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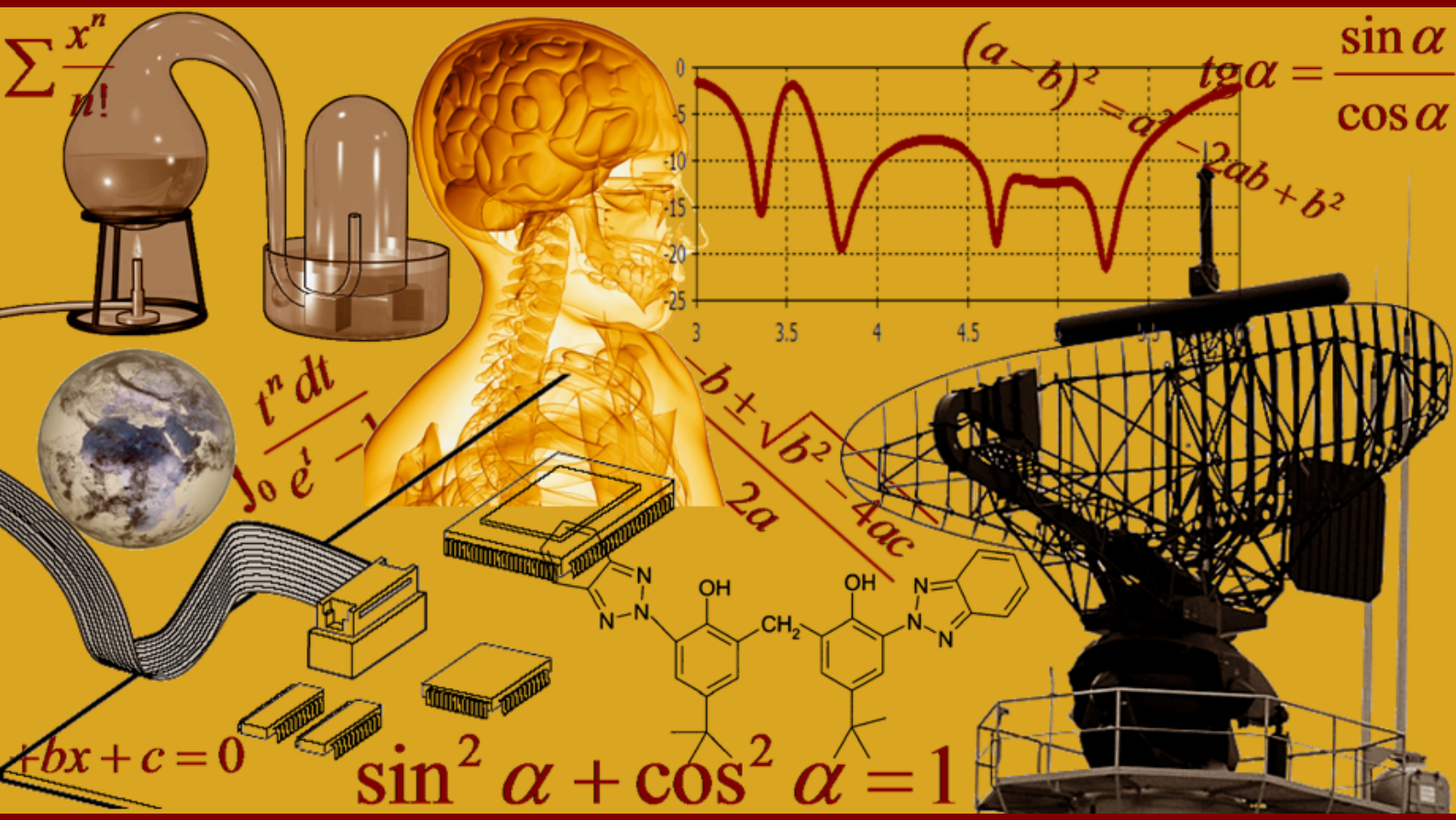

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THE DEVELOPMENT OF LIGHT REFLECTION PROPS AS A PHYSICS LEARNING MEDIA IN VOCATIONAL HIGH SCHOOL NUMBER 6 TANJUNG JABUNG TIMUR

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ABSTRACT: Physics is the one of thinking rationally media and systematically and also train the ability of learners to be used to solve a problem that exist around them, so that they can develop their potentials and resources, therefore, physics learning should be constantly improved to achieve a better quality level. On the results of begining observation and the interview conducted at vocational high school (SMK) number 6 Tanjung Jabung Timur, gained the information in that school that have not had any light reflection props yet and also the laboratory, thus the learning process is not maximum and caused the low in mastery of the concepts on the reflection of light material. This matter showed that the existence of the props (media) in the study of physics is very important. By used the ADDIE method, this reseach got the testing validation and field validation, so the third assessment aspect such as suitability, convenience and attractiveness then it can be affirmed that the light reflection props that have been developed had the level of suitability, convenience and high attactiveness. Thus the tool is fit for use, especially for Physics learning material of SMK and students at the same level in General.

KEYWORDS: Development, Light Reflection Props, Physics Learning Media, Vocational High School.

1 INTRODUCTION

Physics is the one of thinking rationally media and systematically and also train the ability of learners to be used to solve a problem that exist around them, so that they can develop their potentials and resources, therefore, physics learning should be constantly improved to achieve a better quality level. Because, as with the improvement of the learning outcomes of physics expected have the positive impact to the educational enhancement and development of technology in Indonesia. With an increase of the education quality, then Indonesia will have progressed and develop rapidly both from the aspect of science and technology, either in economy aspects.

But in the education matter, physics is the one of the lessons that was less interest of the learners. Generally, they reason is because it has many formulas used in learning. Therefore, of course it necessary needs by the overcome steps to solve this problem, by the one way is provide the teaching methods and the using of interesting props, distinct, effective, and efficient. So it will produce the comfortable teaching and learning situation that is easy and not bored and also students will be easy to acquire the explanations of physics subjects.

On the results of begining observation and the interview conducted at vocational high school (SMK) number 6 Tanjung Jabung Timur, gained the information in that school that have not had any light reflection props yet and also the laboratory, thus the learning process is not maximum and caused the low in mastery of the concepts on the reflection of light material. This matter showed that the existence of the props (media) in the study of physics is very important.

The importance of props or media in learning physics has also been presented by the education experts, for example; Ashyar, (2012), conveyed that: 1. The learning media can provide the information that is accurate and up-to-date. 2. The

Learning Media can add the attractiveness of the material, so it can increase the motivation and the proclivity. Then it can take the student's attention to focus on following the material presented, so it also expected the learning effectively will be increased. 3. The media can stimulate the students to think critically, used their imagination, have an attitude and be further developed, thus it will utter the creativity and innovative works.

In addition, Notoatmodjo (2009) mentioned that the media as an assist tool in the education matter that has any functions to help in demonstrating something in the process of teaching. The same thing that also delivered by Sitanggang (2013), that the props were part of the learning media that defined as all objects (can be either human or inanimate object, object) as an intermediate used in the process of learning.

By observing to the regard of the importance of education media and there have not the media or the learning props on the concept of light reflection yet in SMK number 6 Tanjung Jabung Timur, its need to development the architecture and that props. According to Jogiyanto (2005) the architecture is a stage of after an analysis of the cycle the development system, that is the definition of any functional needs, as well as describes how a system formed which may include to depict, planning and making sketches or setting of some separate elements in a whole unified and functioning, including to configure from the hardware and software components of a system.

The development of props on the light reflection concept was feeling very important, considering the characteristics of the light reflection concept itself. In the concept of Light reflection involved two elements at once simultaneously, i.e. the concrete elements (visible) and the abstract elements (not visible). Whereas the learning concept of light reflection during this was only done by involving the abstract elements, i.e. through the speech and picture sketch about the way light of the main beam which passes through the mirror. Thus the concrete elements in the process of reflection of light (motion on main beam) do not look for real. Sure, That fact would reduce the meaning in physics learning as the real knowledge .

Some research showed that the props in the teaching and learning process was very important. That research, for instance; Ahmad Kasan Manuri, (2013) in his research entitled " the development of gravitational acceleration measurement tool with a variation distance between the sensors on the free fall motion through the control display based on micro processor " concluded that there is an expert validation result based on the indicator of assessment by practical basic physics expert and the design of the measuring instrument obtained the percentage of 78,75%, and by delphi 7 programmar expert obtained percentage about 75%, so that the average value amount 76,88% by the assessment of the criteria is very good (Manuri, 2013). In addition, according to the results of research Eni Yulianti (2009) "the development of the props using the series-parallel to do the logic mathematics in SMK number 2 palembang about X class student in SKJ on mathematical logic subject", it concluded that there is an impact on student learning outcomes in vocational high schools number 2 palembang if that props have a positive effect to student learning outcomes, this can be seen by corelation that quite positive between the activeness of the learning with the students value and achievement up to 78,38%. Other related research is Izzah Mardliyah (2013), entitled "the development of Multimedia Learning Arabic for Madrasah Ibtidaiyah V Class" concluded that the developing of multimedia of learning Arabic and knowing the quality of its product. The development model that used were the procedural development, that is the description models that described the slot or the procedural steps to be followed to produce a particular product. The Procedural steps namely planning, organizing, executing and assessment. Based on these assessments, the multimedia learning Arabic is worthy to be use as a media of instruction. (Mardliyah, 2013)

To make development of the architecture of light reflection tool needed by some major equipments; 1. flat mirror, that is a mirror by the reflections surface is plane and made from the glass that one of its surface coated with the silver amalgam. The nature of produced shadow by the flat mirror is the transparent could not seen by screen, as big as symmetrical, the upright of shadow direction equal to its thing direction, the flank of shadow changed by the side of the object, the distance of the shadow to the mirror is equal to the distance of objects against to mirror. as the concept of law of reflection on flat mirrors are: a. the coming ray, reflection rays, and normal line lied on one surface. b. Coming angle (i) = angle of reflection (r) or (θ i = θ r).

The second tool needed in developing props of light reflection tool is a concave mirror. Concave mirror is a mirror that the surface is curved like the inside of the ball. (Cider; 2009). If a beam of line light falling on a surface concave mirror, the rays that reflected will gather at some point. So, the concave mirror has the quality to collects the light (convergent) and also known as positive mirrors. Conceptually, there are three exceptional rays on a concave mirror. Three exceptional rays are used to painting the formation of shadows on a concave mirror. The Three exceptional Rays are: a. the coming rays that aligned with the main axle of mirror will be reflected through the foccuss point. b. the coming rays that through the foccuss point of the mirror will reflect in align with the main axle. c. The coming rays through a curvature central point of the mirror will be re-reflect through the same point.

The third tool is a convex mirror. A convex mirror is a mirror by surface that same with the outer part of ball ". (Sari 1009). If the parallel rays fall on a surface of convex mirrors, the beam reflected will be spread. so a convex mirror has the quality to spreading rays (diverging) or call the negative mirror. Conceptually, there are three exceptional rays of convex mirrors, i.e.; a. the coming rays that aligned with the main axle of the mirror will reflect as though from the focuss point, b. The coming Ray that through a transparent foccuss point of mirror will reflect in align with the main axle, c. The coming rays through a central point of curvature mirror will be re-reflect as though from the same point.

2 RESEARCH METHODS

This research used the ADDIE method because it can be used for a variety of development product such as models, learning strategies, learning methods, learning media and learning materials. According to Buharuddi (2012) the ADDIE method was the one of instructional design model where the one of its functions is to be a guidelines in building the devices and infrastructure of training programs that effective, dynamic and can support the performance of training program itself.

On this research, the instruments used for testing product is in the form of close questionnaire or Check list. "Check list is a list where the respondents are only need the sign (v) in the appropriate column (Arikunto, 2010). Check list is used to determine the perception of lecturers, teachers and students toward the architecture of props light reflection as a learning medium.

The Datas that resulted from the products evaluation were in the form of qualitative that quantitiving. "Likert Scale " used to measure the attitudes, opinions and perceptions of a person about social phenomena in the study, its social phenomenon has been specifically defined by the researchers, that inafter called as the research variable " (Sugiyono 2012). Likert scales used in evaluating the light reflection props on the mirror were five scales which are:

a. strongly agree (SS) with score 5
b. agree(S) with score 4
c. neutral (N) with score 3
d. disagree (TS) with score 2
e. strongly disagree (STS) with score of 1

The Score obtained from the results of the recapitulation were modify in the form of percentage by using the following calculation.

$$\frac{Total\ of\ respondents\ score}{Total\ of\ maximum\ score} \text{ x } 100\%$$

Explanation: the criteria of score interpretation

Number of 0%-20% = very weak
Number of 21%-40% = weak
Number of 41%-60% = quite

Number 61%-80% = Strong
Number of 81%-100% = very strong (Riduwan 2012)

3 RESULT AND DISCUSSION

3.1 THE DEVELOPMENT OF PRODUCT/TOOL

The Product or props that produced by this research is in the form of light reflection props. This tool used as a media of learning physics on the light reflection material and used to prove the Snelius' law of the light reflection concept to the flat mirror (θ i = θ r), determining the focal length, the distance of shadow, exceptional rays on concave and convex mirror in the light reflection props where there a box glass made from clear glass that used as a container of the smoke media in order to help the eyesight the beam of laser light. The materials used to make the smoke media were a type of aluminum cans and the materials used to make beams of laser light were equipped with plastic boxes to place/position of a laser beam which there are 3 pieces of lasers beams by completing with the 3 scalars and the formation of this laser is in parallel shaped, whereas the strains used amount 4.5 DC. The light reflection props is also completed with a worksheet, needle, ruler, bow, power supply, spritus, flat mirror, concave mirror, and convex mirror.

After the preparing of tools and materials finished, then the procces of making light reflection props in the mirror by following steps:

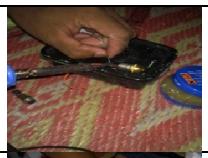
THE PRODUCING OF GLASS BOXES

The producing of clear glass box with a length of 45 cm and a width of 30 cm in 2 pieces, length 17 cm width 45 in 2 pieces, and a length 30 cm and width 17 cm in 2 pieces. After measurement has done, cut the glass by using the glass cutters then clung it by beam pattern. After it complete then create a glass lis in order not dangerous when use the aluminum. The results of this glass box shaped beam like the pictures below:

Figure 1. Glass Box

THE PRODUCING OF LASER BOX

The producing of the laser box as a light beams that will be used to prove the Snell's law of light reflection in a mirror. The producing of the laser used a beam-shaped plastic box with measurement amount 6 cm in width, length 12 cm, height 5 cm, 3 pieces of lasers , 3 pieces of scalars, and 2 meter cable. As for the laser box producing process, such as:

No	Process	Description	Picture
1	The process of making laser lights	The process of making this laser light was require 3 pieces of lasers, then the laser could open and take thelasertlights, thenn assembled in a series of parallel use the soldering tool.	
2	The process of making laser foundation	In the process of making the laser foundation is first of all create a scheme shaped line in a plastic box, then makes three points where the distance between the point of each other approximately 2.5 cm	
3	The depletion process	The process of depletion is a process that held in deplete the plastic box by use the soldering tool.	
4	Making the Scalar	The making of a scalar is used by 3 pieces of black color scalar as scalar set in every lasers, each assembled series of parallel shape so that the laser can turn on one by one.	
5	Assembling the laser box	Assembled this laser box is consolidating between the boxes with laser and then consolidate the laser with a scalar and the negative and positive connection cables.	

THE PRODUCING OF SMOKE MEDIUM

The producing of smoke media used aluminum cans that scissore in variaton to be easy to use and give the coir and equipped by spirtus as shown in the following picture:

Figure 8 : The result of smoke media

3.2 THE TEST OF LIGHT REFLECTION PROPS

3.2.1 INDEPENDENT TEST

The aim of props light reflection test itself is to find out the results of a product that has been made whether it accordance or not with the theory (the law snelius) i.e. the first one in especially for the light reflection to flat mirror that proved the theory of coming angle size is equal with the angle of reflection (θ i = θ r), second, determine the focal distance of concave mirror, determine the exceptional beams of concave mirror, and determine the distance of shadow on concave mirror. The third is to determine the foccus distance of curve mirror , determine the exceptional beams on a convex mirror, and determine the distance of the shadow on a convex mirror. Which the test of this light reflection props itself was guided with worksheets that have been prepared. Further it can be seen the trial results on the picture below, namely:

a. The Trial results of light reflection props on the on flat mirror determine (*Θi = Θr)*

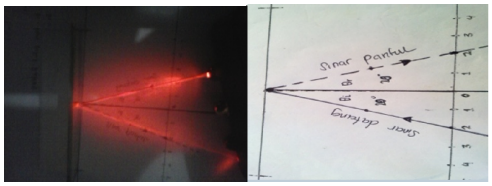


Figure 9. The practical results of coming angle and reflection angle on flat mirror

Tabel IV.2. The calculation of observation result in light reflection test on a flat mirror

No	Experiment	Distance of objects to the normal line (cm)	Size of coming Angle (Θ*i*)	Size of reflect Angle (Θ*r*)	Difference (Δ)
1	Experiment 1	2 cm	20^0	20^0	0^0
		2 cm	20^0	20^0	0^0
2	Experiment 2	4 cm	23^0	23^0	0^0
		4 cm	23^0	23^0	0^0
3	Experiment 3	5 cm	32^0	32^0	0^0
		5 cm	32^0	32^0	0^0

b. The trial results of light reflection props on concave mirror to determining the focus distance on concave mirror.

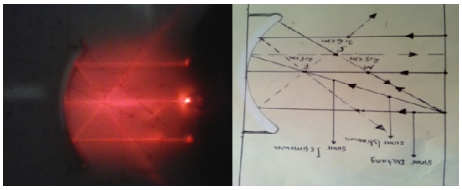


Figure 10. the practical results of foccuss point on a concave mirror

The trial results of three exceptional rays on concave mirror are:

c. coming Rays that aligned with the main axle will reflect through the foccuss point

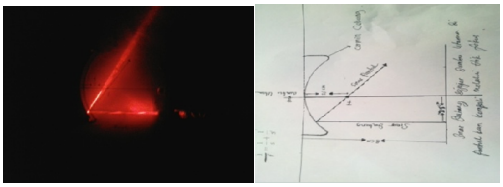


Figure 11. the practical results of first exceptional ray on a concave mirror

d. The coming rays through the focuss point of the mirror will aligned reflect to the main axle of the mirror

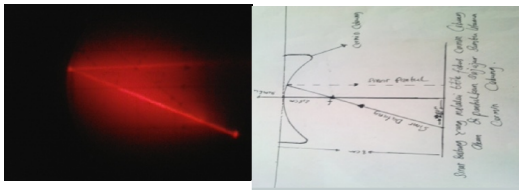


Figure 12. the practical results of second exceptional ray into a concave mirror

e. the coming ray through a curvature central point of the mirror will be re-reflect through the same point.

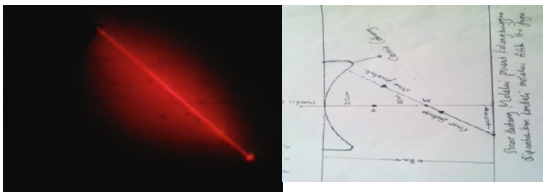


Figure 13. the trial results of the third exceptional ray into a concave mirror

Table IV. The calculation of observation result in light reflection test on a concave mirror

Eksperiment	The distance the laser into a concave mirror (s)	The Experiment Result	The Experiment Result	The Theory Result	Distance (Δ)
Eksperiment 1	8 cm	2.5 cm	3,6 cm	3,6 cm	0
	8 cm	2,5 cm	3,5 cm	3,6 cm	0
Eksperiment 2	10 cm	2,5 cm	3,1 cm	3,3 cm	0
	10 cm	2,5 cm	3,3 cm	3,3 cm	0
Eksperiment 3	12 cm	2,5 cm	3,1 cm	3,1 cm	0
	12 cm	2,5 cm	3,1 cm	3,1 cm	0

f. The trial results result of light relflection props on convex mirror in determining the focal leght of a convex mirror

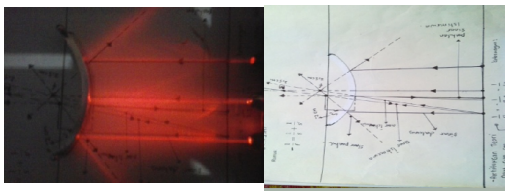


Figure 14. the Practical results of focal point on a convex mirror

The Trial results of three exceptional rays on a convex mirror :

g. coming Rays that aligned with the main axle of the mirror will be reflect as tough from the focal point.

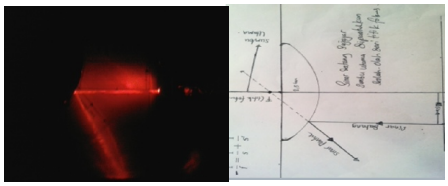


Figure 15. the practical Results of first exceptional ray to on a convex mirror

h. the coming ray that strive to the transparent foccuss point will be aligned reflect on the main axle.

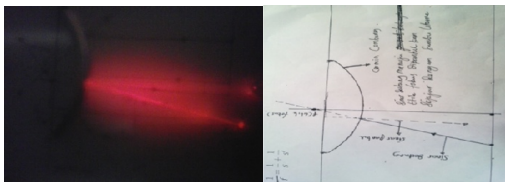


Figure 16. the results of the second exceptional ray on a convex mirror

i. the coming ray through a curvature central point of the mirror will be re-reflected as tough from the same point.

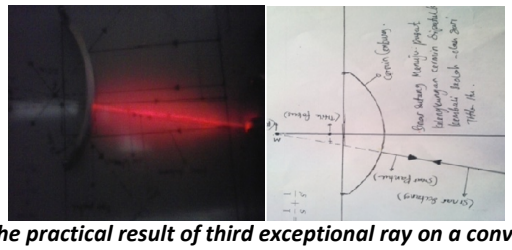


Figure 17. The practical result of third exceptional ray on a convex mirror

Table IV. 4 the calculation of observation result in light reflection test on a concvex mirror.

Eksperiment	The distance the laser into a concave mirror (s)	The Experiment Result	The Experiment Result	The Theory Result	Distance (Δ)
Ekseperiment 1	8 cm	2.5 cm	- 1,9 cm	- 1,9 cm	0
	8 cm	2,5 cm	- 1,9 cm	- 1,9 cm	0
Ekseperiment 2	10 cm	2,5 cm	- 2 cm	- 2 cm	0
	10 cm	2,5 cm	- 2 cm	- 2 cm	0
Ekseperiment 3	12 cm	2,5 cm	- 2 cm	- 2,06 cm	0,06
	12 cm	2,5 cm	- 2 cm	- 2,06 cm	0,06

Based on the datas generated from the practical itself got the conclusion, that the light reflection props is in accordance with the Snell's law concept of light reflection in a mirror.

3.2.2 EXPERT VALIDATION TEST

After the developing finished, the next step is the validation. The Product validation process carried out by way of filing a test expert of light reflection props as a media of learning physics to physics lecturer in IAIN STS Jambi that has expertise in the manufacture of laboratory tools and expert of teaching basic physics as much as 4 people. The test results of manufacturing the light reflection tool as a meda of learning physics to expert lecture maintained on 21-23 April 2014 in physics laboratory of IAIN STS Jambi. As for the results of fourth experts validation were shown as in the following diagram:

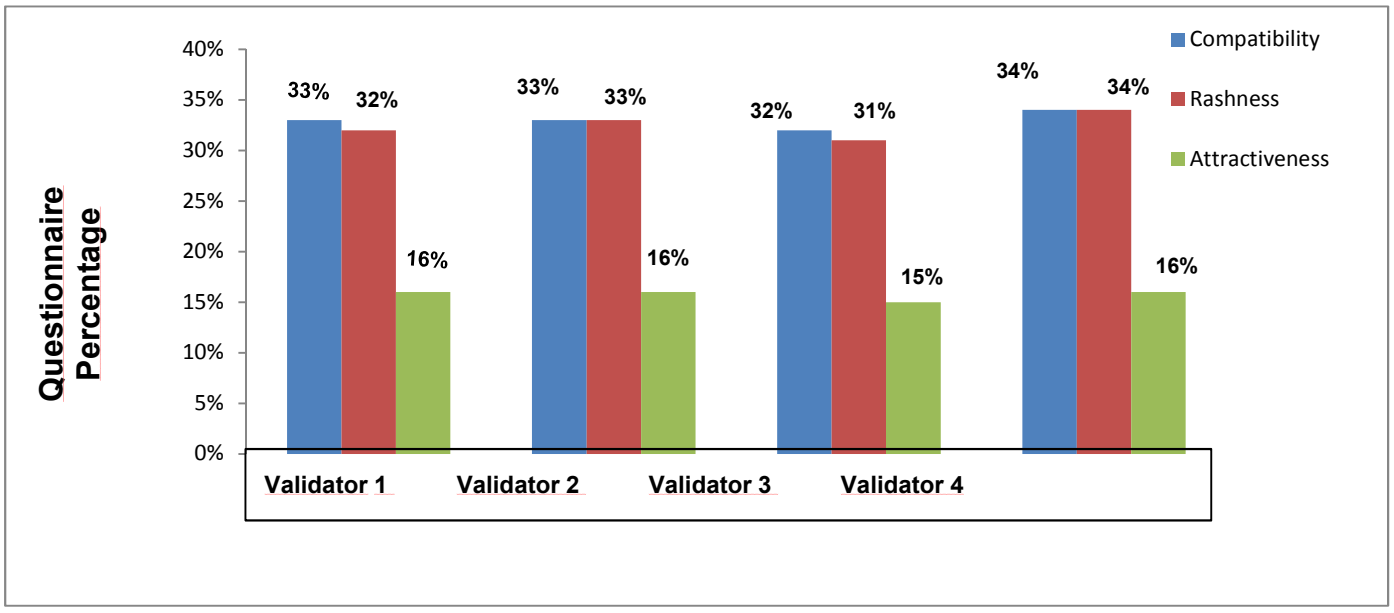


Figure 18. The percentage of steam diagram of the expert validity toward the light reflection props as instructional media

Based on the diagram above, the result perception overall get the score percentage 81,25%, so the light reflection props including the very well criteria for use as a learning media.

3.2.3 FIELD VALIDATION TEST

After this light reflection props on a mirror as physics instructional media was validate test by experts, then the next step is carried out the validation field. Field validation test was conduct by using that props on the teaching and learning process. The Field validation test conducted at vocational highschools number 6 tanjab timur at XI A class was on Monday April 28th 2014.

In the implementation of this light reflection props just wanted to see how great the students perception against to light reflection props on the mirror, for easier in measuring the score of students perceptions used a scale questionnaire with the strongly disagree criteria, Disagree, neutral, agree, and Strongly agree. From the Student perceptions obtained, the authors describe the conclusions of three aspects, namely aspect of suitability, convenience, and aspects of the attraction.

No	Aspecs	Presentation Students' Answers (Percent)				
		Strong Agree	Agree	Neutral	Disagree	Strong disagree
1	Compatibility	75,9	14,1	2,6	7,4	-
2	Rashness	69,7	16,2	12,5	1,6	-
3	Attractiveness	78,3	18,5	-	3,2	

Based on the table above, seen at the aspects of compliance tools, students who stated that the props have high compliance (strongly agree) as 75.9%. While who stating the level of conformity is average (agree) as much as 14.1%. It shows that the props that been created had a high compliance level against to the curriculum (subject matter), in accordance with the circumstances and in accordance with school age level users (students). As for the students who gave a neutral response as much as 2.6%, it means that students do not have sufficient knowledge toward props, curriculum (subject matter) and so on. As for students who stated disagree as much as 7.4%, which means that according to the students that the props do not have any compatibility with curriculum, school condition and the age of the users (students). Thus in general it can be concluded that the props that been developed had any conformity, i.e. Accordance to the curriculum (subject matter), the schools condition and the age of the users (students).

From the viewpoint of "rashness" on the second aspect, the student's answer were dominate by a positive Outlook by giving an answer of "strongly agree" and "agree". The second aspect in the total declared by 85,9% (69,7% + 16.7 percent). It showed that the props have a high level of convenience, which means that most students stated that the tool were easy to use. While students who have difficulty in using the tools just as much as 1.6%. Thus it can be concluded that in general if this tool have developed have high rashness, so it can be used by students, particularly students of SMK number 6 Tanjung Jabung Timur.

The third aspect that assessed by students is associated with the "attractiveness" of tool. On this aspect the students who had positive perception (strongly agree and agree) in total amount 96.8% (78,3% + 18.5 percent). These Data showed that most of the students stated that the developed tool is very interesting. Because of its very interesting it is possible to use of this tools can improve student learning motivation, which can increase the mastery of physics concepts, especially on the subject of reflection of light. As for students who stated that such instrument were less attractive as much as 3.2%, this is because some students had ever seen a similar tool in elsewhere. This indicate some students are students who come from outside of the region. However, in general it can be concluded that the tool that being developed is capable to attract of most students.

4 CONCLUSION

Based on the Testing validation and field validation, so the third assessment aspect such as suitability, convenience and attractiveness then it can be affirmed that the light reflection props that have been developed had the level of suitability, convenience and high attactiveness. Thus the tool is fit for use, especially for Physics learning material of SMK and students at the same level in General.

5 SUGGESTION

- In order to achieve the use of props in this light reflection mirror by well in order to use the worksheet reflection light props that have been specified.
- The weakness of the this light reflection props on the media smoke because the manufacture smoke media is still manual and the smoke trouble the breathing and vision when the measurement takes place, so it suggest to carefully and thoroughly at the time of practical takes place.
- In measurement of the effectiveness level of this light reflection props should be carried out by a number of physics teachers of some from any vocational high school or so on that are different.

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ANALYSIS OF FORAMINIFERA IN CERTAIN PART OF AFIKPO AND ITS ENVIRONS, EBONYI STATE SOUTHEASTERN NIGERIA

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ABSTRACT: The study area is geographically bounded by latitude 5^0 51'N - 5^0 57'N and longitude 7^0 51'E – 7^0 58'E. The area is of the Nkporo shale. Fresh samples of shale were collected from different locations of Amuzu, Amangbara, Anofia Nkanu, Amacha and Ozizza. The samples were analysed and viewed under the microscope, to find out the presences of foraminifera. The fora encountered during the research include: *Gavelinella cenomanica, Ramulina Sp, Robertina Sp, Flourensina intermedia, Gavelinella intermedia, Eggerellina mariae, Vaginulina kochii*. Most of the fora encountered were calcareous benthic suggesting a shallow marine environment for Afikpo. The fora encountered in the area indicate that it lived at the time where the environment was favourable for its existence. The *RobertinaSp*, which is abundant in the samples, indicates Campanian – Maastrichtian age for Afikpo and its environs. The fora encountered in the study area are very important for biostratigraphy and can give relative dates to rocks as well as sediments. It was also observed in the study area that foraminifera like *Eggerellina mariae* and *Globigerina* belong to the unrestricted genera which inhabit wide range of salinities. This means that it may to large extent tolerate unfavourable environment for its existence. Benthic foraminifera, mostly calcareous benthic make up the highest abundant in the shales of the study area which also suggest that Afikpo and its environs was deposited in the shallow marine environment.

KEYWORDS: Maastrichtian, Afikpo, Nkporo Shale and Micro-fossil.

1 BACKGROUND

The study of foraminifera has a long history, their first recorded "mention" is in Herodotus (fifth century BC) who noted that the limestone of the Egyptian pyramids contained the large benthic foraminifera Nummulites. Foraminifera are found in all marine environments, they may be planktic or benthic in mode of life. The name foraminifera is derived from the foramen, the connecting hole through the wall (septa) between each chamber. Fora are found in both freshwater and marine environment. Species diversity is usually high in tropical areas. There are an estimated 4,000 species of fora living in the world's oceans today. Of these, fourty (40) species are planktonic, that is they float on the water. The remainder live on or in the sand, mud, rocks and plants at the bottom of the ocean. Foraminifera are found in all marine environments, from the intertidal to the deepest ocean trenches, and from the tropics to the poles, but species of fora can be very particular about the environment in which they live. Some are abundant only in the deep ocean, others are found only on coral reefs, and still other species live only in brackish estuaries or intertidal salt marshes.

The Anambra Basin, which is a post Santonian synclinal sedimentary structure located southern Benue trough contains over 5,000m thick of upper- cretaceous to recent sediments, which represents the third phase of marine sedimentation in the Benue Trough (Ladipo, 1988; Akande and Erdtmann, 1998). The area has attracted numerous studies Tattam (1944), Grove (1951), Simpson (1954), Reyment (1965), Murat (1972), Obi et al (2001), Oboh-Okuenobe et al (2005), Nwajide and Reijers (1996) and Onyekuru and Iwuagwu (2010), recorded that Nkporo Shale consists of dark fossil shales and mudstones with occasional thin beds of sandy shale and sandstone. Thin bands of shaly limestone may be present. They are of shallow water origin and rich in fossil assemblages. It has a wide distribution of zone of libycoceras afikpoense. Tattam (1944),

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Simpson (1955),Reyment (1965), Murat (1972), Dessavggie (1974), Obi et al (2001), Oboh-Okuenobe et al (2005), Nwajide and Reijers (1996) described that Mamu Formation contains a distinctive assemblage of Sandstone, Shale, Mudstone and Sandy Shale, with Coal Seams at several horizons. There are many characteristics which influence foraminifera distribution such as, sediment type, food availability, oxygen levels and hydrostatic pressure. However, some species can tolerate a wide range of unfavorable conditions. Low concentrations of foraminifera in benthic regions may indicate an environment under stress. The foraminifera that exist in Afikpo and its environs *are Eggenellina mariae, Robertina, Flourensina intermedia, Ramulina Sp, Gavelinella, cenomanica, Gavelinella intermedia, Vaginulina Kochii* and many others. Most of the foraminifera encountered were calcareous benthic suggesting a shallow marine environment for Afikpo and its environs.

1.1 STATEMENT OF THE PROBLEM

The problem associated with foraminfera is that they are affected by high temperature. High temperature prevents the diversity of foraminifera. These factors limit the existence of fora in the area. Another factor which limits the existence of foraminifera is excavation of solid minerals in the area. This factor is responsible for the extinction of many foraminifera species. Other observed problems which could also limit the existence of foraminifera are bush burning, erosion, land slide, oil spillage and unfavourable climatic condition.

1.2 AIM AND OBJECTIVES OF THE STUDY

The aim of this research is to determine the types and species of foraminifera that exits in the study area.

The objective of this research project work is as follows:

- To map and demarcate the lithologic unit underlying the area
- To determine the nature of sediment age and environment of deposition using micropalaenotogical analysis.

2 METHODOLOGY

The location within the study area is Amuzu, Amangbara, Anofia Nkanu, Amacha and Ozizza. as shown in Figure 1.

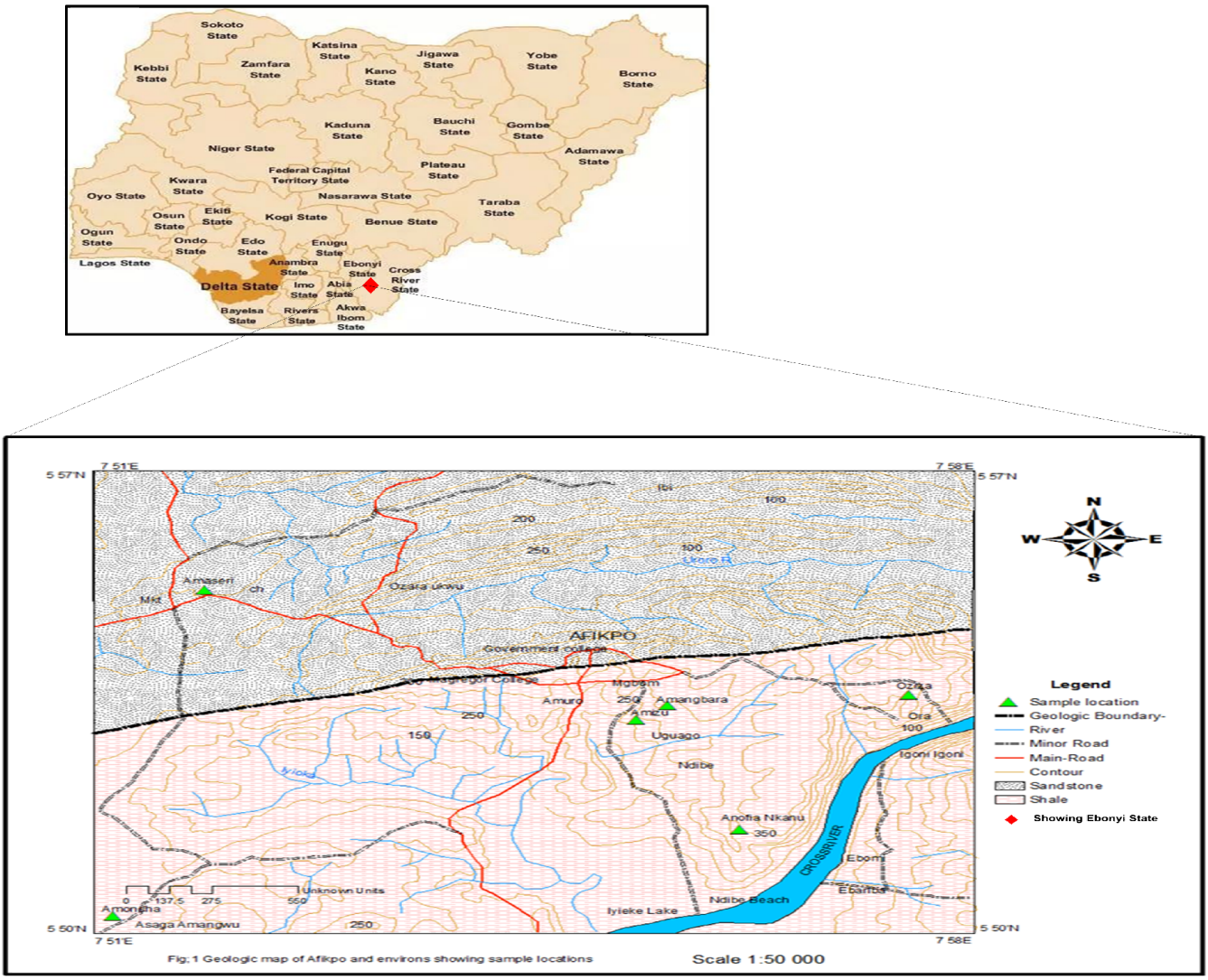


Fig. 1 Geologic map of Afikpo and environs showing sample locations

Fig. 1. Showing Geological Map of the Study Area and Sample Collection Site

2.1 FIELD MAPPING METHOD

An exposure of various places within the study area was visited with the basic knowledge of field mapping techniques and map interpretation. The rocks samples were observed based on the following features: (textures), compositions (mineralogical composition), and structures with the aim of determining the presence of fora.

2.1.1 LABORATORY METHOD

The methods employed for the analysis is discussed below:

Sample disaggregation: About 15-20mg of the fresh shale samples collected from the field were disaggregated or broken into very small fragment with the use of mortar and pestle. This is the first stage in the preparation of the samples the disaggregated sample ranges in size from 1mm-10mm. After the disaggregation, each sample is placed in a separate metal bowel and covered with its lid for the next stage of preparation.

- White spirit treatment (soaking): After the mechanical disaggregation of the sample using mortar and pestle, white spirit was poured in each of the samples. Care was taken to ensure that the sample were properly soaked samples were covered with lids to avoid contamination. This chemical treatment is to further disintegrate the sample and to allow for easy washing and concentration of the microfossils. This was left standing in a fume cupboard, until the rock was saturated after 24 hours, the next stage in samples preparation was carried out.

- Treatment of the sample with de-ionized water**:** In this stage of sample preparation, the excess solvent (white spirit) in each sample was poured- off from the samples, and de-ionized water was poured into each sample bowl; the samples were properly covered by the chemical. It was left in the bowl for 24 hours to enable the rock samples to disintegrate. The reason for this treatment is to enable the light and floating fossils to settle to the bottom, so that they would not be easily decanted away.
- Washing and sieving of samples: Very tiny meshed sieve of about 200mesh (<63ųm sieve) was used in washing the samples. The washing processes enable the mud and disintegrated shale materials to pass out through the sieve and concentrate the fragments containing the microfossils. The fora concentrate settle; afterward the supernatant fluid is decanted away.
- Drying: The sample fragments are either sun-dried or oven-dried to make them ready for study under the microscope in this study, the concentrate was sun dried from a period of 2days (48- hours); after which the dry samples were bottled and labelled according to the locations the samples were gotten from. This is marked the end of the preparation of the shale samples for microscope viewing. The dried sample residue was separated in a "nest" of sieves and small fragment of the sample was used in the next stage.
- Sample Picking (Light Microscope Work)

After the samples have been prepared as described above, the stage was set for studying the sample under the microscope, to identify their microfossil contents each sample was spread on a flat tray and mounted on the microscope. The samples were then viewed through the microscope at a magnification of x40. The picking of the fora from the dried sample residue was done under the reflected light, using a binocular microscope, and the brush was moistened in small dish of water, pointed by using the thumb and the f ore finger, and placed in a hovering position over the field of the microscope. The microfossil picking brush was lowered over the specimen desired and allowed to touch the surface, to which the specimen with adhere.

The picked fossil was removed and transferred into a coated-surface micro-slide that contains water gum, and was allowed to dry. After which the microfossil picking brush was removed with a rotating withdrawal motion, which facilitates the transfer of the fossil into the slide. This was later covered with cover slip (slide cover).

Conscious effort was made to identify as many microfossils as possible in each sample. Each microfossil seen in a sample was identified and named using a comprehensive microfossil album.

- Digital Camera Work

Digital camera was used to obtain the images of the fora seen. The slide containing the fossils, with cover slip covering the digital camera was placed at the top of the eyepiece of the microscope, which viewed through the microscope, and captured the image of the fossil. Lastly, the pictures were transferred to a computerized printing and the slides kept for future use.

3 GEOLOGY OF THE STUDY AREA

The study area of the Nkporo formation is unconformable overlying the Ezeaku formation in the Afikpo sub-basin (Murat,1972). The shales are dark grey, very fissile and soft shale and consisting of mudstone with occasional thin interbeds of sandy shales, fine sandstone and marks with coatings of sulphur and numerous white specks of *Remulina* explicate. Other benthonic foraminifera mostly *Robertina Sp* described by Agagu *et al* (1985) include *Bulimine fang, Buliminaprolixa , Globobulimina Opima, Ammobaculites phummerae, Bolivina miocenica, Bulimina alstica, Bulimine robusta, Bolivina anambra and Gavetinela Sp.*

Other fossil taxa has been reported in the Nkporo shale Odebode, (1987) and Petters (1980) reported the presence of *Gabonita Sp*. (Petters and Edet 1996) reported the presence of *Nonionella Sp, Preabulimma Sp, Heterohlix Sp, Afrobolivia Sp, and Ammobaculities Sp;* among others. But planktonic foraminifera are generally rare (Agagu, *et al* 1985, Zaborski (1983). Gebhardt (1998), described the Ammonite biostratigraphy of the Nkporo formation and noted that the dominant genera is the *Cybicoceras afikponses.*

The lithological and microfuna association in Nkporo Formation suggests a restricted shallow marine environment. The marine origin of the Nkporo Formation is also suggested by the occurrence of the ammonite, *libycoceras afikpoenses* together with *inoceramus*, crab, fish teeth, bryozoans, and *echinords* (Reyment, 1965., Simpson, 1954) based on molluscs and fish remains. Reyment (1965) also describe the maastrichtian zone of *libycorceras afikpoense* in the Nkporo formation while

Murat (1972) used an upper Santonian age. Reyment (1965), and Zaborski, (1983) therefore suggest a Campanian to Maastrichtian age for the Nkporo shale.

4 PHYSIOGRAPHY OF THE STUDY AREA

4.1 TOPOGRAPHY

The studied area has characteristically undulating topography. This is manifested in the arrangement of the ridges, valleys and plains in the area. The valleys and low lying plains are underlain by shales which are more susceptible to erosion than sandstones which under lie ridges. The ridges are more erosion resistant than valleys and the ridges run in ENE-WSW direction, while the low lying plains occur north and south of the ridges. The plans attain the general height of about 30m above sea level while the ridges rise to about 45 meters above sea level.

4.2 DRAINAGE

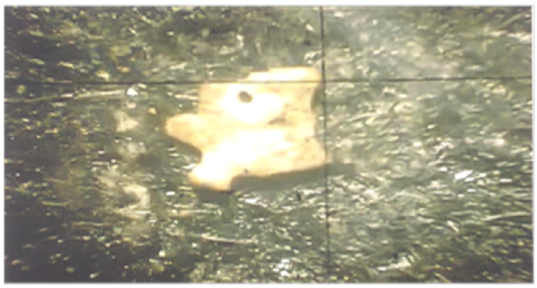
Drainage simply means the arrangement in which a stream erodes the channel of its networks of tributaries; it depends on the soil type, vegetation, relief and topography. The drainage pattern of the mapped area appears dendritic in nature, suggesting that it is possibly controlled by River such as the Lyioka River, Wowo River and Azu river drain the area. All of these flow northeast- wards and empties into the Cross River which is the major River that drains the area.

