age prediction is developed in this research. The system consists of two stages; age prediction and face recognition. In age prediction stage, eigenvectors and eigenfaces are calculated from the input image. New faces are projected onto the space expanded by eigenfaces and represented by weighted sum of the eigenfaces. These weights are used to identify the age of the faces. In face recognition stage, the predicted image will be searched to a certain age group of the database and all images within this age group would be considered as potential matches for the final level recognition.

The age dependent face recognition system is developed based on 11 individual aging classes, which yields a great reduction time complexity in search space than searching the entire database. The algorithms that have been developed are tested on AT&T, Yale, MORPH and FG-NET Face Databases.

The goals of the system are 1) to create the fast recognition system for the face database 2) to predict how old the person is and to carry out the face recognition system based on this predicted age 3) to stop underage drinkers from entering bars, prevent minors from purchasing tobacco products from vending machines 4) deny children access to adult Web sites by predicting their age. The main advantage of this system is reduction of searching time and it requires small memory usage. According to the experiment result, this system is an effective age dependent face recognition system.

KEYWORDS: Face recognition, age prediction, eigenfaces, face space.

1 INTRODUCTION

In recent years face recognition has received substantial attention from researchers in biometrics, pattern recognition, and computer vision communities. The machine learning and computer graphics communities are also increasingly involved in face recognition. This common interest among researchers working in diverse fields is motivated by our remarkable ability to recognize people and the fact that human activity is a primary concern both in everyday life and in cyberspace. Besides, there are a large number of commercial, security, and forensic applications requiring the use of face recognition technologies. These applications include automated crowd surveillance, access control, mugshot identification (e.g., for issuing driver licenses), face reconstruction, design of human computer interface (HCI), multimedia communication (e.g., generation of synthetic faces), and content-based image database management. Facial scan is an effective biometric attribute/indicator. Different biometric indicators are suited for different kinds of identification applications due to their variations in intrusiveness, accuracy, cost, and ease of sensing.

Face recognition is an important field of biometrics which is of great use in our day to day life. Be it the traditional uses in identification documents such as passports, driver's licenses, voter ID, etc., or its uses in recent years, where, face images are being increasingly used as additional means of authentication in applications such as credit/debit cards and in places of high security. But with age progression the facial features changes and the database needs to be updated regularly of the changes which is a tedious task. So we need to address the issue of facial aging and come up with a mechanism that identifies a person in spite of the aging.

During face recognition step if the face image in the database and the recognize face image is matched then the distance between the class and the face space are the same. If the face image in the database and the recognize face image is not matched then the distance between the class and the face space will be different.

To confirm the effectiveness of the proposed method, the experiment has been done with several real images. In the experiment, the frontal images are selected only to construct the face database. Slight rotation of the image is allowed. The exact angle of acquisition is not known. To ensure that the location of the features can be detected precisely, some constraints are fixed such as not wearing glasses, without beards. All images are taken under good lighting conditions. All images are transformed to the gray scale and file sizes are fixed to 150x150 pixel dimensions in JPEG format.

This system used both the Database Faces of AT&T Laboratories Cambridge and other face database images which are collected from UCSY (University of Computer Studies, Yangon) and the Internet.

2 AGE PREDICTION ACCURACY RESULTS

In age prediction system, the accuracy rate is about 88 percent. The accuracy of the system can be analysed by the variation on the range of the age groups from the Database Faces of AT&T Laboratories and face images database which are collected from UCSY (University of Computer Studies, Yangon) and the Internet. The larger errors occur at age 21 to 25 aging group and age 41 to 45 aging group. However, the overall prediction rate for all the experimental images is 88% by the proposed system. The results shown in Table I are tested using the database and the accuracy rate of the age prediction. Figure 1 shows the accuracy graph of the age prediction results.

Table 1. Overall Age Prediction System Performance for Testing Images

Group	Testing Image	Correctly Predicted	Accuracy	Error
1	10	9	90%	10%
2	10	9	90%	10%
3	10	8	80%	20%
4	10	9	90%	10%
5	10	9	90%	10%
6	10	9	90%	10%
7	10	8	80%	20%
8	10	9	90%	10%
9	10	9	90%	10%
10	10	9	90%	10%
11	10	9	90%	10%

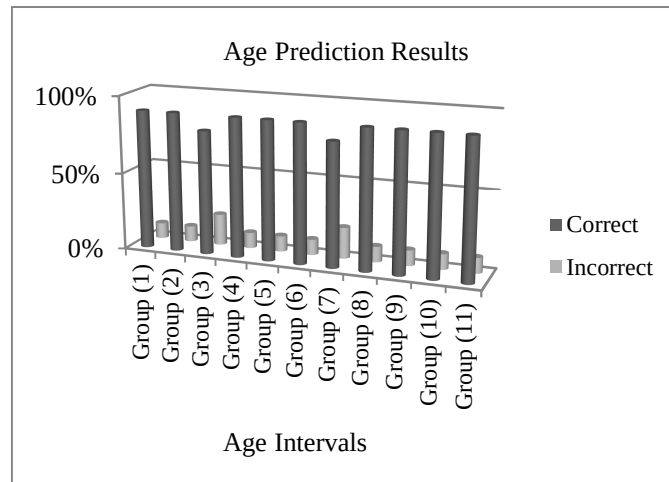


Figure. 1 The Accuracy Graph of Age Prediction Results

3 EXPERIMENTS FOR AGE PREDICTION

In this system, the age groups are divided into 11 classes. The classes are: Class 1 (up to 15 years), Class 2 (16 to 20 years), Class 3 (21 to 25 years), Class 4 (26 to 30 years), Class 5 (31 to 35 years), Class 6 (36 to 40 years), Class 7 (41 to 45 years), Class 8 (46 to 50 years), Class 9 (51 to 55 years), Class 10 (56 to 60 years), Class 11 (more than 60 years).

Step One – Train the system: Twenty (20) images were selected for each class from the face database. The system was trained with these images using eigenface approach described the previous chapter, to derive the Training Feature Vector.

Step Two – Gather the testing images: Ten (10) images were selected for each class from the face database. The images were processed for classification by using the eigenface approach, to derive the Testing Feature Vector.

Step Three: Classification: The PCA (Principle Component Analysis) classifier was used to enhance class separability. The minimum Euclidean distance of the Testing feature vector from the average distance of the three Training feature vectors was computed. The class with the minimum distance was defined as the winner. Thus the image was labeled with the age group of that particular class.

4 SYSTEM PERFORMANCE AND EVALUATION

The proposed system is evaluated by two values. The false acceptance rate, or FAR, is the measure of the likelihood that the proposed face recognition system will incorrectly accept an access attempt by an unauthorized user. FAR typically is calculated as the ratio of the number of false acceptances divided by the number of identification attempts. Figure 2 shows the accuracy rate of the system.

The false rejection rate, or FRR, is the measure of the likelihood that the proposed face recognition system will incorrectly reject an access attempt by an authorized user. FRR typically is calculated as the ratio of the number of false rejections divided by the number of identification attempts. The accuracy is the ratio of the number of correct recognition divided by the number of identification attempts.

FAR (False Accept Rate) is defined as follows:

$$FAR = \frac{no_accept}{no_test} \times 100\% \quad (1.1)$$

FRR (False Reject Rate) is defined as follows:

$$FRR = \frac{no_reject}{no_test} \times 100\% \quad (1.2)$$

Accuracy is calculated as:

$$Accuracy = \frac{no_true\ Result}{no_test} \times 100\% \quad (1.3)$$

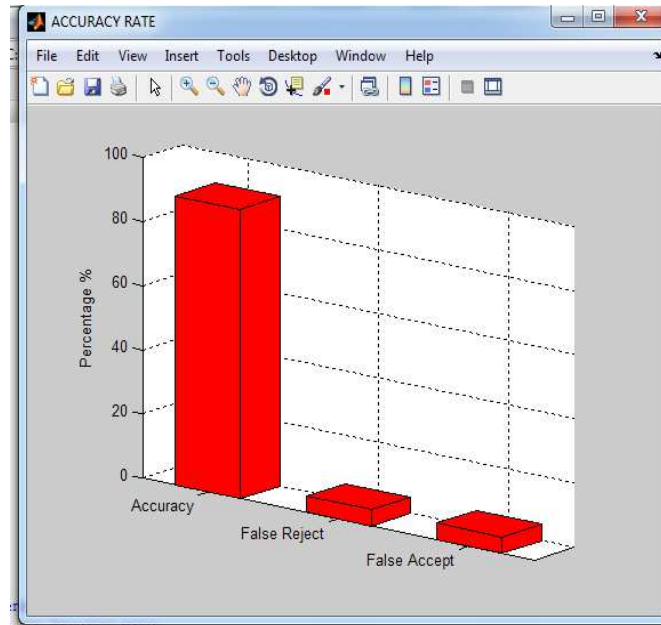


Figure. 2 The Accuracy Rate shows the System Accuracy

1. The no_test is denoted as the total number of tests.
2. no_accept is denoted as the number of false accepted times.
3. no_reject is denoted as the number of rejected times.
4. no_trueResult is denoted as the total number of genuine matches.

For example, if "Htet Htet" enters "MaMa's" predicted age, presents her recognition data, and successfully matching as MaMa. This is classified as **False Acceptance**. The probability of this happening is referred to as **False Acceptance Rate (FAR)** [stated as: percentage, fraction]. If "Htet Htet" enters her predicted age, presents her data to a face recognition system, and fails to match. This is classified as **False Rejection**. The probability of this happening is the **False Rejection rate (FRR)**. This is because two people have similar enough biometric characteristics (a face) that the system finds a high degree of correlation between the users' template.

5 CONCLUSION

This system presented the age dependent face recognition system that combines age prediction and face recognition. A two steps operation is used for this system, where the first step performs a prediction based on 11 individual aging classes and the second step performs the face recognition based on predicted age. The age prediction errors were due to the poor quality images, the lighting condition, and the large variation of pose and so on. The range of five-year age groups was used for age prediction. The complexity and processing time will be reduced by searching the matched face from predicted age group instead of searching the face from the database which contains 11 age groups. Experimental results show that both face recognition and age range estimation may be effectively performed with low computational effort.

The accuracy of eigenface is also satisfactory (over 90 %) with frontal faces. The recognition errors (nearly 10%) were due to the variation of pose, lighting, and so on. But most errors were caused due to the large changes of pose. The advantage of the eigenface method is the system's speed and efficiency. The eigenface approach reduces the amount of data.

ACKNOWLEDGMENT

I thank my parents and my husband for their unconditional love and support without which this journey would not have been possible. My special thanks also go to Database Faces of AT&T Laboratories and face images database which are collected from UCSY (University of Computer Studies, Yangon) and the Internet.

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Evaluation de la qualité microbiologique du lait cru dans la région du Gharb, Maroc

[Evaluation of microbiological quality of raw milk in the region of Gharb, Morocco]

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ABSTRACT: Ce travail a pour objectif d'évaluer la qualité microbiologique du lait cru dans la région du Gharb. Pour ce, nous avons réalisé des études physicochimique et microbiologique du lait cru livré au centre de collecte Al Fouarate. Le nombre des échantillons a été fixé à dix: 2 à partir des bacs réfrigérants, 3 à partir du lait des ramasseurs et 5 à partir de celui des éleveurs. Les prélèvements se faisaient un jour sur deux pendant 20 jours et ont tous été effectués entre 8h et 9h30 du matin.

Dans l'étude physicochimique, nous avons mesuré la température, le pH, la densité, l'acidité titrable, la matière sèche et les cendres. Dans l'étude microbiologique, nous nous sommes intéressés au dénombrement et à l'isolement des bactéries et des champignons, à savoir la flore mésophile aérobie totale, coliformes, Staphylocoques, *Listeria*, bactéries lactiques, levures et moisissures.

L'étude des caractéristiques physico-chimiques du lait cru n'a pas montré de variations significatives pour la plupart des paramètres étudiés. Cependant, la température des échantillons et celle ambiante sont légèrement élevées, ce qui favorise la prolifération des germes et l'altération de la qualité du lait. D'autre part, la valeur moyenne en flore mésophile aérobie totale est de $2.15 \cdot 10^7$ ufc/ml. La charge moyenne en flore de contamination fécale est de l'ordre de $3.02 \cdot 10^5$ ufc/ml. Cette valeur élevée serait une indication d'une pollution fécale des cultures fourragères servant à l'alimentation des vaches laitières par les effluents domestiques des agglomérations de la région. Par ailleurs, la présence massive des levures et moisissures dans le lait cru peut être due à une forte contamination extérieure et une mauvaise hygiène des ustensiles.

MOTS CLES : Lait cru, qualité, Gharb, étude physicochimique, étude microbiologique.

ABSTRACT: In order to evaluate the microbiological quality of raw milk in the region of Gharb, we carried out physicochemical microbiological studies of raw milk delivered to the Fouarate milk collection center. The study was based on ten samples: 2 from the refrigerating compartments, 3 from the collectors and 5 from the farmers. The milk sampling was repeated every other day, during 20 days and was done between 8h and 9h30 AM. In the physicochemical study, we measured temperature, pH, density, titratable acidity, dry matter and cinders. In the microbiological part, we were interested in counting and isolating bacteria and mildew, such as TAMF, coliforms, staphylococci, *Listeria*, lactic bacteria, yeast and mold. The study of physicochemical characteristics of raw milk did not display any significant variation for almost parameters. However, the temperature of samples and the ambient temperature are high, which favours the proliferation of germs and adulterates the quality of milk. Moreover, the mean value of total aerobic mesophilic flora is $2.15 \cdot 10^7$ ufc/ml. the quantity of flora of faecal contamination is $3.02 \cdot 10^5$ ufc/ml. This high value would indicate faecal pollution of fodder cultures, used as food for milk cows, by domestic effluents coming from the surrounding areas. The massive presence of yeast and mold in the raw milk could be due to external contamination and bad hygiene of utensils.

KEY WORDS: raw milk, quality, Gharb, physicochemical study, microbiological study.

1 INTRODUCTION

Les produits laitiers subissent une fermentation lactique qui assure une sécurité alimentaire par acidification et production de bactériocines antagonisant la croissance des bactéries pathogènes [1],[2],[3], et qui améliore la qualité finale des produits laitiers par production de composés aromatiques.

Les bactéries lactiques appartiennent à différents genres et sont généralement reconnues comme non toxiques et bénéfiques pour la santé humaine [4],[5]. Les bactéries lactiques sont parfois dangereuses (*Lactococcus lactis*) [6].

Le lait cru est un produit hautement nutritif sur le plan de la nutrition. Pour cela Sa production doit être sévèrement contrôlée en raison des risques éventuels qu'il peut présenter pour la santé humaine.

Dans la région du Gharb, le secteur laitier est d'une grande importance. Afin d'étudier les effets des conditions de vie et des pratiques d'hygiène sur la qualité du lait, nous avons réalisé une étude dans le centre de collecte Alfouarate qui représente un cas type des centres existants dans la région. Ce centre se situe dans un endroit plein de Merjas qui servent de déversoirs des effluents domestiques des agglomérations qui l'entourent, ce qui peut présenter une pollution par les germes fécaux et les détergents pour les cultures fourragères servant d'aliments pour les vaches laitières. Dans cette optique et pour mettre en évidence la qualité du lait cru livré à ce centre, le présent travail consiste en une étude physico-chimiques et microbiologiques de celui-ci.