5 DICUSSION

The study area of Afikpo and its environs consist predominantly of shale and sandstone. It can be subdivided into six units which are Unit A, Amuzu Shale., Unit B, Amangbara Shale., Unit C, Anofia Nkanu Shale., Unit D, Amacha Shale., Unit E, Ozizza Shale These units consist of shales of different grade while Unit G consist of sandstone ranging from fine to coarse grains.

5.1 LOCATION SCE/02850/01 (AMUZU)

In the dark-grey, carbonaceous and fissile shale sample collected from Amuzu location, relative abundance of Robertina Sp was witnessed. Other foraminifera identified in these samples include: moderate abundance of *Ramulina Sp, Flourensina intermedia.* As shown in Plate.1.



(a) *Ramulina Sp*

(b) *Flourensina Intermedia*

(c) Robertina

Plate 1: Foraminifera indentified at Amuzu

5.2 LOCATION SCE/02850/02 (AMANGBARA)

The thick laminated, dark- grey and carbonaceous shale sample collected from Amangbara (SCE /02850/02) yielded *Gavelinella* intermedia is the relative abundance. The samples were also marked by the common occurrence of other forums such as *Vagmulina kochii, sacammina Sp* as shown in plate 2

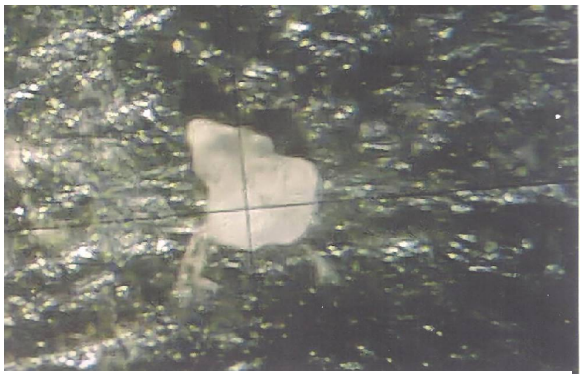
5.3 LOCATION SCE/02850/03 (ANOFIA NKANU)

The laminated black and carbonaceous shale sample collected from Anofia Nkanu (SCE/02850/03) *Eggerellina mariae* yielded moderate abundant. The samples were also marked by the common occurrence of other fora such as *Gabonitas Sp, Epistoma Sp, Eggerellina mariae, Globigerina* (plantonic.

5.4 LOCATION SCE/02850/04 (AMACHA)

Sample from the dark-grey fissile shale of Amacha location (SCE/02850/04) yielded abundant of *Remulina Sp*, moderate abundance of *Eggerellina mariae* and rare occurrence of *Globigerina* (Plantonic), as shown in Plate.2.

(a) *Ramulina Sp*



(b) *Eggerellina mariae*

(c) *Globigerina*

Plate 2: Foraminifera identified at Amacha

5.5 LOCATION SCE/02850/05 (OZIZZA)

Foraminifera identified in the dark-grey sample of Ozizza location (SCE /02850/05) yielded very abundant occurrence of *Robertina Sp, moderate saccammina Sp, Epistoma Sp*, and rare occurrence of *Eggerellina mariae.*

6 PALEOENVIRONMENTAL ANALYSIS

Attempt is made here to analyse the paleoenvironment of the lithofacies encountered in this work, with the help of findings and results obtained from this study. Certain characteristics of this unit are helpful in analysis of its paleoenvironment. In the first place, its dark colour suggests high carbon content which can be traced to an oxygen deficient environment. The shale is also fossiliferous, pynetic and has parallel laminations; a characteristics that suggests a stagnant and oxygen deficient reducing environment; with low energy of deposition (Kogbe 1965., Culver 2006). The presence of minerals such as glauconite, gypsum and pyrite in the shale also confirms marine environment. Micropaleontological evidences suggest a normal shallow marine environment for the units as a result of the fact that most of the foraminifera encountered in the unit were benthics, capable of tolerating normal marine salinities as well as shallow marine depths. Some of the foraminifera encountered in the Amuzu shale unit were small sized and had tapered tests, suggesting a stressed and oxygen deficient environment. Therefore, a shallow marine, stressed and reduced oxygen environment is suggested for Amuzu shale.

Foraminifera identified in the Amuzu and Ozziza indicate Campanian- Maastrichtian age (Reyment 1965; Petters 1982). Of most significance in this regard is the proven endemic West African marker foraminifera Reyment- maastrichtian; *RobertinaSp* in some samples analyzed.

7 PALEOECOLOGY

7.1 OXYGENATION

Oxygen level determines the type and characteristic o foraminifera in environments. Normally oxygen level creates a conductive environment for growth of large size foraminifera. It also enhances the secretion of $CaCo_3$ enabling foraminifera to develop calcareous walls. On the other hand, low oxygen content creates difficulty in $caco_3$ secretion and reduction in size of fora individuals. Hence aranaceous, small sized and thin shelled forams with flattered or tapered test shapes are characteristic of low oxygen environments Mode, (1991)

In extremely reduced oxygen environments (anoxic) it is only plankton foraminifera, which are able to float and get oxygen from the surface that can survive. The occurrence of calcareous and aranaceous foraminifera, the presence of tapered and dwarfed foraminifera, low to moderate dark colour of the shale in dictates a normal oxygen content at the top and reduced oxygen content at the bottom (Mode 1991).

7.2 SALINITY

Most of the foraminifera encountered in this study fall within those that tolerate normal marine salinities (32-37%) such forams include *Afrobolivinaafra, Globigerina Sp, Gabonita Sp.* Few of the foraminifera of *Eggerellina mariae* and *Globigerina* belong to the unrestricted genera which inhabits a wide range of salinities.

7.3 BATHYMETRY

Deep marine conditions are characterized by the dominance of planktics. The dominance of benthic as against planktice indicates shallower marine environments (Petters and Edet 1996). In this study benthic foraminifera were solely identified. Most of the benthic foraminifera are calcareous in nature, indicating a well oxygenated, shallow marine environment. From the above a shallow marine paleoenvironment is suggested for Afikpo and its environs.

8 SUMMARY

This research gave an insight into the Foraminifera content of Afikpo and its environs. Afikpo is rich in foraminifera which include *Gavelinella cenomanica, Ramulina Sp, Robertina Sp, Flourensina intermedia, Gavelinella intermedia, Eggerellina mariae, Vaginulina kochii* . Benthic foraminifera, mostly calcareous benthic make up the highest abundance of foraminifera in

the study area. This suggests a shallow marine environment of deposition for Afikpo and its environs. Most of the foraminifera encountered tolerate normal marine environment of deposition.

Furthermore, the large size of the foraminifera identified, couple with the dominance of calcareous forms suggest proper oxygenation of the deposition of environment.

9 CONCLUSION

From findings the study area is rich in foraminifera which could be used for analytical studies and the determination of the environment of deposition. Most of the foraminifera encountered are of the Campanian- Maastrichtian age. Some of these foraminifera encountered are very useful in paleontological study.

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FACTOR ANALYSIS FOR PERSONAL SKIN CARE PRODUCT'S (PSC) PENDING ORDER ROOT CAUSE at PT. XYZ

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ABSTRACT: This study was conducted to describe product's pending order problem of personal skin care products (PSC) in PT. XYZ, to analyze the factors that caused it and to determine the root cause of the problem. Finally, this research was conducted to produce alternative recommendations or solutions to overcome PSC product's pending order problem in PT. XYZ.

Factors that caused the problem of PSC product's pending order are obtained from exploration result or focus group discussion (FGD) of respondents that are selected by using purposive sampling. FGD was carried out with tools analysis such as fishbone diagrams with "6M" framework of thinking (consist of aspects of human resources, management / financial, equipment / machinery, procedures/ processes, environmental, and aspect of raw material) which are usually used to find the root cause of a problems in manufacturing industry. Moreover, these causative factors of product's pending order are used to create a perception questionnaire. Questionnaires in this conformation stage were filled out by respondents of product's pending order problem in PT. XYZ. Respondents were selected by using snowball sampling technique. The result of this survey of perception was processed by IBM SPSS statistical program version 20, with test of Kendall concordance (W), in order to confirm the result of FGD.

Hence, analytical result concludes that both FGD and questionnaire methods are complementary to each other. Both methods are equally share result that the product's pending order in PT. XYZ is caused by inaccuracy of sales forecasting or demand distributor (DD) forecasting. Relate to inaccuracy of sales forecasting or DD forecasting, research result proposes four recommendations for PT. XYZ as a solution. First recommendation is to improve marketing's key performance indicator (KPI) related with sales target in unit. Second recommendation is the use of combination of quantitative with qualitative sales or DD forecasting technique. Third recommendation is to increase strategic stock for each product for short time period. The last recommendation is DD forecasting should be received by SCM of PT. XYZ from its logistic provider (PT. ZZZ) after having coordination with marketing division of PT. XYZ

KEYWORDS: fish bone, pending order, DD forecasting, sales forecasting, Kendall test.

The article is a part of Theseus in MB IPB (post graduate program of IPB), Indonesia

1 INTRODUCTION

PT. XYZ is a company that started from healthcare facility such as pharmacy store, which was established in the early 1960s. The founder of this company is an Indonesian physician. The pharmacy then developed into a manufacturing company that started its production since 1962. Initially, the company is located in Jakarta. In 1994, the company acquired a foreign company production facility / factory in Bogor. The acquisition, made in 1994, caused the product-making process to be relocated from Jakarta to Bogor. In 2005, under the leadership of the 3rd generation company founder, the company is experiencing a change of name.

PT. XYZ is located in Bogor, Indonesia. The company has a sales target worth 340 billion dollars in 2014. PT. XYZ has a vision of becoming a world-class healthcare company that has a high competitiveness in its service and product quality, and

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safe products for the Asian regional market. To realize this vision, PT. XYZ has 3 company missions: to encourage sustainable growth, providing maximum business results to its stakeholders, and apply the principles of good corporate government. The company has a goal to achieve sales worth 500 billion dollars by 2015 as stated in its statement of purpose. Agreeing with the concept of agribusiness by Edward and Schultz (2005), PT. XYZ is included as a downstream business of agribusiness sector which certified GMP, GMP, OHSAS 18001: 2007, and ISO 9001:2008.

At the beginning of this study, secondary data is acquired that PT. XYZ have 53 PSC item or stock keeping unit (SKU) until this moment. From the existing secondary data, it is known that during 2013 of every month pending orders occur, with the average pending orders per month as many as 7 items. The smallest pending order was in July 2013 as many as 1 items, and the largest pending orders occurred in August 2013 as many as 12 items. Inventory problem in the form of continuing PSC pending orders products in the supply chain management of PT. XYZ became the topic of this thesis study. This study was conducted to describe the problem of PSC products' pending orders at PT. XYZ, analyzing the factors that cause the problems PSC product pending orders that is encountered in the supply chain management of PT. XYZ, and determine the root cause and recommend alternative solutions to overcome the problems of pending order of PSC products which is faced by the supply chain management of PT. XYZ.

The research is conducted at PT. XYZ due to the perceived adverse effects of PT. XYZ as a result of a pending order inventory problem sustained in PT. XYZ. The effect of this pending order is bad for the company, which resulted in loss of sales up to 32% from the sales target (in value) of PT. XYZ.

The research problem is to explore the causing factors of PSC product pending order issue that emerge at PT. XYZ and to generate alternative solutions to overcome the problems of the said pending order of PSC products inventory. This study aims to describe the problem of pending orders PSC products faced by PT. XYZ, analyzing the factors that cause the problems pending orders and determine the root cause and recommend alternative solutions to overcome these problems.

The difference in this research position when compared with related studies that have been inventoried by the researcher, is that in this study a fishbone diagram analysis tools and Kendall's concordance test (W) is combined to find the root cause of the PSC products pending order problem at PT. XYZ.

The benefits derived from combining these two analyzers is if at the FGD stage (fishbone diagram) is intended to explore the causes of the problem, then at the perception questionnaire stage (Kendall's concordance test) is aimed to confirm the results of the FGD stage. Both approaches are expected to be complementary to the shortcomings of each approach are covered, and generate a more validity proven results than if only using one tool analysis only.

2 LITERATURE REVIEW

Perfect Order Concept

Pending orders occurred are due to stock-outs which will affect the decline in customer satisfaction. Mellen and Pujiraharjo (2013) found that drug stock-outs in his study object occurred because of inaccurate floor stock planning in the hospital service unit, and low competence in the related resources. Kanyoma and Khomba (2013) are out of stock at the public health centers in Malawi due to government governance agencies factors that fail to meet the drug orders, delay purchase by the drug procurement staff, and budget cuts by donors.

In order for consumers to be satisfied, Eckert (2007) emphasized the importance of always creating a condition called perfect order. Perfect order condition is a condition that occurs when consumers get the right desired product / product, purpose, condition, quantity, time, documentation, and the cost (Bowersox et al., 2013; Marien (2007) in Eckert (2007)). Consumer dissatisfaction that can be reduced will have an impact on corporate profits. Related research on consumer response to stock-outs when occur in a place somewhere is as much as 62.0% of consumers will shift the purchase to its replacement product, delaying the purchase 15.1%, and 22.9% of them not buying the product when the stock-outs occur (Zinn and Liu 2001).

Supply Chain Management

Gaspersz (2012) suggested that meetings that are too long, conflicts between departments, inability to submit the product on time, customer complaints, finished product stock-outs, inventory imbalances, always abrupt, and frequent production stop are 8 symptoms of a toubled supply chain management, which requires corrective action to eliminate the root cause of the problem.

Of the various definitions that the authors have collected, e.g. from Gaspersz (2013), Siahaya (2013), The Association for Operations Management (APICS) dictionary (2010), Mentzer et al. (2001), the author conclude that according to them, supply

chain is a network used to submit the product (goods or services) from raw materials to end customers through a stream of cash flows, information, and physical distribution. The author agrees with Liu (2011) and Arshinder et al. (2008) that there has been no uniform definition of the term supply chain.

Fishbone Diagram

Fishbone diagram is an analysis tool that is used to identify potential root issues related to both quality and production (Paneru 2011; Jacob 1997). This analysis tool is called fishbone diagrams, because of its fish bone-shape like. This diagram is a diagram illustrating a causal relationship introduced by Dr. Kaoru Ishikawa, a Japanese quality control expert, so this diagram is also called Ishikawa diagrams (Bose 2012; Özdemir 2010). Fishbone diagrams are used when we want to identify possible causes of a problem and especially when a team tends to fail-think in its routine (Tague, 2005).

Kendall's Concordance Test (Kendall W):

Widhiawati (2009), Shaban (2008), Lewis and Johnson (1971) explains that Kendall's concordance test is basically if we want to know if there is an opinions alignment of a subject group (respondents) in assessing a particular object. Sidney (1988) explained that if the Spearman's test and Kendall T describes the degree of relationship / alignment between the two variables that are tested, then the Kendall W describes the degree of relationship / alignment between two or more variables that are tested. Alignments (concordance) are valued as well as correlation, which is from 0 to 1. Generally, the concordance rate above 0.5 can be considered a high enough level alignment Santoso (2003). Santoso (2003) and Widhiawati (2009) state the value of the Kendall concordance (W) can be found with the formula:

$$W = \frac{12\Sigma Ri^2 - 3n^2k(k+1)^2}{n^2k(k^2-1)}$$

k is the number of variables, n is the number of assessors (respondent) and Ri is the number of respondents rating the data.

Conceptual Framework

The conceptual framework of this study is started by confirming the existence of PSC product pending order problems at PT. XYZ. At this stage secondary data obtained from field observations by researchers are collected.

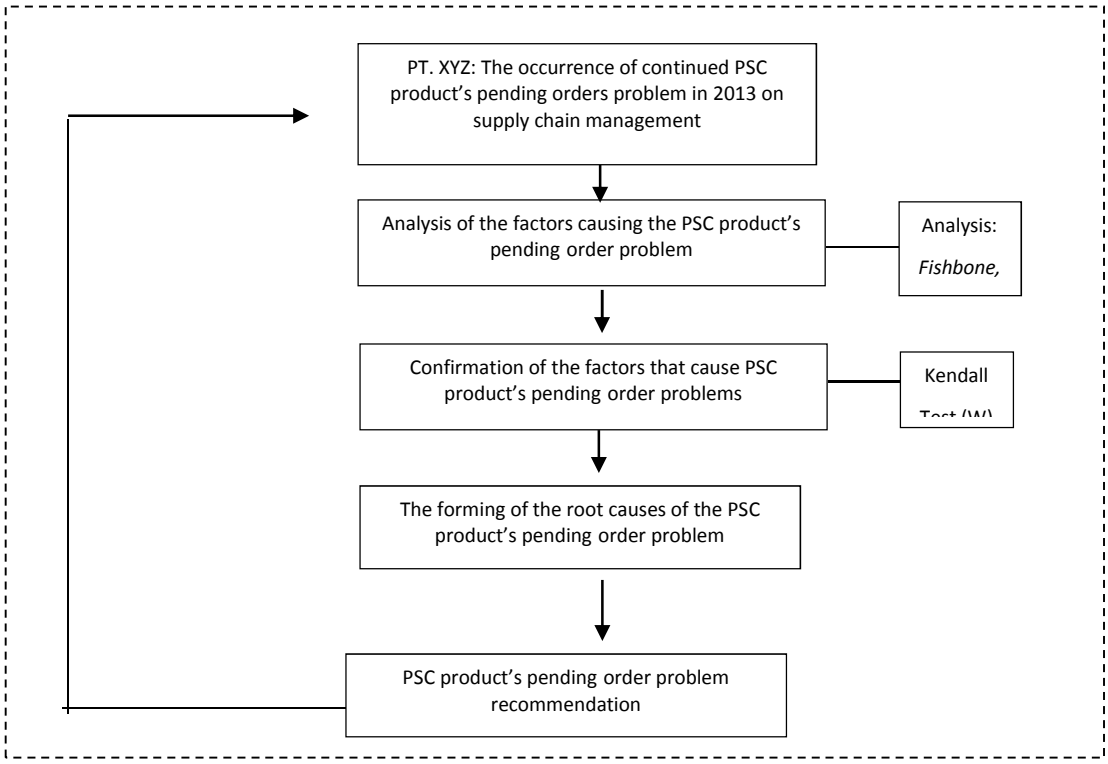

Figure 1 Conceptual Framework. ⟶ Research process,

——— Analysis process, ------- Area of study limitation.

The next stage is analyzing the pending orders' cause of problems factor(s). At this stage, focus group discussions (FGD) by a group of respondents are selected by purposive sampling. FGD will be using fishbone diagram analysis tool based on a 6 M framework (man, machine, money / management, method, milieu, and material).

At this stage, cause of pending order problems factor(s) will be explored. Further causing factor(s) that is found in the exploratory stage will be confirmed by using perception surveys on selected speakers using snowball sampling. The survey results are then processed by Kendall test (W). The results at neither exploration stage nor the confirming factors that cause the PSC products pending order at PT. XYZ is then used to determine the root cause of pending order of PSC products at PT. XYZ. In the final phase of this study, a literature review is conducted related to pending orders issues and research findings to generate pending orders troubleshooting recommendations in PT. XYZ.

3 RESEARCH METHOD

Time of Research and Location

This thesis research is conducted at PT. XYZ which is located in Bogor, Indonesia. This study was conducted from October 2013 to April 2014.

Research Approach

The study was conducted with a descriptive research design through a case study approach at PT. XYZ. PSC product's pending order issues are identified using secondary data processing from the supply chain management of PT. XYZ. Then the factors that cause the problem of pending orders are obtained from the focus group discussion (FGD) of the respondents are selected by purposive sampling. FGD is conducted by the respondents with help of the fishbone diagram analysis tool guide.

The factors that cause the problem of pending orders obtained from FGD stage then is used by the researcher to create the perception questionnaire. This questionnaire will be filled out by the respondents that were selected by snowball sampling. The results of the perception survey will eventually be processed using IBM SPSS statistical program version 20, with nonparametric statistical method which is the Kendall alignment test (W). Once the root cause of pending orders in PT. XYZ is found, by using secondary data from the theories of related literature and scientific opinion of the researchers and experts, the researcher will then recommend alternative solutions to address pending orders issues that emerge.

Data Processing and Analysis Technique

Pending order of PSC products issue at PT. XYZ are identified using secondary data processing which is present at the internal and external supply chain management of PT. XYZ. Then the factors that cause the problem of pending orders are sought by processing the primary data from the FGD, with the guide of fishbone diagram analysis tool. The factors that cause the problem of pending orders that were obtained from FGD stage are then used by the researcher to create the perception questionnaire. This questionnaire will be filled out by the respondents pending order products PSC PT. XYZ, which is obtained by snowball sampling technique. The results of the perception survey will eventually be processed using IBM SPSS statistical program version 20, with nonparametric statistical methods which were the Kendall alignment test (W). Once the root cause of pending orders in PT. XYZ is found from the processed primary data and secondary data of this research, using literature review related research findings and scientific opinion of the researchers and experts, and then the researcher will recommend alternative solutions to address the emerging issues of such pending orders.

4 RESULTS AND DISCUSSION

From the secondary data in Table 1, it is known that during 2013 pending order of PSC products occur in every month. Average pending orders per month is as many as 7 items. The smallest pending orders occurred in July 2013 as many as 1 item, while the largest pending orders occurred in the month of August 2013 as many as 12 items.

There are 10 factors that are suspected to be the cause of PSC product pending order from the fishbone diagram that are generated during the exploration stage or FGD which are: running out of finished goods (FG) inventory; management / financial governance (MK); material delays in production; unstandardized sales and operations planning (SNOP); human resources (HR) regeneration programs or HR knowledge related with market demand forecasting techniques; the function of supply chain (SCM) at PT. XYZ and low function of quality management system (QMS); inaccurate distributor demand (DD) or sales demand; regulatory developments; unstandardized and slow material requirements planning (MRP) system / tool; uncontrolled market developments and the dissolution of a sales operation manager / suboptimal logistics provider function.

Table 1 Profile products PSC pending orders in PT. XYZ

Month	Amount of SKU pending order PSC	Month	Amount of SKU pending order PSC
Dec-12	5	Jul-13	1
Jan-13	7	Aug-13	12
Feb-13	6	Sep-13	4
Mar-13	8	Oct-13	2
Apr-13	9	Nov-13	10
May-13	6	Dec-13	10
Jun-13	9		

To prioritize the root causes, then out of 10 factors only 3 factors are taken that are the most factors that often appear on the diagram. These three factors are as follows:

1. Working capital which leads to unbalanced outstanding payment (accounts payable). Problems that relate to financial management governance at PT. XYZ,
2. Unstandardized sales and operations planning (SNOP), and
3. Unstandardized Material requirements planning (MRP).

The first factor is suspected as the cause of having the highest frequency of occurrence as many as six times, while the second and third factors had the same second-highest frequency that appeared on the generated fishbone diagram, where each equally appear four times. The most frequent causative factor that appeared on a fishbone diagram is usually the root cause of the problem or the effects of the problems that are being discussed. Hence, for a temporary conclusion of this research it is alleged that financial management governance factor at PT. XYZ to be the root cause of the pending orders in PT. XYZ for PSC products.

The results of this fishbone is then attempted to be verified using a perception survey of the respondents that know about the PSC products' pending order matter at PT. XYZ. This will be presented by the researcher in the subsequent discussion.

The results at this stage of the perception questionnaire states that the low accuracy of DD being ranked 1 as an actual cause for PSC products' pending order does not conflict with the results from the fishbone diagram. If noticed again on the said fishbone diagram part, then MK (management / financial governance) causes an imbalance in the working capital, if further asked, they arise because of two things, namely operational expenditure (OPEX) which is also used for capital expenditure (CAPEX) e.g. for a construction project or due to inaccurate DD conditions that ultimately lead to an accumulation / motionless supply of certain products. Therefore, if we do 2 stages of decision making as described above in the fishbone diagram, it can be concluded further that the root cause of the PSC products' pending orders problems at PT. XYZ is because of inaccurate DD conditions or it is because of the muddle between OPEX and CAPEX allocation at PT. XYZ.

Fishbone diagram from this FGD stage could not further identify which of the two factors that is the root cause for the occurrence of MK. To answer that, a result from the questionnaire perception is needed. When we consider the results of the questionnaire related to the perception, the parts that are related to the causes of governance management or financial PSC product is less than optimal that eventually led to a pending order, where the results are listed in Table 2.

Table 2 The results of the perception survey of the causes of financial governance which led to working capital management unbalanced in PSC Product[a]

Rank	Factor	*Mean Rank*
1	Stock FG DD does not move because of the low accuracy	1,16
2	OPEX used for CAPEX	1,84

[a] respondent amount =19, Kendall Concordance Coefficient (W) = 0,623, degree of freedom (df) = 1, Asymptotic significance = 0.001, Chi-square SPSS = 11,842, Chi-square count = 11,837, Chi-square table (α = 5%) =3,841, then there is a statistically significant alignment of the opinions of the survey respondents.

From Table 2, it is clear that there is an opinions alignment of respondents in the confirmation stage of the pending order cause. The respondents agreed MK is more caused by inaccurate DD than caused by the CAPEX and OPEX usage jumble. The conclusion is that ultimately inaccurate DD although only appeared 2 times in the fishbone diagram, but if explored further, turned out to be a deeper cause of the factors that appear most often in the fishbone diagram, namely management or financial governance factor which led to imbalanced working capital (MK).

At the end of this discussion we conclude that there are no difference in the root of the PSC products' pending order problem at PT. XYZ that are identified using FGD by fishbone diagram analysis tool with the results of the questionnaire that were processed with Kendall's concordance test (W). Inaccurate DD or low accurate sales plan is a factor which is the root cause of pending order of PSC products at PT. XYZ.

Hence, analytical result concludes that both FGD and questionnaire methods are complementary to each other. Both methods are equally share result that the product's pending order in PT. XYZ is caused by inaccuracy of sales forecasting or demand distributor (DD) forecasting. Relate to inaccuracy of sales forecasting or DD forecasting, research result proposes four recommendations for PT. XYZ as a solution. First recommendation is to improve marketing's key performance indicator (KPI) related with sales target in unit. Second recommendation is the use of combination of quantitative with qualitative sales or DD forecasting technique. Third recommendation is to increase strategic stock for each product for short time period. The last recommendation is DD forecasting should be received by SCM of PT. XYZ from its logistic provider (PT. ZZZ) after having coordination with marketing division of PT. XYZ.

5 CONCLUSIONS AND SUGGESTIONS

Conclusions

1. At the beginning of this study a secondary data is acquired that PT. XYZ until now have 53 sku of personal skin care products (in 2013). From the existing secondary data it is known that during the year 2013 in every month there occurred pending orders, an average pending order per month can be as many as 7 items. The smallest pending order was in July 2013 as many as 1 item, and the largest pending orders occurred in August 2013 as many as 12 items. The effect of this pending order is bad for the company, which resulted in sales loss up to 32% of the sales target (in value) at PT. XYZ.
2. At the end of this discussion we conclude that there are no differences in the root of the pending order of PSC products problem at PT. XYZ by using FGD with fishbone diagram analysis tool and the results of the perception questionnaire that were processed with Kendall's concordance test (W). Inaccurate DD or low accuracy of the sales plan is a factor which is the most significant cause of the pending order of products at PT. XYZ as well as PSC products.
3. Relate to inaccuracy of sales forecasting or DD forecasting, research result proposes four recommendations for PT. XYZ as a solution. First recommendation is to improve marketing's key performance indicator (KPI) related with sales target in unit. Second recommendation is the use of combination of quantitative with qualitative sales or DD forecasting technique. Third recommendation is to increase strategic stock for each product for short time period. The last recommendation is DD forecasting should be received by SCM of PT. XYZ from its logistic provider (PT. ZZZ) after having coordination with marketing division of PT. XYZ.

Suggestions

1. From this research it is known that the root cause of the problem is the DD accuracy or low sales planning. Therefore, it is recommended for further researcher to conduct further research in order to find the root cause of the demand distributor / sales forecasting low accuracy in PT. XYZ by using similar methods in this study or different methods. So far, the cause of the low accuracy of DD for PSC product at PT. XYZ has only been confirmed by the researcher through field observations of its process.
2. It is advisable to do further research to study the problem of the research (pending order of PSC products at PT. XYZ) with other analytical instruments such as current reality tree (CRT), Pareto diagrams or analytical hierarchy process (AHP), to further strengthen the validity of the results of this study.
3. It is advisable for the management of PT. XYZ to immediately execute the proposed alternative solutions that the researcher suggests in order to discover immediately its effectiveness and efficiency in addressing the PSC products' pending order PT. XYZ.

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LIQUID LEVEL CONTROLLING BY FUZZY LOGIC TECHNIQUE

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ABSTRACT: The liquid level controlling is useful and important phenomena in industrial, domestic and many other applications. We designed a system to control the liquid level of a container/boiler or any other type of tank. There are many techniques use to control the level of particular tank like PID and PI. We used fuzzy logic technique for liquid controller. Our FLC consist of two input parameters liquid level in the tank and the consumption of the liquid from the tank. To control these two input parameters one output parameter valve is used. The technique used by us involve the FIS with define rules.

KEYWORDS: Proportional integral derivative(PID), Proportional integral(PI), Fuzzy logic controller(FLC), Fuzzy inference system(FIS).

1 INTRODUCTION

Liquid level controlling is now a days much important in many applications. If proper check and balance of the level of any fluid is not maintained there will be very hard and dangerous consequences in industry. To maintain the arrangement of proper controlling of the level of the fluid many controlling techniques or many controllers are used. Our system is fuzzy logic system. The fuzzy logic technique is much important and useful it solutions faster and most efficient way than conventional control techniques to control the level of the fluid through valve as an output function.We under go Matlab simulated values for output and check out these results by comparing with the software simulated values with Mamdani model mathematical calculations and reveal the percentage difference for output parameter. We focused on the level controlling technique of the tank or container to design the controller. Such type of controller has many industrial, domestic applications. These type of controllers have specific applications for boilers .To control the liquid level we involve two input parameters and valve as output parameter.

Fuzzy Logic is a design methodology, useful for both linear and non linear systems. With the help of fuzzy logic, designers can realize smallest development costs, and better performance [1]. In this paper etl mehmood in 2013 stated the application of Fuzzy Logic Controller (FLC) used to control the liquid level in the second tank of two cascaded coupled containers. System modeling involves to develop mathematical model. Software simulated studies are conducted which are based on the developed Matlab model or a simulink[2]. Fuzzy logic system(FLS) is used to tackle non linear systems which are hard to deal mathematically. The fuzzy Logic concept to solve the problems ist time reported by Lotfi Zedeh [3]. Fuzzy logic technique is used in modeling solutions for non linear control models with multi parameters for a control strategy. Such system delivers solutions efficiently and in precise way then other design techniques for control. Fuzzy logic technique based temperature control system is established in this paper. The system consists of operational amplifiers, temperature sensors, Analogue to Digital Converter, microcontroller based display interfaced circuit. This technique successfully introduces controller design to control the temperature [4]. Berthold et al. at 2006 stated a designed room air cooling system from fuzzy logic technique .The two input variables temperature and humidity and the output variables are, cooler fan, water pump and exhaust fan [5]. Akyildiz et al. at 2008 proposed his work on cognitive radio. He worked on spectrum sensing for cognitive radio. He presented main issues for cognitive radio like spectrum sharing , spectrum sensing and spectrum mobility[6].

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2 METHODOLOGY

We use fuzzy logic tool in a Matlab to design a liquid or fluid level controller. There are two main models in a fuzzy logic tool Mamdani model and Sugeno model But we focused on Mamdani model. The basic difference between Sugeno and Mamdani model is that the sugeno output member ship functions are linear and constant, but Mamdani model deals with member ship functions which are non linear. Another important difference between these models is In sugeno weighted average method use to generate the specific output but in Mamdani the Defuzzification process use to generate crisp output [7].

Fuzzy logic is a form of logic which deals with approximate values for the reasoning in spite of the fixed or exact values. The variables involve in fuzzy logic having a range between 0 and 1. In order to implement the fuzzy logic on the system it is necessary to have input data firstly then this data goes to fuzzification process in a fuzzifier the third stage is the analysis which is based on the rules defined in the rule editor and analyze with the conditions in the inference engine and then goes to Defuzzification system and at the end decision takes place. Here is the diagram which shows this implementation.

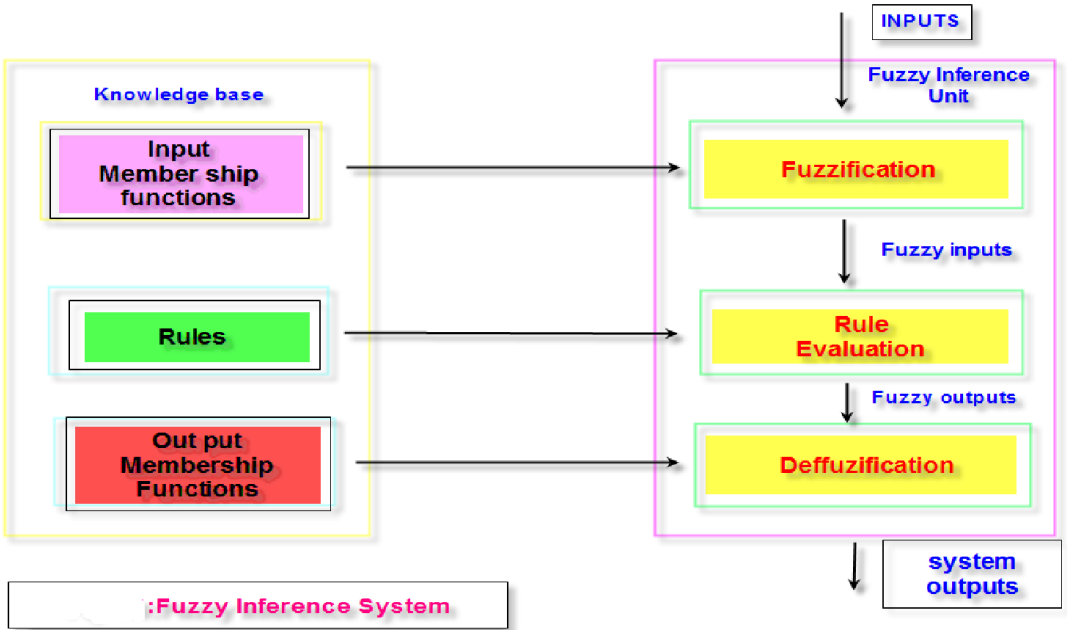


Fig 1. Fuzzy Inference System

3 MATLAB SIMULATION

In our Matlab simulation we have Mamdani liquid level controller having two input parameters first one is the liquid level in the container/tank and second one is the liquid consumption from the tank. Output parameter valve the only function to control two input parameters. The position of the valve satisfies the level of the tank.

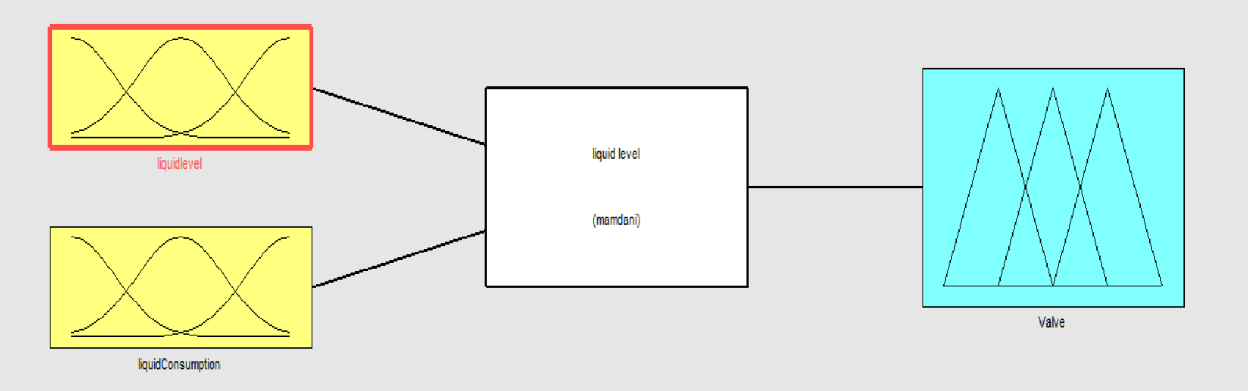


Fig 2. FIS editor for the FLC

Here is the first input parameter liquid level for our controller. It involves five different membership functions starting from the dead level then low, normal, high and full. The region 1 included from the peak point of dead level to the peak point of the low level. Second region consist of the peak point of low level to normal level peak point same as third region and fourth region having ranges involving the peak points.FIG 3 showing the membership functions for the input liquid level.

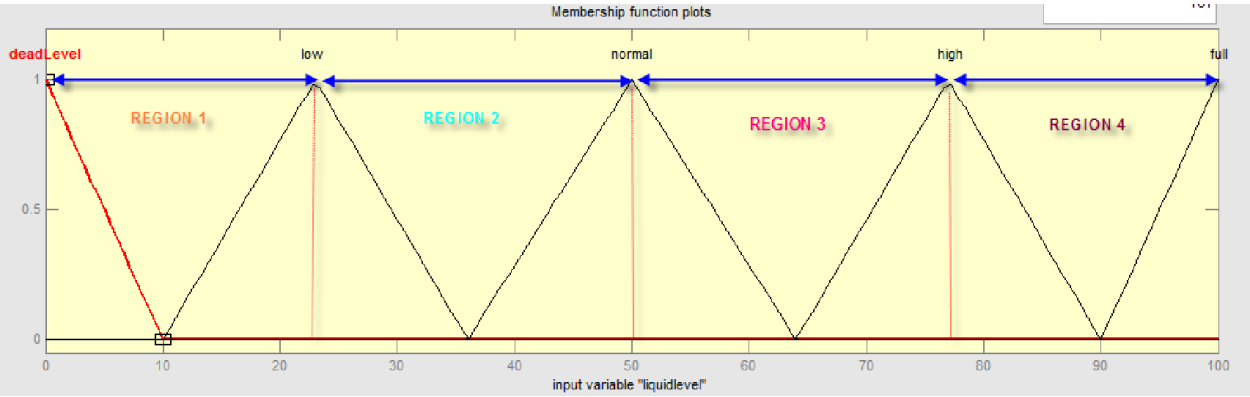


Fig 3. Input liquid level membership function ranges

Second input parameter for our controller is the liquid consumption from the tank. This second input also consist of four regions with five membership function. liquid consumption involving very large consumption from the tank second membership function is large third membership function is normal and last two are less consumption and very less consumption of the liquid from the tank. Four specific regions involving the peak to peak points from one membership function to the next membership function. Fig 4 shows the input parameter membership function ranges.

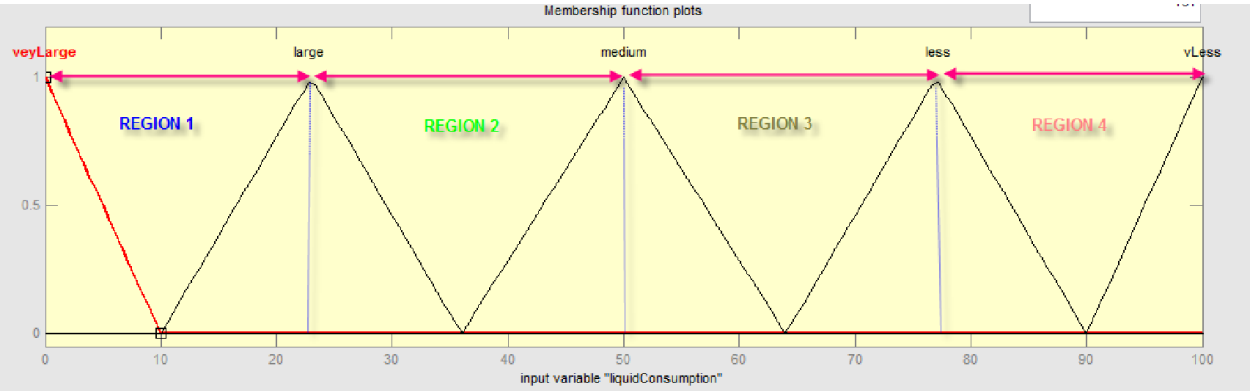


Fig 4. Liquid consumption membership functions with ranges and regions

Output parameter valve also having five membership function with specific ranges. Membership function Quick open having ranges from 0 to 20, same for slow open having ranges from 20 to 40 and no change from 40 to 60,for slow close ranges from 60 to 80 and the final membership function quick close having ranges from 80 to 100.

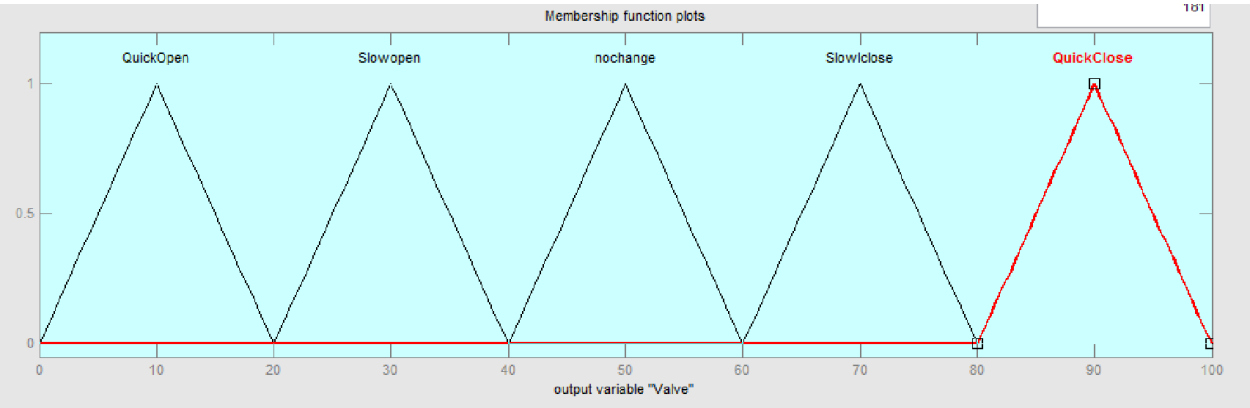


Fig 5. Membership functions for output variable valve with ranges

In a fuzzification process the crisp input values converted into its specific linguistic variables. The table no 1 which shows the relationship between the two input variables and four linguistic variables, each input variable has its own specific effect on output.

fn[m]. Here n= number of input, m= number of member ship function.

Table I Linguistic value of fuzzifier output

INPUT	Linguistic fuzzifier output	Region 1	Region 2	Region 3	Region 4
Liquid Level	f1	f1[1]	f1[2]	f1[3]	f1[4]
	f2	f1[2]	f1[3]	f1[4]	f1[5]
Liquid Consumption	f3	f2[1]	f2[2]	f2[3]	f2[4]
	f4	f2[2]	f2[3]	f2[4]	f2[5]

The Fuzzy Logic Rules used in the fuzzy controller are considered by the formula= $m^{n.}$. n=number of inputs and m=number of membership functions for each input .Total fuzzy rules are 5^2=25 rules.

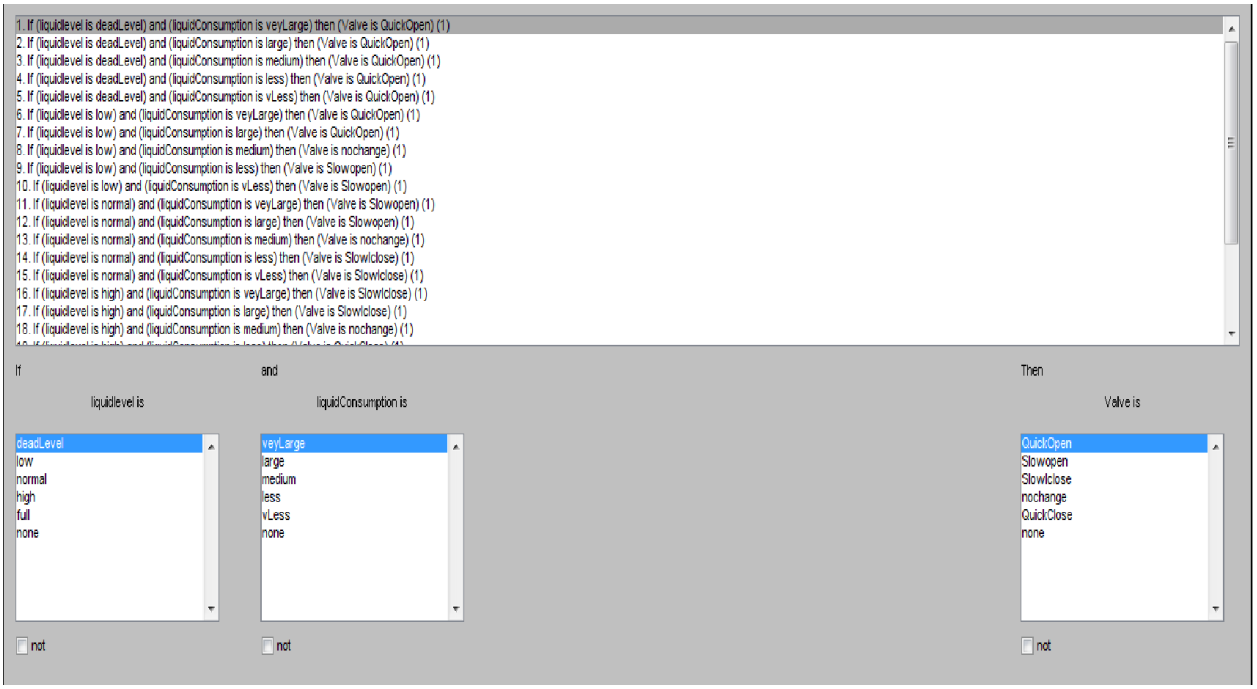


Fig 6. Fuzzy Rules Editor

These rules are defined to get the desired response from the controller on a specific condition. fuzzy rules are same like if and then condition. These rules are much near to natural human language. Rules are specified in the FIS and according to these rules the linguistic values are defuzzified to get the crisp output value.

The rule editor use to specify the Matlab simulated values for inputs and outputs.

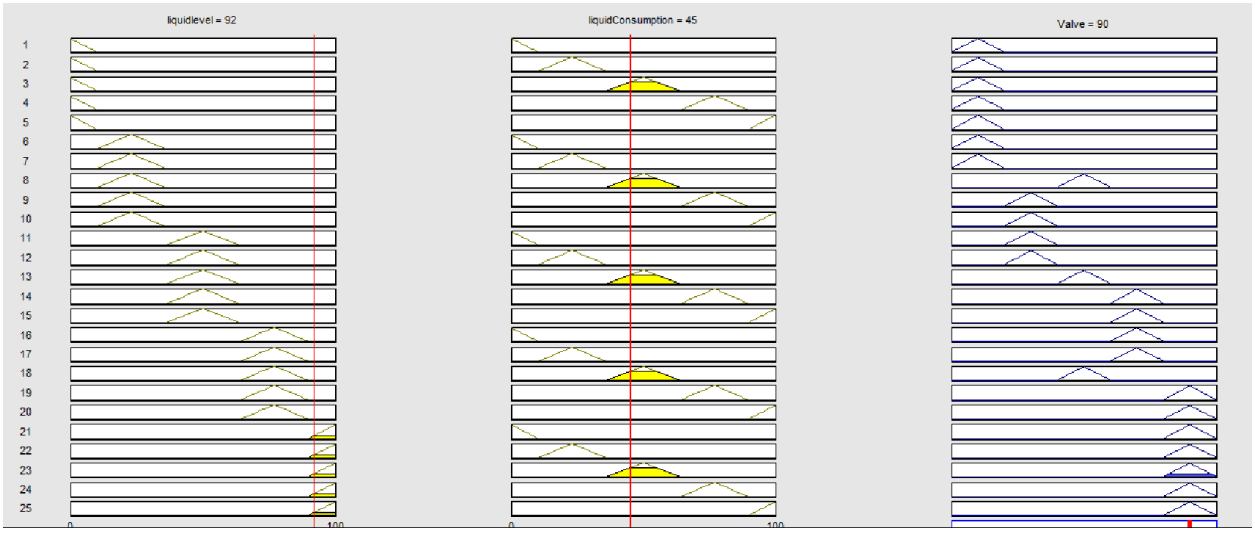


Fig 7. Fuzzy logic Rule viewer

The surface viewer graph is present which shows us the three dimensional view of the input liquid level ,liquid consumption with respect to its output Valve. This graph shows us the non linear behavior when the liquid is at its dead level and liquid consumption is also very less then valve is at the position according to the requirement. as the liquid consumption increases valve will quick open, another condition which lead to quick open when liquid is at its dead level. Same when tank is at its full level and liquid consumption is also very less the valve will goes to quick close.

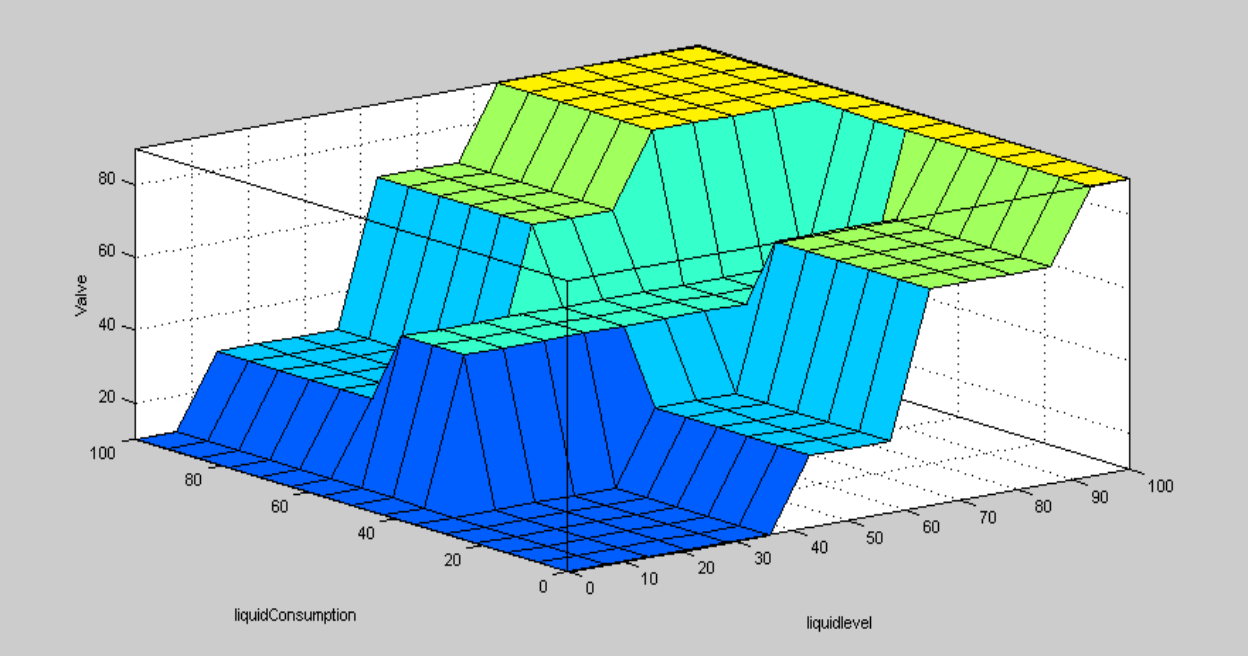


Fig 8. Surface Viewer graph between liquid level, liquid consumption and Valve

4 DESIGN ALGORITHM

The values of inputs and outputs are in percentage.

Liquid level = 92, Liquid consumption = 45 and output valve = 90.These values are software simulated values.

Liquid level

The first input parameter for the fuzzy logic controller is liquid level as the input value from the Matlab oriented result is 92.This value is placed in region 4.We have to find out the linguistic variable values .The first input having two linguistic variables.f1 and f2.

f1=100-92/100=0.08

f2=1-0.08=0.92.

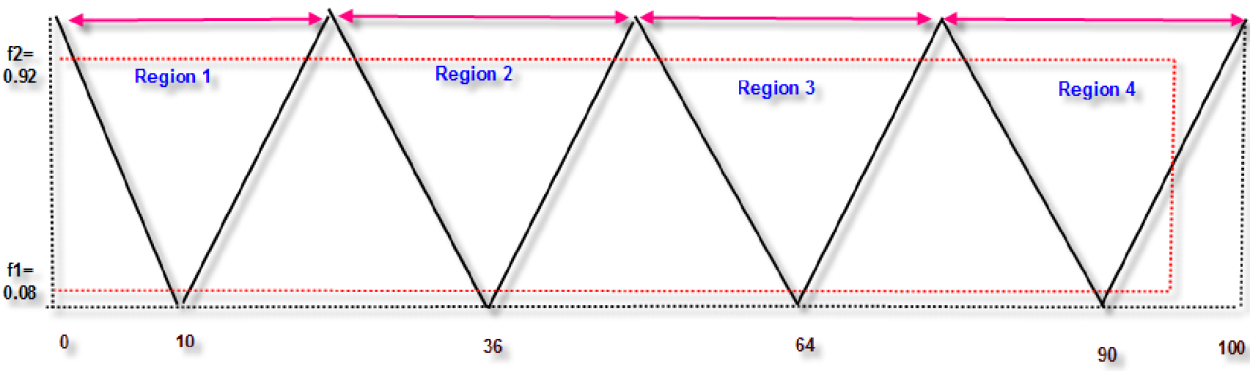


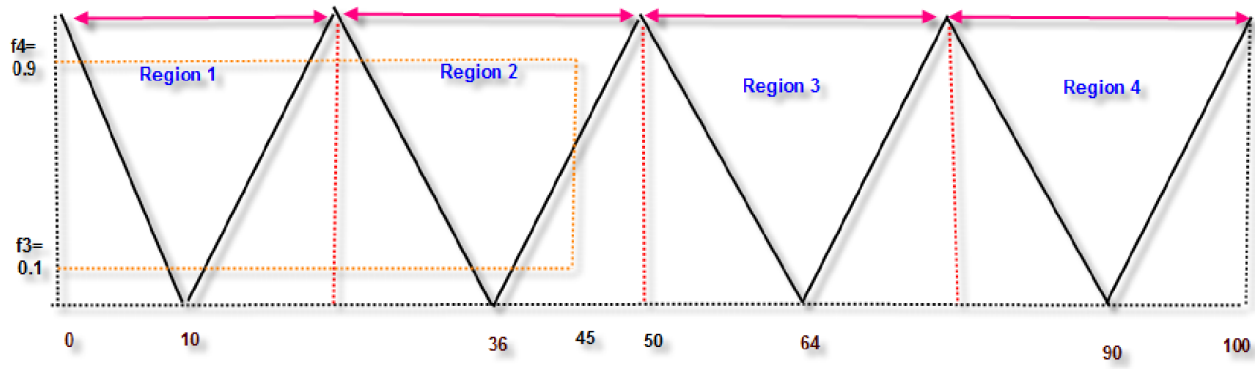
Fig 9. Ranges in different regions

Liquid Consumption

The second input parameter for the fuzzy logic controller is liquid consumption as the input value from the Matlab oriented result is 45 which is in region 2.We have to find out the linguistic variable values .The first input having two linguistic variables.f3 and f4.

f3=50-45/50=0.1

f4=1-0.1=0.9



Composite rules values finding.

The most common rules among the twenty five rules are as below.

Table II Composite rules finding

Rules	Membership functions
R0	f1^f3=0.08^0.1=0.08
R1	f1^f4=0.08^0.9=0.08
R2	f2^f3=0.92^0.1=0.1
R3	f2^f4=0.92^0.9=0.9

Table III Singleton values for Valve (output)

Rule No	Liquid level	Liquid Consumption	Output Valve value	Singleton values
R0	High	Large	Slow close	0.7
R1	High	Medium	No change	0.5
R2	Full	Large	Quick close	0.9
R3	Full	Medium	Quick close	0.9

Table IV Summition of Values

R0=0.08	S0=0.7	R0*S0=0.58
R1=0.08	S1=0.5	R1*S1=0.40
R2=0.1	S2=0.9	R2*S2=0.09
R3=0.9	S3=0.9	R3*S3=0.819
∑Ri=1.16		∑Ri*Si=1

The Mamdani model used to calculate crisp values for fuzzy logic controller. The formula for Mamdani model is as follows:

∑Ri = R0+R1+R2+R3.

∑Ri * Si = R0*S0+R1*S1+R2*S2+R3*S3.

after putting values =[1/1.16]*100=86.25

Matlab simulated value=90

% Error = [difference /Simulated Value] *100

Difference =90-86.25=3.75

Percentage Error=[3.75/90]*100=4.1%

Comparison

The comparison between design and simulated values is shown in table below.

Table V Comparison between designed and simulated value

Results	Output Valve
Matlab Simulated Value	90
Designed Value	86.25
% Error	4.1

5 CONCLUSION

Design of level controller to control the level of the tank/container is presented. This controller consists of two input levels like the level of the tank and the consumption of the liquid from the tank. The simulated values from the Matlab having output valve value is 90 but the designed value is 86.25. The percentage error difference between software oriented value and mathematically calculated value is 4.1%.

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REDUCTION OF INTER-CARRIER INTERFERENCE IN ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING SYSTEM USING ICI SELF CANCELLATION METHOD

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ABSTRACT: Orthogonal Frequency Division Multiplexing (OFDM) is known to be a multicarrier digital communication scheme which helps in addressing problems of interference which are the Inter-carrier Interference (ICI) and Inter-symbol Interference (ISI). OFDM gather large number of low data rate carrier to build a complex high data rate communication system. OFDM is a technique for transmitting data in parallel by the usage of large number of modulated subcarriers and the said subcarriers are separated in frequency after dividing the available bandwidth so that they are orthogonal. OFDM problem is that it is sensitive to frequency offset caused by the relative motion which occurs between the transmitter and the receiver (Doppler shift) which introduces Inter-carrier Interference (loss of orthogonality between sub-carriers) in the OFDM symbol and the use of ICI Self cancellation method will help to reduce the ICI which has been analyzed in this paper and the MATLAB simulation was carried out on the receiver and its transmitter in terms of carrier-to-interference ratio (CIR).

KEYWORDS: Inter-carrier Interference (ICI), Orthogonal Frequency Division Multiplexing (OFDM), ICI self cancellation method.

1 INTRODUCTION

There is need for higher data rate services such as voice and data over wired and wireless lines due to the advancement of communication technology. Multipath propagation problems such as delay spread, Doppler spread and Signal fading affects the system and causes interference in the system [7], [9], [11]. OFDM problem is that it is sensitive to frequency offset caused by the relative motion which occurs between the transmitter and the receiver and this frequency offset predominates loss of orthogonality between the sub-carriers and the signal which is transmitted on each carrier are not independent on each other leading to ICI [4]. The idea of OFDM is the usage of parallel data and FDM with overlapping sub-channels and to achieve this technique, there is need for reduction of cross talk between sub-carriers which implies the orthogonality between the different modulated carriers is desired [2]. The OFDM overlapping method predominates a better spectral efficiency than the remaining system types like the Frequency Division Multiple Access (FDMA) where spectral overlap of carriers is prohibited and the modulator with the demodulator implementation using FFT algorithm on the receiver side and the inverse FFT on the sender side in OFDM system is possible due to the orthogonality which exist between the subcarriers. OFDM being a form of multicarrier modulation scheme helps to eliminate the use of complex equalizer, meet high data rate, withstand severe channel condition and changes a frequency selective wideband channels into a group of non-selective narrowband channel which in turn makes it robust against large delay spread by maintaining its orthogonality in the frequency domain [3], [5], [8].

2 DESCRIPTION OF OFDM SYSTEM

The input bit stream is multiplexed into N-symbol stream and each has a symbol period T_s, each symbol stream is then used in modulating parallel sub-carriers [10]. The subcarriers are orthogonal over the interval (0, T_s) hence they are spaced by $1/NT_s$ in frequency.

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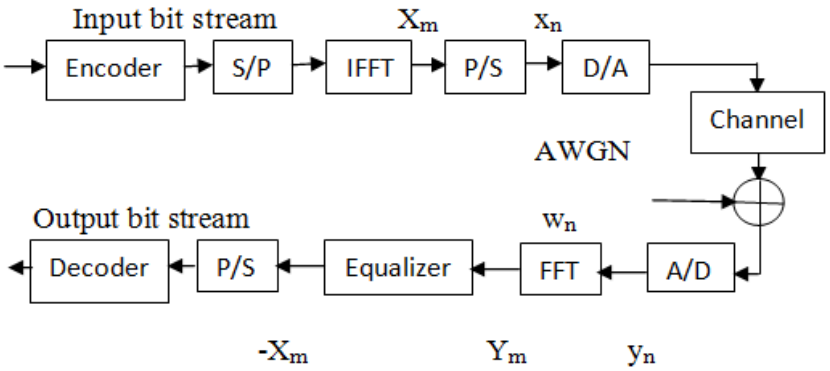

Fig. 1. OFDM Baseband Transeiver.

OFDM symbol is expressed as: $x(n) = \frac{1}{N}\sum_{m=0}^{N-1} Xm e^{\frac{j2\pi nm}{N}}$ (1)

X_m's are baseband symbols on each subcarrier while the digital-to-analogue (D/A) converter creates an analogue time-domain signal which is transmitted through the channel.

From figure 1, a serial-to-parallel (S/P) converter divides the stream of input bits into groups from the source encoder into categories of Log_2M bits whereby the M stands for alphabet of size of the modulation scheme (digital modulation) used on each sub-carrier. The total of such N symbols X_m are created and the N symbols are thus mapped to the bins of Inverse FFT which corresponds to the orthogonized sub-carriers which is in the Orthogonal Frequency Division Multiplexing (OFDM) symbol. The signal is then converted back to a discrete N point sequence $y_{(n)}$ at d receiver corresponding to each sub-carrier. The discrete signal is then demodulated using an N-point FFT operation at the receiver and the demodulated symbol stream is given as: $Y(m) = \sum_{n=0}^{N-1} y(n)\, e^{\frac{-j2\pi nm}{N}} + W(m)$ (2)

W(m) is the FFT of the samples of w(n) which is the Additive White Gaussian Noise (AWGN)) brought into the channel.

3 INTER-CARRIER INTERFERENCE ANALYSIS

The vulnerability to small difference in frequency at the transmitter and the receiver is called "Frequency Offset" which is usually caused by Doppler shift due to the relative motion which exist between the system transmitter and the system receiver or by differences between the frequency of the local oscillators at the transmitter and receiver. Frequency offset is been modeled as a multiplicative factor brought in the channel.

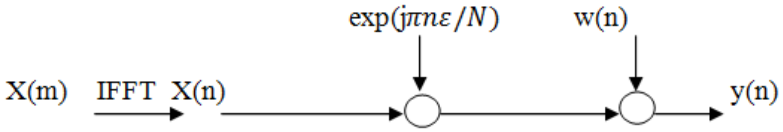

Fig. 2: Frequency Offset Model.

The received signal is given by,

$$y(n) = x(n)\, e^{\frac{j2\pi n\varepsilon}{N}} + w(n) \quad (3)$$

w(n) is referred to as the Additive White Gaussian Noise introduced into the channel, ε is the normalized frequency which is stated as ΔFNT_s, ΔF is the frequency difference, T_s is the sub-carrier symbol period and N is the total number of sub-carrier. The frequency offset effect on the signal stream received can be understood by putting into consideration the received symbol Y(k) on the K^{th}sub-carrier

$$Y(k) = X(k)S(0) + \sum_{l=0,l\neq k}^{N-1} X(l)S(l-k) + n_k \quad (4)$$

K = 0,1,…N-1

n_k is the FFT of w(n), X(k) is the transmitted symbol for the K^{th}sub-carrier, N is the total number of sub-carrier and S(*l*-k) are the complex co-efficient for the Inter-carrier Interference components in the signal received. The first term on the right

hand side of equation (4) represent the desired signal and the second term is the ICI component. The interfering signal transmitted on the sub-carriers other than the K^{th} sub-carrier are called the ICI components and the complex co-efficient are given by:

$$S(l\text{-}k) = \frac{Sin(\pi(l+\varepsilon-k))}{NSin(\pi(l+\varepsilon-k)/N)} \exp\left(j\pi\left(1-\frac{1}{N}\right)(l+\varepsilon-k)\right) \quad (5)$$

The plots for S (*l*-k) when *l* =0, frequency offset are 0.2 and 0.4 and when N=16 is shown in fig. 3 and it is seen that as the desired part S(0) decreases and the undesired part S (*l*-k) increases the frequency offset becomes large.

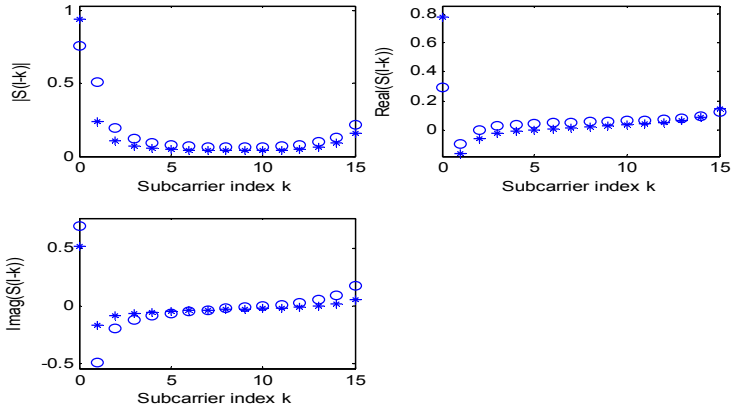

Fig. 3: ICI co-efficient for N=16.

The adjacent carrier has a maximum contribution to the Inter-carrier Interference thus, it is used in the ICI self cancellation method.

The carrier-to-interference ratio (CIR) is known as the ratio of the signal power in the interference component and it serves as a very good indication of quality signal. The CIR is derived from (4) in [1], [6] and it is given below:

$$CIR = \frac{[S(K)]2}{\sum_{l=0,l\neq k}^{N-1}[S(l-k)]2} = \frac{[S(0)]2}{\sum_{l=0}^{N-1}[S(l)]2} \quad (6)$$

3.1 ICI CANCELLING MODULATION

When ε is reduced then the ICI will equally reduce and this is achieved by increasing the sub-carriers separation, reducing the time domain symbol length and allowing guard interval take a big portion of useful signal which predominantly reduced bandwidth efficiency.

The difference of ICI co-efficient between two consecutive sub-carriers {S(*l*-k) and S(1+*l*-k)} is very minimal for majority of the *l*-k values. However, if a data pair (a, -a) is modulated onto two adjacent sub-carriers (*l*, *l* + 1) where "a" is a complex. The ICI signal obtained by the sub-carrier *l* will be nullified significantly by the ICI generated by sub-carrier *l* + 1. Assuming that the transmitted symbols are given as X(1) = -X(0), X(3) = -X(2)…X(N-1) = -X(N-2), then the received signal on sub-carrier K becomes:

$$Y'(K) = \sum_{l=0,l=even}^{N-2} X(l)[S(l-k) - S(l+1-K)] + n_k \quad (7)$$

Also, the received signal on sub-carrier K + 1 becomes:

$$Y'(K+1) = \sum_{l=0,l=even}^{N-2} X(l)[S(l-k) - S(l+1-K)] + n_k + 1 \quad (8)$$

In that case, the ICI co-efficient is denoted by:

$S'(l-k) = S(l-k) - S(l+1-k)$ and it is found that $S'(l-k) << S(l\text{-}k)$ (9)

Only even sub-carriers are involved in the summation and that makes the total number of interference to be halved.

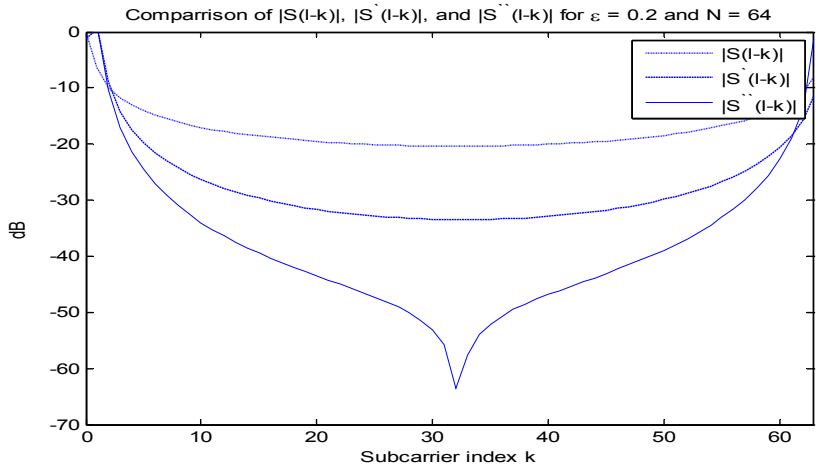

Fig. 4: Comparison of $|S(l-k)|, |S'(l-k)|$ *and* $|S"(l-k)|$.

3.2 ICI CANCELLING DEMODULATION

The received signal experience redundancy which is introduced by ICI modulation since each pair of sub-carrier transmit only one data symbol. Therefore, the received signal at the (k + 1)th subcarrier, where k is even and it is subtracted from the K^{th}sub-carrier so as to take advantage of the redundancy and it is expressed mathematically as:

$$Y''(k) = Y'(k) - Y'(k+1) \quad (10)$$

$$Y''(k)=\sum_{l=0,l=even}^{N-2} X(l)[-S(l-K-1) + 2S(l-K) - S(l-K+1)] + n_k - n_k + 1 \quad (11)$$

Therefore, ICI co-efficient for this received signal becomes:

$$S''(l-k) = -S(l-k+1) + 2S(l-k) - S(l-k+1) \quad (12)$$

When compared to the two ICI co-efficient that was earlier shown in fig. 4 which are: $|S(l-k)|$ for the standard Orthogonal Frequency Division Modulation system, $|S'(l-k)|$ for the Inter-carrier Interference cancelling modulation and $|S"(l-k)|$ which has the smallest Inter-carrier Interference co-efficient for the majority of the l-k value preceded by the $|S'(l-k)|$ and $|S(l-k)|$.

The combination of these modulation and demodulation process is referred to as the ICI Self-cancellation scheme and using the ICI co-efficient given by (12), the theoretical CIR expression is given as:

$$CIR = \frac{|-S(-1)+2S(0)-S(1)|2}{\sum_{l=2,4,6\ldots}^{N-1}|-S(l-1)+2S(l)-S(l+1)|2} \quad (13)$$

Fig. 5 shows the CIR which is greatly improved by ICI self cancellation scheme.

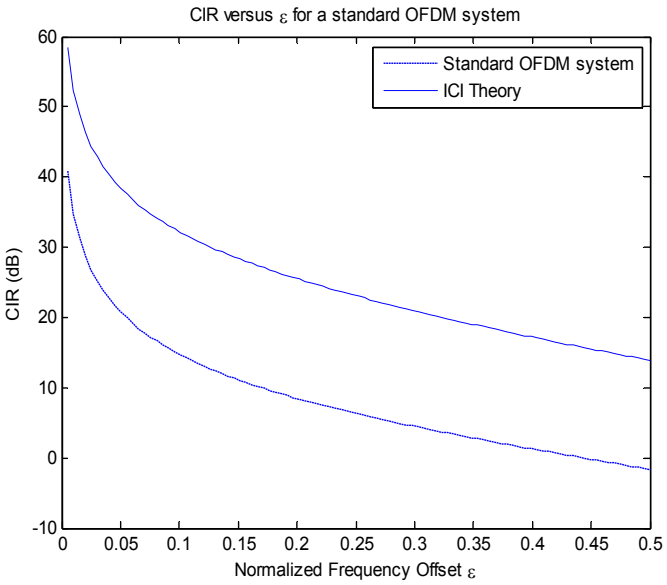

Fig. 5: CIR against ε for standard OFDM system.

4 CONCLUSION

In this paper, the performance of OFDM system was studied when frequency offset is present between the transmitter and the receiver and the study was accomplished in terms of Carrier-to-Interference Ratio performance. The frequency offset which gives rise to ICI degrades the performance of the OFDM system. ICI self-cancellation scheme was used in combating the impact of ICI on OFDM system for different frequency offset value, the scheme doesn't require complex hardware or software for implementation and the scheme also provides significant CIR improvement.

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PEAK EXPIRATORY FLOW RATE AND ITS CORRELATION WITH WEIGHT IN NORMAL SCHOOL CHILDREN

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ABSTRACT: *Aims:* The aim of this study was to correlate the "PEAK EXPIRATORY FLOW RATE" as measured by miniature Wright Peak Flow Meter in normal school children between 5 – 18 years with Weight.
Objectives: This study was done to correlate Weight of healthy school children with PEFR.
Study area: R.G.M. School Sindhanur.
Study design: This is an observational study of 495 urban school going healthy children from SINDHANUR. This sample comprised of 268 boys and 227 girls in the age range of 5- 18 years.
Results: PEFR increases progressively with increase in Weight. The correlation of PEFR with Weight was statistically significant.
Conclusion: The present study has led to the following conclusions.
A. There is a positive and statistically significant correlation between PEFR and Weight in the sample of children selected.
B. Weight has a less closer correlation with PEFR than height.

KEYWORDS: Peak Expiratory Flow Rate (PEFR), Peak Flow Meter, S.D. (Standard Deviation), C.V. (Coefficient of Variation), S.E.M. (Standard Error of Mean).

1 INTRODUCTION

Rapid advances in technology since the beginning of this century have enabled a better understanding of physiological principles underlying pulmonary function. The pulmonary function tests have not only widened the knowledge about the functional capability of the lungs in normal healthy persons but also have made it possible to assess the functional abnormalities in persons with restrictive and obstructive airway disorders both qualitatively and quantitatively. The important functional abnormality in patients disabled by asthma, bronchitis, emphysema and other COPDs (Chronic Obtructive Pulmonary Disorders) is the difficulty in expiration. Hence the measurement of Peak Expiratory Flow Rate (PEFR) has gained world wide acceptability as a method for identification, assessment, rational therapy and followup of such patients.

PEFR is defined as the maximal expiratory flow rate which can be sustained by a subject for at least 10 milliseconds during forced expiration starting from total lung capacity. PEFR is expressed in litres/min. PEFR is influenced by various factors such as age, sex, height, weight, body surface area, environmental and ethnic differences. The measurement of PEFR is of value

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for the identification of chronic obstructive bronchitis and for assessment and follow up of patients with asthma.It is also very useful in the assessment of severity of airway obstruction. The Wright Peak Flow Meter, which was designed as a simple and reliable device is used for measuring PEFR. This instrument has undergone many changes and reached its present form known as the miniature Wright Peak Flow Meter. For the purposes of evaluation of an observed reading of PEFR, a knowledge of its range in normal subjects of the same sex, age and body size is required.

2 MATERIALS AND METHODS

2.1 MATERIALS

SELECTION OF SUBJECTS:

The present study reports normal values for PEFR in 495 normal children from 5 – 18 years of age, measured using a miniature Wright Peak Flow Meter (MWPFM). These children constitute a representative cross section of normal school children. Students of both sexes were selected randomly from the primary, middle and high school (of R.G.M.School Sindhanur)

The following criteria were employed for acceptance as a Normal subject.

1) No history of cardiopulmonary disease.

2) No clinical evidence of cardiopulmonary disease.

3) No history or evidence of any other disease which could be expected to affect pulmonary function.

4) Capable of adequate co-operation.Children willing to participate with the consent of parent/guardian.

THE INSTRUMENT:

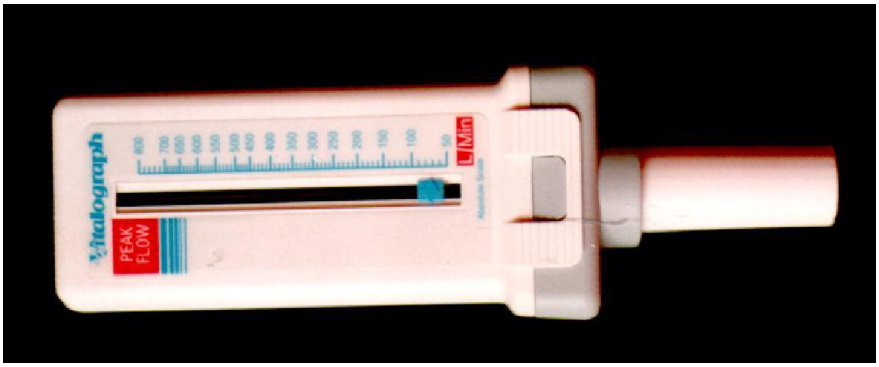

Fig. 1. Wright Peak Flow Meter

PEAK FLOW METER:

Background: The Peak flow meter was introduced in 1959 by B.M.Wright. This device became popular soon after, but was expensive, cumbersome & too sensitive for routine clinical use. However the concept of Peak flow rate caught on and efforts to develop a cheaper, simple and portable instrument to measure the same got under way. Thus was born in 1969, the miniature Wright Peak Flow Meter, commercial production of the same began in 1977.

THE MINI WRIGHT PEAK FLOW METER:

The mini Wright peak flow meter operates on a spring loaded piston and a longitudinal slot as a variable orifice, which carries a rider or marker as Peak flow indicator. These are housed in a cylindrical plastic frame of dimension 5.0 cm diameter and 15 cms length. The instrument weighs 75 gms.

OPERATION AND USE:

Air blown into mouth piece cannot escape until it has moved and uncovered part of the longitudinal slot. When the area of the slot uncovered is such that the pressure behind the piston is just enough to balance the tension in the spring, the piston comes to rest in a position that depends on the flow rate.

2.2 METHODS

Each child was weighed with normal light clothing. The purpose and technique of the test was described to the subjects in groups of ten and the method of blowing into the instrument was demonstrated. Each subject then held the instrument and had several trial blows, until it was clear that he/she was using the meter properly and comfortably (this usually required 2-4 blows). Each was encouraged to make a maximal effort and was closely watched to ensure that he/she maintained an airtight seal between the lips and mouth piece of the instrument. Each child blew five times into the flow meter and three maximum readings were recorded.

3 OBSERVATIONS/ RESULTS

The children in 10 – 20 Kgs weight group had a mean PEFR of 192.39 L/Min. with a S.D. of 35.98; the children in 21 – 30 Kgs weight group had a mean PEFR of 294.59 L/Min. with a S.D. of 39.21; the children in 31 – 40 Kgs weight group had a mean PEFR of 359.41 L/Min. with a S.D. of 40.77; the children in 41 – 50 Kgs weight group had a mean PEFR of 421.48 L/Min with a S.D. of 32.28; the children in 51 – 60 Kgs weight group had a mean PEFR of 479.43 L/Min with a S.D. of 26.09 and the children in 61 – 70 Kgs weight group had a mean PEFR of 541.82 L/Min. with a S.D. of 27.24.

4 DISCUSSION

PEFR AND WEIGHT

The minimum and maximum weights of the Boys were 14 and 70 Kgs respectively. The minimum and maximum weights of the Girls were 13 and 56 Kgs respectively. The percentage distribution of the subjects with respect to weight and sex are shown in Table 1.

The mean weight of 268 boys was 35.07 Kgs with a S.D. of 14.64. The mean weight of 227 girls was 30.21 Kgs with a S.D. of 12.34. The mean weight of all the 495 students was 32.84 Kgs with a S.D. of 13.72. The mean weights of the subjects fall within normal limits and are comparable to those included in the study of Malik S.K. et.al.

The mean PEFRs with S.D. , C.V. and S.E.M of all the subjects with respect to weight are shown in Table 3.

The children in 10 – 20 Kgs weight group had a mean PEFR of 192.39 L/Min. with a S.D. of 35.98; the children in 21 – 30 Kgs weight group had a mean PEFR of 294.59 L/Min. with a S.D. of 39.21; the children in 31 – 40 Kgs weight group had a mean PEFR of 359.41 L/Min. with a S.D. of 40.77; the children in 41 – 50 Kgs weight group had a mean PEFR of 421.48 L/Min with a S.D. of 32.28; the children in 51 – 60 Kgs weight group had a mean PEFR of 479.43 L/Min with a S.D. of 26.09 and the children in 61 – 70 Kgs weight group had a mean PEFR of 541.82 L/Min. with a S.D. of 27.24.

The progressive increase in the PEFR values with increasing weight is obvious. PEFR shows good correlation with weight. The relationship is statistically significant as indicated by the correlation coefficient i.e. , r = 0.953 both sexes combined , 0.967 in boys and 0.925 in girls. The P value is less than 0.001 in all the cases. The r values are comparable to those obtained in the studies by Parmar V.R. et.al and Malik S.K. et.al.

From the above discussion , the statistically highly significant relation of PEFR and Weight is evident. Though full efforts have been made to get the subjects best cooperation it is possible that some of the children might not have given their best performance during the test. Also some might not have recalled the previous history of chest illness correctly and might have had subtle grade of asymptomatic small airways obstruction which is not detectable by PEFR test.In addition genetic makeup of the individual which contributes to one third of the phenotypic expression, also influences the performance of the individual.The Co-efficients (r) of PEFR obtained in the present study has been compared with those of other work done in North India and Western Countries. The values in different studies are in close concordance with each other.

Table 1. The percentage distribution of the subjects with respect to Weight and Sex

	Total (n=495)		Boys (n=268)		Girls (n=227)	
Weight (Kgs)	No	%	No	%	No	%
10 - 20	113	22.8	49	18.2	64	28.2
21 - 30	135	27.3	65	24.3	70	30.8
31 - 40	102	20.6	68	25.4	34	15
41 - 50	81	16.4	38	14.2	43	18.9
51 - 60	53	10.7	37	13.8	16	7.1
61 - 70	11	2.2	11	4.1	-	-

Table 2. The mean Weight with S.D. , C.V. & S.E.M of Boys , Girls and all the subjects

Weight (Kgs)	Total (n=495)	Boys (n=268)	Girls (n=227)
Mean	32.84	35.07	30.21
S.D.	13.72	14.64	12.34
C.V.	41.78	41.74	40.85
S.E.M	0.62	0.89	0.82

Table 3. The mean PEFR with S.D. , C.V and S.E.M of All Subjects with respect to Weight

	Total (n = 495)		PEFR (L / Min.)		
Weight (Kgs)	No	Mean	S.D.	C.V %	S.E.M
10 - 20	113	192.39	35.98	18.7	3.38
21 - 30	135	284.59	39.21	13.78	3.37
31 - 40	102	359.41	40.77	11.34	4.04
41 - 50	81	421.48	32.38	7.66	3.59
51 - 60	53	479.43	26.09	5.44	3.58
61 - 70	11	541.82	27.24	5.03	8.21

5 CONCLUSION

PEFRs were measured in a sample of 495 urban school going children from SINDHANUR. This sample comprised of 268 boys and 227 girls in the age group 5-18 years. The mean values of age, height, weight, B.S.A. and PEFR were 11.5 yrs, 140.21 cms , 32.84 Kgs , 1.14 Sq.mts and 328.18 L/min respectively.The correlation of PEFR with Weight was statistically significant. With the detailed statistical analysis and discussion it is quite evident that the present study is statistically highly significant and can be considered as a standard reference for the child population of South India.

The present study has led to the following conclusions :

There is a positive and statistically significant correlation between PEFR and WEIGHT.

Weight has a lesser closer correlation with PEFR than height.

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Assessing the role of Institutional factors on the use of Improved Cook stoves in Kenya's Homabay County

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ABSTRACT: The aim of the study was to examine the influence of institutional factors on the adoption of improved cook stoves in Homabay County, Kenya. The economic, social, ecological and environmental roles and benefits of forests are obvious and need no emphasis. Inefficient use of fuel wood is considered one of the main causes of deforestation. Use of more efficient improved cook stoves is proposed as one of the measures that can reduce demand for fuel wood and charcoal and help in lowering the annoying deforestation rate in many developing countries. During the 2000s several programs aiming at testing and disseminating energy saving technologies were implemented in Kenya. One of these technologies was improved cook stove (ICSs), which was intended to increase the efficiency of using energy from biomass sources. The global focus on ICS and clean fuels has increased because of their potential for delivering the triple dividends: household health, local environment quality and regional climate benefits. However, ICS and clean fuel dissemination programs have been met with low rates of adoption. This study was carried out to examine the adoption rate and the factors affecting adoption of improved cook stoves in Homabay County. The study is based on primary data collected through personal interviews with husbands and wives in 220 randomly selected households. In Kenya all the household domestic tasks, particularly food preparation and related activities, are considered women's responsibilities and all the decisions related to them are taken by women. An *ex-post-facto* survey design which utilized both qualitative and quantitative methods of data collection was used in the study. For quantitative data collection, a sample of 220 small scale farmers households selected using systematic random sampling from the households in the Division were engaged. For qualitative data, 40 households and 37 Key Informants selected using purposive sampling from the division were used. The results showed that the device's adoption rate is low. Results of the study indicated that that, access to credit, participation in extension, participation in cooperative society and membership in social groups were important variables which had positively and significantly influenced adoption of ICS. Whereas, the study found no evidence to show that tenancy status influences adoption of ICS. The overall finding of the study underlined the high importance of institutional support in the areas of extension training, strengthening cooperatives and social groups and improving market and credit condition to enhance adoption of ICS.

KEYWORDS: Institutional factors; Improved cook stoves: Smallholder households.

1 INTRODUCTION

Nearly half of the global population relies on solid fuel, such as biomass, coal, or dung, for their cooking needs (Legros *et al*., 2009; Rehfuess *et al*., 2006). Unprocessed biomass (e.g. charcoal, wood, crop waste) remains a major household fuel source for most residents of low income countries particularly the poor (Bruce *et al*., 2000). During cooking, inadequate ventilation and incomplete combustion through the use of rudimentary stoves or open fire pits are common resulting in acute and chronic exposure to air pollutants (particulate matter, carbon monoxide, nitrous oxides, carcinogens and others) (Fullerton *et al*., 2008; Smith *et al*., 2000). Exposure to household air pollution has been linked to a range of negative health outcomes in children and adult, including pneumonia, tuberculosis, chronic obstructive pulmonary disease, lung cancer low birth weight and premature mortality (Bruce *et al*., 2000; Dherani *et al*., 2008; Pope *et al*., 2010).

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Indoor air pollution (IAP) emitted by burning solid fuel indoors in poorly ventilated conditions is possible for 2 million premature deaths per year, or 3.3% of the global burden of disease, particularly women and children (World Health Organization (WHO), 2009). The adverse health outcomes are chiefly caused by inhalation of fine soot particles ≤ 2.5µm in aerodynamic diameter (Smith et al., 2009). In addition to adverse health effects, negative social impacts often result from using traditional stoves. For example, inefficient stoves require more time to cook and gather fuel, a burden usually borne by women and children, which diverts their time from education and income producing activities.

Local environmental impacts arise from damages arise from damages to ambient air and local forest ecosystems. Due to the fact that only a fraction of the IAP is deposited indoors, biomass burning contributes to ambient air pollution (Shindell *et al*., 2011). Additionally, the unsustainable harvest of fuel wood degrades local forests (Hofstad et al., 2009; Kohli et al., 2011), sometimes even damaging wildlife habitat and watershed functions and contributing to deforestation (Geist and Lambin, 2001).

Cooking with unsustainably harvested biomass can affect climate because inefficient fuel combustion releases products of incomplete combustion with a higher global warming potential than carbon dioxide, such as methane and carbon monoxide (Sargar and Kartha, 2007). Biomass and fossil fuel cook stoves also emit 22% and 7% of global carbon (BC) emissions, respectively, which is the second strongest contributor to current global warming (Ramadhan and Carmichael, 2008). Unlike globally distributed greenhouse gases, such as carbon dioxide, the shorter 8 to 10 day atmospheric lifetime of BC results in localized impacts (Smith *et al*., 2009).

Improved cook stoves (ICSs) were developed initially to address these adverse health and livelihood impacts. Since ICSs improves cooing efficiency compared with traditional cook stoves, ICSs can reduce the amount of fuel required, fuel gathering time and cooking time, all of which have the potential to improve health and increase household income. In addition, these efficiencies can benefit the local environment and global climate because of reduction in fuelwood harvesting and particulate and particulate emissions. Despite clear scientific evidence on efficacy of these innovations, initial efforts to promote these technologies have run into challenges surrounding diffusion, dissemination and implementation.

Initially, failed attempts to foster untested technologies on reluctant households and consumers turned the focus of research to identifying the drivers of demand. The demand-side of thinking has been bolstered by a small yet growing body of field evidence suggesting that potential consumers often do not invest in or maintain use of environmental health technologies (e.g., piped water, water filters, private latrines, insecticide treated bed nets, improved stoves), because they do not know about or value the benefits of the technology. In addition, consumers are unwilling to finance or unable to pay the prevailing prices for the technologies (Pattanayak and Pfaff, 2009). More generally, implementation and diffusion challenges may be due to ICSs that are unsuitable for local customs, ineffective financing, poor distribution channels, or insufficient social marketing (Mitchell, 2010).