2 MATÉRIEL ET MÉTHODES

2.1 LIEU

L'étude a eu lieu au centre de collecte Al Fouarate qui se trouve tout près de la route qui sépare la ville de Kenitra et l'agglomérât d'Al Fouarate, se situant dans la région Gharb-Chrarda-Bni hssen. C'est une coopérative constituée en 1978 par 27 éleveurs de la région. Il compte actuellement 48 adhérents contre 36 en 1999 [7]. Le local est formé par la salle de collecte, la salle de réunion et une maison servant d'habitat pour le gérant.

En plus des adhérents, le centre reçoit le lait des ramasseurs qui collectent le lait des exploitations non adhérentes au centre.

Le centre livre la totalité de sa collecte du lait à la centrale laitière. Le camion citerne de l'usine passe une fois par jour. La salle de collecte du lait, qui occupe une surface de 64 m², contient trois bacs réfrigérants, deux ayant une capacité de 1000 litres et le troisième ayant une capacité de 1200 litres. Cette salle est alimentée par l'électricité et l'eau potable.

2.2 PRÉPARATION DES ÉCHANTILLONS

Pour mieux évaluer la qualité du lait livré au centre de collecte Alfouarat, nous avons essayé de faire un échantillonnage représentatif de tous les livreurs. Le nombre des échantillons a été fixé à dix par prélèvement : 2 à partir des bacs réfrigérants, 3 à partir du lait des ramasseurs et 5 à partir de celui des éleveurs. Les prélèvements ont tous été effectués entre 8h et 9h30 du matin, un jour sur deux pendant 20 jours.

2.3 MÉTHODE DE PRÉLÈVEMENT

Les prélèvements ont été collectés dans des flacons stériles de 100 ml d'une façon aseptique puis acheminés immédiatement dans une glacière vers le laboratoire de microbiologie de la Faculté des sciences de Kenitra. Dès leur arrivée au laboratoire les échantillons ont fait l'objet d'une série d'analyses physico-chimiques et micro biologiques.

2.4 ANALYSES PHYSICOCHIMIQUES

Ces analyses ont pour but la détermination des caractéristiques physicochimiques du lait collecté [8], et sont :

- La température : déterminée sur place à l'aide d'un thermomètre.
- La densité : déterminée aussi sur place à l'aide d'un thermolactodensimètre gradué de 1015 à 1040 et étalonné à 15°C.
- Le pH : mesuré à l'aide d'un pH-mètre électronique muni d'une électrode combinée Sen Tix 81 et préalablement étalonnée.

- L'acidité titrable : À 10 ml de lait, on ajoute une goutte de phénol phtaléine à 1 % puis on titre l'acidité en ajoutant la solution de la soude à 0.1 N goutte à goutte à l'aide d'une burette de Mohr à robinet jusqu'à l'obtention d'une coloration rose persistante. Le résultat est calculé en fonction de la quantité de la soude ajoutée. Le changement de couleur détermine le volume de soude équivalent V_{eq} .

Les résultats sont exprimés en degré Dornic ou en pourcentage de l'acide lactique [8], 1 degré Dornic °D correspondant à 0,1g d'acide lactique par litre de lait. Pour cela, il faut calculer la concentration massique C_0 en g/L; c'est à dire la masse d'acide lactique contenu dans un litre de lait, on utilisant la formule suivante :

$$C_0 = \frac{C_1 \times V_{eq} \times Mac}{V_0}$$

Où C_1 est la concentration d'hydroxyde de sodium (soude) : $C_1 = 0,05 \text{ mol/L}$

V_{eq} le volume équivalent, en mL, d'hydroxyde de sodium déterminé précédemment

Mac est la masse molaire de la molécule d'acide lactique : $Mac = 90 \text{ g/mol}$

V_0 est le volume de lait : $V_0 = 10 \text{ mL}$

D'où, L'acidité en degré Dornic est donné par la formule suivante :

$$D = \frac{C_0}{0,1}$$

- Matières sèches : la teneur en extrait sec est déterminé après dessiccation à une température de 103°C pendant 3 heures, jusqu'à l'évaporation totale de l'eau et stabilisation de poids du 10 ml du lait à sécher [9].
- Les cendres : la teneur en cendres est déterminée après incinération de la matière sèche du lait à 530 °C jusqu'à poids constant.

2.5 ANALYSE MICROBIOLOGIQUE DU LAIT

Dans ces analyses on va s'intéresser au dénombrement et à l'isolement de quelques germes du lait, à savoir les bactéries et les champignons.

L'analyse de ces germes va être réalisée selon la procédure suivante :

2.5.1 PRÉPARATION DES DILUTIONS

Après agitation des flacons on prélève à l'aide d'une miropipette munit d'un cône stérile 1ml du lait que l'on ajoute à 9ml de l'eau physiologique contenu dans un tube à essai. Puis on agite sur vortex puis on procède à des dilutions successives jusqu'à 10^{-7} .

Pour l'identification de listeria nous allons travailler sur la solution mère.

2.5.2 ENSEMENCEMENT EN PROFONDEUR

Dans des boîtes de pétri stérile on verse 1 ml des dilutions 10^{-1} à 10^{-7} , puis on ajoute 15 à 20 ml de milieu de culture préparé au préalable, on agite doucement puis on laisse la gélose se gélifier.

Ces analyses sont effectuées dans la hotte à flux laminaire Telstar 100.

2.5.3 DÉNOMBREMENT DES GERMES DU LAIT

Il consiste à dénombrer les colonies contenu dans une boîte de pétri après incubation puis à multiplier le nombre trouvé par le coefficient de dilution pour trouver le nombre approximatif du germe étudié par ml de lait.

Tableau 1. Conditions de culture selon le type de germes.

Germes	Milieux de culture	Incubation
Flore mésophile aérobie totale (FMAT)	PCA (Plate Count Agar)	30°C pendant 72 h
Coliformes	Eosine Méthyle Bleue	44°C pendant 48 h
Staphylocoques	Milieu Chapman	37°C pendant 24 à 48 h
Listeria	Milieu Oxford après enrichissement dans le bouillon d' UVM	30° pendant 24 h
Bactéries lactiques	Milieu MRS (Man, Rogosa et Sharpe)	30°C pendant 48 h
Levures	Milieu Sabouraud Chloramphénicol	30°C pendant 48 à 72 h
Moisissures	Milieu Sabouraud Chloramphénicol	30°C pendant 48 à 72 h

3 RÉSULTATS

3.1 CARACTÉRISTIQUES PHYSICO-CHIMIQUE DU LAIT

Dans cette partie de l'étude nous nous sommes intéressés à six variables physiques et chimiques, à savoir la température, la densité, le pH, l'acidité titrable, la teneur en matière sèche et la teneur en cendres.

La température du lait de mélange contenu dans les bacs de réfrigération est de 4°C. Les résultats concernant les paramètres physico-chimiques du lait de vache des 100 échantillons analysés, sont résumés dans le tableau 2 qui comporte les valeurs maximales, les valeurs minimales, les valeurs moyennes, les écarts types et les coefficients de variation (CV) des paramètres analysés.

Tableau 2. Caractéristiques physico-chimique du lait cru réceptionné au centre de collecte Alfouarate, n= 100.

Paramètres	Maximum	Minimum	1.	Moyenne	Ecart-type	CV%
Densité	1.0325	1.024		1.0291	0.01	0.01
pH	6.56	6.18		6.26	0.18	2.8
Acidité titrable (°D)	16.5	14.50		15.40	0.53	3.4
Matière sèche (g/l)	126.8	114.20		122.92	3.55	2.88
Cendres (g/l)	6.98	6		6.44	0.31	4.81

La densité du lait cru de nos échantillons varie entre 1.024 et 1.0325 avec une valeur moyenne de 1.0291 et une dispersion presque nulle, tandis que le pH varie entre 6.18 et de 6.58, avec une valeur moyenne de 6.26. Par ailleurs, la moyenne de l'acidité titrable de l'ensemble des échantillons est de 15.40°D.

L'extrait sec total du lait cru varie entre 114.20 et 126.8 g/l, avec une valeur moyenne de 122.92 g/l. La valeur moyenne en cendre est de 6.44g/l, allant de 6g/l jusqu'à 6.98g/l.

De manière générale, les coefficients de variation des paramètres physico-chimiques entre les différents échantillons de lait analysés sont très faibles.

3.2 CARACTÉRISTIQUES MICROBIOLOGIQUES DU LAIT

Dans cette deuxième partie, nous avons investigué cinq variables d'ordre microbiologique, notamment la quantité de flore mésophile aérobie totale (FMAT), de bactéries lactiques, de coliformes totaux, de staphylocoques et de champignons.

Les résultats des analyses microbiologiques sont résumés dans le tableau 3 qui comporte les valeurs maximales, les valeurs minimales, les valeurs moyennes, les écarts-types ainsi que les coefficients de variation. En effet, la qualité bactériologique du lait cru peut être évaluée par le dénombrement de la flore mésophile aérobie totale. Dans cette dernière on va dénombrer exhaustivement tous les germes qui peuvent être présents dans l'échantillon du lait analysé. La valeur moyenne de la FMAT est de 2.15 10⁷ (ufc/ml). Par ailleurs, la charge moyenne des bactéries lactiques dans les échantillons analysés est de 5.02 10⁵ufc/ml.

La teneur en coliformes totaux, qui indique quant à elle le degré de contamination fécale, la valeur moyenne trouvée dans nos analyses est de $3.02 \cdot 10^5$ ufc/ml.

En ce qui concerne les staphylocoques, la teneur moyenne enregistrée est de $2.15 \cdot 10^4$. Le coefficient de variation est élevé (40.93 %) ce qui reflète une variation significative entre les différents échantillons en terme de teneur en staphylocoques. D'autre part, le dénombrement des levures et des moisissures a révélé une teneur moyenne de $1.5 \cdot 10^4$ ufc/ml.

Tableau 3. Dénombrement des germes du lait cru réceptionné au centre de collecte Alfouarate (ufc/ml), $n=100$.

Germes	Maximum	Minimum	2.	Moyenne	Ecart-type	C.V en %
FMAT	$2.9 \cdot 10^7$	$1.7 \cdot 10^7$		$2.15 \cdot 10^7$	$0.36 \cdot 10^7$	16.74
Bactéries Lactiques	$6.5 \cdot 10^5$	$3.9 \cdot 10^5$		$5.02 \cdot 10^5$	$0.84 \cdot 10^5$	16.73
Coliformes totaux	$4.5 \cdot 10^5$	$2.1 \cdot 10^5$		$3.02 \cdot 10^5$	$0.80 \cdot 10^5$	26.49
Staphylocoques	$3.4 \cdot 10^4$	$1.9 \cdot 10^4$		$2.15 \cdot 10^4$	$0.88 \cdot 10^4$	40.93
Levures et moisissures	$1.6 \cdot 10^4$	$0.5 \cdot 10^4$		$1.09 \cdot 10^4$	$0.34 \cdot 10^4$	31.19

4 DISCUSSION

4.1 ANALYSE PHYSICO-CHIMIQUE

La température du lait apporté au centre de collecte est proche de la température ambiante que ce soit chez les ramasseurs ou chez les particuliers, ce qui montre que le lait de traite n'arrive pas immédiatement au centre de collecte. La température du lait de mélange contenu dans les bacs de réfrigération est de 4°C . Cette température est idéale pour la conservation du lait jusqu'à l'arrivée du camion de l'usine, mais parfois il y a une rupture brutale du courant électrique ce qui influence la qualité du lait contenu dans les bacs. Ce lait est transformé en (Leben), est vendu directement aux consommateurs.

La densité moyenne du lait de nos échantillons est de 1.03. Ce résultat concorde avec ceux trouvés dans la région Mnasra du Maroc par Labioui [10]. En fait, la densité dépend de la teneur en matière sèche, en matière grasse, de l'augmentation de la température et des disponibilités alimentaires.

Le pH moyen des échantillons du lait cru analysés, qui est de 6.26, est inférieur à celui trouvé par d'autres études [10],[11]. Cette valeur faible du pH serait expliquée par le retard de livraison du lait au centre de collecte, ce qui peut déclencher un début de fermentation lactique. En effet, Les variabilités sont liées au climat, au stade de lactation, à la disponibilité alimentaire, à l'apport hydrique, à l'état de santé des vaches et aux conditions de la traite [10].

La valeur moyenne de l'acidité titrable de l'ensemble des échantillons du lait est de 15.40°D . Cette valeur est proche de celles rencontrées dans la littérature [10],[11], ce qui prouve que la qualité de notre lait est dans les normes de point de vue acidité. Cette moyenne reste dans l'intervalle d'acidité d'un lait frais. En effet, le pH et l'acidité dépendent de la teneur en caséine, en sels minéraux et en ions [11], des conditions hygiéniques lors de la traite, de la flore microbienne totale et son activité métabolique [12], de la manutention du lait.

L'extrait sec total, quant à lui, a une valeur moyenne de 122.92 g/l. Cette valeur est supérieure à celle trouvée par Oubari [13] mais concorde avec celle obtenue par Labioui [10] qui est de l'ordre de 117 g/l. Cette différence des valeurs pourrait être expliquée par les pratiques d'alimentation et par la race des bovins.

La valeur moyenne en cendre, qui est de 6.44g/l, témoigne de l'interférence de plusieurs facteurs dont nous citons essentiellement la période de lactation, la race, l'amélioration et l'état sanitaire de l'animal [14].

De manière générale, les coefficients de variation des paramètres physico-chimiques entre les différents échantillons de lait analysés sont très faibles, ce qui nous laisse dire que le lait réceptionné au centre de collecte Alfouarate passe par les mêmes conditions de production et de ramassage.

4.2 ANALYSE MICROBIOLOGIQUE

La valeur moyenne de la FMAT au niveau de nos échantillons est de $2.15 \cdot 10^7$ (ufc/ml). Cette teneur est élevée par rapport à celle trouvée par Oubari [13] qui est de $7.42 \cdot 10^6$, et celle avancée par Hamama et El Mouktafi [15] qui est de $2 \cdot 10^7$. Aussi, cette teneur en FMAT est plus élevée par rapport à la région de Tadla [16] et à la région d'Errachidia [17].

Le lait de mélange a une charge microbienne plus importante que le lait des particuliers, d'où leur degré de contamination supérieur. En général, la valeur moyenne trouvée dépasse de loin la norme fixée dans la directive 92/46/CEE qui stipule une teneur en FMAT < 106ufc/ml.

Cela laisse dire que la qualité de notre lait est médiocre.

En ce qui concerne bactéries lactiques, la charge moyenne dans les échantillons analysés est de 5.02 10⁵ufc/ml, valeur inférieure à celles rapportées par d'autres études dans les régions de Gharb [13] et Tadla [16].