Several coinciding “game changers” may now make the large-scale deployment of ICSs more feasible: the development of a new generation of ICSs, significant experience in implementing small-scale credit operations, and new financing instruments and sources, especially those linked to climate change mitigation (World Bank, 2011). The influence of the game changers is further strengthened by general trends in low-income countries such as the rising cost of fuel wood (because of increasing scarcity and forest sector reforms). Collectively, these forces have led to increased attention on ICSs and related technologies, culminating in the recent formation of the Global Alliance for Clean Cook stoves (GACC, 2011), which aims to have 100 million homes adopt clean cook stoves by 2020. Additionally, countries such as India have launched a new National Biomass Cook stoves Initiative in 2009 to provide 160 million ICSs to households currently using solid biomass fuel (Venkataraman et al., 2010).

To mitigate adverse health and livelihood impacts in Western Kenya, a partnership was established between Ministry of Agriculture and German Society for International Cooperation (GIZ). GIZ is a nongovernmental organization that provides training, outreach and mobilization for community based groups. Use of ICSs was designed to improve health, conserve fuel wood and reduce emissions. The use of improved cook stoves is also appealing because it may translate in saving time and money used for gathering or purchasing fuel.

The cook stove technology promoted and distributed by Ministry of Agriculture and GIZ was *Maendeleo/Upesi jiko.* The functional unit of *Maendeleo jiko* is a simple ceramic liner. Using clay found in nearby river banks, these units were produced locally by skilled laborers in the Keyo and Masogo pottery groups, which are located in the cities of Kisumu and Ahero, respectively. Pottery skills are developed similarly to a trade organization with informal apprentices, journal and masters. The ceramic liners installed into simple, earthen, base that is constructed semi-permanently within a kitchen. The ceramic liner dimensions are guided by the Kenya Bureau of Standards (KS 1814:2005)[20], which aims to ensure that the correct shape and size are retained so that energy saving efficiency is maintained in the design. Practical Action, non-governmental

organization that has promoted improved cook stoves for low income countries (including Kenya), calculated the yearly savings of Kshs 7,400 could be obtained by improving the efficiency of fuel use with maendeleo jiko (Bates, 2005) However, the health impact of *maendeleo jiko* or similar cook stoves in rural Africa has not been fully established (Wafula *et al*.,; Bates, 2007). The relative cost of Ksh 150 is a primary advantage of the liners, although additional material and labor costs for the installation of the liner into a base typically Ksks 150 to Kshs 200 to the cost.

This study provides a useful insight into whether and how external assistance can be used more effectively to enable smallholder households to secure their basic needs, promote self-reliance and adopt sustainable appropriate technologies as a means of breaking the cycle of natural resource degradation to ensure environmental sustainability and eradicate disease, poverty and hunger in these households.

The findings from the study may also be used by researchers, planners, and policy makers to build the case for more focused planning for interventions on technology within the development sector and also contribute to knowledge in the area of environment and natural resource management.

2 MATERIAL AND METHODS

2.1 THE STUDY AREA

The study was carried out in Homabay County. It is one of the ten counties in Western Kenya, located in the southwestern part of Kenya along Lake Victoria. It is located between longitude 34^0 12' and 34^0 40' east and latitudes 0^0 28' and 0^0 40' south (G.O.K, 2001). Homabay is inhabited mainly by the Luo community. The County has an annual population growth of approximately 2.7%. The County has a mean density of 270 persons per square kilometer but the distribution within the County is influenced by the availability of road infrastructure and climate (G.O.K, 2001). The female/male sex ratio is 100/110 with the youth and labor force comprising 23% and 47.8%, while the dependency ratio is 100:110. The Couny is typical of rural areas of Africa where women and children are exposed to household indoor air pollution. In Homabay, rates of acute respiratory infectios, malnutrition, infant and child mortality and malaria transmission is endemic (Adazu *et al*., 2005). Access to health interventions in Homabay County is inadequate due to poverty and limited transportation and communication infrastructure. At least half of the households rely on fuel wood for cooking and superficial sources of drinking water (Centres for Disease Control and Prevention, 2007). In this polygamous society of Luo ethnicity, families live in multigenerational compounds. The County is further sub divided into 8 constituencies. According to Jaetzold and Schmidt (1982), the County lies in lower midland (lm3) agro-ecological zone. It is situated at an altitude of 1200-1400m above seal level. The mean rainfall is about 1300mm received in a bimodal pattern. The County has three types of soils; black cotton soil (vertisol), silt loam, clay loam (luvisoils) with drainage being poor in some of the soils (Jaetzold and Schmidt, 1982).

Agriculture is the lifeline of the County's economy employing over 50% of the residents. Smallholder farming is the dominant land use practice accounting for about 86.8% of land cultivated in the division (G.O.K, 2001). The cultivation of food crops is dominated by maize, sorghum and bean production (G.O.K, 2001).

The high use of firewood and charcoal contributes to deteriorating tree and vegetation cover exposing the soil to severe degradation especially on hill tops, a trend that threatens future livelihood activities. Agronomic and soil science research in recent years has shown that soil nutrient mining, monocroping and continuous cropping is widespread in Homabay County undermining the ability of many agrarian households to produce enough food supplies for subsistence (Smaling *et al.,* 1993; Van der Bosch *et al.,* 1998; FAO, 2004). For instance, Smaling *et al*. (1993) report average annual net mining of 42 Kg nitrogen/ha, 3Kg phosphorus/ha, and 29 Kg potassium/ha from the soils in this region.

2.2 SOURCES OF DATA

The study used both qualitative and quantitative data collection techniques. The data collection tools included;

2.2.1 QUESTIONNAIRES

Questionnaires were administered to the first sub-category (220 households selected for the study. Questionnaires were considered ideal because of the ease of administration and scoring of the instrument besides the results being readily analyzed (Ary, Jacobs & Razarieh, 1979; FAO, 1995a). The items on the questionnaire were developed on the basis of the objectives of the study. The questionnaire captured data on the socio-demographic characteristics of the respondents, the degree of adoption of ICS, socio-economic determinants of the adoption of ICSs, socio-cultural determinants of the adoption of ICSs and the institutional determinants of the adoption of ICSs.

2.2.2 IN-DEPTH INTERVIEWS

Semi-structured interview schedule guidelines with relevant questions were developed for the 18 key informants. The semi-structured interview schedule was considered appropriate for extension officers from the Ministry of Agriculture and opinion leaders because they have varied literacy levels. Some of them were not able to interpret and react to a questionnaire. Thus the semi-structured interview schedule was used to obtain in-depth information from the extension officers and opinion leaders regarding their opinion on the determinants of the adoption of ICSs in Homabay County.

2.2.3 FOCUS GROUP DISCUSSION.

Focus group discussion (FGD) guideline was developed for the 40 households. A total of four FGDs were held. FGDs were important in obtaining information that could not be easily obtained through face-to-face interview or questionnaire. For this method, the researcher brought together forty small scale farmers in four groups, to discuss the topic. Atopic guide to aid discussion was prepared beforehand and a range of aspects of the topic will be explored. Brainstorming techniques were used to explore the topic.

2.2.4 OBSERVATIONS

To get a greater picture of ICSs, a checklist was developed for observations to be made. Data was collected by the researcher so that a detailed understanding of the values and beliefs held by the members of the population can be understood. Observations were done to gather evidence about how value judgments made by extension staff and farmers impact on decision making. Observation were recorded as field notes and analyzed for content.

2.3 SAMPLE SIZE AND SAMPLING PROCEDURE

The sampling frame was a list of household in Homabay County. The sample size was obtained using the coefficient of variation (Nassiuma, 2000). This is because for most surveys or experiment, a coefficient variation of at most 30% is usually acceptable. The study took a coefficient variation of 21% and a standard error of 0.02. The formula given by Nassiuma (2000) is;

$$n = \frac{NC^2}{C^2 + (N-1)\,e^2}$$

Where n =sample
N = population
C= covariance
e = standard error

The eight constituencies was the criterion for stratified simple random sampling. All the households in the eight constituencies were used to enable random selection of households to be included in the study. A systematic random sampling procedure was used to select the number of households in each stratum. Purposive sampling technique was applied to identify individuals to participate in the focus group discussion and Key informants to be interviewed. A total of 40 households were purposively selected to participate in the four FGDs.

From each constituency, three categories of target group, viz the households, Ministry of Agriculture Officers and opinion leaders were targeted. Among the Ministry of Agriculture target category, one District Agricultural Officer from District/Constituency yielding a total of eight Ministry of Agriculture officers. From the third category of opinion leaders (1 District Commissioner) were selected yielding eight opinion leaders. They supplemented the information from the small scale farmers. The entire sampling matrix yielded a total sample size of 276 for the study.

2.4 DATA ANALYSIS

All the data collected from the study area as in the questionnaires, FGDs, in depth interviews and observation reports were analyzed in an ongoing process. Quantitative data was processed, coded and analyzed using computer statistical packages (S.P.S.S version 13). The results were presented by use of descriptive statistics, namely percentages and frequencies. Qualitative data will be transcribed and subsequently themes and sub-themes derived. The themes and subthemes were then presented as they emerged.

2.5 ETHICAL CONSIDERATION

The study was conducted in accordance with the standard research ethics. Informed consent was sought prior to data collection. Anonymity and confidentiality was also upheld. An appointment for administration of questionnaires to the respondents was prepared with the assistance of the village headmen. The principal researcher guided and supervised the fieldwork during data collection. The instruments were then administered to household heads to collect the required data in face-to-face interview and their responses recorded accordingly.

2.6 DEFINITION OF VARIABLES

Dependent Variable: The dependent variable in this study was adoption index which indicated the degree of adoption of ICS. Degree of adoption in this case was a continuous dependent variable. The degree of adoption refers to farmers' level of use of ICS.

Independent (explanatory) variable: The independent variables of importance in this study are those variables, which are thought to have influence on the degree of adoption ICS. These include households' personal and demographic variables, and socio-cultural variables. These explanatory variables are defined as follows:

Table 1. Summary of Explanatory Variables

Variable	Variable Code	Operational definition of the variable
Access to credit	CREDIT	A dummy variable, with value 1, if a person has access to credit and 0 otherwise.
Contact with extension	EXTCON	It is measured as the number of times the farmer has Made contact with extension agent in the last 1year
Access to market	MARKET	A dummy variable, with value 1, if a person has access to market and 0 otherwise.
Participation in cooperative society	COOPS	Is measured as the number of times the farmer has participated in cooperative society activities for the last one year
Participation in barazas	BARAZAS	Is measured as the number of times the farmer has participated in barazas for the last one year.
Participation in field days	FIELDAYS	Is measured as the number of times the farmer has participated in field days for the last one year.
Participation in agricultural shows	AGRICSH	Is measured as the number of times the farmer has participated in agricultural shows for the last one year.
Participation in workshops	AGRICSH	Is measured as the number of times the farmer has participated in agricultural shows for the last one year.
Participation in training	AGRICSH	Is measured as the number of times the farmer has participated in agricultural shows for the last one year.
Land tenure	LANDTN	Land ownership status.
Access to inputs	INPUTS	A dummy variable, with value 1, if a person has access to inputs and 0 otherwise.

Membership in Social groups	AGRICSH	Is measured as farmers' membership in social groups for the last one year.
Contact with non governmental organization	CONNGO	Is measured in terms of frequency of contact with non governmental organization
Contact with government organization	CONTGO	Is measured in terms of frequency of contact with non governmental organization
Contact with community based organization	CONCBO	Is measured in terms of frequency of contact with community based organization

3 RESULT AND DISCUSSION

3.1 ADOPTION OF IMPROVED COOK STOVES.

The study focused on ICS. These was the use of *Maendeleo/Upesi jiko* for emissions reduction and conserving fuel wood. To determine the level of adoption of ICSs, household representatives were asked to respond to a set of questions on degree of adoption of ICSs. The questions were based on the type of stoves used for cooking. The results obtained indicated that out of the 220 respondents, 105 households (47.7%) had adopted ICSs. On the other hand the remaining 115 (52.3%) had not adopted ICSs. Table 2 presents results of how farmers adopted ICSs.

Table 2. Adoption of ICSs

Technology	Frequency	Percentage
ICS	105	47.3

From the table 3 above, it was noted that only 47.3% of the respondents had fully adopted the practice. It is to be recognized that all the respondents were aware and interested to use manure but not all did. The respondents indicated that even though they were interested in ICS, the technology was not always available and when it became available, it was limited in quantity and consequently, it would not be within the reach of most poor rural households.

The use of ICS was also known to all (100%) of the respondents while only a few (47.3%) of the respondent respondents eventually adopted the technology. It was noted here that the non significant adoption of this technology could be attributed to non ready availability of the ICSs and lack of affordability on the part of the respondents due to high cost. During group discussion most respondents expressed that none of them had used ICSs.

Respondents' interest in adopting new practices may be constrained by inadequate information about that particular innovation, which may in part be caused by inability of the extension personnel to reach the farmers. It has been reported that most rural households stick to old practices as result of economic inability on the part of the farmers to afford the cost of innovations, risk involved, ignorance of existence of innovations and their attitude (Wasula, 2000). Non adoption of some of these technologies could be as a result of high prices, relative scarcity, and poor presentation of the technologies to farmers, unavailability of the technologies and inability of extension agents to facilitate their adoption (Wasula, 2000).

During focus group discussion participants pointed out that, use of ICSs is impossible due to it was expensive and hence low adoption of this. Key informants from the sampled institutions cited the rising cost of the rising cost of ICS as a major budgetary constraint. "Everything is going up in price, even firewood and ICSs are very expensive these days". Similarly, key informants from the sampled institutions cited additional cost for use of ICSs in their houses.

FGD results also indicated that people are aware of the technologies like ICSs but such technologies are priced out of their reach. Even in relatively better off regions only a few participants said they use ICSs. A woman FGD participant from one cluster said "we long to use ICSs but we cannot afford". In some cases FGD participants expressed awareness of the ICSs but cited lack of information on whether such technologies are affordable or easily accessible.

3.2 INSTITUTIONAL FACTORS DETERMINING ADOPTION OF INRM TECHNOLOGIES BY SMALL SCALE FARMERS

The farmers were asked to respond to respond to a set of questions on the institutional factors that have influence on the adoption of ICS. The factors included land tenure, access to credit, source of inputs, membership in social groups, access to market and contact with extension.

Land tenure

Land tenure provides farmers with full rights of land ownership and usage thus influencing the decision to participate in natural resource management. Land ownership with title deeds accords the farmers the right to usage (security of tenure) thus creating an incentive to farmers to adopt new, long term and even riskier technologies.

Table 3. Land ownership status by farmers

Monthly income	Adopters (n=105)	Non-adopters (n=115)
Communal	18 (17.1%)	30(26.1%)
Private	84(80%)	85(73.9%)
Rented	3(2.9%)	0(0%)
Total	105(100%)	115(100%)

Table 3 shows that a significant majority (80%) of the adopters owned land privately but the adoption of these technologies was still low. Only a minority (2.9%) rented land. These findings agree with those found by Current *et al.,* (1995) where land ownership did not seem to have a significant effect on the adoption of agro forestry systems in Central America and Caribbean. According to Current *et al.,* (1995) what seemed important was how farmers feel about their property with or without the land ownership.

Access to credit

Adoption of ICS by households is motivated by the income gained from the sale of the produce. Farmers grow crops not for consumption purpose only but to fetch cash income which is allocated for purchasing farm inputs and meet other family needs. But constraints to adoption of ICS are numerous: the cost of ICS, sourcing and its management

Table 4. Access to credit by households

Use of credit	Adopters (n=105)	Non-adopters (n=115)
Yes	19(18.1%)	10(8.7%)
No	86(81.9%)	105(91.3%)
Total	105(100%)	115(100%)

are some of the constraints that hinder the adoption of this technology. Households without cash and no access to credit will find it very difficult to adopt new technologies. Previous authors verified this preposition (Legesse, 1992; Teressa, 1997). It is expected that access to credit will increase the probability of adopting ICS.

According to table 4, eighty six (81.9%) out of 105 adopters had not used credit as compared to nineteen (18.1%).This could have been the reason for the low adoption of the technologies. This showed that there was a significant relationship between access to credit and adoption of ICS. This finding concurs with Ascroft *et al.,* (1993) where only 5% of the progressive householdss obtained loans.

This is disadvantageous to households who operate on a small scale level and are less influential to the credit sector. Poor credit conditions may also be another reason that suppresses the capacity to adopt an innovation. Although credit may appear quite rational to a farmer, social forces outside his control dictate his propensity to adopt the technology. The optimal effective ICS require cash for buying the ICS and fuel. Credit therefore is a strong facilitator in enhancing effective access to ICS.

Access to quality ICS

ICS delivered by an institution will have its own impact on adoption of a given technology and production and productivity of crops. With this understanding data on problems of ICS delivered by organizations and purchased from market were collected and summarized as in Table 5 below.

Table 5. Access to ICS by households

Access to ICS	Adopters (n=105)	Non-adopters (n=115)
Yes	25(23.8%)	10(8.7%)
No	80(76.2%)	105(91.3%)
Total	105(100%)	115(100%)

According to table 5, eighty (76.2%) out of 105 adopters had not used quality ICS as compared to twenty five (23.8%).This could have been the reason for the low adoption of the technology. This showed that there was a significant relationship between access to credit and adoption of ICS. This finding concurs with Ascroft *et al.,* (1993) where only 5% of the progressive farmers obtained inputs from reputable source. This is disadvantageous to farmers who operate on a small scale level and are less influential to the input and credit sector.

Poor ICS sources may also be another reason that suppresses the capacity to adopt an innovation. Although ICS from reputable source may appear quite rational to a household, social forces outside his control dictate his propensity to adopt the technology. The optimal effective ICS adoption requires cook stoves from reputable sources. Cook stove sources therefore are a strong facilitator in enhancing effective access to the technology.

Focus group discussion reported delay and poor quality ICS and expensive stove as problems of accessing them by households. Key informants also reported increasing trend ICS price

Access to market

Markets are common centers both for producers, consumers and traders.

Table 6. Access to market by farmers

Access to market	Adopters (n=105)	Non-adopters (n=115)
Subsistence	77(73.3%)	86(73.9%)
Commercial	28(26.7%)	30(26.1%)
Total	105(100%)	115(100%)

Table 6 shows that a significant majority (73.3%) of the adopters utilized their farm produce for subsistence. Beside the distance taken to travel from home to the nearest market was an average of 10 km. For sample respondents the minimum and maximum distance that a farmer had to travel to access market center were 2 km and 30 km respectively. This means that they could not access the market easily. Only a minority (26.7%) used their produce for commercial purposes. These findings agree with those found by Ascroftt *et al.,* (1993) where only 8% of the less progress farmers had access to the market. The lack of market information represents a significant impediment to market access especially for small holders' produce. It substantially increases transaction costs and reduces market efficiency (Mwale, 1998). These findings also agree with Pearse (1974) who found that market disadvantaged small, less educated and less influential farmers.

Membership in social groups

Usually participation in the community development activities is perceived as willingness of a person to work together. The relationship between membership in social group and adoption is associated with interpersonal networking and exchanges between adaptors and non-adaptors of technology.

In this study membership in social group is hypothesized as involvement of the respondents in any informal and formal organizations as a member. Farmers who are members of any local organization are more likely to be aware of new information and practices. Therefore it was expected that there would be positive and significant relationship between membership in social group and the adoption of ICS.

Table 7. Farmer's membership in social groups

Social group	Adopters (n=105)	Non-adopters (n=115)
Input supply	10(9.5%)	2(1.7%)
Marketing	6(5.7%)	2(1.7%)
Co-operatives	2(1.9%)	1(0.9%)
Youth groups	6(5.7%)	4(3.5%)
Women groups	18(17.2%)	16(13.9%)
CBOs	10(9.5%)	7(6.1%)
None	53(50.5%)	83(72.2%)
Total	105(100%)	115(100%)

According to table 7, fifty three (50.5%) out of 105 adopters were not members of any social group as compared to twenty five (49.5%).This could have been the reason for the low adoption of the technologies. This showed that there was a significant relationship between membership in social group and adoption of ICS. According to Blackburn *et al.,* (1982), participation in social groups is important because it indicates the extent of contact, which farmers have with organized groups and other public services and mass media. Groups provide forum for improving dialogue among farmers, thereby providing opportunity for efficient ways of ascertaining consensus on opinion about the relevance of technologies being presented to them (Norman *et al.,* 1989).

Farmers contact with extension

Contact with extension is an input to improve farmers' performance. It equips farmers with new knowledge and skills, which help them to perform new practices properly. If a farmer has no skill and technical know-how about certain technology, he/she may have less probability of its adoption. The skill acquired through extension helps to carry out a new technology effectively and efficiently. If farmers are well trained in new practice, they may not need outside support later. They can properly implement technology package as per the recommendation. The major sources of agricultural information for farmers are extension agents. The frequency of visits or availability of extension services is perhaps the single variable that emerged significantly in most of the research work on technology transfer and adoption (Asfaw *et al.,* 1997; Kedir, 1998). It was hypothesized that frequency and timely contact with extension workers will increase a farmer's probability of adoption technologies.

Table 8. Contact with extension staff

Contact with extension	Adopters (n=105)	Non-adopters (n=115)
Yes	41(39%)	15(13%)
No	64(61%)	100(87%)
Total	105(100%)	115(100%)

The relationship between extension contacts and adoption of ICS was found to be significant. According to table 8, (64%) adopters (87%) non adaptors had not interacted with extension staff. It can be argued that extension measured in terms of use and type of information is important in adoption of ICS. However it was difficult to rate the extension service in this study in terms of its adequacy and usefulness since the scope of the study was limited to only ICS. These findings agree with

those found by Chitere (1985) where it was found out that nearly all the farmers in an area previously occupied by European settlers were knowledgeable about improved farming practices. It was also observed that farmers adopt improved farming practices largely because of early exposure to intensive extension education. Several studies also indicated a positive relationship between contact with agricultural information sources and adoption (World bank, 1993). These also agree with Herribera (1985) who found that the level of expertise manifested by farmers with intensive extension contact was consistently higher than that of other farmer.

Participating in extension events

In this study, participation in training, demonstration, field day, visit by extension staff, visit to extension staff, field days and agricultural shows were considered as the most important extension events. Participation in extension events is an input to improve farmers' performance. It equips farmers with new knowledge and skills, which help them to perform new practices properly. If a farmer has no skill and technical know-how about certain technology, he/she may have less probability of its adoption. The skill acquired through extension helps to carry out a new technology effectively and efficiently. If farmers are well trained in new practice, they may not need outside support later. They can properly implement technology package as per the recommendation. The sample farmers' participation in different extension events in relation to adoption of ICS is discussed in the following pages. To describe the level of farmers' participation in extension events, farmers were asked eight questions on the various activities bringing together the extension agents and farmers. The responses from the farmers are summarized in table 9.

Table 9. Number of times farmers (adopters) participated in extension activities

Activity		No of Times							
		0	1	2	3	4	5	>5	Total
Individual visit by extension staff	f	80	5	8	2	0	1	9	105
	%	76.2	4.8	7.6	1.9	0	1	8.6	100
Group visit by extension staff	f	79	15	4	1	0	3	3	105
	%	75.2	14.3	3.8	1	0	2.9	2.9	100
Farmers visit to extension staff	f	80	19	0	2	1	0	3	105
	%	76.2	18.1	0	1.9	1	0	1.9	100
On farm demonstrations	f	81	16	1	2	0	0	5	105
	%	77.1	15.2	1	1	1.9	0	4.8	100
On station demonstrations	f	93	10	0	0	0	0	2	105
	%	88.6	9.5	0	0	0	0	1.9	100
Farmers own demonstrations	f	94	4	1	1	0	0	5	105
	%	89.5	3.8	1	1	0	0	4.8	100
Field days	f	60	16	9	4	1	0	15	105
	%	85.7	15.2	8.6	3.8	1	0	14.3	100
Agricultural shows	f	90	7	3	0	0	0	5	105
	%	85.7	6.7	2.9	0	0	0	4.8	100
Workshops	f	92	7	1	4	0	0	1	105
	%	87.6	6.7	1	3.8	0	0	1	100

Table 10. Number of times farmers (non adopters) participated in extension activities

Activity		No of Times							
		0	1	2	3	4	5	>5	Total
Individual visit by extension staff	f	90	5	8	2	0	1	9	115
	%	78.3	4.8	7.6	1.9	0	1	8.6	100
Group visit by extension staff	f	89	15	4	1	0	3	3	115
	%	77.4	14.3	3.8	1	0	2.9	2.9	100
Farmers visit to extension staff	f	90	19	0	2	1	0	3	115
	%	78.3	18.1	0	1.9	1	0	1.9	100
On farm demonstrations	f	91	16	1	2	0	0	5	115
	%	79.1	15.2	1	1	1.9	0	4.8	100
On station demonstrations	f	103	10	0	0	0	0	2	115
	%	89.6	9.5	0	0	0	0	1.9	100
Farmers own demonstrations	f	104	4	1	1	0	0	5	115
	%	90.4	3.8	1	1	0	0	4.8	100
Field days	f	70	16	9	4	1	0	15	115
	%	60.9	15.2	8.6	3.8	1	0	14.3	100
Agricultural shows	f	100	7	3	0	0	0	5	115
	%	87	6.7	2.9	0	0	0	4.8	100
Workshops	f	102	7	1	4	0	0	1	115
	%	88.7	6.7	1	3.8	0	0	1	100

Visits made by individual extension agent to farmers

Visits made by extension agent to farmers are an important input to improve farmers' performance. It equips farmers with new knowledge and skills, which help them to perform new practice properly. If a farmer has no skill and technical knowledge about a certain technology, he/she may have less probability of its adoption. The skill acquired through training by extension agent helps to carry out a new technology effectively and efficiently. If farmers are well trained in new practice, they may not need outside support later. They can properly implement technology package as per the recommendation.

The analyzed data indicates that more than half of the farmers (76.2%) were never visited by individual extension officers in the past one year while 23.9% were visited at different level of frequency (table 18 above). This could have led to the low adoption of ICS by farmers. There existed a significant relationship between visit by individual extension agent and adoption of ICS.

Group visits by extension agents to farmers

Group visits made by extension agents to farmers are an important input to improve farmers' performance. It equips farmers with new knowledge and skills, which help them to perform new practice properly. If a farmer has no skill and technical knowledge about a certain technology, he/she may have less probability of its adoption.

The skill acquired through training by extension agents helps to carry out a new technology effectively and efficiently. If farmers are well trained in new practice, they may not need outside support later. They can properly implement technology package as per the recommendation. Seventy nine out of one hundred and five adopters interviewed (75.2%) were not visited by a group of extension agents while 24.9% had been visited at different level of frequency in the past one year (table18). This could also have led to the low adoption levels.

Visits made to extension officers by farmers

Visits made to extension agents by farmers are an important input to improve farmers' performance. It equips farmers with new knowledge and skills, which help them to perform new practice properly. If a farmer has no skill and technical knowledge about a certain technology, he/she may have less probability of its adoption.

The skill acquired through training by extension agents helps to carry out a new technology effectively and efficiently. If farmers are well trained in new practice, they may not need outside support later. They can properly implement technology package as per the recommendation. Table 18 clearly indicates that, from the total sample farmers 22.9% farmers had visited extension officers at different level of frequency while majority of the farmers interviewed (76.2%) indicated that they not visited extension officers in the past one year.

On farm and on station demonstration

Demonstration means undertaking field trial with farmers with the aim of creating a learning site for the surrounding farm community. Demonstration is an important method of extension to create concrete awareness among farm community. This situation may facilitate the adoption process. It is also a means of diffusing information to neighboring farmers to see and then adopt the practice into their farm.

Table 10 indicates that only 81%% of total sampled farmers interviewed had participated in on farm demonstration and the rest eighty one out of the 24 farmers (23.9%) indicated that they had not attended any on farm trial. On the contrary eleven (10.6%) farmers had attended on station trials once or more than once. Participation in demonstration significantly and positively influenced the adoption of ICS.

Demonstration in this study means accepting new practices and put in the field in the form of trial with close supervision of extension agents and then inviting others to see how he/she perform it. In this finding, farmers who participated in demonstration were all of adopter categories. The probable reason for this difference is that extension agents may select the one who accept technology easily to put in to practice according to the recommendation. When farmers have a chance to participate in practicing demonstrations they may develop know-how more about the fitness of the package with their socio-economic conditions, this enhances them to take further measures, either to use or not the technological packages. Similar results were identified by Edlu (2006).

Attending ASK shows

ASK show is one of the most popular methods of transferring technology. Conducting shows is a good way of convincing other farmers to adopt new technology. In the shows farmers will get an opportunity to observe how the new technology is put in to practice. This situation may facilitate the adoption process. Table 18 clearly indicates that, fifteen farmers (5%) of farmers attended ASK shows at different levels of frequency while majority of the farmers (85.7%) had not attended any agricultural shows in the past year. They explained that most shows are organized far away from their homes. The participation of respondents in ASK shows with varying level of frequency can be observed in Table13.

Field days

Field day is one of the most popular methods of technology transfer. Conducting field days on farmers' field is a good way of convincing other farmers to adopt new technology. In field day neighboring farmers will get an opportunity to observe how the new technology is put into practice in the field. This situation may facilitate the adoption process. Table 13 clearly indicates that from the total sample farmers 42.9% farmers had attended field days at different level of frequency while majority of the farmers (85.7%) had not attended any field day in the past one year. The participation of respondents in the field day with varying level of frequency can be observed in Table 18.

Workshops and seminars

Training is an important input to improve farmers' performance. It equips farmers with new knowledge and skills, which help them to perform new practice properly. If a farmer has o no skill and technical know-how about certain technology, he/she may have less probability of its adoption. The skill acquired through training helps to carry out a new technology effectively and efficiently. If farmers are well trained in new practice, they may not need outside support later. They can properly implement technology package as per the recommendation. Concerning farmer's attending training programmes, out of total 105 adaptors interviewed 12.5% of them had attended workshops and seminars while ninety-two farmers (87.6%) did not attended workshops and seminars related to ICS (table 18).

Mass media exposure

The adoption process of improved technologies depends on access to information and on the willingness and ability of farmers to use information channels available to them. The role of information in decision-making process is to reduce risk and uncertainties to enable farmers to make the right decision on adoption of improved agricultural technologies. Mass media play the greatest role in provision of information in the shortest possible time over large area of coverage. However, as compared to other communication channels, its effect on behavioral change is weak as it is limited to awareness creation than skill development.

But, as far as awareness is pre-requisite for behavioral change, still its role cannot be underestimated. Hence, mass media exposure was expected to positively influence adoption and intensity of adoption of ICS. The survey result on mass media exposure of sample farmers is provided in Table 11 below.

Table 11. Distribution of respondents with respect to radio listening habit

Frequency of contact with radio	Frequency	Percent
Never	43	41
Monthly	2	2
Weekly	29	28
Daily	31	29
Total	105	100

As indicated in Table 11 above in terms of radio listening habit of the farmers in the study area, 41% of them did not listen to radio programs whereas 2%, 28% and 29% of the respondents have monthly, weekly and daily listening habit (Table 19). Surprisingly, majority of radio listeners in the study area do not pay attention to agricultural programs. Lack of attention to agricultural radio program may be attributed to unfamiliarity of the language and also lack of awareness on the importance of the program. It could also be attributed to lack of favorable attitude towards the program. The result of this study is consistent with the findings of Kidane (2001) and Getahun (2004). This could be due to the fact that agricultural radio programs were not given top priority by farmers in the study area rather the priority was for other non-agricultural programs.

Farmers interaction with non-governmental organization, local cooperatives and community based organizations.

Table 12. Farmer's (adopters) contact with other organizations

Organization		Interaction			
		Never	Often	Rarely	Total
Government Organization	f	71	27	7	105
	%	67.6	25.7	6.7	100
NGO	f	72	26	7	105
	%	68.6	24.8	6.7	100
Local cooperative	f	88	5	2	105
	%	93.3	4.8	1.9	100
CBO	f	59	2	18	105
	%	56.2	26.7	17.1	100

Farmer's (non adopters) contact with other organizations

Organization		Interaction			
		Never	Often	Rarely	Total
Government Organization	f	81	27	7	115
	%	70.4	25.7	6.7	100
NGO	f	82	26	7	115
	%	70	24.8	6.7	100
Local cooperative	f	98	5	2	115
	%	82.6	4.8	1.9	100
CBO	f	69	28	18	115
	%	60	26.7	17.1	100

Interaction with government organization

The government plays a great role in providing information and extension service to farmers. A farmer who interacts with government organization has more chance to get information and training in agricultural production. Therefore, interaction with government organization was hypothesized to have positive and significant relationship with adoption of ICS.

As was expected, interaction with government organization had a significant relationship with the adoption of ICS (Table 21). The majority (67.6%) of total adaptors had not interacted with governmental organizations and the rest 32.4% had interacted with government organizations at different level of level of frequency.

The significant relationship between membership and interaction with government organizations and adoption is an indication for the importance of government organizations in supporting agricultural production. Farmers who had interacted with government organizations were found to be better in access to and use of extension information.

Interaction with cooperative

Cooperatives serve as an important source of rural credit and input supply. A farmer who is a member or service cooperative has more chance to get credit. Therefore, the membership in cooperative and interaction with cooperative was hypothesized to have positive and significant relationship with adoption of ICS.

As was expected, the membership of cooperative society and interaction with cooperative society had a significant relationship with the adoption of ICS (Table 12). Ninety eight farmers (93.3%) were found to be non-members of any local cooperative society and had never interacted with any local cooperative society and the rest 6.7% were reported to be members and had interacted with cooperative societies at different level of level of frequency.

The significant relationship between membership and interaction with cooperative society and adoption is an indication for the importance of rural financial institutions in supporting agricultural production. Cooperative members were found to be better in access to and use of credit services.

Interaction with nongovernmental organization

Nongovernmental organizations play a great role in providing information and extension service to farmers. A farmer who interacts with nongovernmental organization has more chance to get information and training in agricultural production. Therefore, interaction with government organization was hypothesized to have positive and significant relationship with adoption of ICS.

As was expected, interaction with nongovernmental organization had a significant relationship with the adoption of ICS (Table 12). The majority (68.6%) of total adaptors had not interacted with nongovernmental organizations and the rest 31.5% had interacted with nongovernmental organizations at different level of level of frequency. The significant relationship between interaction with nongovernmental organizations and adoption is an indication for the importance of nongovernmental organizations in supporting agricultural production. Farmers who had interacted with nongovernmental organizations were found to be better in access to and use of extension information.

Key informants from public institutions identified NGOs such as CARE C-MAD, GIZ and AEP as some of some of the NGOs that have programmes in the division

Interaction with community based organization

Community based organizations play a great role in providing information and extension service to farmers. A farmer who interacts with community based organization has more chance to get information and training in ICS. Therefore, interaction with community based organization was hypothesized to have positive and significant relationship with adoption of ICS.

As was expected, interaction with non-community based organization had a significant relationship with the adoption of ICS (Table 12). The majority (56.2%) of total adaptors had not interacted with community based organizations and the rest 43.8% had interacted with nongovernmental organizations at different level of level of frequency. The significant relationship between interaction with community based organizations and adoption is an indication for the importance of community based organizations in supporting agricultural production. Farmers who had interacted with community based organizations were found to be better in access to and use of extension information.

4 SUMMARY, CONCLUSION AND RECOMMENDATION

4.1 SUMMARY

This study was set to investigate the determinants of the adoption of ICS by small scale farmers' households in Kenya's Ndhiwa division. The study was necessary because the adoption of improved technologies has remained low even after the introduction of improved technologies. The low adoption levels of these technologies affect the overall natural resource management in the area. The study employed cross sectional survey design with an ex-post-facto approach. Data was collected from a sample of 220 farmers from different locations in the area.

Results of data analysis indicated that more than half (56%) of the farmers interviewed were female as compared to (44%) being male. This is an indication that more women are engaged in natural resource management on a day-to-day basis compared to men. However the adoption INRM technology by women was lower than men.

Among the institutional factors frequency of contact with extension agent, attending training, access to market, availability of inputs, access to credit, membership of social group, interaction with non-governmental organization, interaction with government organization, interaction with local cooperative and interaction with community based organization were also found to have positive and significant relationship with adoption of ICS. Thus households need to get information and institutional support like marketing, cooperative society and rural credit institutions. This is paramount to boost the adoption of ICS and improve natural resource management.

4.2 CONCLUSIONS

In view of the data analysis and results shown in chapter four it can be concluded as follows:

1. Close to 47% of the farmers in the study area had adopted ICS while close to 52% of the farmers had not adopted ICS. This was low given that the technologies have been in existence for more than three years.
2. Farmers mentioned a number of constraints that act as deterrents to adoption of ICS. These include: Cultural beliefs, cultural traditions, social norms, lack of awareness of awareness of ICS information, lack of where to secure quality ICS, high cost of ICS and market. Low level of frequency of extension contacts with farmers was also a common problem, which hindered faster rate of adoption. Others (Amudavi, 1993) have also cited these problems.
3. The most dramatic change that will influence adoption of technologies is the development of institutional strategies that target small-scale farmers so that potential adopters can adopt the ICS to improve natural resource management.
4. As compared to other technologies in agriculture ICS require a little bit more skill to fabricate, install and manage. Therefore sufficient number of training, field day and demonstrations are of paramount importance to equip farmers with the skills. That is why the explanatory variable, education was having a strong relationship with probability and intensity of adoption of ICS in this study. This fact shows that the current extension service delivered to small scale farmers has to change the past trends and special emphasis on skill training on ICS as well as market extension aspects.
5. The findings of this study revealed that the main difference in degree of adoption of ICS was also related to access to credit and inputs and membership in groups. Because of this those sample small scale farmers who did not have access to credit and ICS, had not adopted the technology. So that provision of credit for all and arranging field day visit and

tour program within certain period of time in the production season will be very much important to farmers to adopt new technologies.

6. Being a member of cooperatives and social groups was also positively and significantly related with adoption of ICS. Member of cooperative has got credit and other supply from the cooperative. So strengthening and expansion of cooperatives is one means to enhance adoption of improved technologies in the area.
7. The major constraint of ICS in the study area was the absence of reliable ICS supply. Majority of adopter sample farmers purchased ICS from individual retailers. In line with this the sample farmers complained of ICS quality and lack of ICS.
8. One of the major problems to the development of ICS is poor marketing system. Therefore, much emphasis has to be given to improvement of marketing system particularly through cooperative unions. These cooperative unions should have to create reliable market price by communicating with other cooperatives found outside their localities.

RECOMMENDATIONS

The following recommendations have been suggested from the findings and conclusions of the study.

- Extension agents should consider improving their level of participation in joint activities. They should also consider improving the number of visits to farmer's field to understand the farmers' conditions better.
- Plenty of extension effort is needed in dissemination of ICS technologies information. This effort could be in terms of field days, farm visits, agricultural shows, holding demonstrations that focus on new technologies.
- Ways and means of encouraging small-scale households to adopt ICS without necessarily relying on government subsidies should be developed by encouraging them to form small groups with revolving funds.
- Frequency of contact between the farmers and the extension agents was also quite low hence did not seem to improve the adoption of INRM technologies. However there are a number of institutions dealing with agriculture that include GIZ, CARE-Kenya, C-MAD, KARI, AEP, Ministry of agriculture and Diocese of Homabay. These institutions could be encouraged to step up their extension efforts. There should be a linkage between these institutions, extension agents, farmers and researchers.
- Researchers should encourage multistage development of technologies that favor small-scale farmers' households since they form a large proportion of farmers in Kenya today.
- Policy makers should provide small credit to households to help them meet the cost of adoption of ICS. Such credits will go to purchasing of seeds, fertilizer and chemicals which are very expensive.
- Institutional strategies should be developed to favor young and women farmers since they are the majority who engage in natural resource management activities on the ground.
- Farmers should be encouraged to form groups so that they can access credit and bargain for prices of their commodities.
- Producers and extension agents need adequate skills in production management practices starting from seed selection to post harvest technologies suitable at their level. Marketing principles, bargaining skills, business planning, quality management and post harvest handling of agricultural products are some of the interventions needed in the study area.

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Hydrogeochemistry and ground water quality in and around Joda of Keonjhar District, Odisha, India

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ABSTRACT: The hydrochemical characterstics and quality of ground water in and around Joda have been evaluated collecting seventeen ground water samples in pre-monsoon and post monsoon periods for analysis of various physico-chemical parameters like pH, EC, TDS, total hardness, Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, CO_3^{2-}, HCO_3^{-}, SO_4^{2-}, NO_3^{-}, PO_4^{3-}, Cl^{-}. The recorded pH values ranging from 6.00-7.32 show that all the samples in pre-monsoon and most of the samples in post-monsoon periods are acidic in nature. More or less all samples are suitable for domestic use with respect to other parameters as per the BIS and WHO guidelines. Piper Trilinear plots indicate that the predominant hydro-chemical facies are Ca-HCO_3 type in both the seasons and according to Gibbs diagram the source of ions are mainly due to rock weathering. Along with weathering of rocks and minerals, mining and domestic activities are the contributing factors for the addition of various ions in the water bodies. Wilcox diagram and other indices like % sodium, Sodium adsorption ratio, Residual sodium carbonates and Kelly's ratio reveal that most of the samples are suitable for irrigation. U.S Salinity diagram indicates that the water samples have low to medium salinity hazard and low to medium sodium hazard. All the samples are corrosive with respect to pH in pre-monsoon period and 76 % samples are corrosive in post monsoon period but all are free of incrusting property in both the seasons. The corrosivity ratio indicates that all samples are suitable for industrial use.

KEYWORDS: physico-chemical parameters, hydrochemical facies, weathering, Piper Trilinear plot, salinity hazard, corrosivity.

1 INTRODUCTION

Natural water contains almost every element in the periodic table and also dissolved organic matter of largely unknown composition and colloidal and particulate material, both inanimate and living. The chemistry of water is largely controlled and modified by its medium of contact and directly affects the quality of water for various purposes. It hence needs monitoring and proper assessment. A tremendous increase in the population increased the stress on both surface and groundwater. Ground water, being a key source of fresh drinking water is essential to life as well as for human consumption, irrigation, industrialisation and urbanisation. The quality of ground water also helps for ground water management and development for future water resources development strategies. Ground water quality depends on the quality of recharged water, atmospheric precipitation, inland surface water and sub-surface geochemical processes[1]which is strongly influenced by mineralogy and solubility of rock forming minerals[2].Contamination of ground water occurs due to expansion of industries, mining and socio-economic activities along with unscientific management of water resources. Other potential sources of contamination are waste water treatment lagoons, mine spills, urban and rural run offs and garbage, earthen septic tanks, refuge dumps, barnyard manures. India is a vast country with varied hydro- geological situations resulting from diversified geological, climatological and topographic settings. Hydrochemistry and studies on classification of groundwater are carried out to evaluate its suitability for municipal, agricultural and industrial uses[3]. Majority of metallic mineral mines like Iron, manganese and chromium are concentrated in and around Joda in the district Keonjhar of Odisha. Thus, a large scale mining activities and industrialization based on these metallic minerals are carried out in different mineral-bearing areas, causing a substantial land degradation and contamination of water. The study area in and around Joda is dominated by backward and tribal population. The area is susceptible to be contaminated directly and indirectly at each segment of environment due to industrial and mining activities along with the related activities like transportation of ores, burning of

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coal, domestic activities and automobiles. Local people are not so conscious about its impacts on their health, socio-economic status, etc. due to lack of awareness. No such extensive studies have been done so far in this area to highlight the extent of contamination particularly for water and its impacts on the locality. This study aims to characterise ground water quality with respect to some physico-chemical parameters alongwith hydrogeochemistry and its usability for domestic, agricultural and industrial purposes.

2 STUDY AREA

The study area under investigation, in and around Joda is the north-west part of Keonjhar district of Odisha, bounded by latitude 21^0 49' 55" and 22^0 03' 49'' north and longitude 85^0 22' 08" and 85^0 32' 52" east(fig.1). It comprises Joda Municipality and some part of Joda block as well as Jhumpura block that refers to the Toposheet No. 73 F/8, 73 F/12, 73 G/5 and 73 G/9. The total population of the area is around 1,50,000.The study area forms a part of Singhbhum-Keonjhar- Bonai iron ore formation belonging to Iron Ore Super Group of Pre-Cambrian age. The major rock types of this area belong to Banded Iron formation such as BHJ, BHQ, BHC and banded –ferruginous shale. The BIF along with the volcanic, sedimentary and meta-sedimentary rock piles constitute the Iron Ore group. Other associated rocks are basic rocks and laterites. The geology of the study area comprises various rock types such as sandstone and quarzites of Kolhan Group and Basalt,Tuff, Metagabbro, Shale. BHQ, BHJ, Ferrugenious Shale, Quartzite, Pebbly Quartzite, Grity Quartzite, Singhbhum Granite/ Hornblende Granite and Pellitic Schist. The major mineral deposits are haematite, goethite, pyrolusite and psilomelane and are associated with iron ore group of rocks. There are also some limestone deposits in Joda. The surface of some places is occupied with light textured laterites and medium textured red loam soils. The average minimum and maximum temperature of this region is 8.9^0C and 40.6^0 C respectively with average rain fall of 1501mm for last five years.