Les bactéries lactiques sont des producteurs d'acide lactique [18], et de bactériocines [19] ayant un intérêt technologique important.

Pour la teneur en coliformes totaux, cette étude indique une valeur moyenne de 3.02 10⁵ ufc/ml, largement supérieure à celles obtenues dans d'autres régions du Maroc (0.92 10⁴ufc/ml [14], 2 10⁴ ufc/ml [10] et 1.8 10⁵ ufc/ml [20]). Cette contamination élevée par les germes fécaux serait due au manque d'hygiène des literies et à la conduite alimentaire des vaches laitières.

La teneur moyenne en staphylocoque est de 2.15 10⁴, cette valeur est inférieure à celle avancée par Ounine [21] qui est de 5.37 10⁴ufc/ml, et reste dans l'intervalle des taux qu'a trouvé Bennacir [22] et qui vont de 10³ à 10⁵ufc/ml. Par ailleurs, le coefficient de variation obtenu est élevé (40.93 %) ce qui reflète une variation significative entre les différents échantillons en terme de teneur en staphylocoques. Ceci serait vraisemblablement dû à l'état sanitaire de l'animal (présence de mammite).

Enfin, les teneurs en champignons concordent avec ce qui a été rapporté par Oubari en 2004 (1.22 10⁴ufc/ml) et par Labioui en 2009 (1.2 10⁴ufc/ml) [10],[13]. La présence massive des levures et moisissures dans le lait cru peut être due à une forte contamination extérieure et une mauvaise hygiène des ustensiles.

5 CONCLUSION

L'étude des caractéristiques physico-chimiques du lait cru prélevé auprès des différents adhérents au centre de collecte Alfourate n'a pas donné de variation significative pour la plupart des paramètres étudiés. Par contre la température des échantillons et celle ambiante sont légèrement élevées, ce qui favorise la prolifération des germes et l'altération de la qualité du lait.

Les résultats obtenus dans l'étude microbiologique confirment cette altération, ainsi la charge moyenne en flore de contamination fécale est élevée, témoignant d'une pollution fécale des cultures fourragères servant à l'alimentation des vaches laitières par les effluents domestiques des agglomérations de la région.

En conclusion, malgré l'évolution de la production qu'a connu le secteur laitier dans la région du Gharb pendant ces dernières années, il reste toujours en deçà des normes de point de vue qualité.

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DRAINAGE ANALYSIS OF EXTENDED AREA OF BANNERGHATTA NATIONAL PARK USING GIS

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ABSTRACT: The study focus on land use land cover, drainage network, stream ordering and age of the streams in the extended area of Bannerghatta National Park. The drainage network and micro watersheds are developed for the study, using ArcGIS by manually the drainage network and micro watersheds delineated and for these micro watersheds, bifurcation ratio was found using the Strahler method of stream order to find the age of the streams and also the drainage network and micro watersheds are extracted using ArcHyro tools. In the study area we have tried to understand the landuse and landcover by supervised classification using maximum likely hood classifier with the ENVI software.

KEYWORDS: Drainage network, Stream order, Bannerghatta National Park, Micro watersheds, Land cove.

1 INTRODUCTION

Drainage basin or catchment area is defined as an area in which all water flowing into it goes to a common outlet. Area upon which waterfalls and the network through which it travels to an outlet is referred to as a drainage system.

Digital elevation models (DEMs) provide good terrain representation from which drainages can be derived automatically using Geographical Information System (GIS) technology. The techniques for automated delineation of drainage have been implemented in various GIS systems and custom applications. GIS is basic tool used in this study to achieve various objectives, ArcGIS is software used to extract the information from DEMs, such as drainage, flow direction, watershed, stream order etc. ENVI is a GIS tool used for land use land cover study of area for different classifications such as forest, water bodies, settlements, agricultural, hillocks.

2 STUDY AREA

The study area selected was the extended area of Bannerghatta National Park (as per Notification No: FEE 302 FWL 2011-(II), Bangalore, dated: 27 -12-2011 of GOK) falling in Kankapura taluk, Ramnagara district of Karnataka in India. Total area of Bannerghatta National Park which was 102.74 sq km was as per recent notification extended by including Kodihalli wildlife range of area 157.76 sq. km. The total area of Bannerghatta National Park is now 261.51 sq. km. Study area lies between longitude of 77°32'26.175" to 77°32'2.677"E and latitude of 12°35'40.904" to 12°20'45.32"N covering old area of Bannerghatta National Park to its north, Hosur forest division of Tamil Nadu state to east, Cauvery wildlife range to south and Kankapura taluk of Ramnagara district to the west. It looks highly irregular in shape and measures a maximum of 27.5 km in

length from North to South and varies between 0.1 and 11 km in width from East to West. There are more than 30 water bodies (approx) in the park and many of them are naturally formed and are constantly renovated to augment their water holding capacity along with a few manmade ones. Extended area of Bannerghatta National Park falls under Kodihalli wildlife range with the area of 157.76 sq. km, which is divided into two sections Doddamaralavadi with the area of 110.92 sq. km and Hunasanahalli with the area of 46.84 sq. km. Each section is divided into four beats such as Doddamaralavadi is divided into four beats viz. Therubedi, Hanchaguli, Kadushivanahalli, Gowdahally and Hunasanahalli is divided into four beats viz. Manjunathabetta, Ramdevarabetta, Thattekere, Bilidale.

3 OBJECTIVES

- To understand the land cover pattern in the extended area of BNP
- To delineate and develop a drainage network of the extended area BNP using GIS
- Morphometric analyses of the streams using Strahler method of stream ordering and to find the age of streams

4 RESEARCH METHODOLOGY

4.1 LAND USE LAND COVER CLASSIFICATION

Image classification, which includes both land use and land cover is the process of assigning pixels or the basic units of an image to classes. It is likely to assemble groups of identical pixels found in remotely sensed data into classes that match the informational categories of user interest by comparing pixels to one another and to those of known identity

ENVI's classification workflows include two different methods, depending on whether or not the user has classification training data

1. In a supervised classification, the user selects representative samples for each class such as forest, agricultural, water bodies, urban, settlements etc. from the image. These samples are referred to as training areas. The ENVI classification algorithms use the training data to learn what each class looks like in multi- or hyper-spectral data space. Once the user selects the training areas, then ENVI will perform the classification based on these training areas for the entire image.
2. In an unsupervised classification, ENVI uses an automated technique that searches for natural groups, or clusters, of pixels based on their brightness in several bands. Unlike the supervised method, unsupervised classification does not begin with a predefined set of classes. Here, the user will define the label which the grouped regions in the unsupervised results represent.

4.2 DELINATION OF DRAINAGE NETWORK

In this method the DEM data is used for creating the drainage network. Study area is clipped from the DEM image which was intern delianted from Survey of India topo sheets of the study area.

Using editor tool in ArcMap, a shapefile, is created using polyline feature. The drainage network is created manually by visual interpretation.

4.3 EXTRACTION OF WATERSHED VIA ARCHYDRO TOOL

Extraction of drainage network and watershed with help of ArcGIS is a unsupervised way of creating drainage network and watershed of the area.

Steps to extract watershed from ArchHydro tool

4.3.1 DEM IMAGE

Digital Elevation Model(DEM) image, which is freely available in ISRO website is downloaded.

4.3.2 FLOW DIRECTION

A digital elevation model (DEMs) image should be free of sinks. A depressionless DEM image is the desired input for the flow direction tool. The presence of sinks may result in an erroneous flow-direction raster. In some cases, there may be

legitimate sinks in the data. It is important to understand the morphology of the area well enough to know what features may truly be sinks on the surface of the earth and which are merely errors in the available data.

To create the depressionsless DEM image, if there is any errors to remove from the image. First the raw image should be inputted to flow direction tool.

4.3.3 SINK

Sinks can be located using the Sink tool. This tool requires a flow direction raster that is created by the Flow Direction tool. The result is a raster that identifies any existing sinks in the data.

4.3.4 FILL

The Fill tool uses a variety of ArcGIS Spatial Analyst tools, to create a depressionless DEM. This tool requires an input surface, a fill limit, and an output raster.

4.3.5 DEPRESSIONSLESS DEM IMAGE

Once the depressionless DEM image is created from above process, the depressionless DEM image is used to the create watershed of the area.

4.3.6 FLOW DIRECTION

One of the keys to deriving hydrologic characteristics of a surface is the ability to determine the direction of flow from every cell in the raster. This is done with the Flow Direction tool. This tool takes a surface as input and outputs a raster showing the direction of flow out of each cell.

4.3.7 FLOW ACCUMULATION

The Flow Accumulation tool calculates accumulated flow as the accumulated weight of all cells flowing into each downslope cell in the output raster. If no weight raster is provided, a weight of 1 is applied to each cell, and the value of cells in the output raster is the number of cells that flow into each cell.

4.3.8 STREAM LINK

Links are the sections of a stream channel connecting two successive junctions, a junction and the outlet, or a junction and the drainage divide

The input stream raster can be created by "thresholding" the results of the Flow Accumulation tool.

4.3.9 WATERSHED

A watershed is the upslope area that contributes flow generally water to a common outlet as concentrated drainage. It can be part of a larger watershed and can also contain smaller watersheds, called subbasins/micro watersheds. The boundaries between watersheds are termed drainage divides. The outlet, or pour point, is the point on the surface at which water flows out of an area.

Watershed can be delineated from a DEM by computing the flow direction and using it in the Watershed tool.

4.4 STRAHLER METHOD OF STREAM ORDER

One of the most common stream ordering method is Strahler method. The ordering system is simple wherein all streams start off as order one. If two order one streams join (converge), then they become an order two stream or 2nd order stream. If second order streams join, then they become an order three stream or 3rd order stream. The stream order will only increase if two streams of the same order join. If an order two stream and an order three stream join, then the resulting river will remain order three.

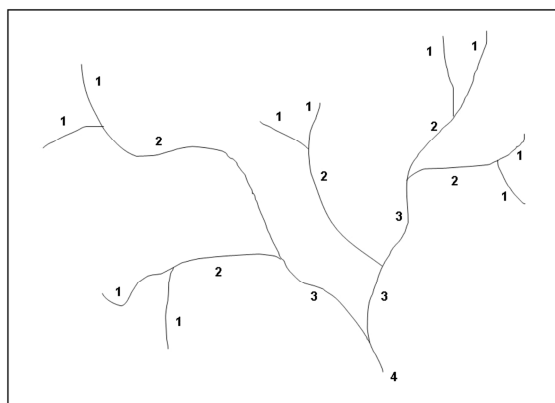


Fig. 1 Strahler method of stream ordering

The Bifurcation ratio looks at the relationship between the streams in different orders. The drainage basin shown (Fig. 1), has 10 order one streams, 5 order two streams, 2 order three and 1 order four streams. To calculate the bifurcation ratio you divide the total number of order 1 streams by the total number of order 2 streams ($10/5 = 2$), then divide the total number of order two streams by the total number of order three streams ($5/2 = 2.5$) and then divide the number of order three streams by the number of order four streams ($2/1 = 2$). You then add together the results ($2 + 2.5 + 2 = 6.5$) and divide by the total sets of values ($6.5/3 = 2.166$). The drainage basin shown above therefore has a bifurcation ratio of 2.166.

The ratio of Bifurcation ratio between 0-3 is considered young stream, the ratio between 3-5 is called matured and >5 it's considered as old stream.

5 RESULTS AND DISCUSSIONS

5.1 LAND COVER CLASSIFICATION OF THE STUDY AREA

Classification percentage wise for the Land cover pattern of extended area of BNP

Table 1 Land cover classification statistics

Class	Area in Percentage (%)	Area in sq.km
Settlements	1.121%	8.748
Forest Cover	60.79%	85.391
Water bodies	17.68%	32.154
Agricultural area	2.20%	10.621
Hillocks	15.62%	27.025
Total	100	156.97

➤ FOREST COVER

Forest cover in the study area is found to be about 60.79% and area is about 85.39 sq. km, major portion is represented by forest in the study area.

➤ WATER BODIES

Water bodies represents to area of about 17.68% which is equalent to 32.15 sq. km.

➤ AGRICULTURAL AREA

Agricultural area accounts to about 2.20% which is about 10.62 sq. km. Agricultural land found in this area are mostly illegal encroachments of the forest land.

➤ SETTLEMENTS

Settlements/built up area has about 1.21% as share in the study area which is equalent to 8.74 sq. km. It was also found that the settlements and agricultural lands were usually adjacent to each other, which is a clear indication of movement in to forest area.

➤ HILLOCKS

Natural hillocks are also present in the study area accounting to about 15.62% which is equalent to 27.024 sq. km, The hillocks are present mostly at the the northernmost part of the study area.

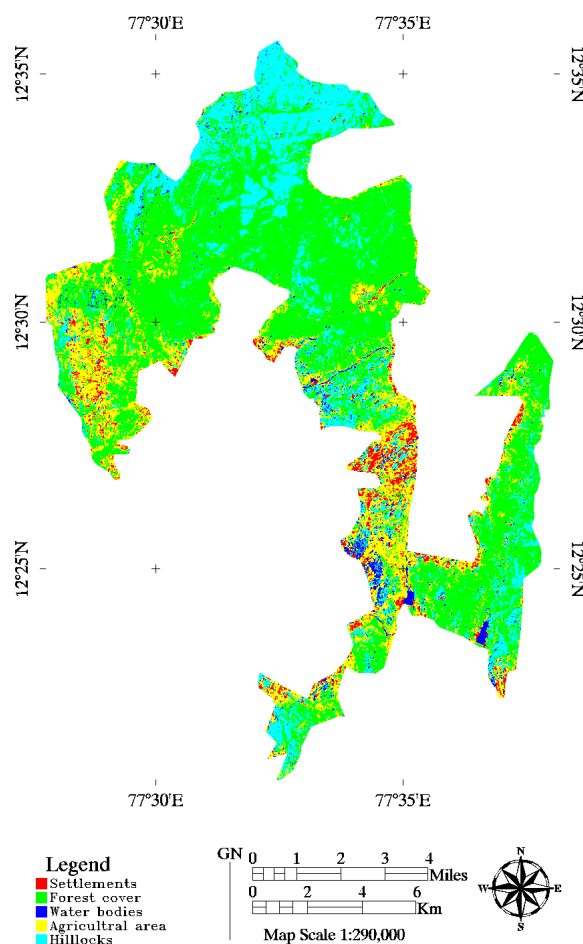


Fig. 2 Land cover classification map

5.2 DRAINAGE MAP OF THE STUDY AREA

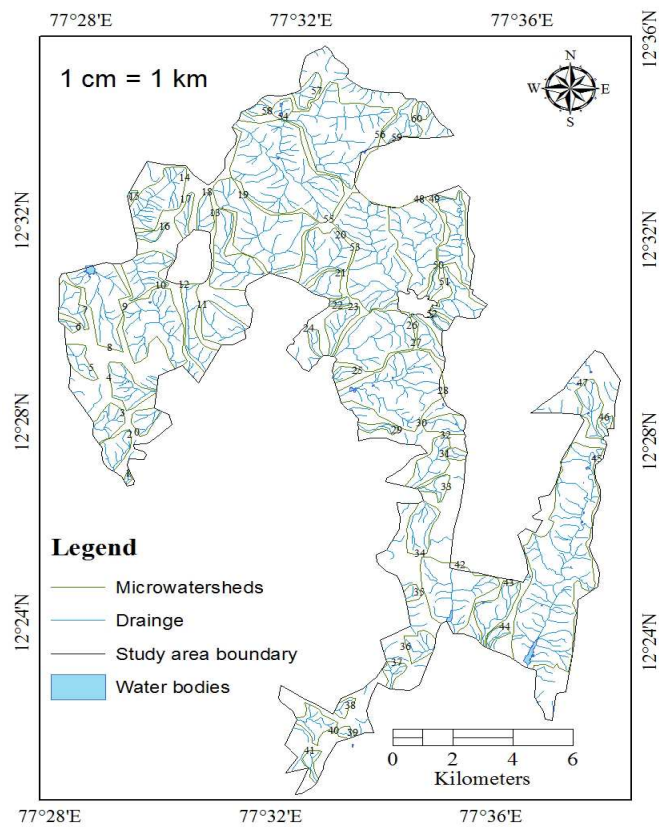


Fig. 3 Manually developed drainage map with micro watersheds

Drainage network and micro watersheds were delineated manually for the study area, to find the stream order and age of the stream by Strahler method as shown (Fig. 3).

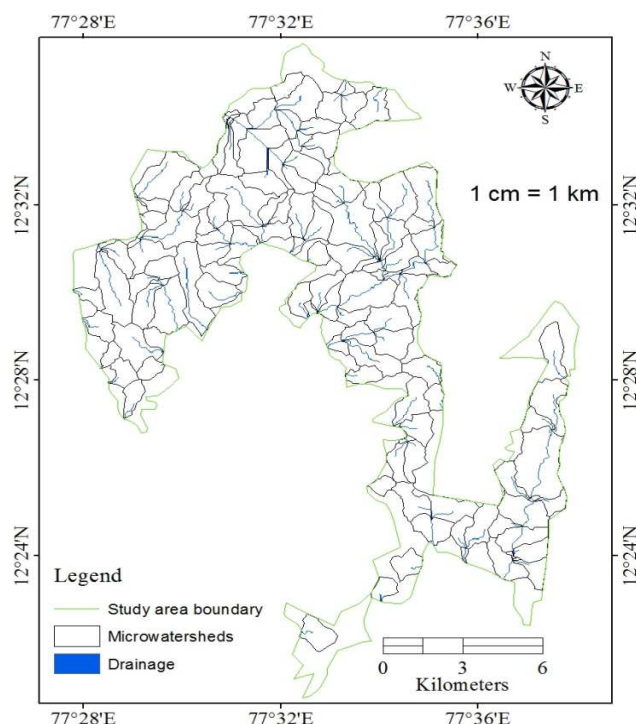


Fig. 4 Extracted drainage and microwatershed map

The drainage network is shown (Fig. 4). The Drainage and micro watersheds map was extracted from ArcMap 10. In the study we tried to better understand the drainage network by further breaking the drainage system to as many possible micro watersheds. It is observed that the manually developed map is more specific and accurate, when compared to GIS extracted map. Thus manually done delineation is used in the study.

5.3 STRAHLER METHOD OF STREAM ORDER

Table 2 Status of the micro watersheds

Status	Number of streams	Percentage (%)
Young	28	45
Mature	26	44
Old	7	10
Total	61	100

The map (Fig 3) shows the manually delineated micro watersheds for stream order from Strahler method and to find the age of the streams of the 61 micro watersheds within the study area. The above table (Table 2) shows the classification based on age of the streams in the study area.

6 CONCLUSIONS

The study done which is the extended area of Bannerghatta national park reveals that there is some encroachment in the forest area. The percentage share of different classifications of the study are as follows: The major share falls under the category forest area with 60.79% of study area followed by the area of water bodies with about 17.68% the third largest is natural formed hillocks with an share of 15.62% of area. Agricultural and settlements account to 2.20% and 1.21% respectively.

The assessment of drainage network of the study area using Strahler method shows wherein total drainage network was divided into micro watersheds reveals that the total drainage network was further sub divided into 61 micro watersheds and on analyses they can be categorised as a healthier. About 45% of the micro watersheds fall under young category, wherein

44% can be classified as matured and about 10% of them fall in old category. The results shows it has a very healthy drainage network for the flora and fauna of the area which should be protected and preserved from any kind of illegal encroachments and sand mining activities.

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Primary Fragmentation of Wood in a Fluidized Bed Combustor - An Experimental Investigation

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ABSTRACT: This work presents the results of experiments conducted to quantify primary fragmentation of wood (*Casuarina Equisetifolia*) during the devolatilization in a bubbling fluidized bed combustor. Cylindrical wood particles having five different sizes ranging from 10 to 30 mm and aspect ratio ($l/d=1$) have been used for the study. Experiments were conducted in a lab scale bubbling fluidized bed combustor having silica sand as the inert bed material and air as the fluidizing medium. Studies have been carried out at three different bed temperatures ($T_{bed}=750, 850$ and $950\text{ }^{\circ}\text{C}$), two inert bed material sizes (mean size $d_p=375$ and $550\text{ }\mu\text{m}$) and two fluidizing velocities ($u=5u_{mf}$ and $u=10u_{mf}$). Limited experiments were also conducted at a bed temperature of $850\text{ }^{\circ}\text{C}$ to study the influence of the presence of wood bark. Primary fragmentation was found to be most severe for larger sizes and at higher bed temperatures. Also, fragmentation did not show any conclusive influence on the devolatilization time.

KEYWORDS: Wood; Devolatilization; Fluidized bed; Primary fragmentation.

1 INTRODUCTION

Devolatilization is an important stage of wood combustion, due to the amount of volatiles contained in it ($\sim 75\%$ by mass) and the amount of heat contained in them ($\sim 80\%$ by mass). Wood is known to shrink during devolatilization. It is also known to fragment under certain combustor conditions [1-3]. The fragmentation (breakage of initial wood particle into smaller char particles) during devolatilization is known as Primary Fragmentation. Both these phenomena (Shrinkage + Primary Fragmentation) greatly reduce the size of the wood particle. The reduced size could have significant influence on the heat conducted and oxygen diffusion into the particle and on the rate of the subsequent chemical reactions. Significant size reduction could result in elutriation of un-burnt fuel, thereby causing direct carbon loss. The size reduction could also play a dominant role in the sizing of the down-stream particulate collection equipment.

Therefore the size reduction could be beneficial as well as detrimental to the combustion process depending on its magnitude. The present work aims at finding the cause of primary fragmentation by quantifying it as a function of various operating conditions. For a wider range of applicability, experiments are conducted at different wood particle sizes, bed temperatures, inert bed material sizes and fluidization velocities.

2 EXPERIMENTAL

Experiments have been conducted in a lab scale fluidized bed combustor at three bed temperatures ($T_{bed}=750, 850$ and $950\text{ }^{\circ}\text{C}$), two inert bed material sizes (mean size $d_p=375$ and $550\text{ }\mu\text{m}$) and two fluidizing velocities ($u=5u_{mf}$ and $u=10u_{mf}$). Details of the experimental facility, sample preparation, and experimental procedure have been discussed elsewhere by Sreekanth et al. [4, 5]. The Proximate and Ultimate analysis of *Casuarina Equisetifolia* is given in Table 1 below:

Table 1. Proximate and Ultimate analysis of *Casuarina Equisetifolia*

Quantity	Content (%)
Proximate Analysis	
Moisture	10.8
Volatiles	72.5
Fixed carbon	16.4
Ash	0.3
Ultimate Analysis	
Carbon	42.5
Hydrogen	6.1
Nitrogen	0.16
Oxygen	51.24

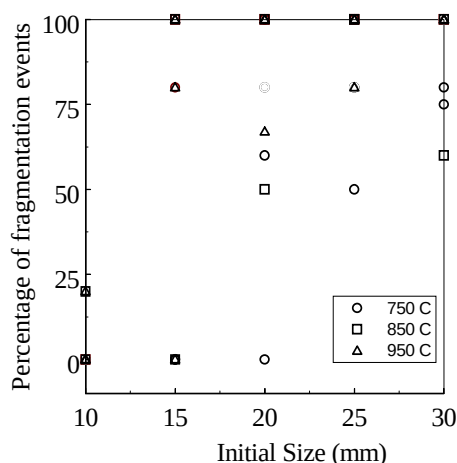
3 RESULTS AND DISCUSSION

3.1 PRIMARY FRAGMENTATION

On devolatilization, wood could undergo fracture or primary fragmentation. Fracture is the state when cracks form in the char particle but the particle itself is intact without breaking down. On undergoing primary fragmentation, the char particle fractures and further the fragments separate from the main body of the char. Hence primary fragmentation is defined as the breakage of the wood particle into smaller wood/char particles during devolatilization. It can be quantified by the Percentage of Fragmentation Events (SF), Number of Fragments (NF), Size Reduction Index (SRI) and Timing of Fragmentation (TOF).

3.1.1 PERCENTAGE OF FRAGMENTATION EVENTS (SF)

It is defined as the percentage of times a similar wood particle underwent fragmentation on repeating the experiment for a certain number of times. For example, on ten repetitions of a single particle experiment, if the particle fragments 6 times, the value of SF is 60%. It speaks about the consistency with which a wood particle would break. This takes care of the chance factor involved in a stochastic process like primary fragmentation. Figure 1 shows SF as it varies with size and bed temperature.

**Fig.1. SF as a function of size and bed temperature**

Two general observations can be made. First, as the initial wood particle size increases, the probability increases. Secondly, as the bed temperature increases, there is a rise in SF. Therefore high likelihood of fragmentation at larger sizes and bed temperatures can be observed.

Another important observation is related to the threshold size below which fragmentation does not occur. For a bed temperature of 750 °C, fragmentation does not occur for sizes equal to and below 15 mm. But for the other bed

temperatures, fragmentation occurred even at the minimum size of 10 mm, though with a lesser frequency. For the 30 mm wood particle, the least chance is around 75% even at 700 °C.

3.1.2 NUMBER OF FRAGMENTS (NF)

It is defined as the ratio of the number of char pieces found at the end of devolatilization to the initial number of wood particles introduced. In the present study, only a single wood particle was introduced and hence NF is equal to the number of char fragments found at the end of devolatilization. The minimum value NF can take is unity, when no fragmentation occurred. Figure 2 shows the influence of size and bed temperature on NF.

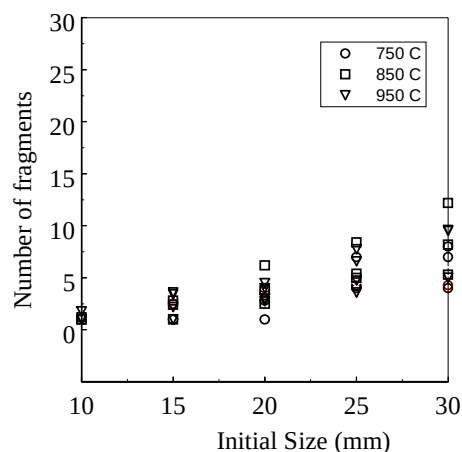


Fig.2. NF as a function of size and bed temperature

Again, there is an increase in NF with size and bed temperature, though the rise is not always consistent. This, too, indicates the stochastic nature of the process. In the figure, one would notice NF as fraction too. This is because of averaging the NF obtained in five repetitions. A 30 mm particle fragmented to 10-13 fragments at bed temperatures of 850 and 950 °C. A 20 mm particle fragmented to 5-7 particles at the same temperatures.

As pointed out in Section 3.1.1, fragmentation seldom occurred for 10 mm size wood. It would be interesting to compare the results of Ammendola et al. [6], where experiments on *Pinus radiata* wood of 10 mm size were found to fragment into 4.5 fragments, even at a bed temperature 800 °C. This fact cautions that each wood is different and has to be studied separately.

3.1.3 SIZE REDUCTION INDEX (SRI)

SRI, earlier known as Fragmentation Index (FI) according to Zhang et. al. [7] is a measure of the degree of size reduction a wood particle underwent. The name Size Reduction Index has been chosen for this study so as to also include shrunk [8, 9] but un-fragmented wood particles too. SRI is defined as:

$$SRI = \frac{NF}{\sum_{i=1}^n \frac{x_i d_i}{d_o}}$$

Therefore, the Size Reduction Index (SRI) includes both shrinkage as well as primary fragmentation in this study.

In the above equation, x_i is the mass fraction of the i^{th} fragment, d_i is the size of the i^{th} fragment and d_o is the initial size of the wood particle. In computing SRI, the value of d_i is taken as the mass equivalent sphere diameter of each fragment. This was necessary as the fragment shapes were usually irregular. Theoretically the minimum value SRI could take is unity. Even for an unfragmented wood particle, SRI at the end of devolatilization would be greater than unity because there was some size reduction due to shrinkage.

SRI is an indicator of the degree of size reduction achieved. Higher SRI indicates good size reduction. As an example, consider two similar wood particles each breaking into two fragments at the end of devolatilization. The first particle breaks into a larger and a smaller char particle while the second one breaks into two equal sized fragments. Since the second one could undergo larger size reduction, its SRI would be greater than the first wood particle.

Figure 3 shows the SRI as a function of size and bed temperature. SRI increases with size and bed temperature. SRI is observed to be higher for largest size and highest bed temperature. Its value ranges from little over 1 up to 25.

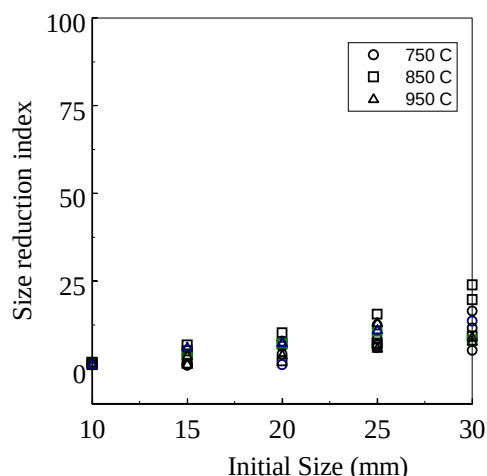


Fig.3. SRI as a function of size and bed temperature.

In general, smaller particles at lower bed temperatures, underwent only a fracture. This fracture was noted at two locations. First one at the centre, where an irregular radial crack was observed and second one near the periphery, where a clearly defined circular weak line was noticed. Also, the wood particle was found to have reduced to a minimal diameter (necking) at the mid point along the length. Under adverse conditions, i.e. at larger sizes and higher bed temperature, the char particle's surface peeled and fell off, with a cracked but intact core remaining. On rare occasions during the entire experimental campaign, fragmentation across the length was noticed. Figure 4 shows the progress of the fragmentation process during devolatilization.