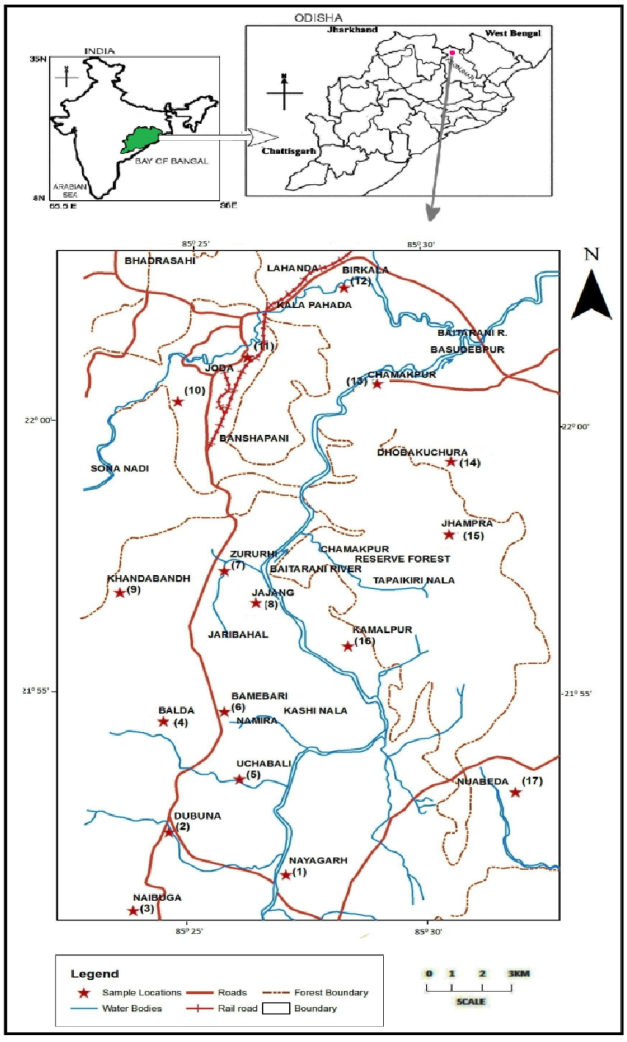

Fig. 1. Study area map,in and around Joda with ground water sampling stations

3 MATERIALS AND METHODS

The present study was carried out for a period of one year 2011-12 and ground water samples were collected from 17 different stations in pre-monsoon(March-June-2011), and post monsoon(November-2011-February-2012) periods at a regular interval of once in a month.Water samples were collected in acid- washed plastic bottles of one ltr. capacity having double stopper facilities to its full capacity without entrapping air bubbles inside. The collected samples were sent to water quality laboratory of Central Water Commission, Bhubaneswar for analysis. Analysis of samples were conducted for various physico-chemical parameters like pH, EC, TDS, total hardness, cations like Ca^{2+},Mg^{2+},Na^{+},K^{+} and anions like CO_3^{2-},HCO_3^{-}, SO_4^{2-}, NO_3^{-}, PO_4^{3-},Cl^{-}. However pH, EC, were measured by using respective digital meters. Other parameters were measured by standard methodology [4], [5]. These parameters were compared with the standard guideline values, recommended by BIS[6] and WHO [7] to assess the potability of the ground water samples. Suitability of these water samples for Irrigation was determined according to various parameters like Salinity, Percent Sodium (Na%), Sodium Adsorption Ratio (SAR), Residual Sodium carbonate **(** RSC), Magnesium Ratio (MR) and Kelley's Ratio (KR)[8], [9],[10].

Percent Sodium (Na%)

It is an important parameter to classify the groundwater samples for irrigation purpose which is calculated by the formula proposed by as under in epm,

$$\mathrm{Na\%} = \frac{\mathrm{Na}^{+} + K^{+}}{\mathrm{Ca}^{++} + Mg^{++} + \mathrm{Na}^{+} + K^{+}} \times 100$$

Sodium Adsorption Ratio (SAR)

The degree to which the irrigation water tends to enter into cation exchange reaction in soil can be indicated by the sodium adsorption ratio Since sodium replaces adsorbed calcium and magnesium in soil, hence it is expressed as ;

$$\mathrm{SAR} = \frac{\mathrm{Na}^{+}}{\sqrt{\{\mathrm{Ca}^{++} + Mg^{++}\}/2}} (epm)$$

Residual Sodium Carbonate (RSC)

It refers to the residual alkalinity and is calculated for irrigation water by the following formula

RSC = $(HCO_3^{-} + CO_3^{--})$ –$(Ca^{++} + Mg^{++})$ in epm.

Kelley's Ratio (KR)

It is the ratio of sodium ion to calcium and magnesium ion in epm[11] and expressed as;

KR=$Na^{+}/(Ca^{++}+Mg^{++})$

Magnesium Ratio (MR

It is expressed as MR= $[Mg^{++}/ (Ca^{++}+Mg^{++})]$ in epm.

Assessment of the water quality of the study area for industrial use was done by considering various industrial quality criteria like pH ,EC, Cl^{-}, HCO_3^{-}, SO_4^{2-} and Corrosivity Ratio (CR) .

Corrosivity Ratio (CR)

It denotes susceptibility of groundwater to corrosion and is expressed as ratio of alkaline earth to alkali salts in ground water, which is of folloing formula;

$$\mathrm{C.R.} = \frac{Cl^{-}/35.5 + 2\left(\frac{SO_4^{--}}{96}\right)}{2\left(\frac{\mathrm{HCO}_3^{-} + CO_3^{--}}{100}\right)}$$ where all the ions are expressed in ppm.

4 RESULTS AND DISCUSSION

4.1 WATER QUALITY FOR DOMESTIC USE

The chemical analysis data(Table.1) shows that the values of pH, TDS, EC and Total Hardness of the water samples varies from 6.00 - 7.32, 103-409 mg/l, 161-645 µs/cm and 42.89-183.06 mg/l respectively in pre-monsoon and post monsoon periods..The concentrations of various anions HCO_3^-, SO_4^{2-} NO_3^- , PO_4^{3-} and Cl ranges 53.51-191.62, 1.32-25.79-, 0.51-5.33, 0.02-2.37 and 6.10-40.02 mg/l respectively. Various cations such as Ca^{2+},Mg^{2+},$Na^+$and K^+ have the concentrations which ranges from 10.42-48.12, 2.92-16.52, 1.80- 21.10 and 0.20-12.67 mg/l respectively. The values are within BIS and WHO limits. Some samples are of pH values less than 6.5,the lower limit of both BIS and WHO guidelines for drinking water.

Seasonal variations of the recorded parameters of the water samples are not in a particular trend. In most of the cases EC, TDS, SO^{2-}_4, PO_4^{3-} and Cl^- have higher concentrations in Pre-monsoon than that of post monsoon period. At the same time some samples are with higher concentrations in post-monsoon than those of pre-monsoon period. Parameters like TH, Ca^{2+},Mg^{2+},Na^+,K^+,, HCO_3^{--} and NO_3^- have higher concentrations in post monsoon with comparison to pre-monsoon period for the most of the samples and few samples having the reverse trends. Higher concentration of cations and anions in pre-monsoon period is because of semi arid type of climate, which promotes higher rate of evaporation causing increase in concentration of ions [12]where as lower concentrations in post monsoon is due to recharge of water body, infiltration and dilution factor as effect of the monsoon period. This trend is specifically remarkable in topographically flat areas with comparison to that of hilly areas[9].On the other hand, mining operations along with associated activities and domestic activities may contribute more dissolved ions during monsoon. Active leaching and subsequent infiltration causes the higher concentration of various ions in post monsoon period by percolation of water through various layers of soil, dissolution of minerals from lithological composition in mining areas[1]. The water samples in study area are nearly neutral to slightly acidic in pre-monsoon and acidic as well as alkaline in various stations in post monsoon periods. Acidic nature is due to the interaction of ground water with iron rich laterite, silicate rocks and iron ores[9]. Water, discharged on the surface during mining ultimately takes route through ground water and surface water and contaminates both[13],[14]. The slightly alkaline nature of some water samples like Balda, Joda, Uchhabali, Birkala is due to the factors like air temperature, which brings about changes in the pH of water. The reduced rate of photosynthetic activities reduces the assimilation of CO_2 and HCO_3^- which are ultimately responsible for increase in pH[15]. Also it indicates the presence of weak basic salts in the soil and maximum pertcentage of CO_2. in water present as bi-carbonate. The variation of pH from 6.00 -7.32 mg/l may be attributed to different types of buffers normally present in ground water[16]. Considering the hardness of different samples, only a few are categorised as soft water both in pre and post monsoon period. Most of the water samples are moderately hard and water samples at Joda, Chamakpur, Dhobakuchura, Jajang are categorised as hard water. Hard water is unsuitable for domestic use. Electrical conductivity of water is a direct function of its total dissolved salts, which is a measure of salinity of water. Comparatively higher EC values of some samples than others may be due to multiple factors like weathering of rocks and minerals, leaching of various ions from mine sites, domestic activities and untreated sewage disposal etc..Generally TDS and EC are higher in ground water because of longer residence time of solutions in sub-surface environment[17].

Sulphates in ground water is principally derived from the dissolution of naturally occurring gypsum. Secondary sources are the weathering of pyrites, dissolving of ammonia sulphates fertilizers, and anthropogenic activities**.** The Sulphate contents in the study area is mainly due to oxidation of traces of pyrites, associated with iron ore deposits, atmospheric precipitations and domestic wastes[18]. Comparatively more concentration of NO_3^- ions in some of the samples is attributed to the leaching of the ions from agricultural land, sewage system, dumping of domestic waste, open animal yards. PO_4^{3-} is of very less amount in all water samples showing less agricultural activities. Maximum PO_4^{3-} concentration is recorded at Dhobakuchura due to cultivated lands in the area. As the chloride content of common rocks and minerals type of the study area is very low, the main source of this ion may be rain water, which might have undergone the base exchange phenomenon[19].Agricultural activities, industries, sewage contamination, invasion of domestic wastes and disposals by human activities also causes significant amount of chloride in water samples [16].

In the study area, the degree of variation of Na content is probably due to the differential weathering of the plagioclase feldspar of the parent rocks. In some localities, the higher value of Na might be due to the base exchange of Ca and Mg, causing a reduction in their amount[20]. Minerals like orthoclase, microline, and muscovite are responsible for the K content in the groundwater of the study area, the range of which is relatively low, because of its resistance towards dissolution and its adherence to clay minerals. Water samples of Zururhi, Chamakpur, Jajang, Joda, Balda have higher concentrations of almost all cations and anions in comparision to other samples may be because of their locations, nearer to surface water bodies, mining sites and densely populated areas. The water samples of Dubuna, Jajang,Bamebari, Zururhi have pH less than 6.5. This indicates that the surface water ground water ineraction, mining activities, domestic wastes and untreated sewages alongwith natural weathering processes are the causative factors leading to the contamination of ground water in

the study area. Thus, the overall assessment is that, more or less all the ground water samples of the study area are potable with respect to maximum permissible limits of various physico-chemical parameters except for pH as proposed by BIS (2012) and WHO (2008).

4.2 HYDROGEOCHEMISTRY

4.2.1 HYDROGEOCHEMICAL FACIES

The plots of major cations and anions in the groundwater samples in Piper Trilinear diagram(Fig.2a and 2b) shows that all samples represent Ca-HCO_3 facies both in pre-monsoon and post-monsoon period. The Ca-HCO_3 facies indicates the predominance of of alkaline earths over alkalis and abundance of weak acids over strong acids[21],[22].No significant change in the hydro-chemical facies is noticed during the study period both pre-monsoon and post-monsoon, indicating the natural origin of most of the major ions [23]. In the normal groundwater systems, the principal origin of Ca and Mg ions is carbonate minerals and their dissolution and depositional processes. Weathering of silicate minerals also contributes towards the enrichment of these minerals. Relatively less abundance of the carbonate minerals in the study area indicate that the major origin of Ca and Mg is silicate weathering. Bicarbonate is the dominant anion in the study area. Apart from the dissolution of carbonated minerals and rocks the major origin of bicarbonates are the sewage systems[18].

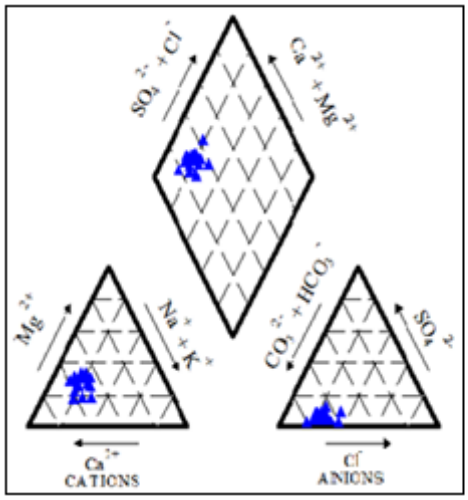

Fig. 2a

Fig.2b

Fig. 2a & 2b. Piper Trilinear diagram for ground water in pre-monsoon and post-monsoon period

4.2.2 MECHANISM CONTROLLING GROUNDWATER QUALITY

The mechanism controlling chemical relationships of ground water, based on aquifer lithology has been studied to interprete the rock -water interaction [24]. It is observed that the plots of different samples in Gibbs' diagram (Fig.- 3a,3b and 4a,4b)fall in the "rock dominance" field indicate that the chemistry of the aquifers and rock weathering is the major mechanism controlling the ground water chemistry.

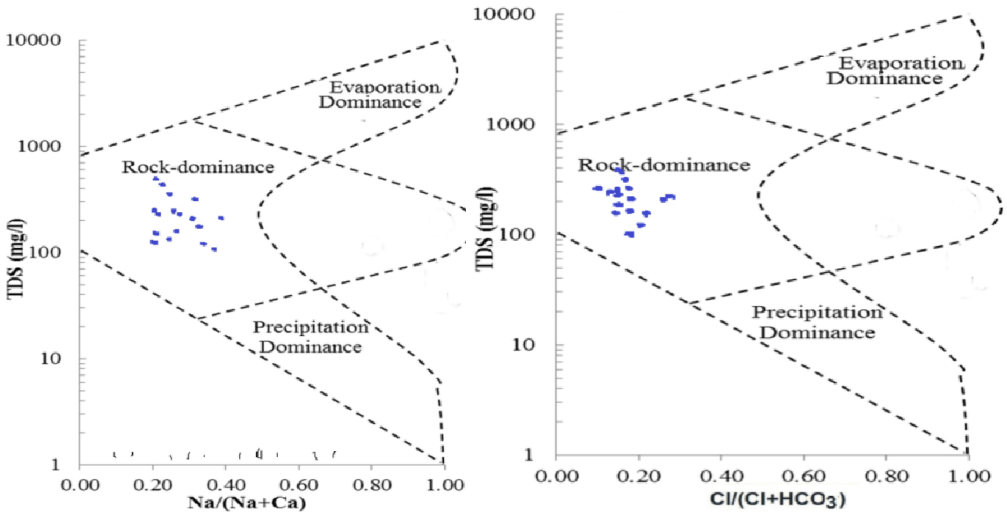

Fig. 3a **Fig. 3b**

Fig. 3a & 3b. Gibbs diagram for ground water in pre-monsoon period

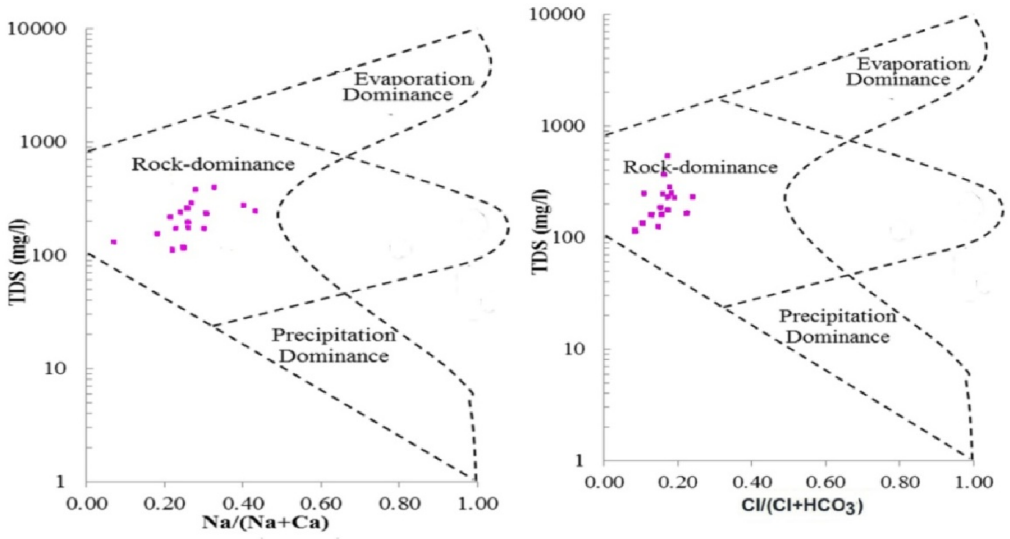

Fig. 4a **Fig. 4b**

Fig. 4a & 4b. Gibbs diagram for ground water in post-monsoon period

4.3 WATER QUALITY FOR IRRIGATION

The suitability of ground water samples for irrigation purpose have been evaluated according to various indices for water quality criteria for irrigation as computed in Table:-2.

4.3.1 SALINITY

The TDS content, which determines the electrical conductance(EC) indicates salinity hazard to irrigation. Most of the water samples of the study area fall under low to medium salinity class.

4.3.2 % SODIUM

In natural water, % of sodium contents is a vital parameter to assess the ground water suitability for irrigation purpose because sodium reacts with soil to reduce its permeability and support a little or no growth. Out of total 17 samples 53 %

belong to excellent and 47 % belong to good in pre-monsoon period but 59 % belong to excellent and 41 % belong to good in post monsoon period. The suitability of water samples for irrigation use was identified from Wilcox diagram(Fig.5a and 5b), based on EC and % Na[25] show that all the water samples are excellent to good quality for irrigation both in pre-monsoon and post- monsoon period.

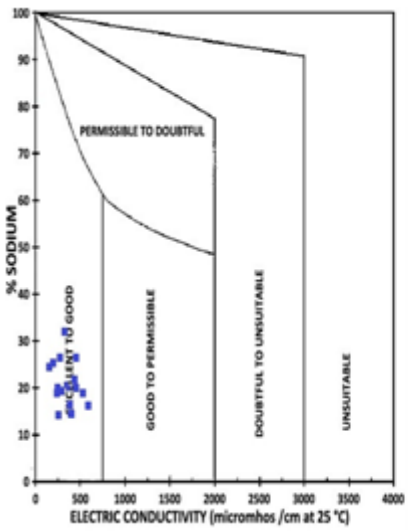

Fig. 5a

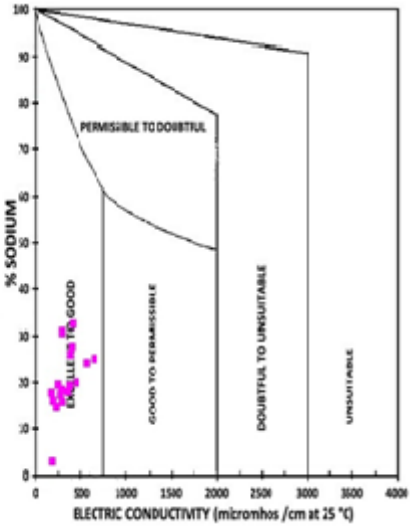

Fig. 5b

Fig. 5a & 5b. Wilcox diagram for ground water in pre-monsoon and post-monsoon period

4.3.3 SODIUM ADSORPTION RATIO (SAR)

The Sodium Adsorption Ratio (SAR) parameter evaluates the sodium hazard in relation to calcium and magnesium concentrations. The classification of water samples with reference to SAR are under no problem category both in post monsoon and pre-monsoon period. According to the U.S. Salinity diagram classification[26] (Fig.6a and 6b), the water samples fall in the field of C_1- S_1 & C_2- S_1 indicating low and medium salinity hazard and low sodium hazard in pre-monsoon period. The samples of post -monsoon period are in C_1-S_1,C_2-S_1 and C_2-S_2 field.12% of the samples are in C_2-S_2 field indicating medium salinity and sodium hazard.

4.3.4 RESIDUAL SODIUM CARBONATES (RSC)

The Residual Sodium Carbonates is the excess of carbonate and bicarbonate concentration over the alkaline earth mainly calcium and magnesium. All the water samples are safe for agricultural purposes with respect to RSC both in pre-monsoon and post- monsoon periods.

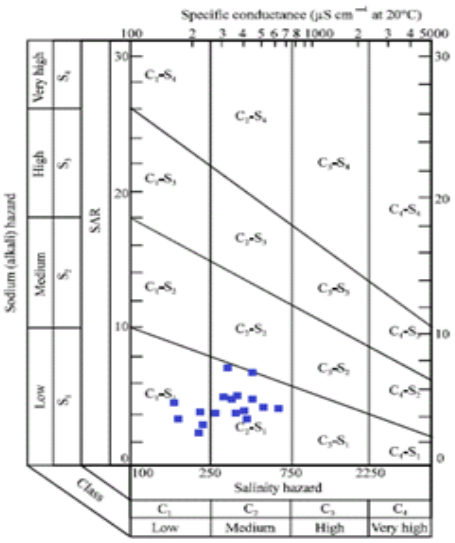

Fig. 6a

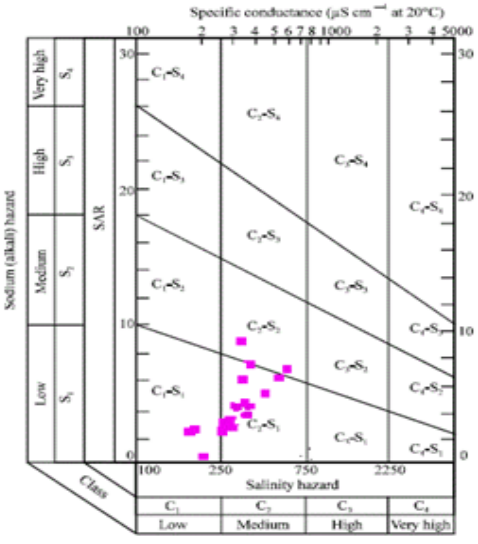

Fig. 6b

Fig. 6a& 6b. US Salinity diagram for ground water in pre-monsoon and post-monsoon period

4.3.5 MAGNESIUM RATIO (MR)

Magnesium ratio (hazard) may be described as the excess amount of magnesium over calcium and magnesium amount where otherwise generally calcium and magnesium will be in condition of equilibrium. The excess of magnesium affects the quality of soil which is the cause of poor yield of crops. The magnesium ratio in water sample in study area was found to be less than the permissible limit (more than 50 %) for all samples in pre-monsoon and post monsoon period.

4.3.6 KELLY'S RATIO (KR)

With respect to Kelly's ratio all the water samples are suitable for irrigation both in pre-monsoon and post monsoon periods as KR < 1.

5 WATER QUALITY FOR INDUSTRIAL USE

5.1 CHEMICAL PARAMETERS

Quality criteria for industrial use vary widely since different industries require water of varying quality. The mining industry is the most important industry in the study area. The quality requirement for water used in the mining industry is highly variable, depending on the stage at which it is required, i.e whether during mining, refining operation or for water supply to industrial township. To understand the chemical action of water on the mine machinery, iron pipes, vessels, casing pipes of tube wells etc. The corrosive and incrusting properties of water of the study area have been analysed and classified using the criteria like pH, EC, Cl, HCO_3& SO_4 along with corrosivity ratio (CR).

1.Criteria for corrosion.
a) pH < 7
b) EC> 1500 mhos/cm
c) Cl^- > 500 mg/l

2. Criteria for Incrustation
a) HCO_3^- > 400 (Soft incrustation)
b) SO_4^{2-} > 100 (Hard incrustation)

Depending upon the factors such as pH, alkanity, hardness of more than 200 mg/l will lead to scale deposits in the piping system[27].From the above study, it is clear that all water samples in pre-monsoon period have corrosive property with respect to pH and no samples has incrusting property with respect to HCO_3 and SO_4. In post-monsoon period 76 % of the samples have corrosive property with respect to pH and all samples are free of incrusting property.

5.2 CORROSIVITY RATIO (CR)

Ryner (1944) proposed a ratio to access the corrosive nature of groundwater on metals. Corrosion is an electrolytic process, which attacks and corrodes away the metal surfaces. The effects of corrosion are losses of hydraulic capacity of pipes[28],[29],[30]. The water samples have corrosively ratio less than 1 which are in safe zone both in pre and post monsoon periods.

Table1. Physico-Chemical parameters of ground water samples in and around Joda.

Sample locations	Period	pH	TDS (mg/l)	EC (µs/cm)	TH (mg/l)	HCO_3^- (mg/l)	SO_4^{2-} (mg/l)	NO_3^- (mg/l)	PO_4^{3-} (mg/l)	Cl^- (mg/l)	Ca^{2+} (mg/l)	Mg^{2+} (mg/l)	Na^+ (mg/l)	K^+ (mg/l)
S1-Nayagarh (T)	pre-mon	6 .75	103	187	42.89	53.51	1.78	0.83	0.38	9.29	10.42	4.13	5.90	1.17
	post-mon	6.83	112	170	61.24	75.72	1.32	1.02	0.41	6.10	16.63	4.84	4.80	1.10
S2-Dubuna (T)	pre-mon	6.14	145	227	83.80	78.65	7.49	0.51	0.62	11.56	22.85	6.56	5.70	0.80
	post-mon	6.26	138	208	104.69	88.96	4.28	0.53	0.02	10.71	25.65	9.96	1.80	0.20
S3-Naibuga (D)	pre-mon	6.45	120	161	59.86	62.48	3.08	0.73	0.30	15.31	15.63	5.11	8.30	1.40
	post-mon	6.78	125	198	43.89	75.29	2.68	0.98	0.03	11.95	12.83	2.92	4.20	0.80
S4-Balda(T)	pre-mon	6.46	196	298	87.34	112.32	8.25	2.24	0.06	18.50	23.25	7.18	11.79	5.01
	post-mon	7.00	192	300	74.80	97.68	7.93	2.56	0.05	16.02	18.84	6.80	8.10	12.67
S5-Uchabali(T)	pre-mon	6.82	273	427	78.57	86.27	3.75	1.73	0.08	13.29	25.15	3.89	8.21	2.35
	post-mon	7.01	256	407	132.14	165.59	3.84	1.82	0.04	18.65	36.87	9.83	10.80	6.84
S6-Bamebari(B)	pre-mon	6.28	208	320	79.93	78.58	2.16	1.02	0.02	26.87	24.05	4.89	15.80	1.60
	post-mon	6.32	153	259	89.79	101.40	6.87	0.73	0.03	12.30	27.25	5.35	6.09	1.10
S7-Jururhi (D)	pre-mon	6.32	310	482	127.76	145.15	20.70	3.31	0.35	32.97	39.28	7.31	18.76	2.54
	post-mon	6.74	280	460	137.17	137.10	25.79	4.54	0.11	30.77	42.28	7.78	15.30	1.30
S8-Jajanga (D)	pre-mon	6.00	232	343	125.19	111.71	13.06	2.74	0.13	40.02	30.02	11.30	13.20	2.40
	post-mon	6.16	210	316	153.04	100.92	7.88	3.65	0.18	30.91	40.24	8.01	11.70	2.10
S9-Khandbandh(D)	pre-mon	6.61	167	262	88.22	86.88	4.07	0.93	0.04	14.85	22.63	7.78	8.80	1.20
	post-mon	6.63	166	267	77.40	66.38	9.63	1.21	0.02	18.65	24.12	4.23	7.30	1.90
S10-Joda 1 (D)	pre-mon	6.23	284	430	155.98	162.36	16.19	3.60	0.05	33.92	42.24	12.39	15.61	3.10
	post-mon	7.00	409	645	146.62	164.19	12.01	3.53	0.06	32.83	39.68	11.66	19.22	3.70
S11-Joda 2 (D)	pre-mon	6.16	235	367	135.23	148.32	5.72	3.60	0.24	24.10	36.47	10.83	10.60	1.90
	post-mon	6.14	243	380	128.75	158.95	2.43	4.52	0.10	32.61	36.87	9.01	19.40	4.46
S12-Birkala (D)	pre-mon	6.90	241	382	141.61	146.54	2.78	1.19	0.98	16.73	38.28	11.30	9.90	0.80
	post-mon	7.32	228	354	99.75	126.85	12.60	2.36	0.45	30.17	28.86	6.80	21.10	0.80
S13-Chamakpur (T)	pre-mon	6.70	346	540	179.52	163.64	14.94	4.65	0.25	31.73	44.89	16.52	13.80	8.60
	post-mon	6.90	364	557	182.51	191.62	22.66	3.74	0.09	35.52	47.70	15.55	19.20	12.16
S14-Dhobakuchura (T)	pre-mon	6.88	380	610	183.06	168.64	10.90	5.33	2.37	28.68	48.12	15.43	13.49	3.30
	post-mon	6.76	226	349	115.71	115.99	6.39	3.82	1.64	26.16	33.67	7.78	14.70	4.80
S15-Jhampra (T)	pre-mon	6.67	151	230	88.98	74.68	3.46	2.85	0.89	15.10	26.13	5.83	8.00	2.80
	post-mon	6.74	168	265	110.81	85.23	5.96	4.28	1.49	11.41	20.63	9.62	6.50	3.10
S16- Kamalpur (T)	pre-mon	6.83	143	224	95.00	80.78	2.74	2.85	0.76	22.31	24.32	8.40	8.99	2.80
	post-mon	6.81	174	282	108.36	104.09	4.66	3.41	1.08	20.28	24.32	11.66	7.70	1.80
S17-Nuabeda(T)	pre-mon	6.61	229	346	125.20	118.79	7.88	1.26	0.87	25.52	34.67	9.48	13.31	2.30
	post-mon	6.84	228	353	145.01	137.10	7.06	1.87	0.71	24.71	41.02	10.45	12.09	3.50
BIS Standards (IS10500)		6.5-8.5	500	-	200	300	200	45	30	250	75	30	-	-
WHO Standard		6.5-8.5	500	-	500	300	200	50	30	250	75	30	50	10

Table 2. Indices for water quality criteria for irrigation and industrial use of ground water samples in and around Joda

SAMPLE LOCATION	PRE-MONSOON						POST-MONSOON					
	Na%	SAR	RSC	MR	KR	CR	Na%	SAR	RSC	MR	KR	CR
S1-Nayagah (TW)	25.00	0.39	0.017	39.53	0.30	0.279	16.18	0.27	0.01	32.40	0.17	0.13
S2-Dubuna (TW)	13.78	0.27	-0.39	32.14	0.15	0.31	3.82	0.08	-0.64	39.02	0.04	0.22
S3-Naibuga (DW)	24.85	0.47	-0.18	35.00	0.30	0.40	18.76	0.28	0.35	27.26	0.21	0.26
S4-Balada(TW)	26.80	0.55	0.09	33.75	0.29	0.31	31.08	0.41	0.10	37.32	0.23	0.32
S5-Uchabali(TW)	20.93	0.40	-0.16	20.32	0.23	0.26	19.58	0.41	0.06	30.54	0.18	0.18
S6-Bamebari(BW)	31.25	0.77	-0.31	25.11	0.43	0.51	14.00	0.28	-0.14	24.44	0.15	0.24
S7-Zururhi (DW)	25.60	0.72	-0.18	23.47	0.32	0.47	20.26	0.57	-0.50	23.26	0.24	0.51
S8-Jajanga (DW)	20.21	0.51	-0.68	40.32	0.23	0.63	17.42	0.44	-1.01	24.71	0.19	0.51
S9-Khandbandh(DW)	18.96	0.41	-0.34	36.17	0.22	0.29	19.09	0.36	-0.46	22.43	0.20	0.55
S10-Joda 1 (DW)	19.52	0.54	-0.47	32.59	0.22	0.40	24.05	0.69	-0.25	32.64	0.28	0.36
S11-Joda 2 (DW)	15.82	0.40	-0.28	32.87	0.17	0.27	27.07	0.74	0.02	28.71	0.33	0.30
S12-Birkala (DW)	13.71	0.36	-0.44	32.72	0.15	0.18	31.94	0.92	0.08	27.99	0.46	0.44
S13-Chamakpur (TW)	18.56	0.45	-0.92	37.76	0.17	0.37	23.85	0.62	-0.52	34.95	0.23	0.38
S14-Dhobakuchura (TW)	15.46	0.43	-0.91	34.58	0.16	0.31	24.73	0.59	-0.42	27.58	0.28	0.38
S15-Jhampra(TW)	19.04	0.37	-0.56	26.90	0.20	0.33	16.59	0.30	-0.42	43.46	0.16	0.26
S16- Kamalpur (TW)	19.54	0.40	-0.58	36.28	0.21	0.42	14.92	0.32	-0.47	44.15	0.15	0.32
S17-Nuabeda(TW)	20.26	0.52	-0.56	31.08	0.23	0.37	17.47	0.44	-0.66	29.58	0.18	0.31

6 CONCLUSION

The ground water samples in study area show limited seasonal variability in quality.The pH ranging from 6.00-7.32 indicate that most of the samples are acidic in nature. Some samples are of hard water categories and most of the samples are moderately hard. The concentration of various cations and anions along with physical parameters are within the permissible limits of BIS and WHO. Hydrochemistry of ground water samples reveals that the samples are enriched with bicarbonate of Ca and Mg in pre and post monsoon periods. The chemistry of water is controlled mainly by the lithology of the area. Along with natural weathering, mining operations, anthropogenic activities and improper waste disposal are the sources of contamination of ground water. Wilcox classification shows that the water quality is excellent to good for irrigation and U.S. salinity classification indicates that the water samples have low to medium salinity hazards and low to medium sodium hazards. The overall quality of water samples for irrigation purpose is good with respect to sodium %, SAR, RSC, KR and MR. All samples in pre-monsoon and 76 % of samples in post monsoon period have corrosive properties with respect to pH. Considering corrosivity ratio, the ground water samples are safe for industrial use. All these above results confirm that the overall ground water quality is good to use for various purposes though it is not up to the mark with respect to all factors and is slowly degrading. If the present condition of the study area continues in future, the ground water source will be contaminated and may become unfit for domestic and other purposes. Various measures including proper management of mining wastes, improved mining techniques, proper waste and sewage disposal have to be taken up to control the contamination of ground water from different sources. Above all, the public awareness is the most effective means to conserve and protect the valuable ground water resources.

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A Review on Chronic Stress Mediated Tumor Angiogenesis through IL-6 & VEGF

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ABSTRACT: Chronic Stress plays a significant role in the progression of tumor angiogenesis through the secretion of Catecholamines, which take part in increased production of IL-6 & VEGF. Chronic psychological stress induces secretion of catecolamines such as epinephrine (E) & noreepinephrine (NE) from adrenal medulla & sympathetic neurons which activate β-adrenergic receptors on tumor cells, which in turn enhances increased production of IL-6. IL-6 then plays a significant role in VEGF production through STAT3 activation. Il-6 follows a series of signaling cascades including cAMP/PKA & MAPK. NF-kB activation through MEK/ERK is crucial for IL-6 production. Angiogenesis, the formation of new blood vessels from preexisting vasculatures is mediated by VEGF. It also takes part in cell proliferation, cell migration & vasculogenesis, thus leading to tumor angiogenesis. The aim of this study was to know the relationship between chronic stress and tumor angiogenesis and to highlight the therapeutic point where further works may proceed on.

KEYWORDS: Angiogenesis, Therapeutic, Catecholamines, Epinephrine, Noreepinephrine, Cell Proliferation, Cell Migration and Vasculogenesis.

INTRODUCTION

In every sphere of life we are coming in contact with different type of stresses which are the ultimate source of depression and tension, affecting our mental and physical health. So called modern life living elevates the level of stress among us. There is hardly any sector where there is no stressful situation. The long lasting consequence of it is the progression of disease like cancer. Chronic psychological stress that persists for several hours a day for an extended period of time generally month to years (Dhabhar *et al.,* 1997) has a strong potential to induce tumor angiogenesis in the host body. Angiogenesis, the formation neo blood capillaries from existing vessels (Folkman *et al.,* 1992) is crucial for the supplement of nutrients to the endothelial cells for growth and survival which has utmost importance for the progression of tumor. Chronic stress, which results in increased induction of stress hormones such as norepinephrine (NE) and epinephrine (E) from adrenal medulla and sympathetic neurons has a significant role for the production of proangiogenic IL-6 and VEGF molecules. These are synthesized via a series of signaling pathways activation including cAMP/PKA and ERK/MEK. Experimentally it has been shown that ovarian carcinoma cells express elevated level of IL-6 and VEGF through the action of chronic stress mediated catecolamines. STAT3 pathway activation by JNK binding with IL-6 is crucial for VEGF transcription. On the other hand VEGF is the major modulator of angiogenesis, vasculogenesis, cell migration and proliferation. PLCγ binding with VEGFR2 activates PKC which leads to cell proliferation and vascular permeability through eNOS and MEK signaling. ERK/MEK are downstream pathways activated by IL-6 play a vital role for vascular endothelial growth factor activation can also participate in upstream regulation of IL-6 expression by activating NF-kB (Sano *et al.,* 2005). However, in this review it has been emphasized on how chronic stress induces tumor angiogenesis through VEGF and IL-6 production via stress hormone epinephrine and norepinephrine.

STRESS

Stress is a term that means different things to different people but generally has a negative connotation. Yet, stress is a familiar aspect of modern life, being a stimulant for some individuals, but a burden to many others. Stress is a constellation

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of events, consisting of stimulus (stressor) that precipitates a reaction in the brain (stress perception), which activates physiological fight-or-flight systems in the body (stress response) (Dhabhar *et al.*, 1997). Stress is of two types such as acute stress & chronic stress. Important distinguishing characteristics of stress include its duration & intensity. Acute stress lasts for a period of minutes to hour & chronic stress persists for several hours a day for extended period of time generally month to years. The magnitude of stress is gauged by the peak level of stress hormones, neurotransmitters & other physiological changes such as increases heart rate & blood pressure & by the amount of these changes persists during or following stressor exposure. Stress has long been suspected as a causal agent of many diseases, among them cancer is the most fatal one. A number of studies have been shown that stress can be detrimental & immunosuppressive to human health.

STRESS HORMONE CATECHOLAMINE THE MAJOR REGULATOR OF TUMOR ANGIOGENESIS

Catecholamines such as epinephrine (E) & norepinephrine (NE) play a significant role in the progression of tumor angiogenesis. Catecholamines are being secreted from the adrenal medulla & sympathetic neurons under the action of chronic stress which may adversely affect the health from various points of view (Kemp *et al.,* 1989). CAs is synthesized from the amino acid tyrosine. These neurotransmitters are also considered to be the physiological regulators of flight or fight response during stress and have both excitatory and inhibitory roles. NE and E act on their respective target cells through α and β adrenoceptors (Ganong *et al.,* 2005). These receptors are further subdivided into different subtypes; the α1 adrenoceptors act by increasing the intracellular calcium level, whereas the α2 adrenoceptors inhibit intracellular cyclic AMP (cAMP) by down-regulating adenylate cyclase (Ganong *et al.,* 2005). The β1 and β2 adrenoceptors increase intracellular cAMP by activating adenylate cyclase (Ganong *et al.,* 2005). NE & E have been implicated in stress –induced augmentation of tumor growth & progression. In an orthotropic model of ovarian carcinoma, the growth promoting effect was mimicked by a β- AR agonist. Similarly, activation of β-AR resulted in an increase in metastases in animal models of lung & breast cancer. Interestingly, recent reports have indicated that substantial amounts of NE and E are produced during chronic stress owing to the activation of sympathoadrenal medullary axis, and these CAs act through the β adrenoceptors to directly stimulate the growth of different types of malignant human tumors by up-regulating the synthesis of proangiogenic factors like VPF/VEGF (Thaker *et al.,* 2006, Lutgendorf *et al.,* 2003, Yang *et al.,* 2006, Yang *et al.,* 2008, Nilsson *et al.,* 2007 & Landen *et al.,* 2007). It is important to mention here that among the several proangiogenic factors, VPF/VEGF is the most critical cytokine required for the induction of tumor angiogenesis, and the action of VPF/VEGF is mediated mainly through its VEGFR 2receptors present in the tumor endothelial cells.

SIGNALING PATHWAYS ACTIVATED BY NE & E CRUCIAL FOR TUMOR ANGIOGENESIS

Stress induced signaling cascades are the key to tumor angiogenesis. It is proven in case of human malignant ovarian tumors (Hey-A8, SKOV3ip1) grown orthotopically in nude mice by acting through the β2 adrenoceptors present in these tumor cells (Thaker *et al.,* 2006). Thus, the underlying signaling pathway to promote angiogenesis in these malignant ovarian tumors can be summarized as βreceptor→ cAMP→ PKA→ VEGF. A similar result has been shown in the human pharyngeal carcinoma cell line HONE 1, in which NE by acting through β2 adrenoceptors stimulates synthesis of VPF/VEGF and matrix metalloproteases MMP-2 and MMP-9 (Lutgendorf *et al.,* 2003). Also, NE treatment significantly increases VPF/VEGF synthesis in several human multiple myeloma cell lines (NCI-H929, MM-M1, and FLAM-76) by acting through β_1 and β_2 adrenoceptors present in these cells (Yang *et al.,* 2008).

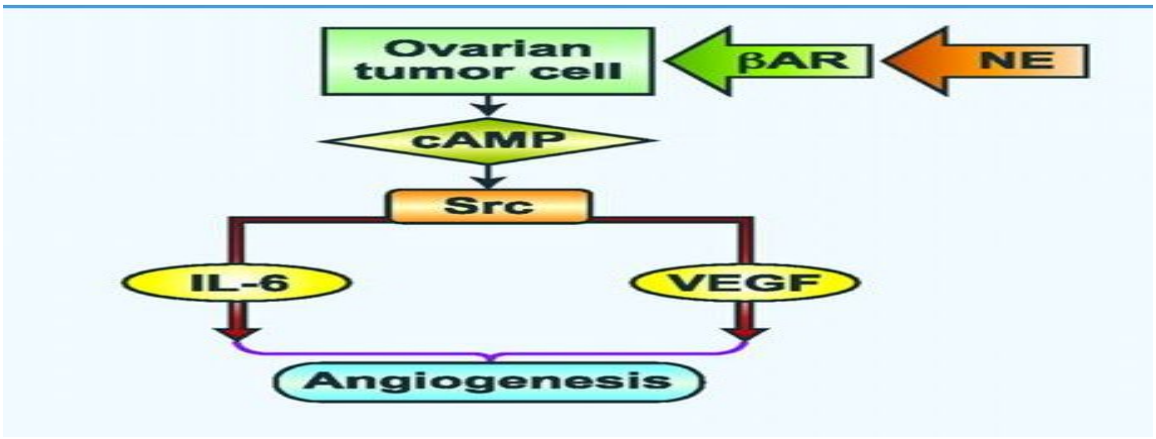

Figure 1. Schematic diagram of nor-epinephrine mediated signaling pathways in tumor cells, endothelial cells, & endothelial progenitor cells that regulate tumor angiogenesis (Chakroborty et al., 2009).

cAMP &PKA

Extracellular signals are often converted into an intracellular signal referred to as a second messenger. Adenosine 3', 5' cyclic monophosphate (cAMP) was one of the first secondary messengers identified in cells. Adenylyl cyclases, a large family of proteins that are regulated by trimeric G-proteins linked to G-protein coupled receptors, use ATP to generate cAMP (Beavo *et al.,* 2002 & Cooper *et al.,* 2005) which activates various signaling pathways involved in disease progression.

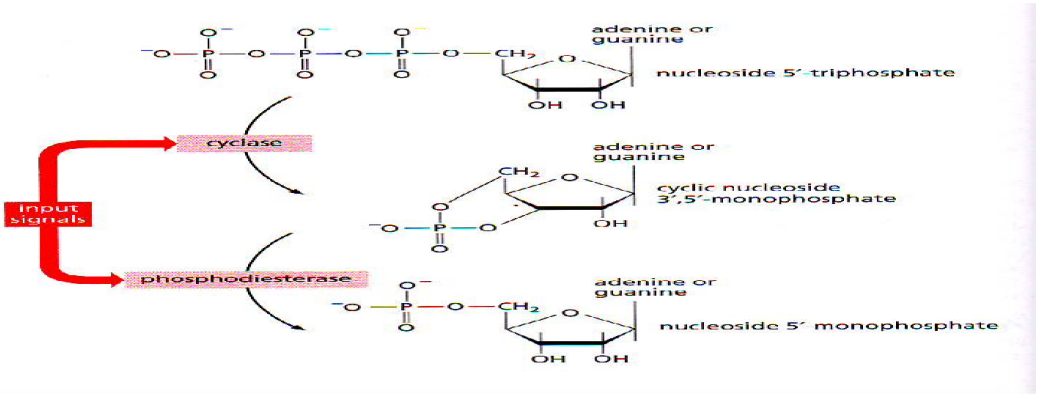

Figure 2. Generation & termination of cAMP/cGMP signal.