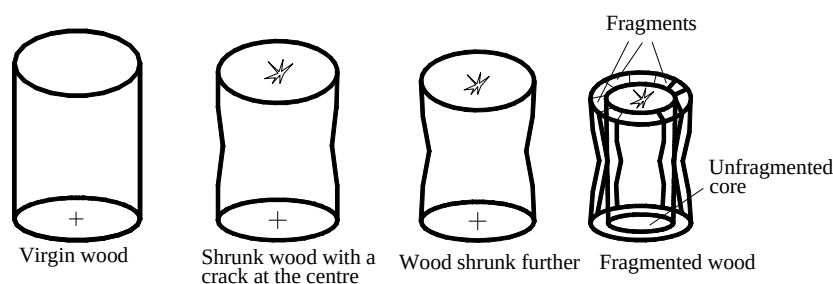


Fig.4. Sequence and mode of fragmentation of a wood

3.1.4 TIMING OF FRAGMENTATION (TOF)

Timing of fragmentation is an estimate of the time period during which fragmentation would occur. It also indicates the possible cause of fragmentation. If fragmentation occurred immediately after introduction, thermal shock could be the cause. If it occurred during the initial period of devolatilization, thermal stress could have been the cause. If it occurred at the middle of devolatilization time, volatiles pressure along with thermal stress could be the cause. If it occurred near to the end of devolatilization, the particle would have attained a uniform temperature and hence thermal stresses would have reduced. Therefore, weakening of the particle along with bed particle impact could be the cause. In addition, shrinkage could be a cause if fragmentation occurred during the end of devolatilization, because shrinkage increased rapidly during that period [10]. Figure 5 shows this phenomenon in wood cylinders at a bed temperature of 750 °C. For more detailed discussion on the time dependant shrinkage, the reader is referred to Sreekanth [10].

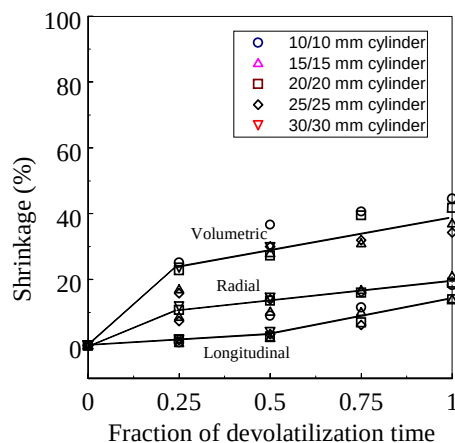


Fig.5. Progress of shrinkage during devolatilization. $T_{bed}=750\text{ }^{\circ}\text{C}$.

Figure 6 shows the NF against the fraction of devolatilization time for different sizes at a bed temperature of 950 °C. Figure 7 shows the influence of bed temperature on the timing of fragmentation of a 30/30 mm particle.

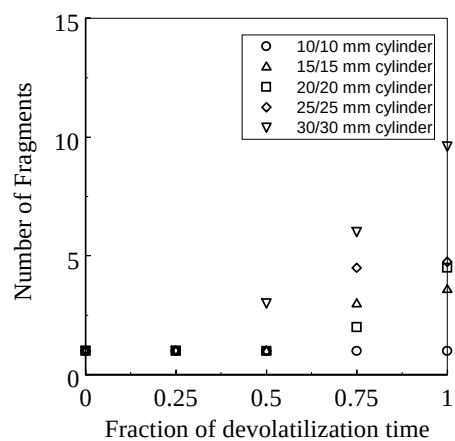


Fig.6. Timing of fragmentation at a bed temperature of 950 °C.

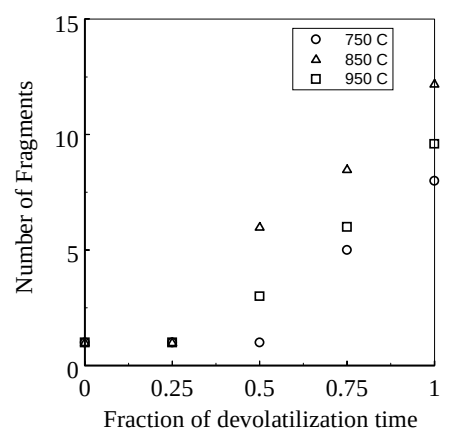


Fig.7. Timing of fragmentation of a 30/30 mm cylinder at different bed temperatures

It can be seen that the NF increases towards the end of devolatilization. Also there are few occasions where there is multiple fragmentation occurring, i.e. fragmentation taking place in the 3rd and 4th quarter too. Since fragmentation is observed near to end of devolatilization, it could be concluded that shrinkage stress along with particle weakening and bed particle impact could be the cause of fragmentation.

At this point, absence of fragmentation in smaller wood particles could be explained. As seen from earlier studies, radial shrinkage is higher in magnitude than longitudinal shrinkage [8, 9] and longitudinal shrinkage decreases with an increase in size while radial shrinkage increases only mildly [10]. Moreover as most of the heat is transferred in the radial direction, the thermal gradients and thereby thermal stresses are high in that direction. Hence radial stresses due to shrinkage and thermal gradients are higher in larger particles, causing fracture in them. This makes the particle weak and prone to failure. Such a particle on subjection to bed particle impact would undergo fragmentation. In smaller particles, since radial stresses are smaller, the particle only cracks at certain locations (centre and near the periphery). It does not become sufficiently weak so as to fragment under bed material impact. Also, in larger particles, char combustion begins at the surface while the interiors are still releasing volatiles. This could aid in further weakening of the surface.

3.2 INFLUENCE OF FLUIDIZING VELOCITY AND BED PARTICLE SIZE

Higher velocities and larger bed particle sizes have larger momentum and hence are capable of delivering larger impact to the char particle. Figures 8 and 9 show the influence of fluidizing velocity and bed particle size on the number of fragments. The results are against intuition. In a broader sense, the figures show that fragmentation is low at higher velocities and at larger bed particle sizes. This result is interesting and needs to be explained.

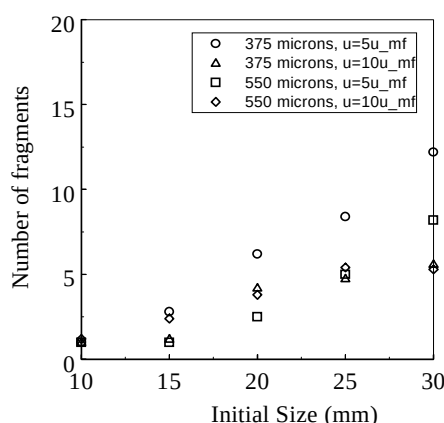


Figure 8: Influence of fluidizing velocity on the NF at a bed temperature of 850 °C.

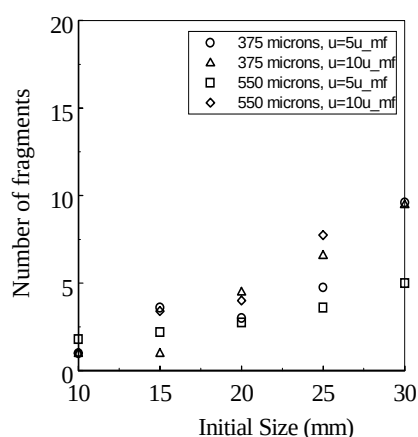


Fig. 9. Influence of fluidizing velocity on the NF at a bed temperature of 950 °C.

3.3 INFLUENCE OF FRAGMENTATION ON THE DEVOLATILIZATION TIME

Primary fragmentation exposes a large surface area of the particle thereby accelerating the reactions. However its influence on the process during which it occurs would be interesting to know. Figure 10 shows the devolatilization time for particles which fragment and also for particles which do not fragment at 850 °C. Figure 11 shows similar data at 950 °C. This data was obtained from experiments where only some of the particles underwent fragmentation. The solid symbols indicate un-fragmented particles while empty symbols depict fragmented ones.

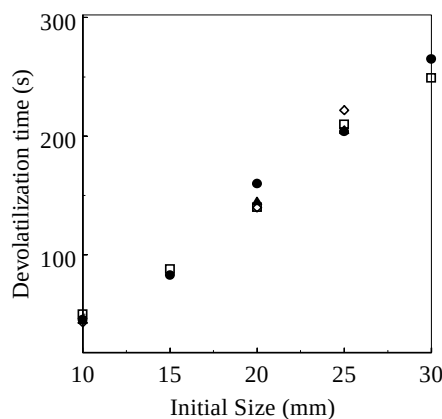


Fig.10. Influence of fragmentation on devolatilization time at 850 °C. Hollow symbols indicate fragmented particles and solid symbols indicate un-fragmented particles.

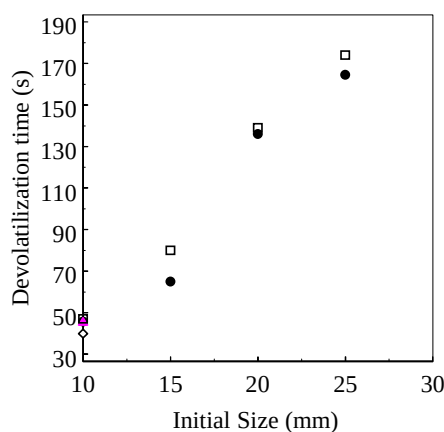


Fig. 11. Influence of fragmentation on devolatilization time at 950 °C. Hollow symbols indicate fragmented particles and solid symbols indicate un-fragmented particles.

There is no definite influence of fragmentation on devolatilization time. At times, the devolatilization time for fragmented particle was longer than the non-fragmented particle and at other times it was vice versa. This could be attributed to the experimental scatter. The absence of an influence could be due to the fact that fragmentation occurs at the end of devolatilization time, as indicated by the timing of fragmentation. Therefore most of the volatiles left the particle by the time of fragmentation.

3.4 INFLUENCE OF BARK

Wood constitutes of 5% bark, which is usually burned along with it. Bark could alter the heat transfer rate into the particle, by forming an additional resistance to heat conduction and oxygen diffusion. Also, it could hold the char so that it does not undergo fragmentation. In order to study the influence of bark, wood of 25 mm diameter (which was the only size

with bark, among the sizes studied) and 25 mm height was used. Figure 12 shows the devolatilization times of 25/25 mm wood samples with and without bark, subjected to a bed temperature of 850 °C.

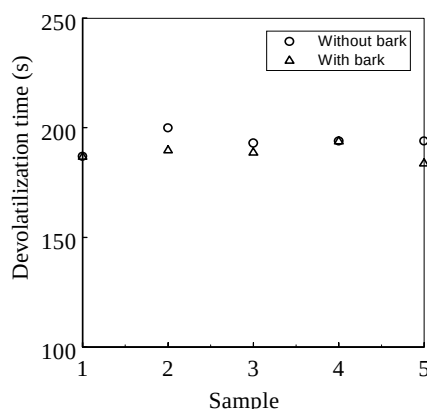


Fig. 12. Influence of bark on the devolatilization time of a 25 mm wood particle at a bed temperature of 850 °C

It can be seen that the difference is negligible. Also the number of fragments with bark and without bark ranged from 4-12 and 5-10 respectively while the average NF was 8.4 for both cases. Similarly the size reduction index was found to be 15.5 for both cases. Though this appears to be too much coincidence, from the limited experiments conducted, it could be concluded that presence of bark has no influence on the devolatilization time, NF and SRI.

4 CONCLUSIONS

1. Primary fragmentation takes place mostly for particles above 10 mm size and at higher bed temperatures.
2. The Number of Fragments varies from 1 to 13 in the range studied.
3. The Size Reduction Index varied from over 1 to 25 in the range studied.
4. No clear influence of fluidizing velocity and bed particle size was observed.
5. Primary fragmentation occurs in the 3rd and 4th quarter of the devolatilization time.
6. Devolatilization time is independent of the occurrence of fragmentation for the species of wood studied.
7. Presence of bark does not influence the devolatilization time and primary fragmentation characteristics.

ACKNOWLEDGEMENT

The experimental work reported in this article has been carried out at the Heat Transfer and Thermal Power Laboratory at the Indian Institute of Technology Madras (IIT Madras), Chennai, India, by the funding provided by The Swedish International Development Agency (SIDA). The author gratefully acknowledges the same.

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Enhancing Thermal Image Segmentation By The Application Of The Concepts Used In Unsupervised Artificial Neural Network

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ABSTRACT: In image processing an essential step is image segmentation. The aim of segmentation is to simplify and to change the representation of an image into a form easier to analyse. Many image segmentation methods are available but most of these methods are not suitable for thermal image and they need prior knowledge. In order to overcome these obstacles, a new thermal image segmentation method is developed using an unsupervised artificial neural network method called Kohonen's self-organizing map and a threshold technique. Kohonen's self-organizing map is used to organize the pixels according to gray level values of multiple bands into groups then a threshold technique is used to cluster the image into dislocate zone, this mode is TSOM.

KEYWORDS: Image segmentation, Kohonen's self-organizing map, Neural Networks, Unsupervised.

1 INTRODUCTION

SOM are data visualization technique invented by professor Teuvo Kohonen which reduce the dimension of data through the use of self-organizing neural network. The problem that data visualization attempts to solve is that humans simply can't visualize high dimensional data as is so techniques are created to help us understand this high dimensional data.

Image Segmentation is the process of image division into regions with similar attributes. Image Segmentation is an important step in the image analysis chain with the application of pattern recognition, object detection and so on.

Neural network [1] base Image Segmentation mostly depends on the supervised segmentation method such as maximum likelihood (ML) with an average efficiency rate of about 85%. Supervised Segmentation method needed to get a successful [2].

Segmentation process and sometimes the required information may not be available and also supervised method is like comparing output with available output information so if any little difference is there in the output it will reject that output this is the main problem in supervised method. So we are going for unsupervised neural network method in this method we don't want any example like supervised method unsupervised method divide the input data into groups of similar points it able to cluster the data in different class.

Thermal images are an important source of information which is used in many types of environmental assessment. I am using FLIR T355 camera. The thermal imaging camera is a type of thermography camera used in fire fighting by rendering infrared radiation as visible light; such camera allows firefighters to see areas of heat through smoke, darkness, heat permeable barriers. Thermal imaging cameras pick up body heat, and they are usually used in cases where persons are trapped where rescuers cannot catch them.

A known research uses SOM incrementally to segment a land sat image by first extracting feature and then SOM is trained to segment their type of images this method was attempted on one type of satellite images and for this method to provide accurate result a field survey must be conducted. The correct sample is provided to the SOM network for further

training for further training in a supervised manner. for segmenting the satellite images base paper they used unsupervised method[3]. The proposed method used both SOM and a developed technique known as T-Cluster.

In this paper we are using thermal image as an input image. The first time we are using SOM and proposed T-clustering method for thermal image. There are many image processing segmentation methods are available. There are many image processing methods are available and also many neural network methods are also available but in image processing segmentation method take more time to execute, The efficiency of output is low and more human power is needed but in neural network the segmentation method take less time, The output accuracy is much higher that the image segmentation and it need less man power and, if we are comparing supervised and unsupervised neural network method in supervised neural network method human expert or operation chooser training images and manually segment them into K sub regions method segment the image and labels the regions according to the training data[4]. In unsupervised method automatically segments the image into K sub region then the algorithm is assigns label to the k sub region.

The paper is structured as follows. In section 2.Flir Camera, 3. An overview of SOM and it is implemented as part of the new segmentation method. In section4.threshold clustering technique (T-cluster) is presented 5. TSOM segmentation method is explained. 6. Experimental result gives the conclusions.

2 FLIR CAMERA

For taking a thermal image I used FLIR T325 camera. This camera is very newly invented one the cost of this camera is around to lack of Indian money. Thermal imaging cameras work based on a principle called Forward Looking Infrared (FLIR). This technology is very similar to the expertise used in non- contact (infrared) thermometers. Infrared thermometers and warm imaging cameras both work on the principle that any object with a temperature above absolute zero (zero degrees Kelvin, (-273.16 C, or -459.69 F) eradiate infrared energy. The warm within an thing causes molecular vibrations. These oscillations in turn induce the electron vibrations which leads to the electromagnetic coupling that causes the infrared energy to be emitted.Because of the mechanics involved in this method, the wavelengths of the resulting infrared energy vary according to temperature. The infrared energy that is released from an object is a kind of electromagnetic radiation, and has several of the same features as light. The energy is transferred at the speed of light, and streams indeterminately in all directions.



Fig1: FLIR T355 Thermal Camera

An infrared thermometer contains a sensor called a thermopile. When the thermometer is sharpened at an object, a lens centres the infrared radiation emanating from that thing onto the thermopile. The thermopile produces a small volume of electricity, which differs depending on the amount of infrared energy that has been received. A simple processor within the thermometer measures this voltage and computes the object's temperature based on the thermometer's inner calibration tables.What makes a thermal imaging camera different from an infrared thermometer is that the thermopile holds multiple sensors. These sensors are organised in both horizontal and vertical rows. The amount of rows fixes the camera's resolution. For model, the thermal imaging camera that Modern Stage Paranormal uses has a resolution of 320 x 200. This fund that the camera's thermopile has 200 rows, each of which contains 320 sensors.

A thermal imaging camera determines temperatures independently for each sensor. The temperature data are then sent to a video processor that is responsible for forming a picture based on the warm data. Typically, the video processor will allot the colorblack to the coldest warm that was detected, and will allot white to the warmest detected temperature. Gradient shades of grayscale are applied to the remaining temperatures comparative to their proximity to the upper and lower temperature limits.

The thermal imaging camera will refresh its warm data several periods of second. One of the things that create thermal imaging cameras so costly is that they require a fast microprocessor that can keep up with the constant movement of new data, and that can allot color codes to the most recently detected temperatures on a actual time basis. For model, a thermal imaging camera with a resolution of 320 x 200 takes 64,000 warm readings at a time. If the camera is designed to display ten frames per second (which is the bare minimum for a flicker unrestricted display), then the microprocessor must be able to dependably process 640,000 data points per second.

3 AN OVERVIEW OF SOM AND ITS IMPLEMENTATION

Kohonen Self Organizing I shall be referring to them from on, are fascinating beasts. They were invented by a man named Teuvo Kohonen, a lecturer of the academy of Finland, and they deliver a way of demonstrating multidimensional data in much lower dimensional spaces-usually one or two dimensions. This process of decreasing the dimensionality of vectors is fundamentally a data compression method known as Vector Quantisation. We are using unsupervised SOM neural network method[5]. A SOM converts pattern of arbitrary dimensionality into the responses of two dimensional array of neurons. Feature map preserves neighborhood relations of the most important.

SOM is a type of artificial neural network that is trained using unsupervised training to produce a low dimensional discretized representation of the input space of the training samples called a map. It is little differ from the other artificial neural network in the sense that they use a neighborhood function to preserve the topological properties of input space.

A typical SOM structure is given in figure 2. This consists of two layers, An input layer and An output layer. The sum of input neurons is equivalent to the dimension of the input data[6]. The output neurons are arranged in a two dimensional array and each and every SOM maps node directly connected with the input node.

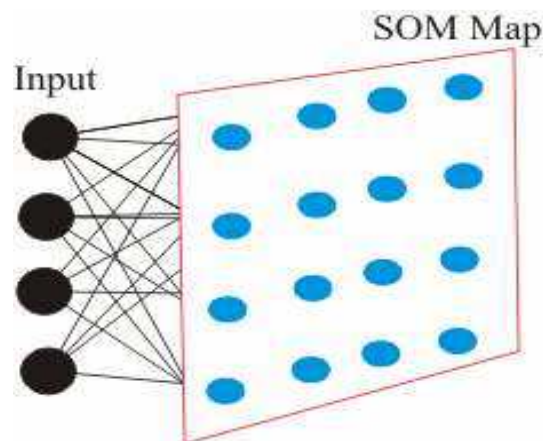


Fig2: Self Organizing Map

Colors are more important features considered in the biological virtual system, since it is used to separate object and patterns, even in condition of equal luminance. SOM is used to map patterns in three-dimensional color space to a double dimensional space. In SOM, the input signals are n-tuples and there is a set of m cluster units. Each input is finally connected to all units. In SOM initial weights are random and small, and their contribution to the final state decreases with the decrease of the number of samples.

Each input is fully connected to all units. The initial weights are random and small, and their contribution to the final state decrease the decrease of an orthogonal grid of cluster units, each is associated with three internal weights for the three layers of the satellite image. At each step in the training phase, the cluster unit with weights that best match the input pattern is elected as the winner usually by using minimum Euclidean distance as in equation 1

$$D(j) = \sum (w_{ij} - x_i)^2 \quad (1)$$

$i=1$ to n and $j=1$ to m ;

When $D(j)$ is minimum.

For all units J , with the specified neighborhood of J , and for all I , update the weights.

$$W_{ij(new)} = W_{ij(old)} + \alpha [X_i - W_{ij(old)}] \quad (2)$$

A is the initial learning rate and it is equal to 0.1. The learning rate is updated every iteration (old), initially can be half the length of the network or the maximum of the either the width or length of the image divided by two. As the learning proceeds, the size of the neighborhood should be diminished until it encompasses only a single unit.

After the SOM neural network converges to balance state, the original image is mapped from a high color space to a smaller color in this space. The number of colours is equal to the number of neurons of SOM network. The final weight vectors in the map as the new sample space. This new data set is used for clustering, and allows determining a set of cluster centers.

4 THRESHOLD TECHNIQUE (T-CLUSTER)

In order to eliminate small clusters and to reduce over segmentation problem the following technique is implemented. This technique consists of several steps as follows:

1. After obtaining cluster center's by SOM the process of clustering starts by calculating the distance between the values of the cluster centers representing the sum of the three bands.
2. Two clusters are combined if the distance between their centers is less than a predefined threshold T.
3. If step two is correct, the minimum number of pixels is considered in the combination procedure. where the cluster with smaller number of pixels is merged with the large one. Figure 3 shows more details of the merging procedure and the equation 3 explains the procedure of distance calculation.

$$d(V(p_i), V(p_j)) \leq T \quad (3)$$

where T is a predefined threshold and $V(P_i)$ is the value of the three bands of the cluster centers P_i which is the sum of the result 3 weights obtained from the running SOM each weight is multiplied by 255. $V(P_j)$ is the value of the three bands of another cluster center P_j . these two clusters centers are combined together if the distance value is less than a predefined threshold T. The value of the final cluster is the cluster with higher number of pixels.

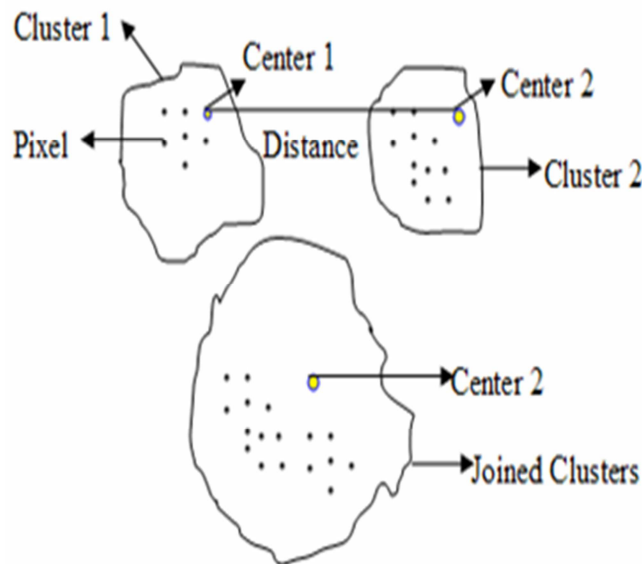


Fig 3. The merging process according to the distance between the clusters.

TSOM segmentation method

SOM and the threshold technique(t-cluster) work sequentially in order to complete the segmentation process. In order to complete the segmentation process. In other words, working separately cannot complete the job correctly as shown fig (below).

SOM use thermal image features to organize pixels in group. The highest peaks of the histogram are used as cluster centers and are provided to T-cluster to deliver the final solution in the image segmentation.

This method starts by reading the thermal image than it is provided to SOM to organize the pixels in the group. The organize pixels are used by T-cluster to obtain the final number of cluster centers. TSOM fixes the problem of under and over segmentation which are caused by using SOM separately.

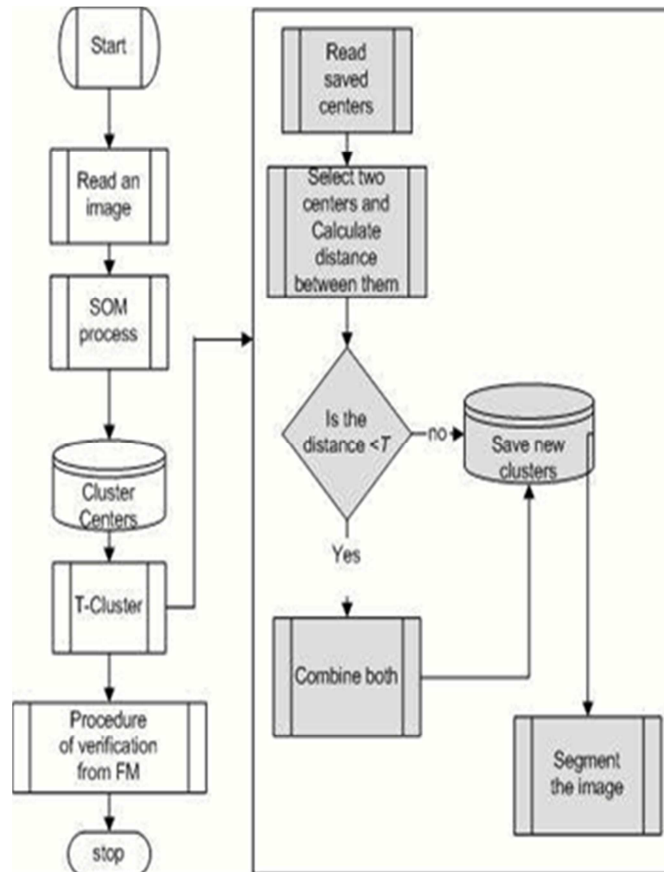


Fig 4: SOM and T cluster sequential process

Reading the image from the input then we are giving that image to the SOM processor for segmenting the image by using SOM algorithm then we are finding the cluster centers then we are using T-cluster to avoid the over segmentation problem in T-clustering the SOM process output is given as a input then we selecting two cluster centers and then we are calculating the distance between them then the T value is more than the distance between 2 clusters then it automatically save the new clusters then new image segmentation is saved before that the 2 cluster will combine if the cluster size is small.

5 EXPERIMENTAL RESULTS

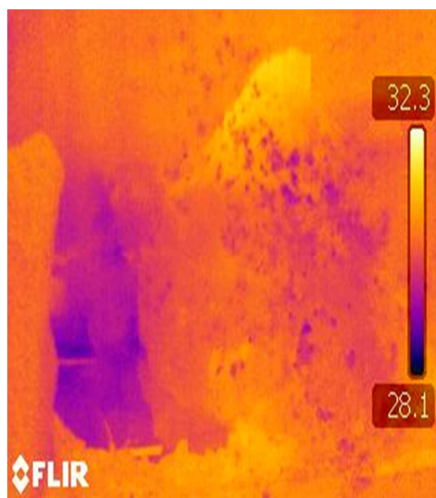


Fig 5: Input Thermal Image

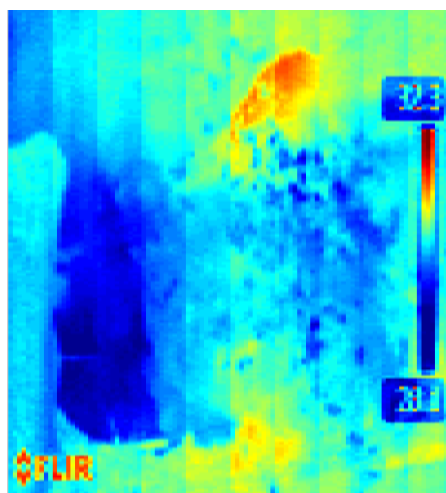


Fig 6: Output Thermal Image

The proposed image segmentation method is implemented using MATLAB .In figure 5 a) is input image and b) is output image .The result obtained by TSOM segmentation process with threshold value equal to the 75 and iteration number equal to 1000 .To increase the confidence in the obtained results, the segmented image is converted into vector format. There are many raster to vector conversion method such as the one by Suzuki and by Zenzo etc. These methods are available in many commercial software such as Arc Info. In this research the conversion process is done using the vector module. The vector layer elements are labelled according to each cluster number. TSOM took almost 25 seconds to segment the image.

6 CONCLUSION AND FUTURE WORK

Thus this project is based on how to segment the thermal image to find the defected area. Segmentation is an important step's in an image processing lot of the methods therefor segmenting the thermal images but let us implement a sequential method for thermal image segmentation using SOM and threshold technique we called it TSOM.

The efficiency of this new method depends on the selected number of iterations and threshold value. However, these values can be determined easily for type of thermal image, and they can be permanently in segmenting these images. TSOM is compared to ISODATA (Iterative Self Organizing data) method which has some similarities, especially in the need for determining the number of iteration and threshold value. In addition to this we are using a new type camera called FLIR335 camera and the temperature range of the image also we are calculating.

TSOM is almost two times faster if compare to the extreme case of running ISODATA.

Compare to the TSOM method new method they introduced is called Generalized SOM (GenSOM) was proposed to handle distance measurement of mixed-type data via distance hierarchy. Whereas the GenSOM constrains projection result in a predetermined fixed-size map, making the resultant map unable to reflect data distribution in accordance with the nature of data clusters. In this paper, we propose a Growing Mixed-type SOM (GMixSOM) which extends GenSOM with a dynamic structure, to handle mixed-type data and tackle the problem of the fixed map structure of GenSOM. Experimental results show the proposed method can reveal the topological relationship between mixed data and overcome the drawback of map structure constraint arisen in GenSOM.

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Design of Highly stable Femto Second Fiber laser in Similariton regime for Optical Communication application

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ABSTRACT: Analyzing the stability of similariton pulse in a passively mode-locked fiber laser. The intracavity elements comprise an Yb doped fiber, a saturable absorber and a single mode fiber. Stability of the pulse has been investigated in the presence of the higher order linear and nonlinear effects of third order dispersion and self-steepening respectively.