ACTIVATION OF PKA

PKA is a serine/threonine kinase that in its inactive form consists as a tetramer of two regulatory subunits (R) and two catalytic subunits (C). Each R subunit contains two binding sites for cAMP. Upon binding of cAMP to the R subunits, the PKA holoenzyme dissociates and the two C subunits, which possess the protein kinase activity, are released (Smith *et al.,* 2006, & Taylor *et al.,* 2007). Phosphodiesterases (PDE) hydrolyse cAMP into AMP. This represents one way to shut down the activated cAMP/PKA pathway (Taylor *et al.,* 2005 & 2007, Smith *et al.,* 2006, Skålhegg *et al.,* 2000 & Taskén *et al.,* 2004).

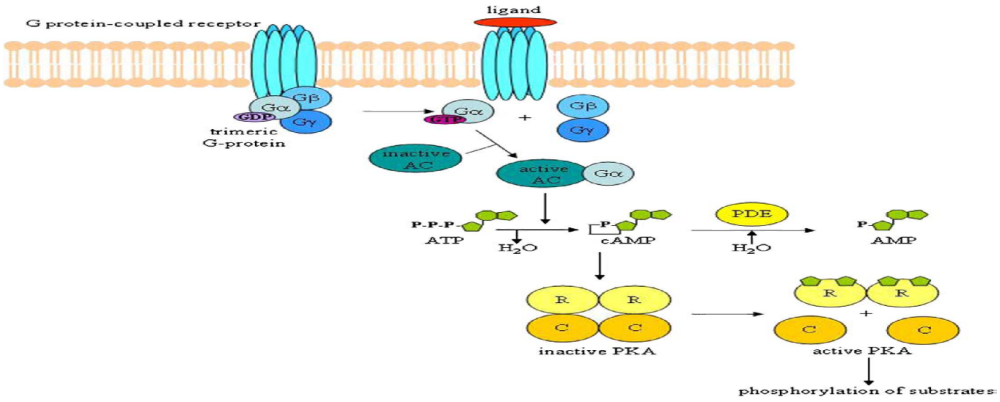

Figure 3. Schematic diagram of the cAMP/PKA signalling pathway. Upon activation of a G-protein coupled receptor, the trimeric Gαβγ protein dissociates into the active Gα subunit, loaded with GTP. The GTP-loaded Gα will activate adenylyl cyclase (AC), which generates cAMP from ATP. Next, cAMP binds to the regulatory subunits (R) of the PKA and induces dissociation of the holoenzyme. The catalytic subunits (C) can then phosphorylate their substrates.

SIGNALING PATHWAY LEADING TO MEK/ERK ACTIVATION

MEK/ERK activated by cAMP/PKA pathway is a strong up-regulator of NF-*k*b. How over NF-kB is crucial for IL-6 production which ultimately activates VEGF. Vascular endothelial growth factor induces angiogenesis & vasculogenesis in endothelial cell which is important for cell growth, metastasis & cancer progression.

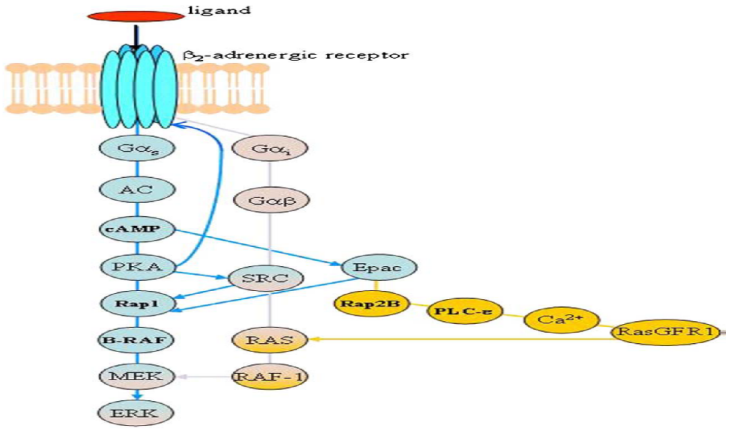

Figure 4. PKA-regulated MAPK signalling through G-coupled protein receptors. G-protein switching redirects the β2 adrenergic receptor-ERK signalling. The signalling from the β2 adrenergic receptor is mediated by Gαs, which through adenylyl cyclase (AC) increases cAMP levels and activates PKA. PKA can than modulate the MEK/ERK pathway. Activated PKA can also phosphorylate the β2 adrenergic receptor, which results in uncoupling of Gαs and increased coupling to Gαi. Next, Gαi regulates the MEK/ERK pathway via SRC, RAS, and RAF- 1. Alternatively, Epac can activate Rap2B and induce the RAS–RAF-1–MEK–ERK cascade in a Ca2+-dependent manner. The compounds of the signaling pathways that are only used by Gαs are shown in blue, while the transducing proteins solely engaged in the Gαi pathway are represented in light brown. The alternative Rap2B pathway is depicted in orange. Commonproteins used by the different pathways are indicated in both colours (Vossler et al., 1997).

NF-κB

NF-kB was first identified as a regulator of the expression of the kappa light-chain gene in murine B-lymphocytes, but has subsequently been found in many different cells. NF-kB represents a group of structurally related and evolutionarily conserved proteins that belong to the Rel family and are regulated via shuttling from the cytoplasm to the nucleus in response to cell stimulation (Birbach *et al.,* 2002). Mammals express 5 Rel (NF-kB) proteins that belong to two classes. The first class includes Rel A (p65), c-Rel and Rel-B proteins that are synthesized as mature products and do not require proteolytic processing. The second group is encoded by the *NF-kB1* and *NF-kB2* genes, whose products are first synthesized

as large precursors, p105 and p100, respectively, that require proteolytic processing to produce the mature p50 and p52 NF-kB proteins (Ghosh *et al.,* 1998).

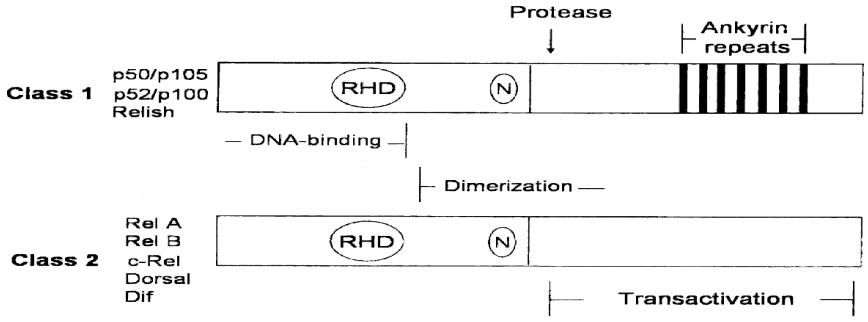

Figure 5. Structure of Rel family transcription factors

Adopted from www.ncbi.nlm.nih.gov/entrez/query.fcgi

NF-kB dimers containing Rel A or c-Rel are held in the cytoplasm through interaction with specific inhibitors, the IkBs. The IkBs are also members of a gene family that contains seven known proteins, IkB*a*, IkB*b*, IkB*e*, IkB*g*, Bcl-3 and the precursor Rel proteins p100 and p105. The IkBs are characterized by the presence of multiple ankyrin repeats and interact with NF-kB via Rel homology domain (RHD). The RHD serves several functions: it is the dimerization and DNA-binding domain for this class of proteins, it contains the nuclear localization sequence (NLS), and most important for its regulation it is the site for binding of NF-kB inhibitors the IkBs (Baldwin *et al.,* 1996, Jacobs *et al.,* 1998 & Ghosh *et al.,* 1998).

IL-6 PRODUCTION THROUGH NF-κB ACTIVATION BY THE IκB COMPLEX

Elevated level of IL-6 was reported with several tissue samples extracted from the cancer patients. So to say IL-6 is critical for tumor progression. Its transcription may be induced by different components. N-*k*B is one of the major inducers of IL-6 production. IkBs are a small family of related proteins with a core consisting of six or more ankyrin repeats, an N-terminal regulatory domain and a C-terminal domain that contains a PEST motif. The IkBs undergo rapid ubiquitin-dependent degradation after exposure to a variety of agonists, which activate the IkB (IKK) complex(Baldwin *et al.,* 1996, Jacobs *et al.,* 1998). IKK is composed of three subunits, IKK*a* (IKK1), IKK*b* (IKK2), and IKK*g* (also known as NF-kB essential modulator, NEMO) (Jacobs *et al.,* 1998). IKK*α* and IKK*β* are the catalytic subunits of the complex. The third subunit, IKK*g*/ NEMO, is the regulatory subunit and is not related to the catalytic subunits. IKK*a* and IKK*b* have similar primary structures and contain protein kinase domains at their Ntermini, and leucine zippers (LZ) and helix–loop–helix (HLH) motifs in their C-terminal portions. In addition to IKK*α,* IKK*β*, NIK, IKB*α* and NF-kB/RelA, IKK complex contains a fourth protein, a 150-kD IKK complex-associated protein called IKAP (IKK complex-associated protein). It is proposed to be involved in bIKK activation and functions as a scaffold protein due tobits ability to assemble IKK*α*, IKK*β*, NIK, and NF-kB :IkB. Stimulation by a diverse array of pathogens and other inducers, including viruses, cytokines, and stress-inducing agents lead to activation of signaling cascades that culminate with the activation of the IKK complex and phosphorylation of the IkB inhibitor. NF-kB DNA binding subunits are released and translocated to the nucleus, where they transactivate NF-kB responsive genes (Shimada *et al.,* 1999 & Thompson *et al.,* 1995).

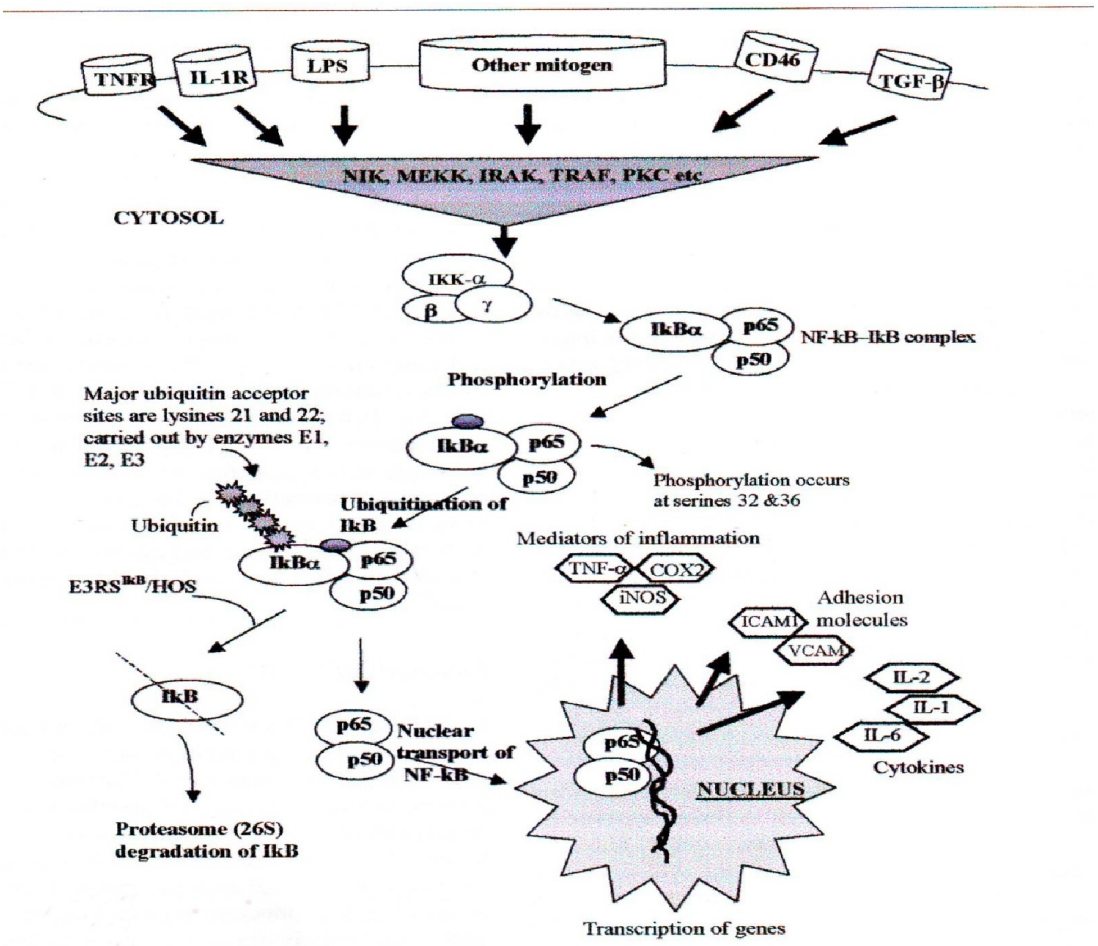

Figure 6. Schematic representation of pathways of activation and regulation of IkB & NF-kB & production of IL-6 (Ghosh et al., 2002, May et al., 1998, Baldwin et al., 2001 & Karin et al., 2000).

I*κ*B REGULATION

The mechanisms by which these highly diverse stimuli activate IKK are, however, poorly understood. Structure prediction programs suggest the presence of numerous docking sites forinteracting proteins on IKK*a*, IKK*b*, IKK*g* and IKAP, but the search for signaling molecules that directly dock to these sites is in its infancy. Mitogen-activated protein kinase/ERK kinase kinases (MAP3Ks), such as NIK and MEK kinase 1 (MEKK1), activate IKK when overexpressed (Tegethoff *et al.,* 2003 & Sun *et al.,* 1993).

THE MAJOR PRO-ANGIOGENIC MOLECULE

Interleukin-6 (IL-6) is a cytokine characterized by its diversified action. It modulates a variety of functions , such as cell proliferation & differentiation, & apoptosis. IL-6 has been implicated as an important molecule in tumor progression & angiogenesis. Human IL-6 is a protein with a molecular weight of 21kDa-28kDa (Noda *et al*., 1991). Crystallography X showed that IL-6 is formed by 4 a-helices, arranged as two couples of anti-parallel helices (Somers, *et al*., 1997), a common mode in the cytokine family. According to the length of the a-helices, IL-6 is part of the "long-chain" cytokine family, which also includes growth hormone (GH), erythropoietin and G-CSF factor (Brabo *et al.,* 2000).

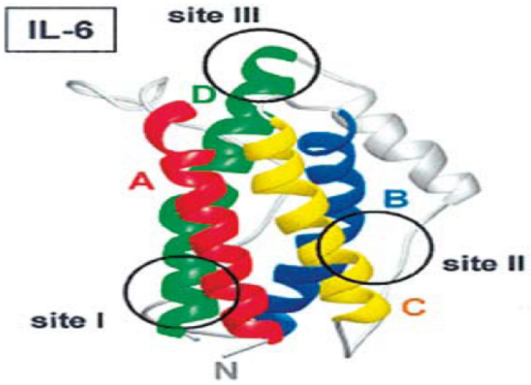

Figure 7. Tertiary Structure of IL-6. IL-6 is composed of four a-helices (colored) linked via connecting loops (grey). The figure also shows IL-6 receptor-binding sites, named site I, II & III, (Heinrich et al., 2003).

IL-6 RECEPTORS & THEIR BINDING PATTERN

IL-6 mediates its action through binding with the receptor molecules. It binds to two different membrane glycoproteins (receptors) that together form the common IL-6 receptor. These proteins are an 80 kDa protein (IL-6Rα, CD126) and a130 kDa protein (gp130, CD130). These receptors are type I membrane proteins, i.e. they contain a transmembrane domain and an extracellular N-terminal domain (Davis *et al.,* 1991) muscles, kidneys, etc (Hibi *et al.,* 1992). In contrast, IL-Rα expression is restricted and thus defines IL-6 target-cells. IL-6Rα is mainly expressed in hepatic cells and in subpopulations of leukocytes (monocytes, neutrophils, B- and T- cells), but also in neural, bone and skeletal tissue, etc. The relatively small intracellular part of IL-6Rα (82 amino acids) indicates that IL-6Rα plays a minor role in signal transmission (Taga *et al.,* 1989), but it is the intracellular domain of gp130 that contributes to the transmission of the Il-6 signal. Like other receptors, gp130 has no kinase activity (Hibi *et al.,* 1990); instead, gp130 binds through its intracellular part to JAK (cytoplasmic tyrosine kinases).

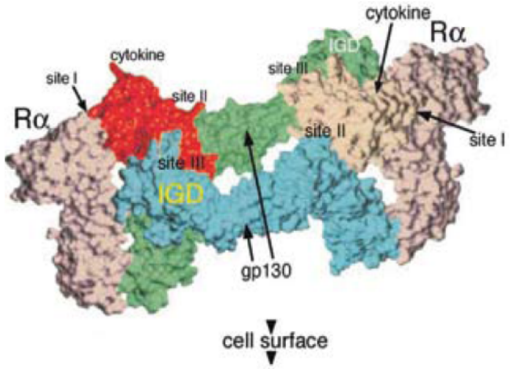

Figure 8. Space-filling model of the active hexamer protein complex produced through the binding of IL-6 to its receptors, Il-6Rα and gp130. The presence of an active membrane hexamer complex produced by the binding of IL-6 to its receptors, IL-6Rα and gp130, with 2:2:2 stoichiometry, is a prerequisite for IL-6 action. Initially, an IL-6 molecule (cytokine, red and brown) binds through site I to an IL-6Rα receptor (Rα, violet). The dimer is then connected through IL-6 site II with a gp130 receptor (gp130, blue and green). Finally, the two trimers bind through IL-6 site III and the gp130 Ig-like (IgD) domain, forming the active hexamer complex. (Bravo et al., 2002).

INTRACELLULAR SIGNALING CASCADES ACTIVATED BY IL-6

The gp130 receptor has not a kinase activity but following the formation of the active receptor complex, it binds to Janus kinase (JAK), which is a cytoplasmic (nonreceptor) kinase. At the active IL-6 receptor complex, the receptor gp130 forms homodimers (Murakami *et al.,* 1993). This leads to a close contact with JAK, which is followed by auto-activation of JAK. Activated JAKs phosphorylate tyrosine residues at the intracellular domain of gp130 and at other target molecules such as STATs In humans, receptor gp130 contains six tyrosine residues in its intracellular domain. Second tyrosine residue (Y759) is a part of the known motif Y759S(serine)T(Threonine)V(Valine), an amino acid sequence which is similar to the motif (amino acid sequence) that serves as a binding site for the protein tyrosine phosphatase SHP236. In detail, upon IL-6 activation, SHP2 (Nash *et al.,* 2002) is phosphorylated and tyrosine residue Y759 is essential for gp130-mediated SHP2 phosphorylation (Himbi

et al., 1996). The following tyrosine residues (Y767, Y814, Y905 and Y915) are part of YXXQ (glutamine) motifs, where X symbolizes any amino acid. These motifs mediate STAT activation (Stahl *et al.,* 1995, Hibi *et al.,* 1996) In short, IL-6-induced JAK activation leads to the activation of two mainly signaling pathways: the JAK/STAT pathway and the MAPK pathway (Figure 9).

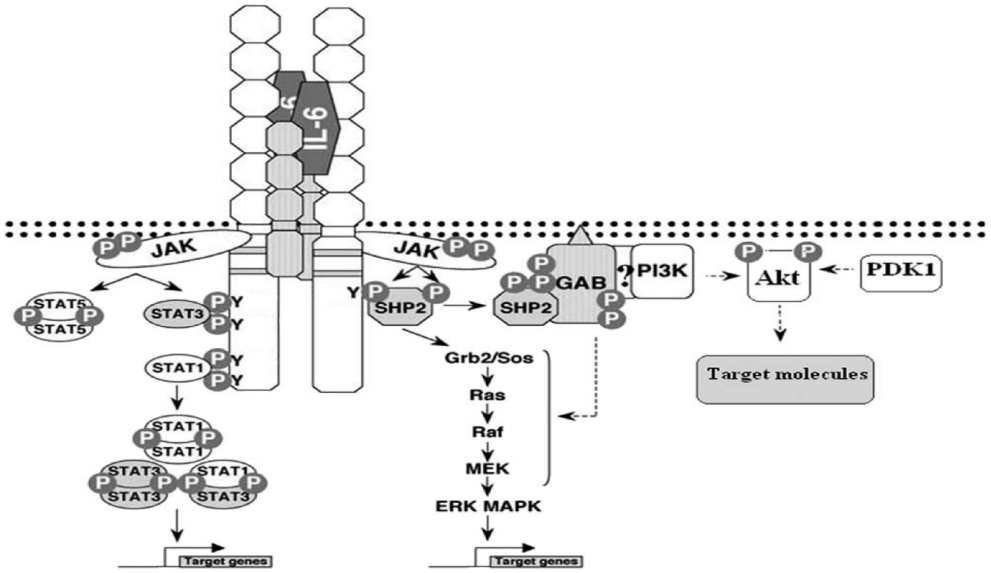

Figure 9. IL-6 regulated intracellular signal cascades. Following formation of the active hexamer complex, the intracellular domains of the two gp130 receptors and consequently the bonded JAK come in close contact. JAKs are activated, phosphorylate each other and certain tyrosine residues in the intracellular domain of gp130 receptor. As presented on the left, STAT factors bind to certain phosphotyrosines of gp130, leading to phosphorylation by JAK. Phosphorylated STAT factors form homo- and hetero- dimers, and translocate to the nucleus, where they induce gene expression. The mechanism that leads to the activation of MAPK cascade and PI3K cascade has not been specified. As presented at the right of the figure, SHP2 binding to the gp130 receptor and its phosphorylation by JAK, leads to the activation of the MAPK cascade. This is in part achieved through SHP2 binding to Gab1 and PI3K proteins. The mode of involvement of Gab1 and the activation of the PI3K cascade remain uncertain, as indicated by the symbol (?) in the figure. Activated PI3K modifies certain phospholipids on the plasma membrane, leading to the recruitment of Akt kinase on the plasma membrane and its subsequent activation through phosphorylation by PDK1 protein. Activated Akt phosphorylates certain target molecules. Y, tyrosine. (Hirano et al., 2003).

STAT3

Signal-transducer-and-activator-of-transcription (STAT) is a family of six different transcription factors, first discovered in 1993 by James Darnell,which play major roles in cytokine signaling (Shuai *et al.,* 1993 & Leavy *et al.,* 2002). A typical STAT protein consists of a coiled-coil domain, a DNA-binding domain, a linker, an SH2 domain, and a transactivation domain (TAD) (FIG. 1). The TAD contains tyrosine and serine phosphorylation sites that are needed for the activation of STAT.

ACTIVATION OF JAK/STAT PATHWAY

STAT proteins are transcription factors that bind to phosphotyrosines in the intracellular domain of gp130 receptor. This binding is followed by STAT phosphorylation by JAK and leads to the formation of STAT dimmers. STAT dimmers are translocated to the nucleus, where they induce gene expression. To date, seven STAT proteins have been recognized (STAT1-4, 5a, 5b and 6) in humans and mice (Bromberg *et al.,* 2000) . IL-6 mediates activation of STAT1, 3 and 5.

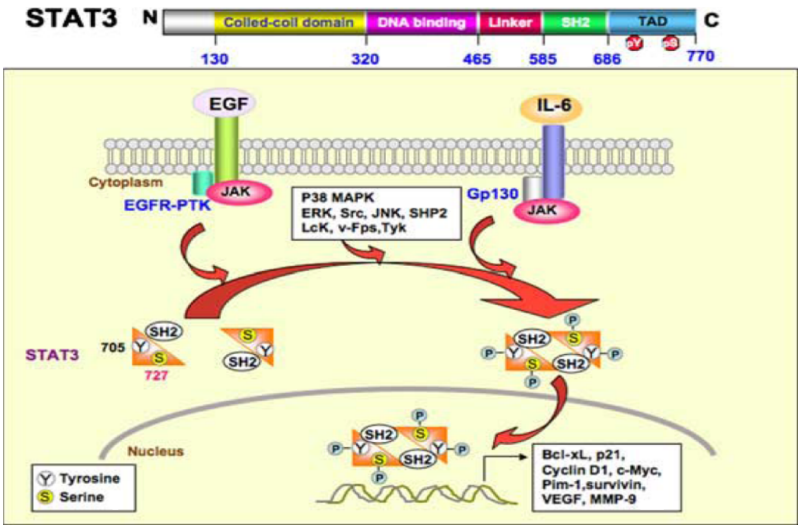

Figure 10. Signaling pathway leading to STAT3 activation.

JAKs INVOLVED IN IL-6 SIGNALLING

JAKs are intracellular tyrosine kinases (TYK) with a molecular weight of 120-140 kDa. In mammals, four JAKs have been recognized: JAK1, JAK2, TYK2 and JAK3. The latter is present mainly in cells from hemopoietic line. IL-6 activates JAK1, JAK2 and TYK2 (Yuan *et al.,* 1994, Farruggella *et al.,* 1994 & Yoshida *et al.,* 1994). Depending on the cell type, different JAKs are activated upon Il-6 stimulation and in different amounts44. The presence of a hierarchy among JAKs is unknown. In the presence of sIL-Rα, IL-6 acts mainly through JAK1 in fibrosarcoma cell types. It is also noted that activated JAK2 and TYK2 cannot replace JAK1 activity in cells with JAK1 deletion45. JAK binding to receptor gp130 is mediated by amino acid sequences of gp130, which are named Box1 and Box2 and are located in the gp130 domain near the plasma membrane. These sequences are also met in various cytokine receptors (Pellegrini *et al.,* 1997 & Hibi *et al.,* 1991) JAK1connection with gp130 is very steady and JAK1 is not diffused like a common cytoplasmic protein, but its motility follows the motility of gp130 receptor.

STAT REGULATION

STAT activity is predominantly regulated by post-translational modifications, such as tyrosine or serine phosphorylation. STAT activation requires a transient binding of STAT to the gp130 receptor and phosphorylation by JAK (Fu *et al.,* 1993 & Greenlund *et al.,* 1994). All IL-6 type cytokines activate mainly STAT3 and to a lesser ext ent STAT1 through the common receptor gp130. In addition to tyrosine phosphorylation, other posttranslational modifications have also been reported, including methylation and serine phosphorylation & so on.

NUCLEAR TRANSLOCATION OF STATs

STATs are activated in the cytoplasm but act on the nucleus. Because of the size of STATs, they have to be actively transported through nucleus pores inside the nucleus. Usually this translocation is determined by the presence of a sequence of nuclear localization (NLS). STAT accumulation in the nucleus is triggered by STAT1 dimerism in response to phosphorylation to tyrosine residues (Devgan *et al.,* 1999 & Rosen *et al.,* 1999).

STAT3 REGULATION OF GENES INVOLVED IN TUMORIGENESIS

STAT3 is one of the major mediators of tumorigenesis (GARCIA *et al.,* 1998 & Schlessinger *et al.,* 2005). The oncogenic significance of activated STAT3 molecules is due to their effects on numerous parameters of the development and progression of malignancy, such as apoptosis, cell proliferation, angiogenesis, and immune system evasion (Bowman *et al.,* 2000, Kortylewski *et al.,* 2005 & Gamero *et al.,* 2004). Constitutively active STAT3 has been implicated in the induction of resistance to apoptosis, (Catlett-Falcole, R. *et al*. 1999) possibly through the expression of Bcl-xL (Zushi *et al.,* 1998) and cyclin D1(Ahasn *et al.,* 2005). Its role in tumorigenesis is mediated through the expression of various genes that suppress apoptosis, proliferation, invasion, and angiogenesis. These include Mcl-1(Bai *et al.,* 2001, & Putheir *et al.,* 1999), Bcl-xL, and survivin

(Aoki *et al.,* 2003), all of which suppress apoptosis; c-myc (Kiuchi *et al.,* 1999) and cyclin D1, which mediate cell proliferation; matrix metalloproteinase-9 which mediates cellular invasion; and vascular endothelial growth factor (VEGF), which mediates angiogenesis(Niu *et al.,* 2002). (Other genes that have been shown to be regulated by STAT3 include p21 (Sinibaldi *et al.,* 2000), SOCS-3(Naka *et al.,* 1997), receptor activator of NF-_B ligand (RANKL) (Lin *et al*. 1999) tumor necrosis factor (TNF) (Miscia *et al.,* 2002), MyD interferon-regulatory factor 1, c-fos, β-macroglobulin,antichymotrypsin, 108 and angiotensinogen (Mascerano *et al.,* 1998) which also have been linked with tumorigenesis.

VEGF: THE KEY REGULATOR OF ANGIOGENESIS

VEGF (vascular endothelial growth factor, vascular permeability factor, vasculotropin) – homodimeric protein -42 kDa produced by many types of cells (e.g. macrophages, VSMC, fibroblasts, and cancer cells). Expression is induced in response to hypoxia and proinflammatory cytokines. Receptors (-R1 and -R2) are present mostly on endothelial cells, therefore VEGF acts specifically on endothelium (but also on neurons and Schwann cells). It protects endothelial cells from apoptosis and induces their proliferation, migration, and formation of capillaries. VEGF is required for the normal development of embryonic vasculature, the cyclic growth of blood vessels in the female reproductive tract, and the formation of capillaries during wound repair. However, VEGF is also involved in abnormal angiogenesis, as seen in proliferative retinopathies, rheumatoid arthritis, psoriasis, and malignancies. Vascular endothelial growth factor (VEGF) is one of the most potent and specific angiogenic factors of tumor induced angiogenesis. Originally identified for its ability to induce vascular permeability and stimulate endothelial cell growth, VEGF is now recognized as a key factor required for growth of tumors.

VEGFS AND VEGFRS

The VEGF family members are secreted, dimeric glycoproteins of approximately 40 kDa. In mammals, the VEGF family consists of five members, VEGFA, B, C, D and placenta growth factor (PLGF). In addition, proteins that are structurally related to the VEGFs exist in parapoxvirus1 (Takahashi *et al.,* 2005) (VEGFE) and snake venom (Suto *et al.,* 2005) (a group of proteins known as VEGFFs). VEGFA, B and PLGFbind to VEGFR1, VEGFA and E bind to VEGFR2, and VEGFC and D bind to VEGFR3. Proteolytic processingof the human VEGFC and D allows for binding toVEGFR2. Structurally, the VEGFs are related to the PDGF family of growth factors, with intrachain and interchain disulfide bonds between eight cysteine residues in conserved positions. The cry stal structure of VEGFA revealed two monomers that are organized in an anti-parallel fashion to form a dimer, with the receptor-binding sites located at each pole of the dimer (Muller *et al.,* 1997). The VEGFs preferentially form homodimers, although VEGFA and PLGF heterodimers have been identified (De Falco *et al.,* 2002). The VEGFRs are members of the RTK superfamily and they belong to the same subclass as receptors for PDGFs and fibroblast growth factors (FGFs). The VEGFRs are equipped with an approximately 750-amino-acid-residue extracellular domain, which is organized into seven immunoglobulin (Ig)-like folds. In VEGFR3, the fifth Ig domain is replaced by a disulfide bridge. The extracellular domainis followed by a single transmembrane region, a juxtamembrane domain, a split tyrosine-kinase domain that is interrupted by a 70-amino-acid kinase insert, and a C-terminal tail (FIG. 2). Structural and functional studies have yielded insights into how the distinct domains contribute to VEGFR activity. The crystal structure of part of the extracellular domain of VEGFR1, alone and in complex with ligand, shows that the Ig domain-2 constitutes the ligand-binding site on the receptor (Christinger *et al.,* 2004). In addition, biochemical analyses showed that the Ig domain-3 in VEGFR2 is important for the determination of ligand-binding specificity (Fuh *et al.,* 1998).

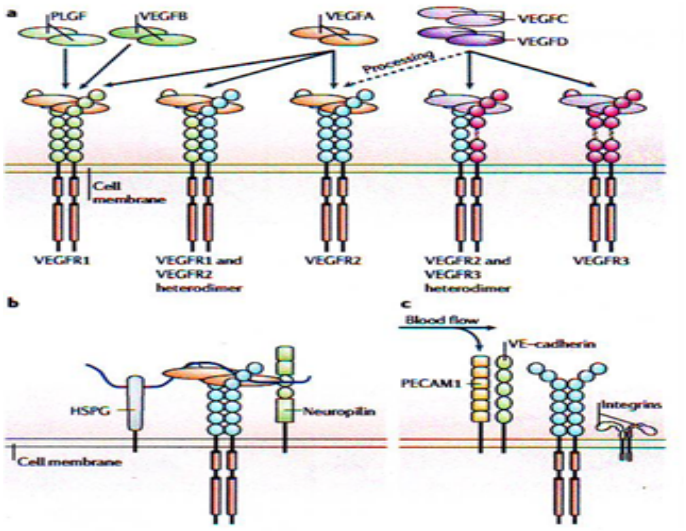

Figure 11. VEGF receptor-binding properties and signalling complexes. (a) Mammalian vascular endothelial growth factors (VEGFs) bind to the three VEGF receptor (VEGFR) tyrosine kinases, leading to the formation of VEGFR homodimers and heterodimers. Proteolytic processing of VEGFC and D allows for binding to VEGFR2. (b) VEGFR signalling is modulated by different co-receptors. VEGFs as well as VEGFRs bind to co-receptors such as heparan sulphate proteoglycans (HSPGs) and neuropilins. These interactions can influence VEGFR-mediated responses, for example, affecting the half-life of the receptor complex. (c) Mechanosensory complex formation. Blood flow might activate VEGFRs in a ligand-independent manner, by the formation of mechanosensory complexes that consist of platelet-endothelial-cell adhesion molecule-1 (PECAM1), vascular endothelial (VE)–cadherin, VEGFRs and integrins. PLGF, placenta growth factor.

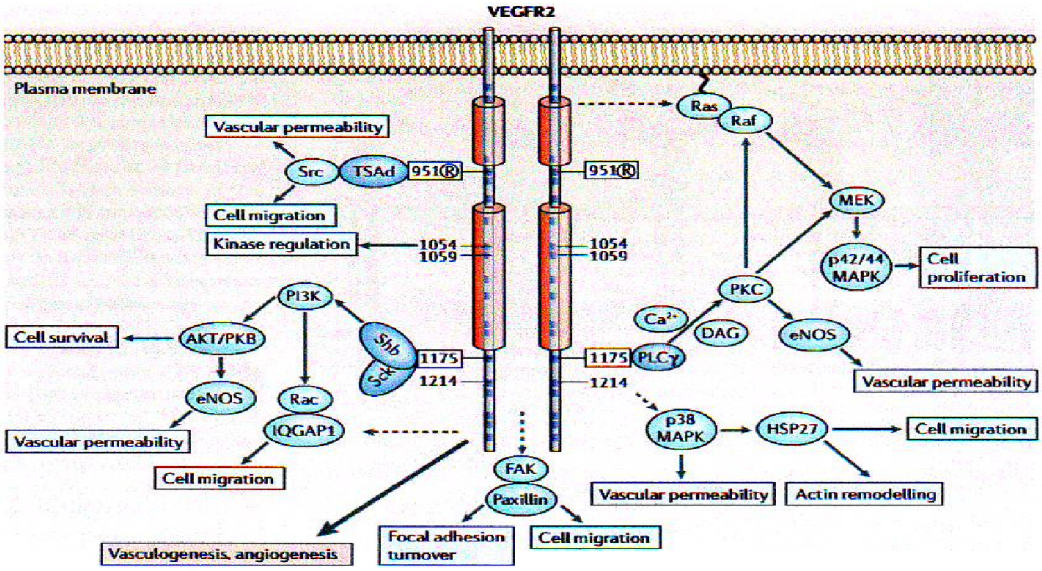

Figure 12. VEGFR phosphorylation sites and signal transduction. Intracellular domains of dimerized and activated vascular endothelial growth-factor receptor is shown with tyrosine-phosphorylation sites that are indicated by numbers. Circled R indicates that use of the phosphorylation site is regulated dependent on the angiogenic state of the endothelial cell (for VEGFR2) Dark blue squares in the receptor molecules indicate positions of tyrosine residues. Binding of signaling molecules (dark blue ovals) to certain phosphorylation sites (boxed numbers), initiates signalling cascades (light blue ovals), which leads to the establishment of specific biological responses (pale blue boxes). The mode of initiation of certain signalling chains is unclear (dashed arrows). Final biological outcomes that are coupled to the respective receptors are indicated in pink boxes. DAG, diacylglycerol; EC, endothelial cell; eNOS, endothelial nitric oxide synthase; FAK, focal adhesion kinase; HPC, haematopoietic progenitor cell; HSP27, heat-shock protein-27; MAPK, mitogen-activated protein kinase; MEK, MAPK and ERK kinase; PI3K, phosphatidylinositol 3′ kinase; PKC, protein kinase C; PLCγ, phospholipase C-γ; Shb, SH2 and ß-cells; TSAd, T-cell-specific adaptor.

ANGIOGENESIS

Angiogenesis, the formation of new blood capillaries from existing vessels, is an important mechanism for supplying nutrients to cells that are distant from existing blood vessels (Folkman *et al.,* 1992). Angiogenesis is critically important during embryonic development (Breier *et al.,* 2000)**.** Angiogenesis is a complex process that is mediated by the endothelial cells that line blood vessels (Daniel *et al.,* 2000). Unlike quiescent endothelial cells that rarely divide, angiogenic endothelial cells undergo a complex sequence of events that includes the secretion of metalloproteases and other matrix-degrading enzymes, cell migration into the newly created space, endothelial cell division and proliferation, and vessel formationThese are wellregulatedprocesses involving a number of stimulators such as fibroblast growth factor (FGF) (Nugent *et al.,* 2000), vascular endothelial growth factor (VEGF) (Petrova *et al.,* 1999), angiopoietins (Davis *et al.,* 1996), activators of integrins (Eliceiri *et al.,* 1999), and inhibitors such as thrombospondin (Roberts *et al.,* 1996), angiostatin (O'Reilly *et al.,* 1994), and endostatin (O'Reilly *et al.,* 1997).

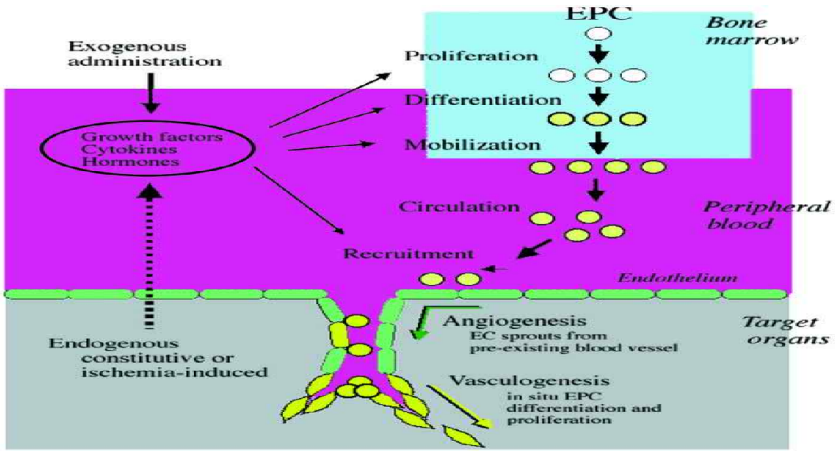

Figure 13. Vasculogenesis & Aangiogenesis

TUMORANGIOGENESIS

In addition to its important role in normal physiological processes, angiogenesis contributes to the pathology of a number of diseases (Patz *et al.,* 1980, McLaren *et al.,* 1996, Fava *et al.,* 1994), including tumor progression (Carmeliet *et al.,* 2000). This is because angiogenesis provides nutrients that maintain the viability of diseased tissue. Tu m o r-associated angiogenesis allows the tumor to maintain its growth advantage and also facilitates metastatic spreading by establishing connections to the existing vasculature.

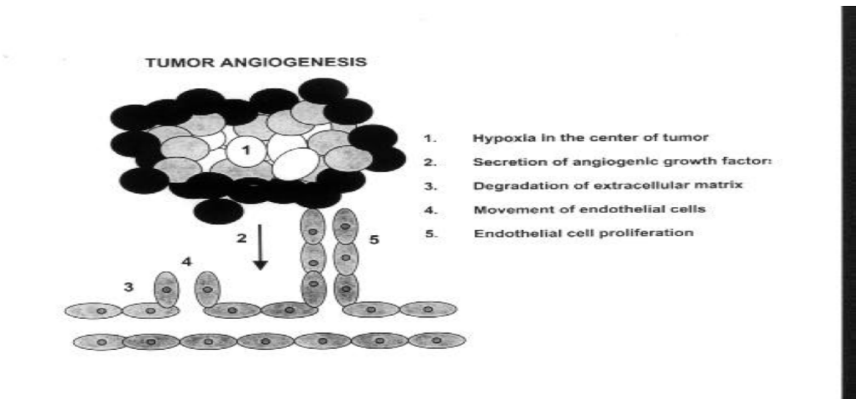

Figure 14. Tumor angiogenesis. Once a tumor grows to a certain size, the cells in the center are too far away from existing blood vessels to receive the necessary nutrients for cell survival. The lack of oxygen stimulates the production of VEGF, which is secreted from the starved cells. VEGF binds to receptors on endothelial cells of existing blood vessels, stimulating a series of events, including the secretion of matrix degrading enzymes, cellularmovement into the newly created space, and cell proliferation. The endothelial cells then form tubes, and provide the necessary nutrients to the tumor.

CONCLUSIONS AND FUTURE DIRECTIONS

Chronic stress and disease progression are the two opposite parts of a coin. Huge numbers of researches are being conducted, focusing these two correlated factors. Chronic stress persists a prolonged period and its long lasting consequence is dangerous for human health. Chronic stress upregulates catecholamines such as, epinephrine and nor-epinephrine secretion from adrenal medulla. Subsequently NE or E mediates tumor angiogenesis through a number of signaling cascades. Thus the underline signaling pathway to promote angiogenesis (the formation of new blood vessels) in tumor cells can be summarized as, β-adrenoceptor→ cAMP→PKA→VEGF. cAMP, the first second messenger actives PKA which is involved in activation of a variety of signaling pathways. MEK/ERK activated by cAMP/PKA through RAS/RAF pathway is a strong upregulator of NF-kB. NF-kB represents a group of proteins which are regulated via shuttling from cytoplasm to nucleus in response to cell stimulation. Active transport of NF-kB to the nucleus generates the major pro-angiogenic molecule IL-6. IL-6 activate target gene like VEGF through JAK/STAT or ERK/MEK. VEGF is the key regulator of angiogenesis & mediates its action through activated VEGFR2. Signaling molecules bind to the VEGFR2 receptor which phosphorylates second group of signaling molecules & ultimately leading to cell proliferation, cell migration, cell survival, vascular permeability & the final outcome of these signaling pathways is vasculogenesis & angiogenesis. Adhesion molecules such as FAK and paxillin are very important for cell migration but their mode of initiation of signaling chains are obscure through VEGF. VEGF mediated IQGAP1 and p38/MAPK are also unclear. Future research may be under taken through these directories. Targeting stress induced VEGF and Il-6 rather than tumor which is already developed would be a potential checkpoint for angiogenesis.

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RESERVE ESTIMATION OF DOLERITE DEPOSIT IN OBIAGU LEKWESI, ABIA STATE SOUTHEASTERN PART OF NIGERIA USING GEOPHYSICAL APPROACH

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ABSTRACT: The survey is aimed at evaluating the geological parameters and establishing the surface and downward trends of a suspected quarry rock material, through resistivity variation characteristics, prior to the location of a rock quarry as well as estimating the overburden thickness. Geological study revealed that the dolerite has density of 1,200kgm^3**.** A total of six (6) vertical electrical soundings (VES) and four (4) horizontal resistivity profiling (HRP) were carried out using Abem Terrameter SAS 1000 with Schlumberger array of electrode spacing of 200m and Wenner electrode array configuration were carried out with 10m respectively, field data were processed using different forward and inverse modeling computer Res2Div software. The VES results revealed that dolerite occurred at VES 5, VES 8 and VES 9 positions with thickness ranging from 12meters to 25meters but dolerite did not appear at; VES 2, VES 3 and VES 7. The results of the horizontal resistivity profiling HRP line trending north-east and south-west reveals that the intrusive rock occurs in boulders form scatter beneath the overburden in a very limited quantity while north-east direction indicates abortive. Results of the analysis show that the overburden thickness is not uniformly distributed, it decreases toward the natural hills (places of appreciable elevation and decreases as one approaches the low land areas (valley). The estimated volume of dolerite is 34, 92000.00 million tons.