KEYWORDS: Mode locked fiber laser, Split step Fourier transform.

1 INTRODUCTION

The generation of ultrashort optical pulses is an extremely exciting and rapidly growing field. A lot of research has been done on ultrafast technology during the last decade and this has created a strong demand for short pulsed laser systems. These lasers find applications in various fields such as optical frequency metrology, terahertz generation, optical coherence tomography, eye laser surgery, dentist drills, micro-machining and marking, high speed soliton transmission and ultrahigh speed OTDM transmission. Of utmost importance in ultrafast optics is the mode-locked laser and development of mode-locked laser is, in itself, a huge research field.

Mode-locked lasers can be of two types: actively mode-locked lasers and passively mode-locked lasers. On the basis of the operation regime, there are three basic classifications: the soliton lasers where the net intracavity dispersion must be anomalous, the stretched pulse fiber laser where dispersion management is used with fiber spans of alternating dispersion, and the similariton (self-similar) lasers where net intracavity dispersion must be normal. The advantage of similariton lasers over the other two types is that self-similar pulses are highly stable and can travel long distances without undergoing wave-breaking. Here, in this paper, we have studied pulse evolution in a passively mode-locked fiber laser in the self-similar regime, and the effect of higher order dispersion and nonlinear terms on the stability of pulses.[1]

2 LASER MODEL

The laser described here consists of a gain fiber, a saturable absorber and a single mode fiber. Propagation of pulses through the gain fiber and the single mode fiber can be described by the extended nonlinear Schrödinger equation given by (1).

$$\frac{\partial A}{\partial z} = -\frac{i}{2}(\beta_2 + igT_2^2)\frac{\partial^2 A}{\partial t^2} + \frac{\beta_3}{6}\frac{\partial^3 A}{\partial t^3} + i\gamma|A|^2A + \frac{1}{2}(g - \alpha)A \quad (1)$$

where A is the envelope of the field, z is the propagation coordinate, t is time, β_2 is the GVD, β_3 is the TOD, T_2 is the dipole relaxation time, γ is the coefficient of cubic nonlinearity, α is the linear loss and g is the gain coefficient. The gain saturates with total energy according to the equation:

$$= \quad (2)$$

Where γ is the small signal gain, E_s is the saturation energy, and E_p is the pulse energy. The dipole relaxation time is given by:

$$(3)$$

Where c is the speed of light in vacuum, $\Delta\omega$ is the gain bandwidth, and k is the wave number. The saturable absorber is modeled by its intensity dependent reflectivity given by:

$$R = R_0 + \frac{R_{sat}}{1 + \frac{P}{P_{sat}}} \quad (4)$$

Where R_0 is the unsaturated reflection coefficient, R_{sat} is the saturated reflection coefficient, P_{sat} the saturation power (150W) and P the instantaneous pulse power.

3 SIMULATION OF THE MODEL

The above model is simulated numerically using the split-step Fourier method. A Gaussian pulse with pulse energy of 200pJ and pulse width equal to 30ps is chosen as the initial pulse. The GVD of the gain fiber is $-0.075 \text{ ps}^2/\text{m}$, TOD is $+0.002 \text{ ps}^3/\text{m}$, and the length is 0.4m. γ for both SMF and gain fiber is $0.003 \text{ W}^{-1}\text{m}^{-1}$. The GVD of the SMF is $+0.0023 \text{ ps}^2/\text{m}$ and its length is 4m. E_{sat} is 400pJ, σ_0 is 7 m^{-1} , and the center wavelength of the laser is 1035nm. The resulting net cavity dispersion is $+0.062 \text{ ps}^2$, i.e., net intracavity dispersion is positive. As expected, the simulation yields steady wave-breaking-free pulses.

4 RESULTS AND DISCUSSION

4.1 PULSE EVOLUTION IN PRESENCE OF DISPERSION AND NONLINEARITY

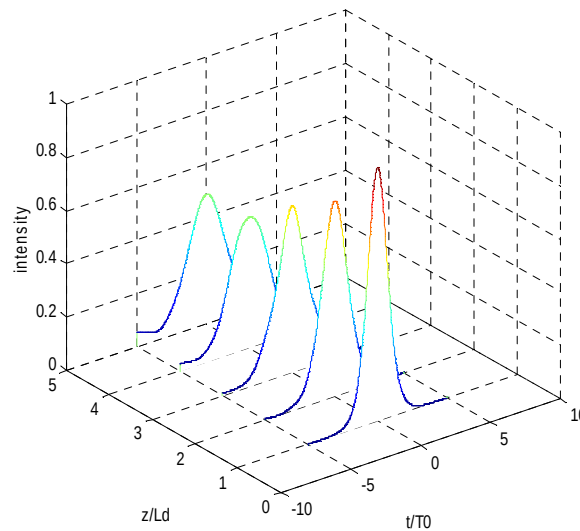


Fig.1: Evolution of pulse in the presence of both dispersion and nonlinearity

Figure 1 shows how the pulse evolves when both GVD and nonlinearity are present. Over here, of importance is the parameter N (called the broadening factor) defined by:

$$N^2 = L_d / L_{NL}$$

Dispersion dominates for $N \ll 1$ while self-phase modulation dominates for $N \gg 1$. The above graph has been obtained for the condition $N=1$, i.e. when $L_d = L_{NL}$. Here, both GVD and self-phase modulation are equally effective.

4.2 PULSE EVOLUTION IN AN ALL-FIBER-RING-LASER IN THE WAVE-BREAKING-FREE REGIME [5]

The formation of wave-breaking-free pulses from an initial Gaussian pulse, and the various factors affecting pulse stability have been studied and presented in the following sections.

4.3 BUILD UP OF WAVE-BREAKING FREE PULSE FROM INITIAL GAUSSIAN PULSE

Fig.2: Pulse evolution over 100 roundtrips

Figure 2 shows how the pulse evolves over 100 roundtrips. We have taken Gaussian pulse as the initial pulse. Under normal conditions, the pulse would undergo wave-breaking after few roundtrips. However, here the conditions of self-similar pulse evolution have been met, ensuring that the net intracavity dispersion is positive, whereby parabolic pulses evolve which travel without any change in their shape.

If, however, these conditions are not met and net intracavity dispersion is not positive, then parabolic pulses will not evolve. This would result in wave-breaking, and we will not get stable pulses in that case.

4.4 OUTPUT PULSE PROFILE

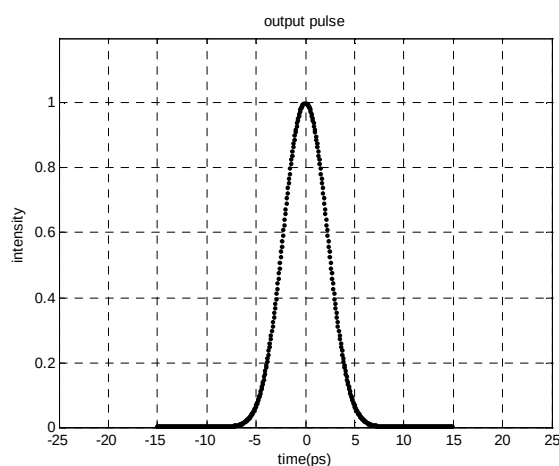


Fig.3: Shape of the output pulse

Figure 3 shows the output pulse profile. The x-axis shows the pulse duration in ps whereas the y-axis shows the normalized pulse intensity. This is the output taken from the cavity. If we use external pulse compression techniques such as prism or grating pairs, then the pulse width can be further reduced.

4.5 EFFECT OF DIFFERENT g_0 VALUES ON PULSE EVOLUTION

The gain of the AS-Yb-PBGF is modeled by:

$$g = \frac{g_0}{1 + E_{pulse}/E_{sat}}$$

where g_0 gives the small-signal gain, specific to the particular fiber. Thus, g_0 plays a major role in pulse evolution. Presented below are the graphs for different values of g_0 . These help us analyze the effect of g_0 on pulse evolution.

Fig.4: Pulse evolution for $g_0=7.5$

Simulations have been carried out for various values of g_0 and these show that values of g_0 between 7 and 8 are acceptable. Beyond this value, energy saturation occurs. This happens because every gain fiber has a particular value of saturation energy which puts an upper limit on the amount of amplification the fiber would produce. Hence, the gain fiber cannot increase the pulse energy beyond a certain value. This can be seen in the following graphs. The next two graphs show pulse evolution for g_0 values equal to 15 and 20. [2]

$g_0=15$

$$g_0=20$$

Effect of initial pulse energy on pulse evolution

The initial pulse energy also affects pulse stability. By carrying out simulations with different values of initial pulse energy, it has been observed that initial pulse energy in the range 200pJ to 400pJ is acceptable. Beyond this range, the pulse energy suddenly decreases after the first roundtrip itself. This again happens because of the energy saturation effect in the gain fiber. The next three graphs show pulse evolution for initial pulse energies equal to 300pJ, 600pJ and 1000pJ.

Fig.5: Pulse evolution for initial pulse energy $E_0=300\text{pJ}$

Initial pulse energy $E_0=600\text{pJ}$

Initial pulse energy $E_0=1000\text{pJ}$

4.6 EFFECT OF NONLINEARITY

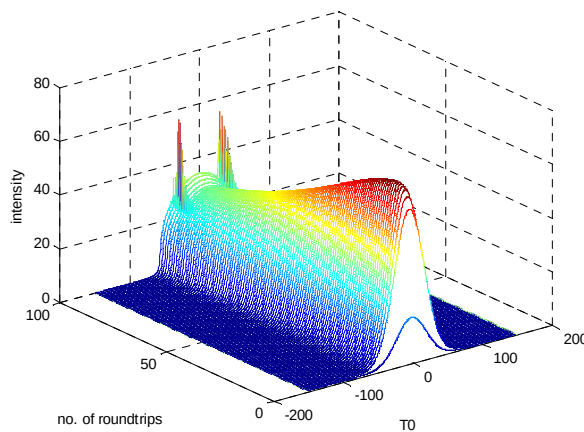


Fig.6 Pulse evolution for increased value of nonlinearity ($\gamma=0.0075\text{W}^{-1}\text{m}^{-1}$)

Figure 6 shows the effect of increasing the fiber nonlinearity. As the nonlinearity of the fiber increases, self-phase modulation increases which causes spectral broadening and makes the pulse unstable, with the result that wave-breaking occurs. Nonlinearity becomes more and more dominant as the pulse width decreases. Thus, to avoid the effects of nonlinearity, the pulse width within the cavity should not be reduced to a very short value. We can rather use some external

pulse compression techniques to shorten the pulse. We get stable wave-breaking-free pulses for gamma less than $0.005\text{W}^{-1}\text{m}^{-1}$. However, as gamma increases beyond this value, optical wave-breaking occurs. Figure 6 shows pulse evolution for $\gamma=0.0075\text{W}^{-1}\text{m}^{-1}$.

4.6 EFFECT OF DISPERSION

Fig.7: Effect of increased dispersion (β_2 of SMF = $0.075\text{ps}^2/\text{m}$)

Figure 7 shows the effect of increased second order dispersion on pulse evolution. When β_2 of SMF is $0.023\text{ps}^2/\text{m}$, stable pulses are seen to evolve whose shape and intensity remain almost constant. However, when β_2 of SMF is increased to $0.075\text{ps}^2/\text{m}$, the pulses no longer maintain their shape. Broadening of pulses occurs and their intensity is seen to decrease.

5 CONCLUSION

To conclude, modeling of an ultrashort passively mode-locked fiber laser was done using an Yb-doped fiber. Simulations were performed for the case of normal net intracavity dispersion, thereby demonstrating self-similar pulse evolution. The pulses obtained from the laser cavity were further compressed by means of an extra-cavity dispersion compensating fiber.

Stability analysis of the pulses was carried out by varying the system parameters such as gain of the fiber and the initial pulse energy. Besides, the effects of increased nonlinearity and increased second order dispersion, and of including higher order nonlinear and dispersive terms such as self-steepening and third order dispersion were studied.

It was found that values of g_0 between 7 and 8 per meter and initial pulse energy in the range 200pJ to 400pJ is acceptable because beyond this range, energy saturation occurs. Besides, the value of nonlinear parameter γ should not exceed $0.005\text{W}^{-1}\text{m}^{-1}$, and β_2 of SMF should remain close to $0.025\text{ps}^2/\text{m}$.

In the presence of third order dispersion, the pulse becomes asymmetric with one of the edges developing an oscillatory structure. Self-steepening also makes the pulse asymmetric. For small values of the self-steepening parameter 's', the pulse remains stable but as the value of s increases, the pulse becomes unstable with its peak shifting towards the trailing edge.

Finally, the effects of using an initially chirped input pulse and using an intracavity DCF were studied. It was found that the effect of initial chirp is to make the pulse unstable. On the other hand, if we use an intracavity DCF then we can greatly improve the output pulse characteristics. We can get a much narrower and sharper pulse from the cavity by using an intracavity dispersion compensating fiber.

The work, in this project, has been done for the case of net normal intracavity dispersion which leads to self-similar pulses. Future work in this field would include the design of an all normal fiber laser. The advantage of an all normal fiber laser is that it would give highly stable pulses with higher pulse energy and peak power.

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Statistical Analysis – Progress of the Decade for Inclusion of the Roma in Republic Macedonia 2005-2010

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ABSTRACT: The paper summarizes the statistic data about the progress of the Decade for Inclusion of the Roma in Republic Macedonia 2005-2010. The article is divided in 5 parts and gives results in the most vulnerable areas connected with the Roma population. The statistic data is a result of my research where 538 people from 17 municipalities were questioned and answered questions about general health condition of Roma, attitude toward the Roma in the health sector, health insurance situation of the Roma, employment of the Roma in the health sector, housing problems of the Roma, property documentation issues, relationships between Roma and non Roma as neighbors, inclusion in preschool, elementary and high school, and university education, and attitude toward the Roma in the educational sector. The result from the survey is that the highest percent of negative responses are in Kumanovo, Shtip and Vinica. There are no positive changes in the municipalities in Skopje, Gostivar, Kichevo and Kochani. Data show that significantly progress is achieved in the aspect of the inclusion of the Roma in preschool, elementary, high school and university education. 74% of the surveyed state that the inclusion of the Roma at university level is increased and only 1% state that the inclusion is decreased.

KEYWORDS: Decade for Inclusion of the Roma, Republic of Macedonia, Integration, Human rights, Romany people.

1 INTRODUCTION

The Statistical Analysis is about the situation and the progress of the Decade for Inclusion of the Roma 2005 – 2010. During my research, 538 Roma people from 17 municipalities are being questioned [¹]. From the total number of questioned people, 41% were women, while 59% were man, and every age group was covered [²], where the greater number were people between 19-30 years of age, while the lowest number were people over 56 years. I believe that the most important data is the one directly related with the four priorities of the Decade, and for that I am giving a review of that data.