KEYWORDS: Vertical Electrical Sounding, Overburden, Intrusive rock, Quarry and Dolerite.

1 INTRODUCTION

Dolerite is a volcanic rock. While similar to basalt, it contains crystals which can be seen with a hand lens. This indicates that it cooled a little more slowly than basalt. Geographically the study area is located between latitude 5^0 21'N and 5^0 28' N and Longitude $7^0$10' E and 7^0 26' E. It is about few kilometers, off Enugu/ Okigwe/ Port Harcourt Express way and about 11km to Okigwe town. Geophysical exploration techniques are available which give an insight into the nature of subsurface. These include geoelectric, electromagnetic, seismic and geophysical borehole logging. The choice of a particular method is governed by the nature of the terrain and cost considerations (Emenike, 2001). But for this research geoelecteric method was used using schlumberger and wenner confriguation method. A number of factors determine whether a dolerite can be quarried for use. These include the volume that can be quarried, the ease with which it can be quarried; the wastage consequent upon quarrying; and the cost of transportation; as well as its appearance and physical properties (Yavuz, et al, 2005). Furthermore, the volume must sustain not less than good number of years of quarrying (Bell, F.G 2008). The aim of this is to carry out the geophysical assessment of the dolerite deposit within the area. This is done by the study of the resistivity variation characteristics of the subsurface in the area, to determine the overburden thickness (Ibe, et al 2013). This is complemented by the determination of the specific gravity and uniaxial compressive strength and eventually, reserve tonnage is estimated. This study reports abundant occurrence of dolerite deposits in Abia state of Nigeria. Geophysical Survey was employed to unravel most of the dolerite deposits which occur in the study area. The geophysical technique has made it possible to estimate the reserve in the area which is up to 34, 92000.00 million tones.

2 GEOLOGY OF STUDY AREA

The Geology of the area (Fig.1) is located within the Lower Benue Trough of Nigeria. The area is of Albian age and belongs to the Asu River Group.. The Albian sediment of southeastern Nigeria was first named by Reyment, (1965) from a river at Abakaliki called Asu. Therefore the Asu River at Abakaliki, Obiagu, Lekwesi Community is a type locality of the Albian sediment of southeastern Nigeria. Faulting and folding and magmatic activity which occurred in southeastern Nigeria during the Santonian to early Campanian only affected the Albian sediment. That is the reason for Ore deposit, igneous and pyroclastic rock in southeastern Nigeria and is only found in the Albian sediment. Umunneochi local government area are vintage accumulation of lead, zinc and copper (John et al 2009). The sediment of the Asu-River is also associated with Lead zinc pyroclastic sediment, pyroclastic rocks, igneous rock and ore metallic deposit in southeastern Nigeria were all found in Albian sediment.

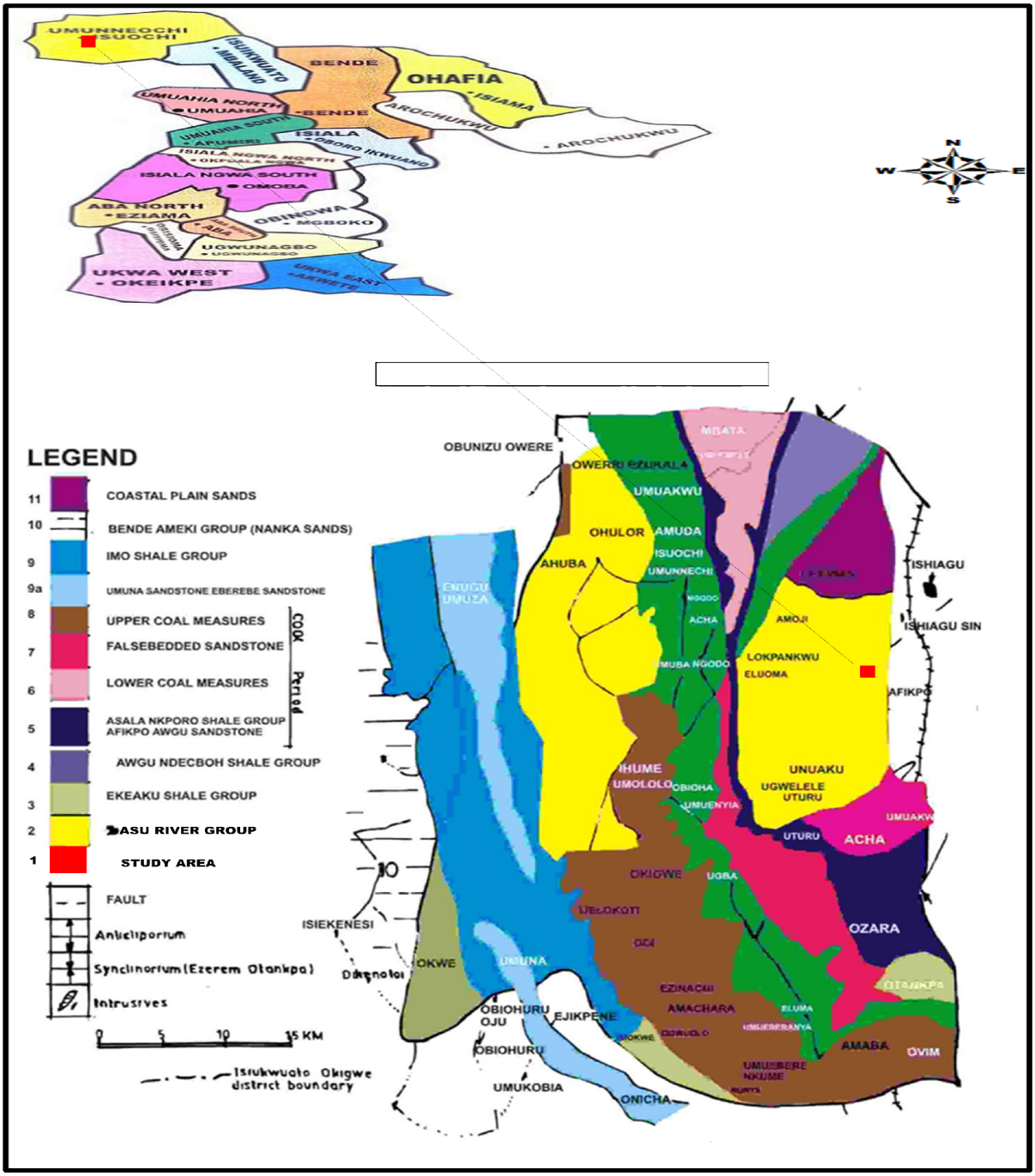

Fig.1 Geological Map of the study Area. Source: Igbokwe et al (2010)

3 METHODOLOGY

3.1 GEOELECTRICAL STUDY

The geophysical investigation was carried out using the ABEM SAS 1000 Terrameter. This equipment is equipped with an in-built digital display and recording system. The geophysical investigation was carried out using the ABEM SAS 1000 Terrameter and employing the Vertical Electrical Sounding (VES) and Horizontal Resistivity Profiling (HRP) techniques. The VES and HRP traverses were made in a more or less NE-SW direction in both areas. The HRP was carried out using Wenner electrode array with a constant station interval of 10m.

This equipment is equipped with an in-built digital display and recording system. Rechargeable 12-volt batteries coupled to the equipment provide the energy for the equipment operation. Schlumberger and Wenner array method was used for the VES data acquisition and is capable of isolating successive geoelectric layers beneath the surface and a maximum electrode spacing (AB/2) of 200m was used throughout the study. The instrument displays the resistance of the area and the result was multiplied by its geometric Factor to calculate the apparent resistivity of each point. The values obtained were then plotted on a log-log paper as points with the apparent resistivity values being on the vertical axis and the electrode spacing (AB/2) on the horizontal axis. The field curves were manually interpreted (Koefoed, O., 1979), using master curves (Orellana,et al 1966) and auxiliary point charts (Keller, et al 1966). Geoelectric parameters obtained from manual interpretation were then used as an in-put model for computer- aided iteration of Res2Div Program for the interpretation (Vander Velpen, B.P.A. 1988) until it finds a final geoelectric model that is satisfactorily best of fits for the data. Six (6) VES surveys were conducted around the study area to determine the overburden thickness and these was carried out. The configuration used is shown in Fig 2.

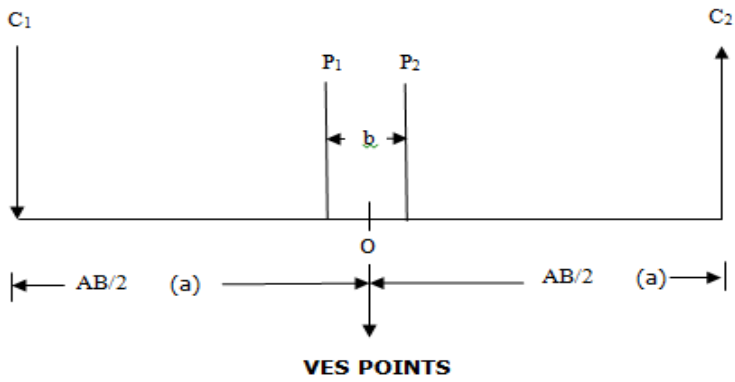

Fig 2: Schlumberger Electrode Configuration

The instrument displays the resistance of the area and the result was multiplied by its Geometric Factor to calculate the apparent resistivity of each point using the relation:

ℓa= (a2/b – b/4) R where
ℓa=apparent resistivity in Ohm-m
a=AB/2, the Half Current Electrode Separation in metres
b=Potential electrode separation in metres
R=Meter Reading in Ohms.

The values obtained were then plotted on a log-log paper as points with the apparent resistivity values being on the vertical axis and the electrode spacing (AB/2) on the horizontal axis. The field curves were manually interpreted (Koefoed, 1979), using master curves (Orellana, et al, 1966) and auxiliary point charts (Zohdy, 1976 and Keller et al, 1966).

Calculation of Reserve

- The volume of the reserve was calculated using the formula:
- Reserve Volume (m3) = Σ (area grid (m2) x average thickness of grid (m)
- The reserve tonnage is therefore calculated by:
- Reserve Tonnage (tons) = Σ (volume grid (m3) x specific gravity of the rock).
- Volume of Reserve = Area x Thickness x Density.

The average thickness of the overburden over the study area is 10m; this is of course rather high overburden thickness especially when the cost of removing it is put into consideration for profitable quarrying. Therefore, there is the need for selection and consideration of parts of the study area that are economically viable for exploitation. The criterion employed for area selection for the reserve estimation is such that the minimum ratio of overburden thickness to rock thickness is ratio 1:1.

4 DISCUSSION

4.1 GEOPHYSICAL INTERPRETATION

Resistivity measurements were made in the field using the vertical electrical sounding VES and horizontal resistivity profiling HRP. The field measurements were analyzed using Res2D. The values of AB/2 and MN/2 were manually keyed into the progamme and subjected to iterative computer modeling and result are shown (Fig. 4-13. Respectively). There is a correlation in the resistivities values within the subsurface layers. Low resistivity values indicate area with clay moderately high values indicate clay shale with possible saturation of groundwater while areas of moderately high resistivity represent dolerite. While high resistivity values indicate intrusive rocks.

For VES. 2, has three (3) layers with resistivity values ranging from 105.81-10.00 (Ohms) and its depth ranges from 0.723-4.34m respectively. Layer with low resistivity indicate present of clay as shown in Fig.4. VES 3. Has five (5) layers with resistivity values ranging from 55.170-351.79 Ohms and its depth ranges from 1.04-62.27m respectively as shown in Fig.5. VES. 5 has five layers with resistivity values ranging from 7.08-1882.1 Ohms and its depth ranges from 0.56-9.7133m respectively as shown in Fig.6. VES 7. has a four(4) layers with resistivity value ranging from 4.44-347.15 Ohms and its depth ranging from 2.37-31.65m respectively shown in Fig.7. VES. 8 has three layers with resistivity value ranging from 0.51-0.251Ohms and its depth ranging from 0.22-3.00m respectively. VES 9 has five layers with resistivity value ranging from 144.69-10.00Ohms and its depth ranging from 0.99-19.52m respectively as shown in Fig. 3 and 9.

The results of the horizontal resistivity profiling HRP line trending north-east and south-west reveals that the intrusive rock occurs in boulders form scatter beneath the overburden in a very limited quantity while north-east direction indicate abortive as shown in (Fig.10-13). VES 3 and 7 shows no presence of dolerite as shown in Fig. 5 and 7, respectively. While for VES 5, 8 and 9 shows occurrence of dolerite based of their resistivity value as shown in Fig 3. Also the result from Wenner shows that line 1 has no evidence of intrusive rock (dolerite) as shown in (Fig.11) based on the resistivity using colour differentiation representing resistivity of the rock (lateritic material to hard shale). Line 2, 3 and 4 showed evidence of occurrence of dolerite with resistivity values from 1182-5252ohmm and depth ranges from 8.32-18.4m as shown in (Fig. 12-14).

4.2 RESOURCE POTENTIAL

Limited quantities of intrusive rock occurring in form of boulders abound in the study area covered with non uniform overburden thickness.

- These rock boulders are seen scatterd at the surface at some places within the proposed quarry site.
- The overburden thickness is not uniform within the study area and varies from 9.1m at VES 9

Generally, subsurface geophysical data agreed with the geology of the Area.

- The static water level within the study area is between 13.m and 27m and the average overburden thickness is 15.9 meters indicating that intrusive rock is within the zone of underground water hence effects of flooding in mining pits will be maximum.

4.3 RESERVE OF ESTIMATION

Approximate area with intrusive rock = 0.12km^2.
Average thickness of intrusive rock = 10.00m.
Total volume of intrusive rock is Approximate area with intrusive rock (0.12km^2) by thickness of the intrusive rock (10m) = 1,200m^3
Density of the dolerite= 2.91kg/m^3
Therefore the quantity of dolerite is volume (1,200.00m^3) by Density of the rock (2.91kg/m^3) = 34, 92000.00 million tons.

5 CONCLUSION

Average overburden thickness is 15.9meters and average tonnage is 35 millions but mining pits may not exceeds 20metres due to problem of both surface and underground water as the study area is liable to flooding.

6 RECOMMENDATIONS

From the geophysical survey Study, the under listed points are highly recommended:

- Limited and localized quantity of dolerite occurring inform of boulders abound in the study area but are not laterally extensive.
- The study area is feasible for mining of the rock only for a very limited time due to the boulders nature, occurrence of the rock and also part of the site has been mined.
- Large Market demand abounds for the product to be mined hence further effort should be made to search for other suitable site as this present site may not last for a long time.
- Also other prospecting measure by way of core drilling is recommended for additional information/ confirmation of this geophysical report.
- Physically, visual look of the sample collected at site but further test for physical and chemical properties of rock is highly recommended.

ACKNOWLEDGMENT

The first author wishes to acknowledge Dr. P. N Nnabo the Head of Department of Geology Ebonyi State University for his assistance and Richard Akpolo of Geoprobe for assistance in acquiring data from the field.

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APPENDIX

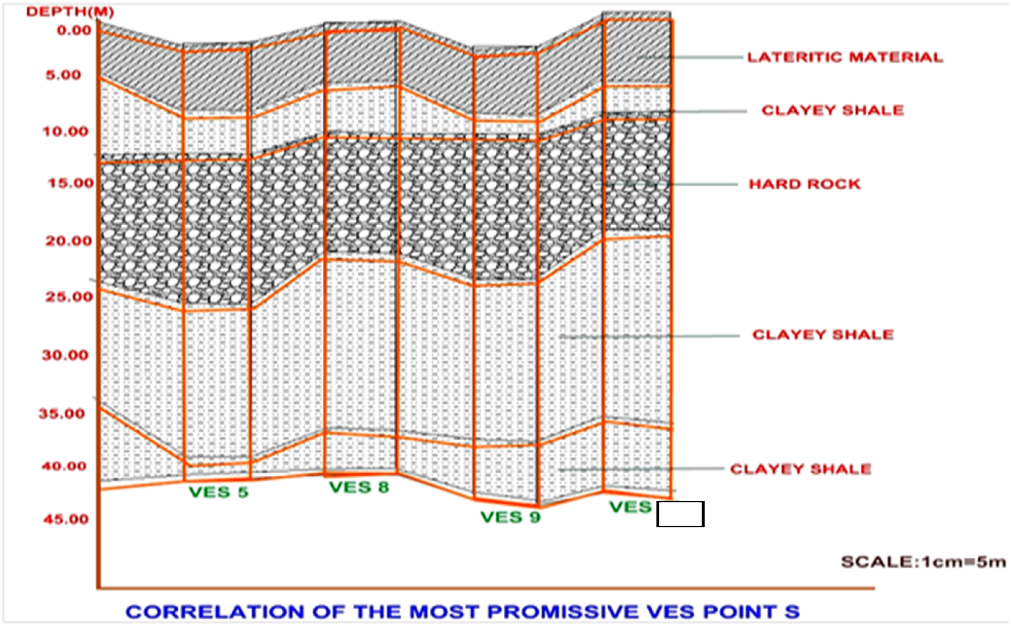


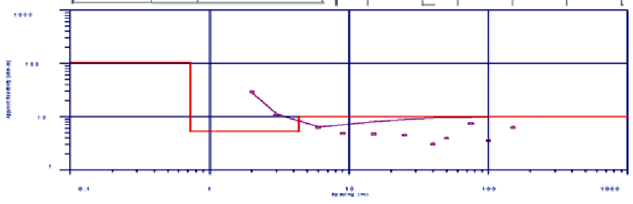
Fig.3.Correlation of the most promissive VES points

VERTICAL ELECTRICAL SOUNDING(SHLUMBERGER ARRAY)

OBINAGU LEKWESI,ABIA STATE

AB/2	MN	Apparent Resistivity
2.00	1.00	218.90
3.00	1.00	155.00
6.00	1.00	77.20
9.00	1.00	45.00
15.00	4.00	45.00
25.00	4.00	27.00
40.00	4.00	5.00
50.00	4.00	10.80
75.00	4.00	10.40
100.00	4.00	18.40
150.00	20.00	50.40
200.00	20.00	67.90
300.00	20.00	100.80

#	Rho	Fix?	Thick	Depth	Elev
1	105.81		0.72360	0.72360	109.28
2	5.3073		3.6200	4.3436	105.66
3	10.000				



N05° 57.064 E007°27.806' EL:110M

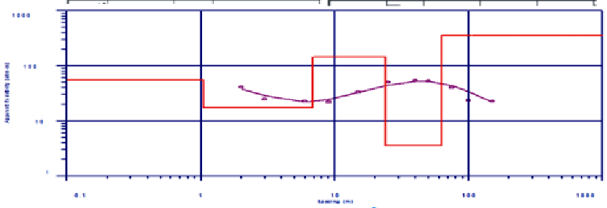
Fig.4 Vertical Electrical Sounding Interpretation (VES 2)

VERTICAL ELECTRICAL SOUNDING(SHLUMBERGER ARRAY)

OBINAGU(VES 2) LEKWESI,ABIA STATE

Point	AB/2	MN	Apparent Resistivity
1	2.00	1.00	41.53
2	3.00	1.00	24.62
3	6.00	1.00	22.79
4	9.00	1.00	22.05
5	15.00	4.00	33.84
6	25.00	4.00	50.95
7	40.00	4.00	54.75
8	50.00	4.00	53.23
9	75.00	4.00	40.30
10	100.00	4.00	23.50
11	150.00	20.00	22.50

Rho	Fix?	Thick	Depth	Elev
55.170		1.0436	1.0436	109.96
17.443		5.8101	6.8537	104.15
143.70		17.317	24.170	86.830
3.5534		38.100	62.270	48.730
351.79				



N05° 57.034 E007°27.798' EL:111M

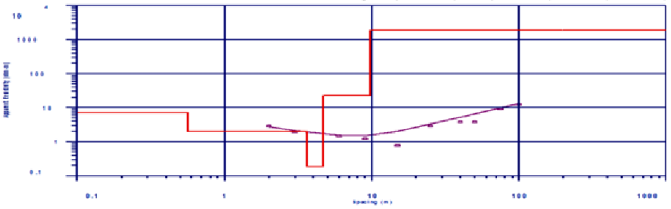
Fig. 5. Vertical Electrical Sounding Interpretation(VES 3)

VERTICAL ELECTRICAL SOUNDING(SHLUMBERGER ARRAY)

OBIAGU(VES 5) LEKWESI,ABIA STATE

Point	AB/2	MN	Apparent Resistivity
1	2.00	1.00	2.90
2	3.00	1.00	1.94
3	6.00	1.00	1.47
4	9.00	1.00	1.25
5	15.00	4.00	0.78
6	25.00	4.00	2.90
7	40.00	4.00	3.85
8	50.00	4.00	3.85
9	75.00	4.00	9.30
10	100.00	4.00	12.70

#	Rho	Fix?	Thick	Depth	Elev
1	7.0804		0.56207	0.56207	110.44
2	1.9804		3.0641	3.6261	107.37
3	0.18759		1.0423	4.6685	106.33
4	22.628		5.0449	9.7133	101.29
5	1882.1				



N05° 57.018' E007° 27.784' EL:116M

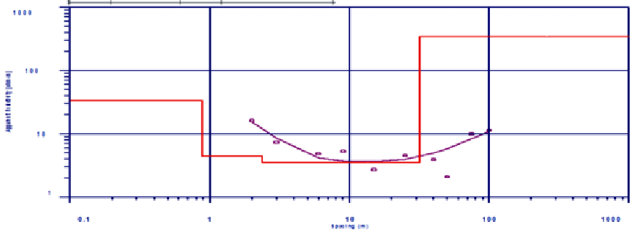
Fig.6. Vertical Electrical Sounding Interpretation (VES 5).

VERTICAL ELECTRICAL SOUNDING(SHLUMBERGER ARRAY)

OBIAGU(VES 7) LEKWESI,ABIA STATE

Point	AB/2	MN	Apparent Resistivity
1	2.00	1.00	16.22
2	3.00	1.00	7.35
3	6.00	1.00	4.66
4	9.00	1.00	5.30
5	15.00	4.00	2.70
6	25.00	4.00	4.57
7	40.00	4.00	3.93
8	50.00	4.00	2.11
9	75.00	4.00	10.00
10	100.00	4.00	11.40

#	Rho	Fix?	Thick	Depth	Elev
2	4.4136		1.4911	2.3743	93.626
3	3.5065		29.276	31.651	64.349
4	347.15				



N05° 56.894' E007° 27.759' EL:96M

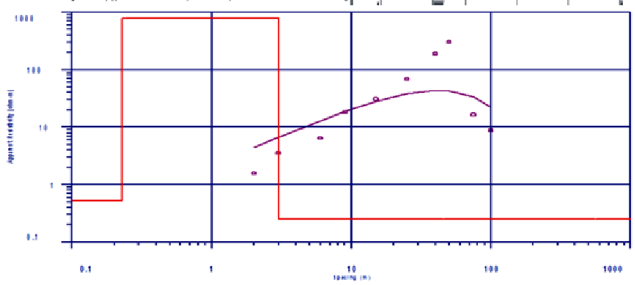
Fig.7 Vertical Electrical Sounding Interpretation (VES 7).

VERTICAL ELECTRICAL SOUNDING(SHLUMBERGER ARRAY)

OBIAGU(VES 8) LEKWESI,ABIA STATE

Point	AB/2	MN	Apparent Resistivity
1	2.00	1.00	1.57
2	3.00	1.00	3.54
3	6.00	1.00	6.45
4	9.00	1.00	18.03
5	15.00	4.00	30.92
6	25.00	4.00	68.71
7	40.00	4.00	189.94
8	50.00	4.00	305.99
9	75.00	4.00	16.50
10	100.00	4.00	8.80

#	Rho	Fix?	Thick	Depth	Elev
1	0.51749		0.22890	0.22890	95.771
2	776.27		2.7744	3.0033	92.957
3	0.25138				



N05° 57.038' E007° 27.858' EL:109M

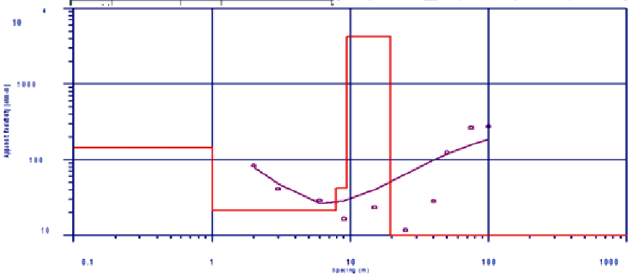
Fig.8. Vertical Electrical Sounding Interpretation (VES 8)

VERTICAL ELECTRICAL SOUNDING(SHLUMBERGER ARRAY)

OBIAGU(VES 9) LEKWESI,ABIA STATE

Point	AB/2	MN	Apparent Resistivity
1	2.00	1.00	83.86
2	3.00	1.00	40.95
3	6.00	1.00	29.17
4	9.00	1.00	16.55
5	15.00	4.00	23.51
6	25.00	4.00	11.69
7	40.00	4.00	28.62
8	50.00	4.00	124.41
9	75.00	4.00	265.00
10	100.00	4.00	277.00

#	Rho	Fix?	Thick	Depth	Elev
1	144.69		0.99975	0.99975	109.00
2	21.386		6.8473	7.8471	102.15
3	42.812		1.6743	9.5214	100.48
4	4238.4		10.000	19.521	90.479
5	10.000				



N05° 56.977' E007° 27.851' EL:112M

Fig.9. Vertical Electrical Sounding Interpretation (VES 9).

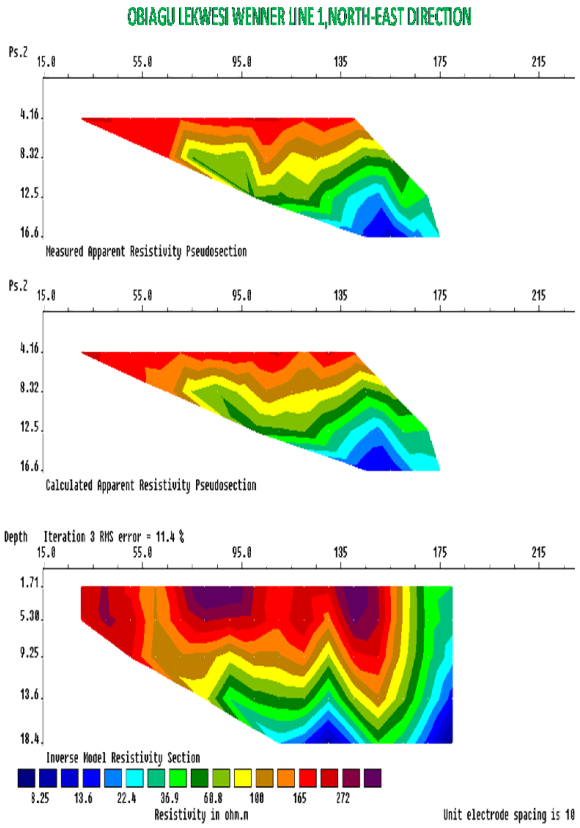


Fig. 10: Wenner North East direction Line 1

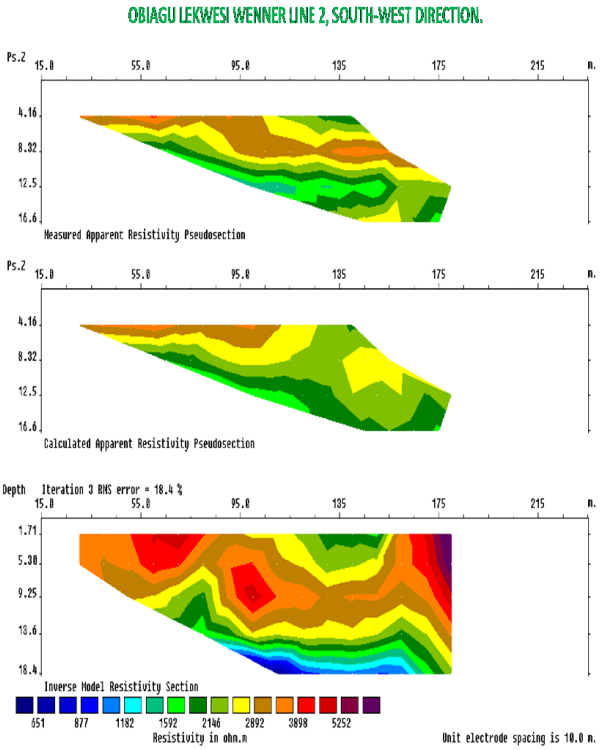


Fig.11: Wenner Line South west direction. Line 2

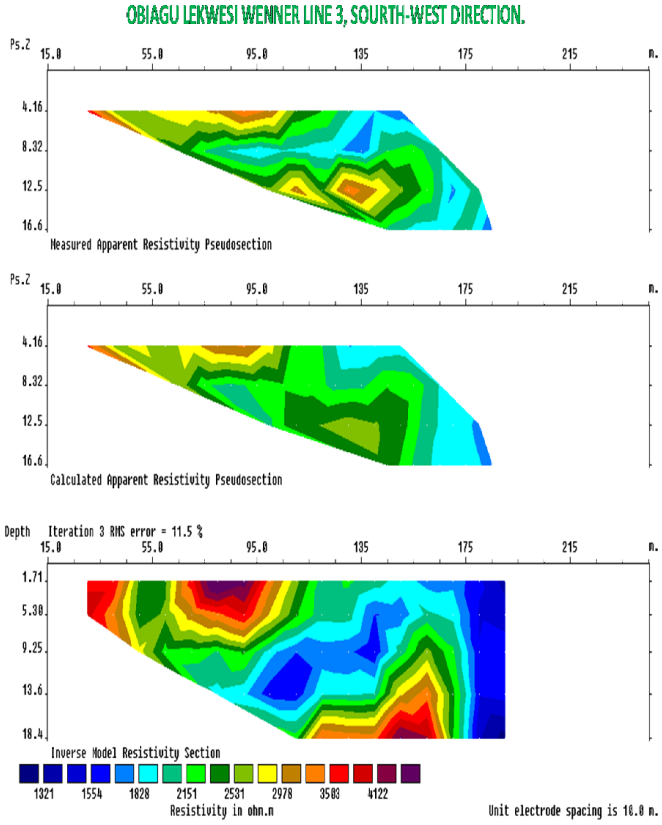


Fig.12: Wenner Line South West direction. Line 3

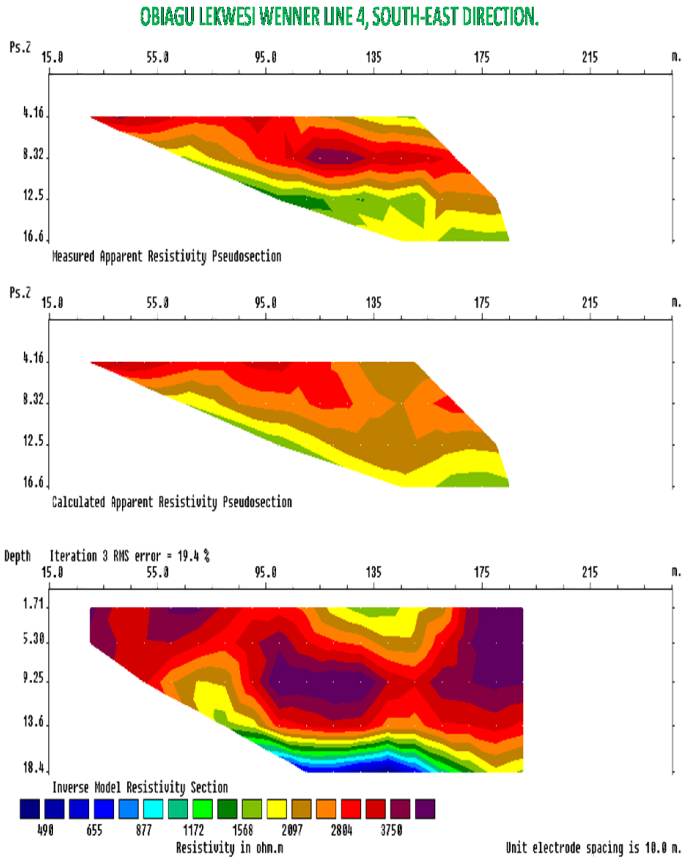


Fig.13: Wenner Line South-East direction. Line 4

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LEVELS OF HEAVY METALS ON GROUNDWATER IN ABAKALIKI AND ITS ENVIRONS, SOUTHEASTERN NIGERIA

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ABSTRACT: The present study was aimed to assess the levels of heavy metals in Abakaliki and its environs, south eastern Nigeria. A total number of 15 water samples (12 boreholes and 3 hand dug wells of groundwater points) were collected from different locations of the study area and analyzed for the concentration of heavy metals: As, Cd, Cu, Ni, Pb, and Zn using Atomic Absorption Spectrophotometer of Perkin-Elmer Analyst 100 Model. The pH of the water samples were determined using Hanna digital pH meter. The result of the analysis showed that water samples from the area have pH range of 6.0-7.8 which falls within the acceptable limit of WHO, 2008 standard permissible limit for portable water. The concentration of these metals in groundwater were found in the ranges of As (nil-2.40mg/l), Cd (0.06-0.41mg/l), Cu (nil-3.10mg/l), Ni (0.08-1.15mg/l), Pb (0.10-0.90mg/l) and Zn (nil-1.35mg/l). The result also revealed that some water samples in some locations such as Hausa quarters, off Onwe road, Azu-Ebonyi, Mechanic village, Ogoja road and Building Materials contained As, Cd, Cu, Ni and Pb that exceeded permissible limit recommended by WHO standard. It also showed that the distribution of these metals was found in both the two sources of waters sampled (borehole and hand dug well) in the area. The reason for these heavy metals in groundwater could be as a result of hydrochemical activities within the rock formations that bear the groundwater in the area. As a result, adequate hydro geological studies should be carried out when locating boreholes in the area for health reasons and domestic use.

KEYWORDS: Groundwater, Asu River Group, Drinking Water, Mining Activities and Industrial Waste.

1 INTRODUCTION

With the rapid industrialization and economic development, heavy metals are continuing to be introduced to soils, sediments and groundwater through several pathways including application of fertilization, irrigation, mining and river runoff. Soils are usually regarded as the ultimate sink for heavy metals discharge into the environment through which, water percolates down to form groundwater. Moreso since water is necessary for the daily activities of animals and humans, however increase in population has led to increase in demand for portable water; inhabitants of the area depend solely on groundwater for domestic and other uses (Moses et al., 2014). Therefore, the environmental problem of soil, sediments and groundwater pollution by heavy metal has received increasing attention in the last few decades in both developing and developed countries throughout the world (Abida et al., 2009). The term "heavy metal" refers to any metallic chemical element that has relatively high atomic density greater than $4gm^3$ and is toxic at low concentration. Examples of heavy metals include lead, zinc, copper, cadmium, mercury, arsenic, chromium, titanium and nickel, (Marscher, 1995). Heavy metals are natural components of the Earth's Crust. They cannot be degraded or destroyed. To small extent they enter our bodies through food, drinking water and air. As trace-elements, some heavy metals for example, copper, selenium and zinc are essential in maintaining the metabolism of the human body system. However, at higher concentration they can be toxic (Bruins et.al., 2000). Heavy metals can enter a water supply through anthropogenic means such as mining, fertilizer application, and industrial wastes or even from acidic rain breaking down soils and releasing heavy metals into streams, lakes, rivers and groundwater (simeonove et al., 2003).

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1.1 Location Of Study Area

The study area lies at the intersection of the Enugu Afikpo and Ogoja roads. It is bounded by longitudes $8^{O}05^{'}$E and $8^{O}10^{'}$E and latitudes $6^{O}15^{'}$N and $6^{O}20^{'}$N. The study area is located at southern part of Abakaliki as seen from the map of Ebonyi State Figure1. The areas were accessed through Enugu, Ogoja and Afikpo through a network of tarred roads which includes the Abakaliki Enugu express road, Abakaliki Afikpo express roads. The entire study area is approximately 81km^2. The villages and towns within the study area include: Ekaeru Inyimagu, Abakaliki, Ndiechi, Igbeagu, Azuiyiokwu, Ugboloke, Obugha Amachi, Agbaja, Agu Akpu and Nkwagu as shown in Figure 1.

2 Geology Of The Study Area

The study area is under in the Benue Trough, lead-zinc occurred in Ishiagu, Enyigba, Ameri and Ameka all in Albian sediment in Abakaliki. In the middle Benue Trough lead-zinc mineralization are found in Akwana and Arufu Albian sediment which is hosted in silicified limestone of Asu River Group. In the upper Benue Trough lead-zinc in Albian sediment are found in Albian and at the same time experienced magmatic intrusion. This folding and uplift at the Albian beds of south-eastern Nigeria led to the Formation of Abakaliki anticlinorium and Afikpo synclinorium.

The Albian sediment of southeastern Nigeria was first named Asu River Group by Reyment, (1965) from the river in Abakaliki called Asu. Therefore Asu River at Abakaliki is the type locality of the Albian sediment of south-eastern Nigeria. Faulting, folding and magmatic activity in south-eastern Nigeria started during the Santonian to early Campanian only affected the Albian sediment. That is the reason ore deposit, igneous and pyroclastic rocks of south-eastern Nigeria are found in the Albian sediment. The lead-zinc in Albian sediment Asu-River Group occur in Albian sediment in lower Benue Trough, upper Benue Trough, in middle Benue Trough and in lower Benue Trough the lead-zinc mineralization are found in Akwana and Arufu Albian sediment which is hosted in silicified limestone of Asu River Group.

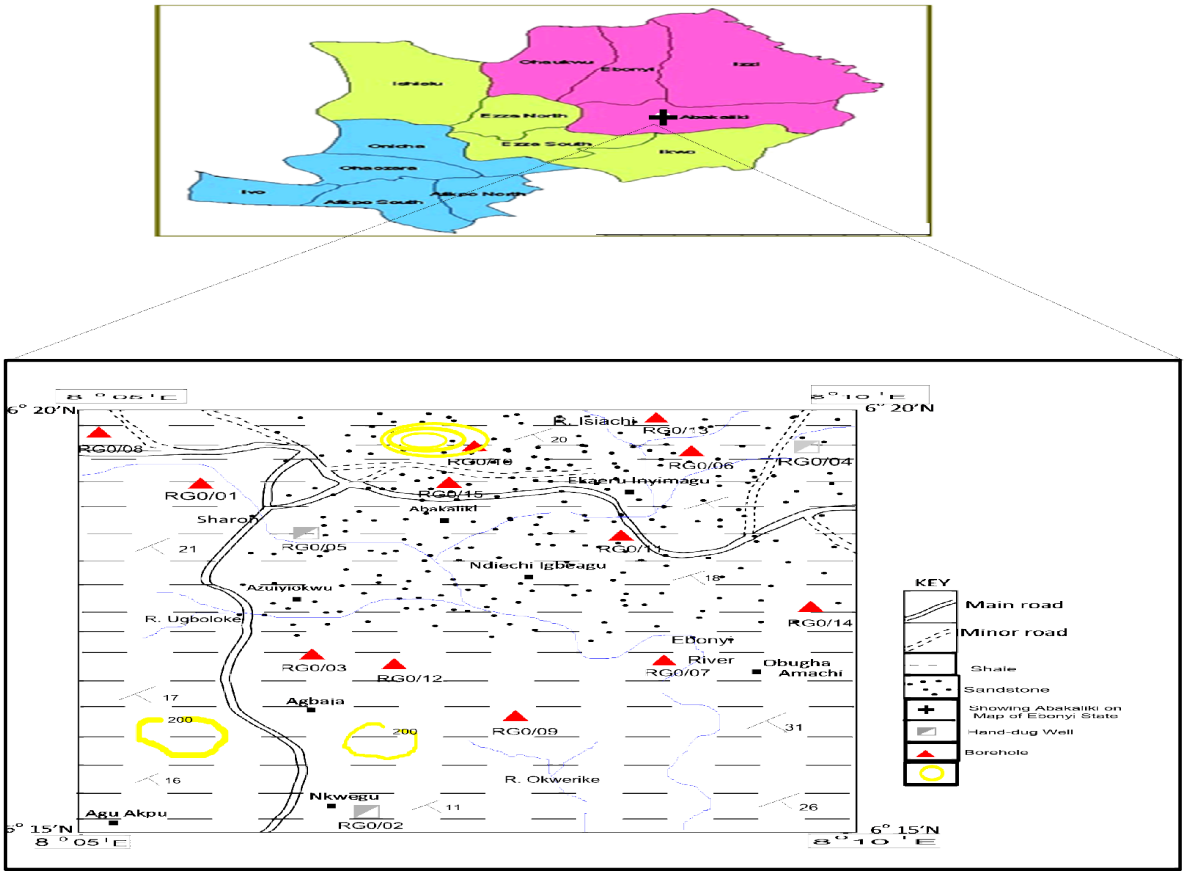

Figure.1 Showing the Geology of the Study Area and Water Sample collection Site

2.1 HYDROGEOLOGY OF THE AREA

The water resources of the study area seem to fall into two categories namely. Surface water (rivers, streams, dams and ponds) and groundwater (boreholes and hand-dug wells)

2.1.1 SURFACE WATER

Source of surface water supply in the study area include streams, rivers and ponds. The shale nature of the area makes it prone to flooding. The few streams that drain the area are seasonal and dry up during the dry season. These can not serve as a good source of water supply. The water available from Ebonyi River unfortunately carries heavy load of suspended and dissolved materials. The materials make the water muddy and highly unfit for domestic use. Other rivers visited are Ochaha River and Iyiokwu River which are also not portable. However, rainwater, boreholes and hand dug-wells are the most available water to the inhabitants for use.

2.1.2 GROUNDWATER

Though, the study area is lithologically shale in nature, groundwater supply in the study area is encouraging. This is because of the extensive fracture in the subsurface lithology which helps to host underground water. There are a quite number of functional boreholes and hand-dug wells as shown in (Plate 1 and 2) in the area, though not conclusively portable as a result of hardness nature of the water and other contaminations. Since the study area is dominantly shale with some micaceous sandstone intercalations, it indicates that the water is mainly from minor joints, cracks, and fractures within the shale and micaceous sandstone unit. Water movement is very slow in these shale rock which are units of poor permeability and there is long period of contact between rock material and water. Adsorption and ion exchange salts are incorporated into these rocks, particularly chlorides and sulphate. A fraction of these substances are locked up during deposition within void and cannot easily be leached out because of the low water velocity. The groundwater in the study area is therefore very rich in dissolved solid which is particularly attributed to high $S0^{2-}_{4}$ and Cl content. Generally, the groundwater in the area is hard which could be shown from its inability to easily foam with soap and coating of the boiling containers. This is likely to be caused by mineralization and occurrence of brine as associated with Pb-Zn minrealization the area (Olade, 1976).

Plate 1: Inhabitants Sourcing for Water from Borehole along Water Works Road, Abakailiki

Plate 2: Inhabitants Sourcing for Water from Hand-dug Well at Mechanic Village

3 MATERIAL AND METHOD

The water samples for analysis were collected at fifteen different groundwater sources from Abakaliki and its environs. The collection was done on the month of November, 2012 when groundwater levels must have declined making it more concentrated by heavy metals. The water samples were randomly collected using 100 milli-litre of clean sterilized transparent plastic containers. The plastic containers were first rinsed with the water sample before collection. Water samples from hand dug wells were collected by drawing water from the well using a clean container and transferring it to a 100 milli-litre clean sterilized bottle, while that of boreholes were collected from running taps in a 100 milli-litre clean sterilized bottles in the study areas.

The water samples were acidified at the site with three drops of ultrapure 1:1 HNO_3 to avoid precipitation of the metals before laboratory analysis. Selective metals such as Pb, Ni, Cd, Cu, As and Zn were determined by atomic Absorption spectrophotometer of Perkin-Elmer Analyst 100 model. At each point of water sample collection, the longitude and latitude of the area where the borehole or hand dug well was sited, were measured with the aid of the Garmin-Etrex (GPS).

The pH of the water samples was determined using Hanna digital pH meter. The pH meter was immersed into a clean plastic bowl containing the water sample. The clean plastic bowl was first rinsed with the water before immersing the pH meter. This was done if the water source is from hand-dug wells. If the water source is from a borehole, the tip of the pH meter is placed in contact with the water flowing out from the pumped borehole. The pH readings were taken after stabilization of the pH meter.

The water samples collected in the transparent plastic container were labeled using a masking tape according to their sampling points.

4 RESULT

The result of the analysis of water samples collected in the area and its bar charts are shown in (Table 1) and (Figure 5 to 10) respectively.

Table 1: Result of Groundwater Analysis from Abakaliki and its Environs in mg/l.