¹ People are questioned from the following municipalities: Bitola, Vinica, Gazi Baba, Gostivar, Gradsko, Debar, Delchevo, Gjorche Petrov, Kichevo, Kochani, Kumanovo, Pehchevo, Prilep, Tetovo, Chair, Shuto Orizari and Shtip.

² 31 people 14-18 years; 92 people 19-25 years; 79 people 26-30 years; 63 people 31-35 years; 63 people 36-40 years; 52 people 41-45 years; 62 people 46-50 years; 54 people 51-55 years; 21 people 56-60 years; 18 people over 60 years.

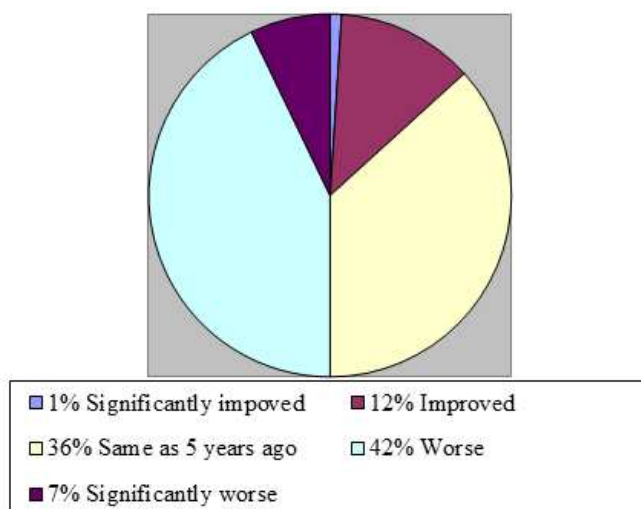
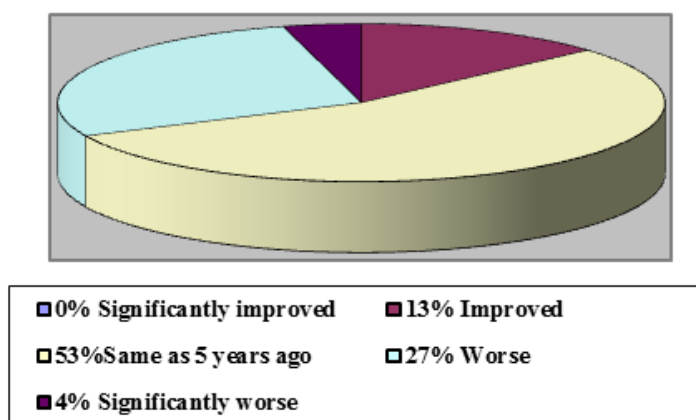


Fig. 1. General Health Situation of Roma

The greater number of the surveyed persons state that the health condition of the Roma is worse while more than 1/3 state that the situation is the same as 5 years ago. 85% of surveyed indicate the need for intensified activities for improvement of the general health condition of the Romany community. The highest percent of negative responses are in Kumanovo, Shtip and Vinica, while some improvement is stated in Prilep. There are no positive changes in the municipalities in Skopje, Gostivar, Kichevo and Kochani. Highest percent of negative responses are given by female respondents, while pointing out the need for serious attention for improving the health situation of the Romany women.

2 ATTITUDE TOWARD THE ROMA IN THE HEALTH SECTOR



More than half from the surveyed state that the attitude toward them is the same as 5 years ago. Only 13% state that the attitude is improved, more than 1/3 state that the relations are worse and none of the surveyed state that the attitude toward the Roma in the health sector is significantly improved. The highest percent of negative response are given in Shtip, Vinica, Kochani, Debar and Gradsko. Positive responses are given in Prilep and Tetova, while negative responses are given by persons over 55 years.

3 STATISTIC IN THE HEALTH INSURANCE AND EMPLOYMENT IN THE HEALTH SECTOR

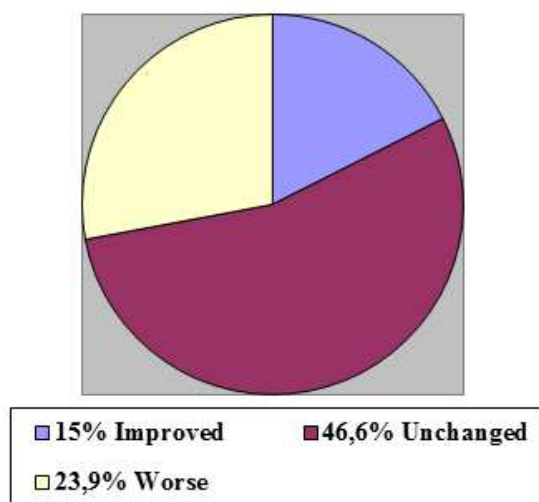


Fig. 2. Health insurance situation of the Roma

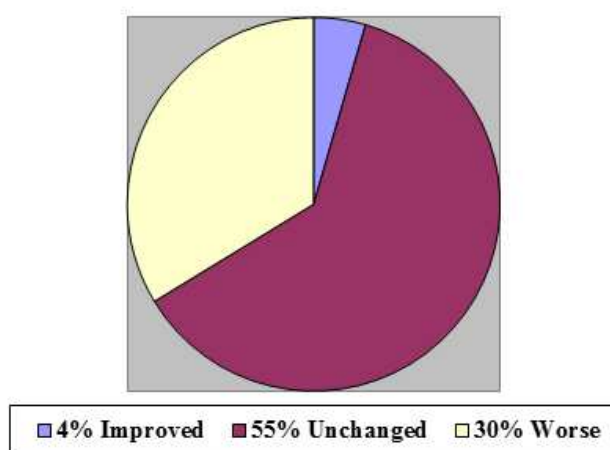
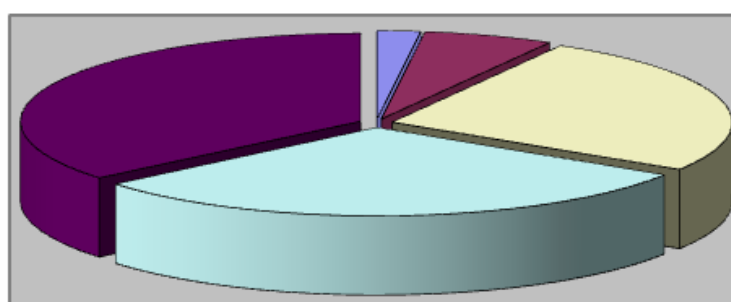


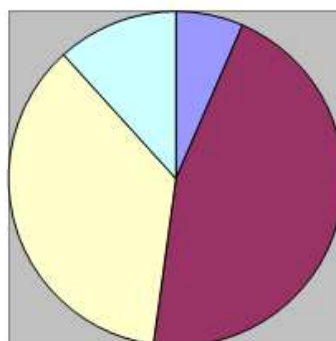
Fig. 3. Employed Roma in the health sector

Almost half of the surveyed state that the situation with the Roma health insurance is the same, while 1/4 state that the situation is worse. With these results I conclude that recent activities in health are ineffective and need to be improved. Highest percent of negative responses are shown in Bitola, Pehchevo and Debar, while the lowest are in Tetovo. The most positive responses are in Kumanovo and Vinica, and the least in Gyorche Petrov. People over 60 years state that the situation with the health insurance is worse. Only 4% of the surveyed state that the situation is improved with the Roma employed in the health sector, more than half state that the situation is the same, while 1/3 state that the situation is worse. Highest percent of negative response are given in Prilep and Kumanovo, and the lowest in Kichevo and Gostivar. The most positive responses are in Tetovo and Chair. People over 60 have the most negative response.



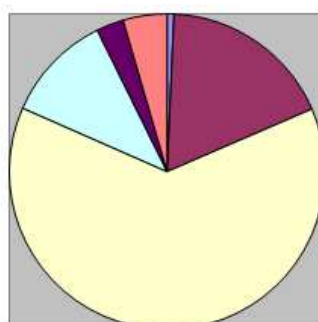
- 2% Improved due to the housing of a greater number of Roma
- 6% Improved with the housing conditions of the Roma
- 25% The same as 5 years ago
- 29% Worse due to the housing conditions
- 35% Worse due to the increase of the Roma homeless

4 SITUATION WITH THE HOUSING OF THE ROMA



- 6,5% Decreased
- 45,6% Unchanged
- 36,1% Increased
- 11,7% No answer

Fig. 4. Property documentation issues of the Roma



- 0,7 % Significantly improved
- 17,8% Improved
- 63,1% The same as 5 years ago
- 11,1% Worse
- 2,8% Significantly worse
- 4,5% No answer

Fig. 5. Attitude toward the Roma neighbours in non-Roma neighborhoods

Almost 2/3 from the surveyed state that the situation with the Roma housing is worse from which 35% state due to the increase of the Roma homeless people and 29% state due to the worse housing conditions. Only 8% from the surveyed state that the situation is improved, most of them are from Kumanovo. Not a single positive answer is given in Prilep, Gyorche Petrov and Kichevo. In Gostivar, 70% from the surveyed state that the housing situation with the Roma is the same as five years ago. The surveyed over 50 years old state that the situation is worse and they highlight the risk of becoming homeless. Not a single surveyed at the age of 26-30, 41-45 and over 55 did not answer that there is improvement of the housing situation with the Roma.

Almost half of the surveyed that the issues with the property documentation of the Roma are the same as five years ago, 6,5% state that these issues are decreased, while more then 1/3 state that the issues are increased. Positive answers about these issues are given in Shuto Orizari, Gostivar, Shtip, Kochani, Debar and Gradsko.

2/3 from the surveyed state that the attitude toward the non Roma and Roma as their neighbours is not changed in the last 5 years. Improvement with the neighbours relations are shown in Kumanovo and Tetovo. The rarest positive answers are given by surveyed at the age of 51-55 and over 60.

5 INCLUSION OF THE ROMA IN THE EDUCATIONAL SYSTEM

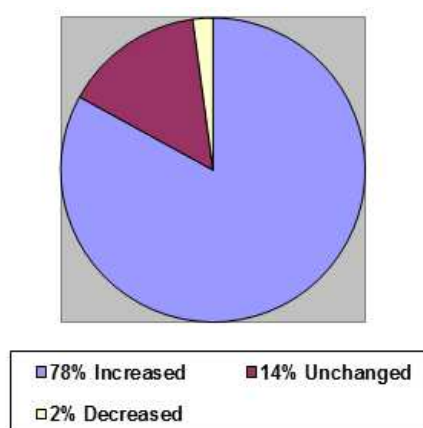


Fig. 6. Inclusion of the Roma in Preschool education

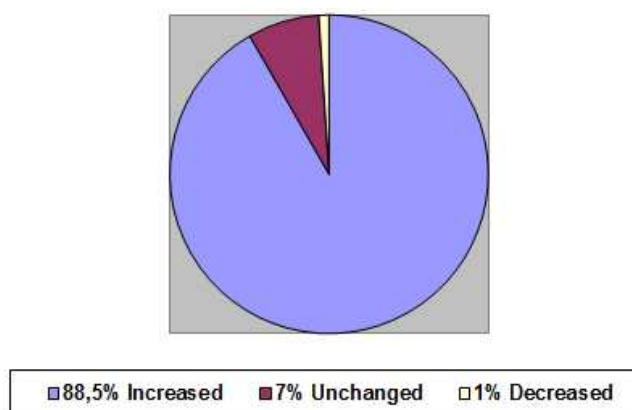


Fig. 7. Inclusion of the Roma in Elementary and Highschool education

78% from the surveyed state that the inclusion of the Roma in the preschool education is increased while only 2 % state that the inclusion is decreased. Positive response are given in Delchevo, Prilep, Kumanovo, Shtip, Kichevo, Pehchevo.

88,5% from the surveyed state that the inclusion of the Roma in the elementary and high school education is increased, while only 7% state that the situation is unchanged and 1% state that the inclusion is decreased. Positive responses are given in Skopje, Prilep, Kumanovo, Shtip and Pehchevo.

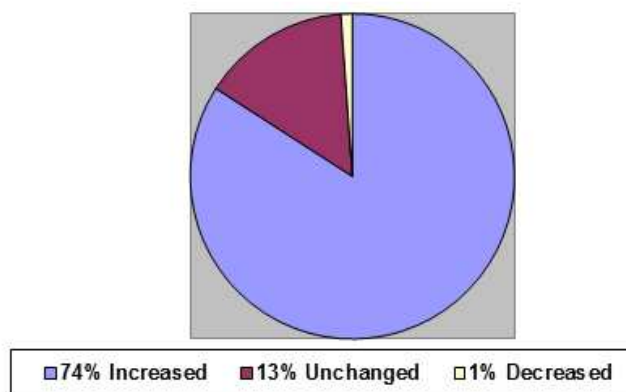


Fig. 8. Inclusion of the Roma in the University education

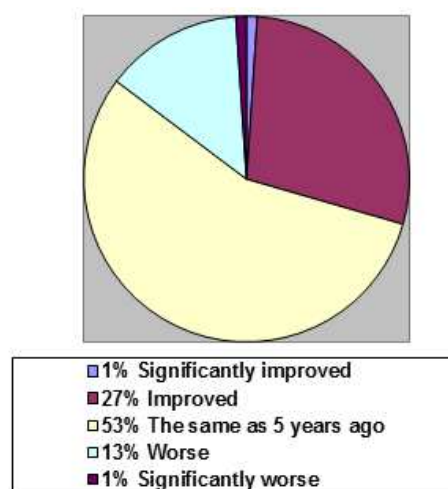


Fig. 9. Attitude of non Roma toward Roma in the education system

Data show that significantly progress is achieved in the last 5 years in the aspect of the inclusion of the Roma in preschool, elementary, high school and university education. 74% of the surveyed state that the inclusion of the Roma in higher education (university) is increased and only 1% state that the inclusion is decreased.

Even do, the inclusion of the Roma in the educational system is significantly increased, more than half of the surveyed state that the attitude toward the Roma from non Roma in the education system is the same as 5 years ago. The highest percentages of negative response are given in Shuto Orizari, Chair, Vinica, Debar and Pehchevo. The highest percentages for improvement in the attitude of non Roma toward Roma are given by surveyed from 14-18 years old.

6 CONCLUSION

The results from the survey show that the most negative responses are given by persons over 55 years and a lot of them are given by female respondents. Only 69 persons (13%) from the total of 538 surveyed people state that the attitude toward the Roma in the health sector is improved. 21 persons (4%) state that the situation is improved with the Roma employed in the health sector. In the housing situation with the Roma only 43 persons (8%) state that the situation is improved and most of them are in the city Kumanovo.

The only positive responses are given in the field of education. 419 persons (78%) from the surveyed state that the inclusion of the Roma in the preschool education is increased and positive responses are given in Delchevo, Prilep, Kichevo, Kumanovo, Shtip and Pehchevo. 476 persons (88,5%) state that the the inclusion of the Roma in the elementary and high school education is increased and positive responses are given in the capital city Skopje, Prilep, Kumanovo, Shtip and Pehchevo. Data show that 398 persons (74%) state that the inclusion of the Roma in higher education system – university education is increased and only 1% (5 persons) state that this inclusion is decreased.

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