Sample no.	Latitude	Longitude	Address	Cu		Zn		As		Cd		Ni		Pb		pH
				$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	
RG0/01	N06^{0}17′48.8″	E008^{0}553.1″	Hausa Quarters (BH)	0.9	0.1	0.09	0.1	2.4	0.16	0.07	0.13	0.1	1.34	0.7	1.22	7.3
RG0/02	N06^{0}15′05.9″	E008^{0}06′36.5″	Nkwagu com. Pri.Sch (HDW)	1	1.1	0.06	0.09	Nil	Nil	0.38	0.2	1.4	0.36	0.5	0.13	6.4
RG0/03	N06^{0}18′57.6″	E008^{0}05′48.1″	Off Onwe Road (BH)	0.8	0.1	0.32	0.05	0.1	1.34	0.26	0.14	0.28	2.35	0.9	0.1	7.8
RG0/04	N06^{0}18′29.3″	E008^{0}09′06.9″	Azu-Ebonyi (HDW)	1.3	0.14	0.13	0.1	0.2	0.62	0.4	0.12	0.56	0.96	0.5	0.16	6.8
RG0/05	N06^{0}20′24.8″	E008^{0}08′44.8″	Sharon (HDW)	1.5	0.21	Nil	Nil	0.1	1.34	0.14	0.23	1.15	2.54	0.6	0.25	6.0
RG0/06	N06^{0}18′41.5″	E008^{0}07′45.5″	Mechanic village (BH)	2.9	0.49	0.1	0.23	0.6	0.21	0.06	0.32	0.23	2.01	0.1	1.34	6.2
RG0/07	N06^{0}19′01.5″	E008^{0}06′17.4″	Onwuegbunna street (BH)	3.1	0.42	0.03	0.09	1	0.22	0.16	0.15	0.25	2.22	0.6	0.17	6.6
RG0/08	N06^{0}18′56.7″	E008^{0}07′08.5″	57 Ogoja Road (BH)	1.5	1.99	0.3	0.03	Nil	Nil	0.3	3.04	0.18	0.16	0.1	1.34	7.2
RG0/09	N06^{0}19′06.9″	E008^{0}06′51.8″	No 3 Abatete Street (BH)	3.1	0.38	1.05	0.15	Nil	Nil	0.41	0.17	0.18	0.16	0.6	1.22	7.1
RG0/10	N06^{0}19′30.4″	E008^{0}07′33.7″	Cas Campus (BH)	2.3	0.08	1.35	0.25	0.7	5.9	0.12	2.89	0.08	0.13	0.1	1.34	6.7
RG0/11	N06^{0}19′42.3″	E008^{0}07′15.0″	Ikaeru (BH)	0.8	0.10	1.01	0.32	Nil	Nil	0.16	0.07	0.12	0.07	0.7	1.22	6.6
RG0/12	N06^{0}19′30.6″	E008^{0}06′55.1″	Water Works Road, (BH)	Nil	Nil	0.87	0.09	0.5	0.45	0.27	0.16	0.09	0.16	0.1	1.34	6.3
RG0/13	N06^{0}18′38.6″	E008^{0}6′15.9″	Building Material (BH)	2.4	0.16	0.96	0.1	Nil	Nil	0.18	2.3	0.08	0.34	0.3	0.11	6.1
RG0/14	N06^{0}18′46.4″	E008^{0}6′11.9″	No 14. Amasiri Street (BH)	1.7	1.22	0.16	2.7	Nil	Nil	0.07	0.16	0.44	0.14	0.6	0.36	7.6
RG0/15	N06^{0}18′48.4″	E008^{0}6′12.9″	No 16 Awgu Street (BH)	Nil	nil	0.09	0.18	Nil	Nil	0.18	0.11	0.74	1.01	0.9	0.1	6.9
Total				23.3	6.51	5.49	4.48	5.60	10.24	3.16	10.19	5.88	13.95	7.30	11.45	
WHO (2008) Maximum Limit mg/l				2		3		0.01		0.003		0.07		0.01		

Key

$\bar{x}$= mean
σ= standard deviation
Cu=Copper
Zn= Zinc
Cd=Cadmium
Ni= Nickel
Pb=Lead
pH=Power of Hydrogen
RGO = Robinson George Ojobor
BH = Borehole
HDW = Hand Dug Well

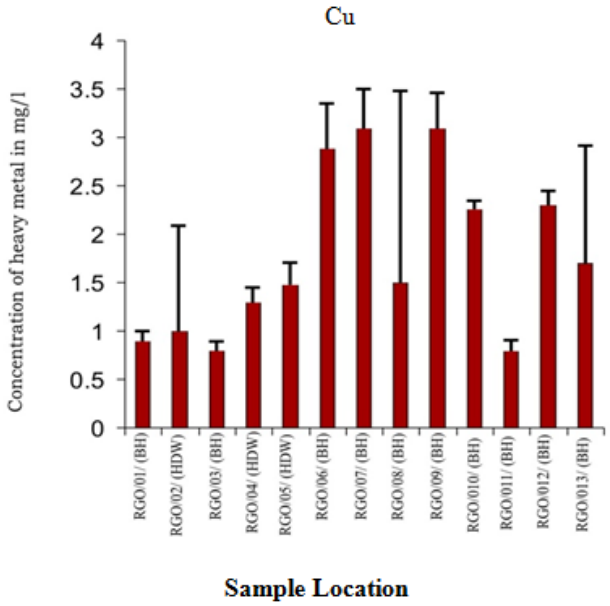

Fig 4: Barchart Representation of Copper Concentration with Error Bars in mg/l in Groundwater from Abakaliki and its Environs.

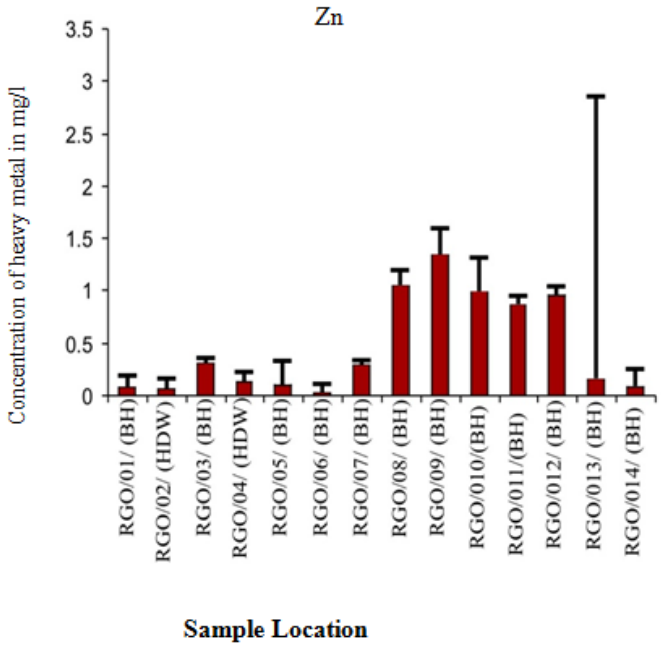

Fig 5: Barchart Representation of Zinc Concentration with Error Bars in mg/l in Groundwater from Abakaliki and its Environs.

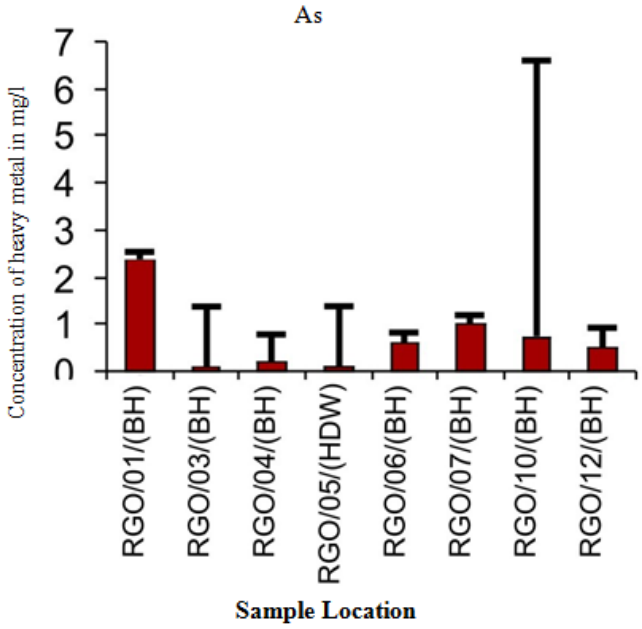

Fig 6: Barchart Representation of Arsenic Concentration with Error Bars in mg/l in Groundwater from Abakaliki and its Environs.

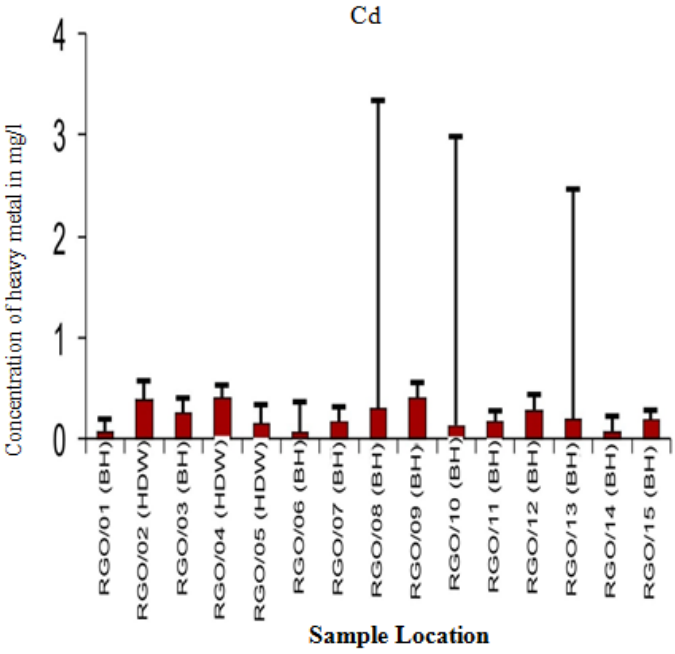

Fig 7: Barchart Representation of Cadmium Concentration with Error Bars in mg/l in Groundwater from Abakaliki and its Environs.

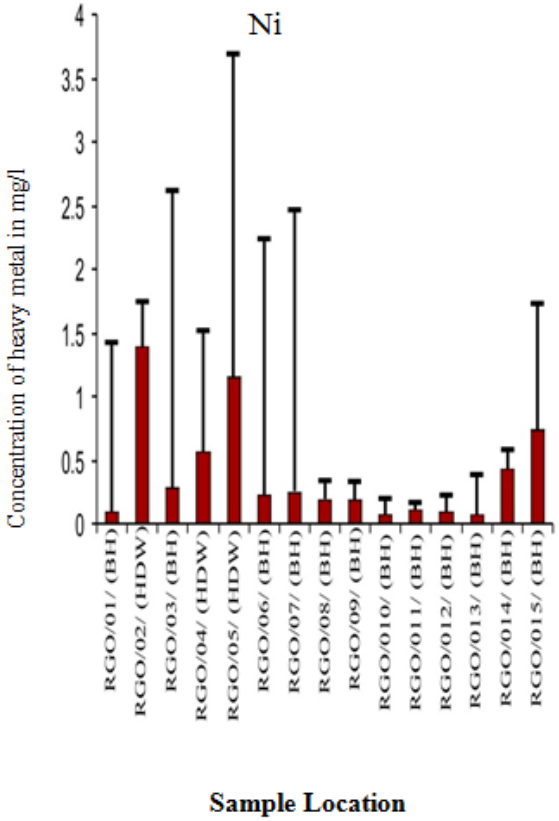

Fig 8: Barchart Representation of Nickel Concentration with Error Bars in mg/l in Groundwater from Abakaliki and its Environs.

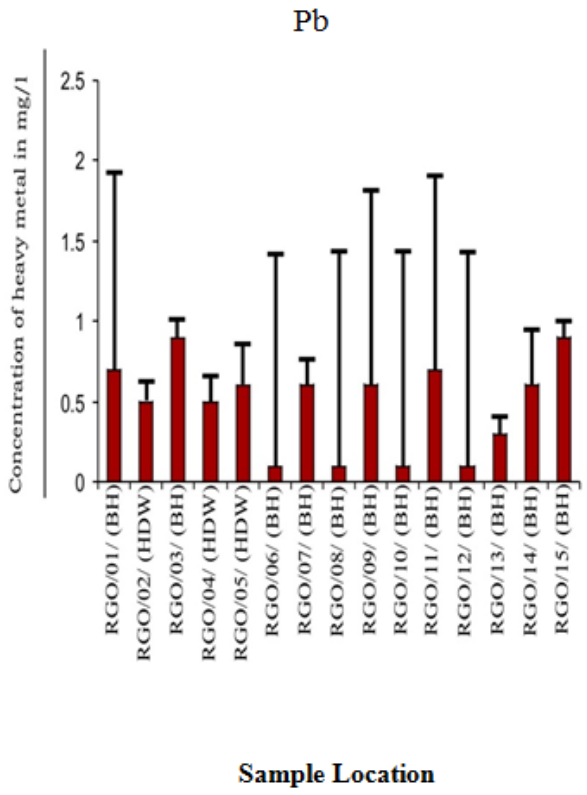

Fig 9: Barchart Representation of Pb Concentration with Error Bars in mg/l in Groundwater from Abakaliki and its Environs.

Table 2: Maximum Limits of Metal Permissible in Water Established by the World Health Organization (2008).

Parameters	Limits (mg/l)
Cu	2
Zn	3
As	0.01
Cd	0.003
Ni	0.07
Pb	0.01

5 DISCUSSION

The standard for the comparison used in this study is the standard guideline for the World Health Organization (2008) permissible limit for portable water. The comparison of the results obtained from the analysis and the recommended limit of these parameters from the World Health Organization (2008) showed deviations in some parameters with the recommended values for portable water which are discussed below:

5.1 PH

The pH of natural water is a measure of its net alkalinity or acidity. It is a measure of the total hydrogen ion concentration of the water.

From (Table 1), the maximum pH of 7.8 was recorded in sample location RGO/03 while minimum pH of 6.0 was also recorded in sample location RGO/05. No acidic water was recorded, as no pH value fall below 6.0. The fall within World

Health Organization (2008) acceptable pH range for portable water is 6.5-8.5.The absence of acidic water in the study area is probably due to non-hydrolysis of lateritic deposit; (Ezeigbo, 1989).

5.2 LEAD

Lead had maximum concentration value of 0.9mg/l (± 0.5mg/l) in location RGO/03 and RGO/15 (off Onwe Road and No. 16 Awgu Street). The minimum lead concentration of 0.10mg/l (± 1.34mg/l) was in location RGO/ 06, 08, 10 and 12 as shown in (Table 1). The range of these values were above the standard limits recommended by WHO permissible limits for portable water set at 0.01mg/l as shown in (Table 2). In all the sampled locations, lead were found to exceed the standard recommended limit by WHO,2008.

The presence of lead in groundwater in the area could be as a result of lead-zinc mineralization, use of lead arsenate as pesticide and lead storage batteries in the study area (Olade, 1976).

5.3 ZINC

Zinc as observed from (Table 1), had maximum concentration value of 1.35mg/l (± 0.25mg/l) in location RGO/10 (CAS campus) and minimum concentration value of 0.03mg/l (± 0.09mg/l) in location RGO/7 (Onwuegbunna street). The concentration of zinc in the study area fall within the permissible limit set by WHO, 2008 for portable water as 3mg/l (Table 2).

The decrease in zinc contamination in the groundwater in the area is as a result of non-oxidation of zinc sulphide minerals (Edmond, 1973) and probably due to zinc co-precipitation with calcium as carbonate phosphate complexation with organic matter of low solubility and adsorption of clay minerals on manganese or iron oxide (Jenne, 1968).

5.4 COPPER

This has maximum concentration value of 3.10mg/l (± 0.42mg/l) in location RGO/09 (No. 3 Abatete street) and minimum concentration value of 0.8mg/l (± 0.10mg/l) in location RGO/11 and 03 (Ikaeru village and off Onwe road) as observed from (Table 1). The following sampled locations in the study area comprising location RGO/01 (Hausa quarters) 0.9mg/l (± 0.10mg/l), RGO/02 (Nkwegu Com. Pri. Sch) 1.0mg/l(± 0.1mg/l), RGO/03 (off Onwe road) 0.8mg/l (± 0.10mg/l), RGO/04 (Azu-Ebonyi) 1.3mg/l (± 0.14mg/l), RGO/05 (Sharon village) 1.5mg/l (± 1.99mg/l), RGO/08 (57 Ogoja road) 1.5mg/l (± 0.21mg/l), RGO/11 (Ikaeru village) 0.8mg/l (± 0.1mg/l) and RGO/14 (Amasiri street) 1.7mg/l(± 1.22mg/l) are within acceptable values recommended by WHO standard for drinking water set at 2mg/l (Table 2). Locations RGO/12 and 15 had no trace of copper. The reason for the absence of copper in the area may be as a result of non-adsorption of copper unto soil constituents and its precipitation with zinc, manganese and cadmium (Richard and Nriagu, 1978).

5.5 CADMIUM

Cadmium as observed from (Table 1), had maximum concentration value of 0.41mg/l (± 0.23mg/l) recorded in location RGO/09 (No. 3 Abatete street) and minimum concentration value of 0.06mg/l (± 0.32mg/l) recorded in location RGO/06 (Mechanic village). Cadmium concentration in the study areas exceeded recommended limit of 0.003mg/l recommended by WHO for portable water. This increase is as a result of agricultural fields due to use of pesticide as well as cadmium containing phosphatic fertilizer used by farmers in the area (Lokeshwari et al.,2006), and the presence of Cd in Pb-Zn minerals in the area

5.6 NICKEL

The maximum concentration value of nickel in the study area was 1.15mg/l (± 2.54mg/l) recorded in sample location RGO/05 (Sharon village) and minimum concentration value of 0.08mg/l (± 0.13mg/l) recorded in location RGO/10 and 13 (CAS campus and building materials) respectively. From the above values, it was shown that the concentration of nickel within the area exceeded the recommended limit set by WHO, 2008 standards for portable water as 0.07mg/l. The increase of nickel in the area could be as a result of used and dumped electroplating and alloy products in the area (Table 2).

5.7 ARSENIC

The maximum concentration value of arsenic in the study area was recorded to be 2.40mg/l ($\pm$ 0.16mg/l) as recorded in sample location RGO/01 (Hausa quarters) and minimum concentration of 0.10mg/l ($\pm$ 1.34mg/l) as recorded in two sampled locations RGO/03 and 05 (off Onwe road and Sharon village) respectively. Seven locations, RGO/02, 08, 09, 11, 13 and 15 showed no trace of arsenic in the area. Other eight locations in the area are contaminated with arsenic, namely RGO/01, 03, 04, 05, 06, 07, 10 and 12 as shown in Table 1. The reason for the presence of arsenic in the area could be as a result of application of phosphate fertilizers which creates the potential for releasing arsenic into groundwater. Laboratory studies suggest that phosphate applied to soil contaminated with lead arsenate can release arsenic to soil water (Davenport and Peryea, 1991). Since the inhabitants in the study area are mostly farmers that make use of fertilizers to boost their crops production, this could probably lead to the high increase of arsenic in the groundwater of the area.

6 CONCLUSION

- Water is one the most essential substance needed to sustain human life, animals, plants and other living beings. From the above studies, it is concluded that the quantity of groundwater varied from place to place.
- However, the situation is not too worst but the higher concentration of heavy metals in some sampling stations indicates that without proper treatment water is not suitable for agricultural and domestic applications.

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LITHOFACIES AND PALEODEPOSITIONAL ENVIRONMENT OF OKPUJE AND ITS ENVIRONS NSUKKA NORTH EAST LOCAL GOVERNMENT OF ENUGU STATE, SOUTH EASTERN NIGERIA

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ABSTRACT: This research gives detailed knowledge on the lithic- geology and brief knowledge on trace fossil analysis of the study area. These lithofacies have been organized into six main lithostratigraphic units namely: Unit A, Unit B, Unit C, Unit D, Unit E and Unit F. The lithic fills of the area show an undulating topography with thickness increasing towards the eastern, south eastern and north eastern parts. Six uneastablished lithofacies(Unit) were encountered which includes fine grained friable Sandstone, dark grey Shale, White to pink clay, fine to coarse grained Sandstone, conglomeratic sandstone and heterolithic Sandstone and clay facies coined out from the establish Ajali and Nsukka Formation that underline the area. This formation was dated upper Maastrichtian with the Ajali Sandstone underlying the Nsukka Formation. Sandstone sedimentological analyses b (sieve, grain size analysis) and record of Scoyena and Skoliths ichnofossils indicates a parallic environment (Delta platform and Delta slope realm).

KEYWORDS: Depositional environment, Ajali Sandstone, Nsukka Formation and Facies.

1 INTRODUCTION

The study area lies between $6^0 5^{'}$ and $6^0 55^{'}$ N and longitude $7^0 15^{'}$ E and $7^0 20^{'}$ E. It is situated in Nsukka which is located at the north eastern part of Nsukka local government of Enugu state Nigeria as shown in Fig. 1. It is part of the Benue trough basin of Nigeria which runs in a north east direction. Facies classification is one of the basic practices which define geology as a field of study. Initially, identification of rock facies was a common practice only to surface geological mapping. However, the story has changed in recent times as facies identification has become an integral part of the oil exploration/exploitation. An understanding of depositional environment is quite important in appreciating the geology of an area. To put together the geologic history of a region, the depositional environments of its sedimentary rocks must be analyzed. By reconstructing depositional environments geologists are able to reconstruct the climates of the past, life forms of the past, and geography of the past, where the mountains, basins, large rivers, and bays of the ocean were ability to locate energy deposits in the form of coal or oil, each of which originates in a certain type of depositional environment. Presently, a search for hydrocarbon is incomplete without sequence stratigraphic analysis of core samples from appraisal wells and it involves detailed Petrographic and geochemical studies,(Obasi et al, 2013).

1.1 DRIANAGE OF THE STUDY AREA

The area has few surface drainage, it is inferred by some U and V shape valley which may in the past serve as surface drainage. The area encompasses five towns and village. It covers in the northwest Okpuje and Aka-Edem; Ibagwa Ani, Alor-Uno, Edem-Ani and Isi-Uja; in the southeast, Ozi-Edem,Ezi-Ani and Odoru Nsukka and in the southwest Nrobo.

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1.2 CLIMATE AND VEGETATION

According to Inyang (1975) the annual record of temperature of Nsukka has a maximum temperature of 27^0c with minimum of 23.3^0C occurring from February and july- August respectively. The mean daily maximum temperature is usually more than 27^0c, while 210c as the mean daily minimum temperature. The relative humidity depends on the type of air mass that prevails: the southwest (Typical maritime) air mass or northeast (Tropical contential) of the ITC- equatorial west lies during high sun and the dry North west trades and sub-tropical anticyclones. However the relative humidity ranges between 35 and 65%. Generally Nsukka lies between the Savannah vegetation type of northern Nigeria and the rain forest belt of the south. The complex trees and grasses which make up the belt have led to the region being referred to as forest- Savannah.

2 GEOLOGY OF THE STUDY AREA

The study area falls within two geologic formations the Nsukka Formation and the Ajali Sandstone:

2.1 NSUKKA FORMATION

The late Campanian-Maastrichtian marine transgression which led to the deposition of Mamu and Ajali Formation proceeded further to lead to the deposition of Nsukka Formation. Nsukka Formation lies conformably on top of Ajali Sandstone as shown i; the formation was first described by Tattam (1944) as the (Upper Coal Measure). The formation represented a phase of fluvio deltaic sedimentation that began close to the Maastrichtian and continue during the paleocene. The Nsukka Formation which overlies the Ajali Sandstone consist of coarse to medium-grained sandstone as passes upward into well bedded blue clay, fine grain sandstone and carbonaceous shale with thin bands of limestone(Reyment 1965 and Obi et al, 2001). The intense ferroginisation of well bedded blue clays, carbonaceous shale and thin band of limestone resulted in ironstone which exist in Nsukka Formation (Obi et al, 2001) used sedimentological evidence to suggest that the Nsukka Formation represent a phase of fluvio-detaltic sedimentation that began close to the end of the Maastrichtian and continued during the Paleocene.

2.2 AJALI SANDSTONE

The Ajali Formation overlies the Mamu Formation. The formation was previously known as the false bedded Sandstone, the formation consists of friable poorly sorted sandstone typically white in colour but sometimes iron-strained. A marking banding of coarse and fine layers is displayed. The sand grain and the fragments are sub angular with coarse cement of white clay. Large cross bedding. The Ajali Sandstone is the source of water of artesian borehole and springs at Oji River, Ajali Sandstone is the most aquiferous sandstone in Nigeria after Benin and Imo Formation, (Nwachineke, 2012).

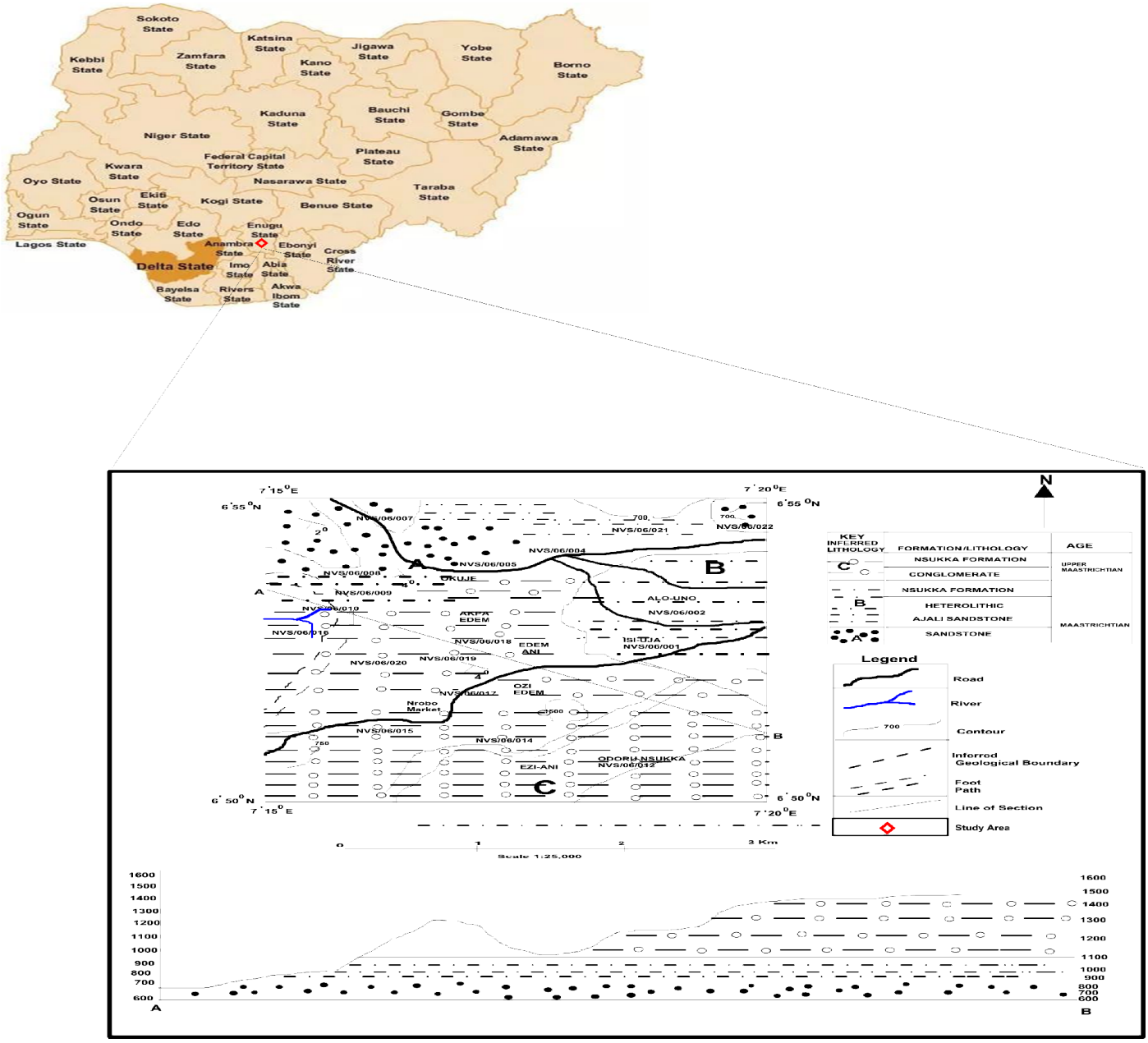

Fig.1 Geology of the Study Area.

3 METHODOLOGY

The samples were taken to the laboratory to help ascertain the depositional environment of the sediment in the study area. The samples were subjected to grain size analysis and they are form stations NVS/06/007(Iyi-Ezer, Okpuje) and NVS/06/016 (Iyi-Iselejuonma in Umuamuna Nrobo Nsukka). The method use is the machine sieved (Electrical) method, the purpose of the sieving is to analyse the sedimentary environment to afford an understanding of the hydrodynamic conditions under which the sediment were deposited. The samples are relatively consolidated and are disaggregated using porcelain mortar and pestle and then dried, the sieving process takes the following steps.

The weight of each sample to be used was weighed in order not to over load the sieves at a 100kg for both the samples are coined and quartered and a suitable fraction examined for the presence of acicular (Kyanite, needles shape) or flacky (Mica) minerals and a note taken of these materials three after quartering. The weighed samples are individually placed at the top of the sieves that are arranged using the root-2 method (1/2-Phi) by Folk (1966) and poorly arranged in order of decreasing mesh size. i.e from base pan to top sieved. These are the apertures sizes, the sieves are tightly covered and

fastened to the sieve shaker which runs for 20 minutes. After shaking for twenty (20) minutes each of the sieve mesh results of sieve analysis were detached and the samples retained on each mesh were measured and recorded accurately against each sieve number.

4 RESULT AND DICUSSION

4.1 DETAIL DESCRIPTION OF EACH UNIT

For easy description of the lithologies there are six unestablished lithologies in the area:

- Fine grained friable Sandstone facies(Facies A)
- Dark grey Shale facies (Facies B)
- White to pink clay facies (Facies C)
- Fine to coarse grained Sandstone facies (Facies D)
- Conglomeratic Sandstone facies (Facies E)
- Heterolithic Sandstone and clay facies(Facies F)

4.2 FINE GRAINED FRIABLE SANDSTONE (UNIT A)

This unit was found at a station NVS/06/011 (Iyi Ovoo spring at Akpa-Edem). This facies was also encountered at a second NVS/06/007 (Iyi Ezeri Okpuje located at the back of community secondary school, opposite federal livestock farm Okpuje). At station NVS/06/011, the outcrop is 5.3m high. The bottom of the outcrop section consists of 1.5m thick of white friable sandstone. The sandstone is fine to medium grained and are well sorted. Directly on the top of these units is a 0.8m thick light coloured and well laminated siltstone. This unit is directly overlain by a 3m thick parallel bedded and bioturdated, dark grey shale. Generally they strike 122^0SE and 302^0Nw and dip along 206^0Sw with a dip amount at about 2^0 . These outcrop marks the contact between the Ajali Sans stone and the overlying Nsukka Formation. Here the white friable fine-grain grain Sandstone represents the Ajali Sandstone. This friable white sandstone facies of Ajali sandstone also outcrops at some other location within the studied area, such as NVS/06/002 (Iyi. Odoru at Alor-Uno), NVS/06/003 (Iyi-Awuna at Ibagwa-Ani), NVS/06/004 a hill at Ibagwa-Ani and at NVS/06/005 (Iyo-Ovogovo at Okpuje. In these areas, the facies has been intensely weathered into red earth.

4.3 DARK GREY SHALE (UNIT B)

This lithofacies belongs to the Nsukka Formation. It outcrops at station NVS/06/011 at Iyi-Ovoo spring in Akpa- Edem as shown in (Fig. 2). The outcrop is about 5.8m high with the base occurrence of white and parallel laminated siltstone. This is followed b about 3m thick dark grey shale. An acid test on this shale shows that it is carbonaceous. It is indurate, bioturdated and fossiliferous. This unit is overlain by very fine-grained, well sorted and yellow sandstone. Overlying the yellow- sandstone it about 1m lateritic overburden. This is weathered and dark brown in colour. The contact between the siltstone and the overlying grey shale is scoured. They strikes 302^0W and 1220SE dips at 206^0W and the amount of dip 2^0.

4.4 WHITE AND PINK CLAY (UNIT C)

The unit lies conformably on the dark grey shales facies. They are encountered at stations NVS/06/006 (Iyi- Okerekere Amujom-Okpuje), NVS/06/022 (Iyi- Ozugum at Ibagwa-Ani), and at NVS/06/021 (Iyi-Odoba at Ibagwa-Ani) of the area as shown in (Fig. 3). The station at Iyi Odoba springs Ibagwa –Ani shows typical section of this facies, the outcrop is about is about 12.8m thick with a bas occurrence of about 0.6m thick of fine grained well sorted sandstone. Overlying this sandstone unit is white and pink coloured clay which is about 11.1m thick. It is well laminated and is intensely bioturbated. With abundant biogenic boring structures of Ophiomorpha and Skoliths. The weathered samples are purple and grey coloured. The more detailed description of this clay facies. This unit is overlain by a 0.2m thick unit of indurated ironstone band. The top occurrence at this section is a 0.6m thick vesicular latertitic overburden of weathered earth.

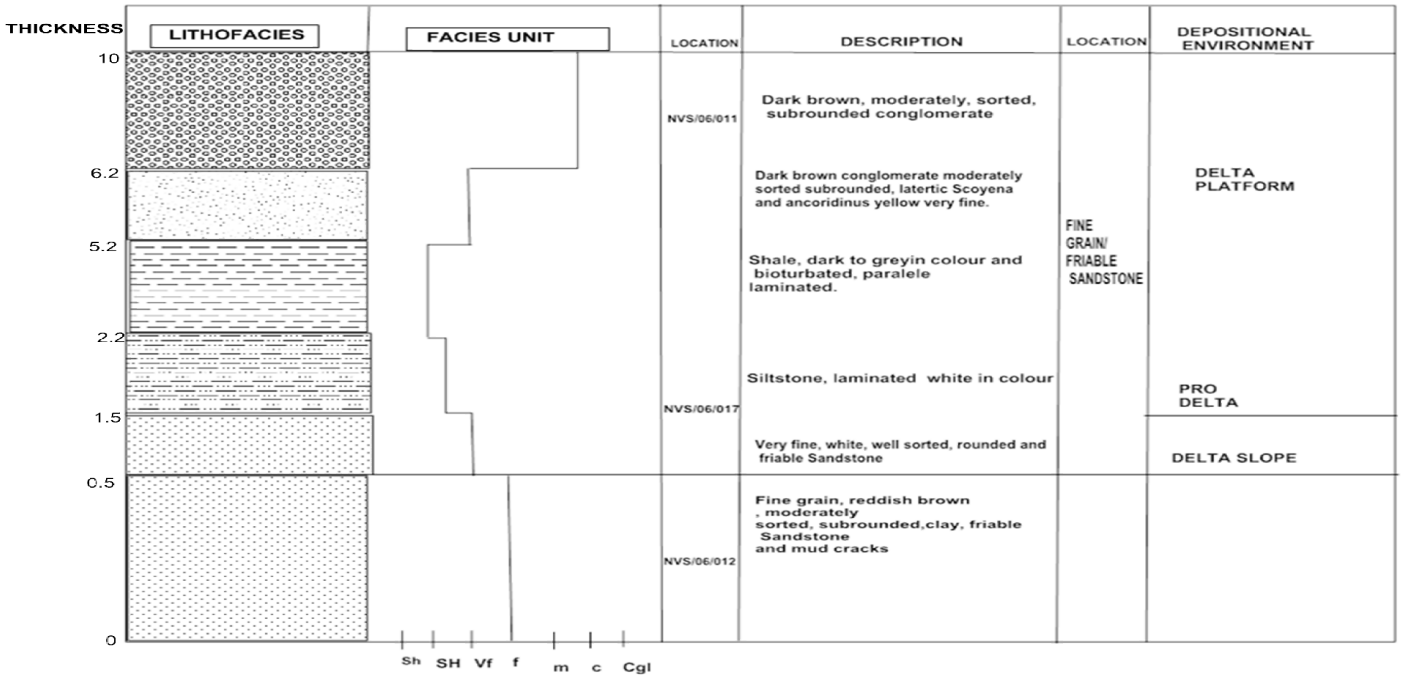

Fig. 2: Lithology and Interpretation of Location NVS/06/011, NVS/06/017 and NVS/06/012. Exposed outcrop

4.5 FINE TO COARSE GRAIN SANDSTONE (UNIT D)

This unit was encountered in Nsukka Formation and it conformably lies on top of the white/pink clay facies. This unit are seen at stations NVS/06/009 (Iyi- Ayata), NVS/06/010 (Mmiri Jesus at Igah-Okpuje), NVS/06/003 (Iyi Awuna at Ibagwa-Ani), as shown in (Fig. 4)NVS/06/020 (Iyi-Okpu at Akpa-Edem), NVS/06/011 (Iyi-Ovoo at Akpa-Edem-Igoro) as shown in (Fig.8), NVS/06/002 (Iyi-Adoro at Alor-Uno) and NVS/06/001 (at Isi Uja). A typical outcrop of these facies is found at location NVS/006/009, NVS/006/010and NVS/006/011 as shown in (Fig.1 and 2). At location NVS/006/010 the outcrop is about 4.5m thick and consists of three lithological units.

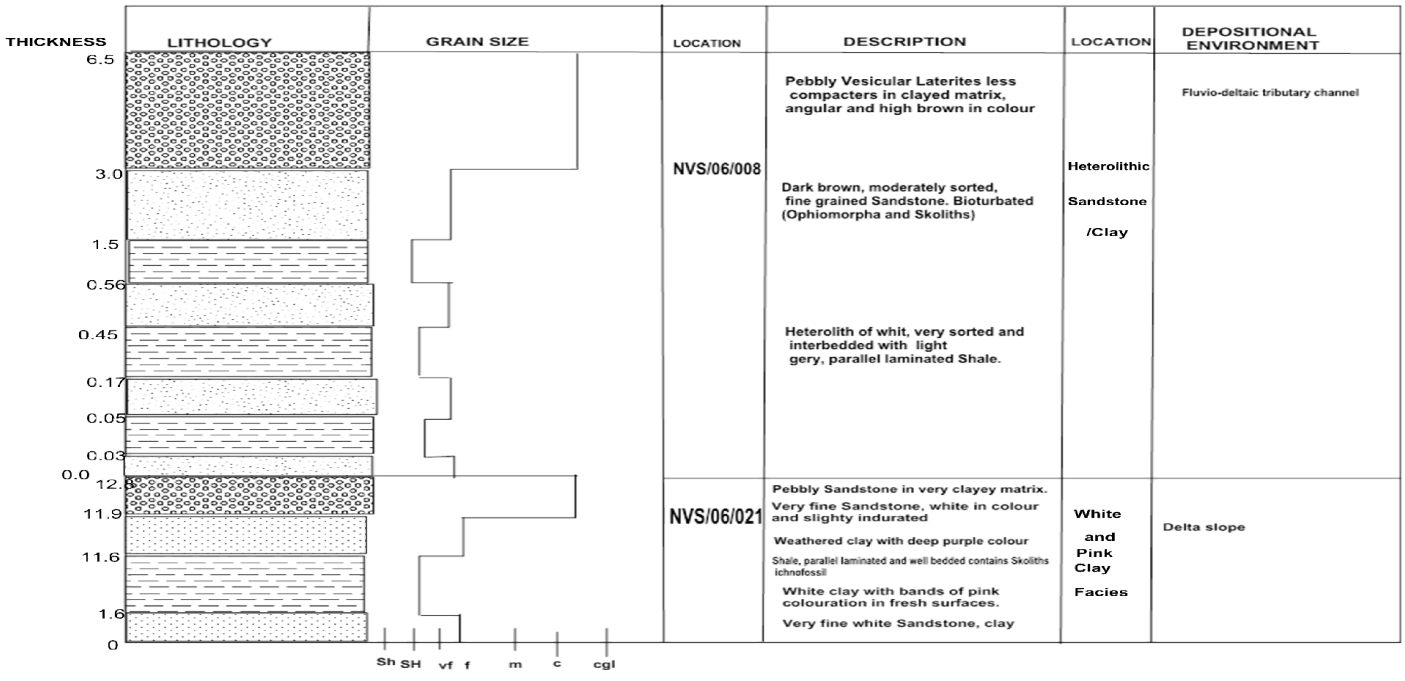

Fig.3: Lithology and Interpretation of Location NVS/06/008 and NVS/06/02. Exposed outcrop

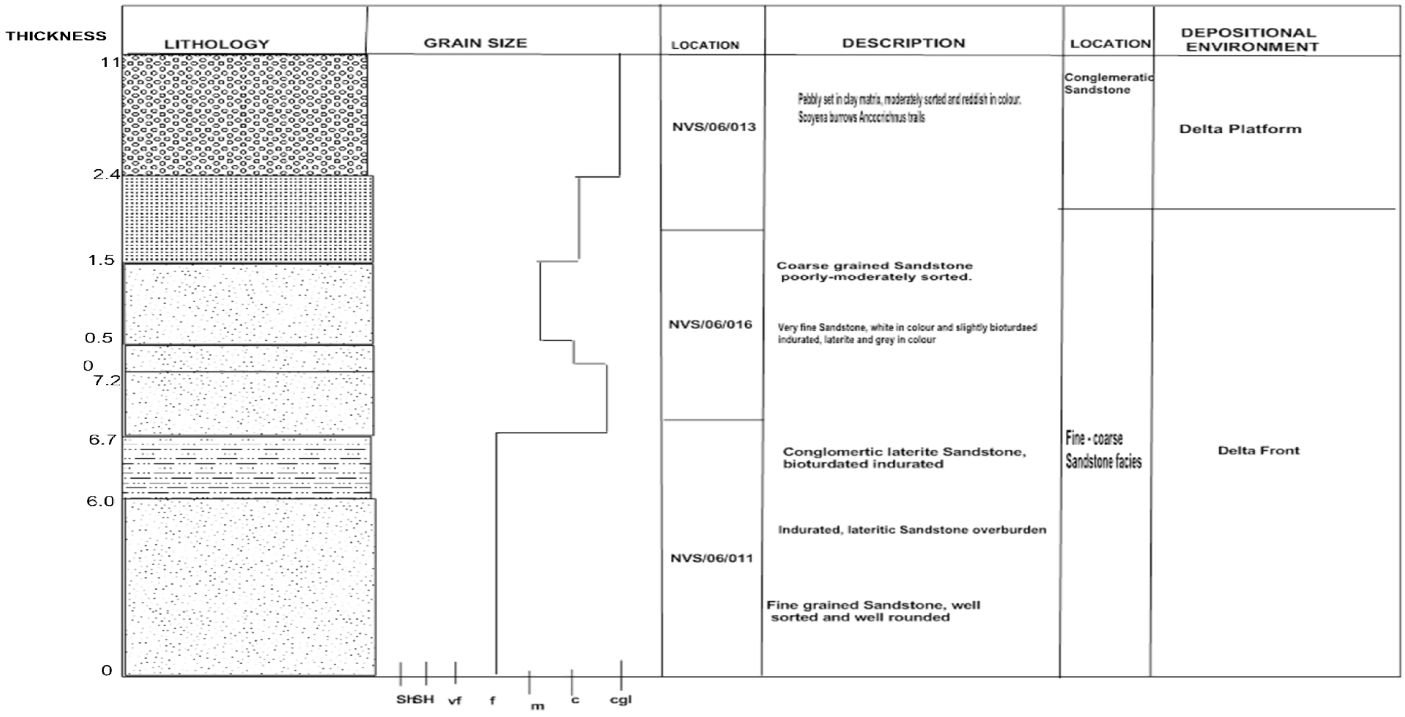

Fig.4: Lithology and Interpretation of Location NVS/06/013, NVS/06/016 and NVS/06/011 exposed outcrop.

Biogenic structure like Ophiomorpha nodosa. This unit serves as the aquifer through which the springs flow. The top-most occurrence of this section consists of an overburden of weathered vesicular lateritic cap. At location NVS/06/003, Iyi Awuna the section is about 7.25m thick a clean and fast rushing spring. This facies consists of a 0.3m thick of indurated sandstone. This unit is overlain by another indurated lateritic sandstone that is light brown to yellow, very fine grained sandstone that is well sorted with a thickness of about 3m thick, fine grained, poorly sorted, angular and very. Fig. The different units of this facies have sharp contact and the beds strikes at 250^0SW and 70^0NE. It dips at an amount of 2^0.

4.6 CONGLOMERATIC SANDSTONE (UNIT E)

The unit was studied at the following stations NVS/06/012(Iyi-Ohe at Odoru Nsukka located opposite St. Cyprain Special Science School), NVS/06/013 (Iyi-Adoka at Ezi-Ani Nsikka), NVS/06/014 (Iyi-Nwankwu at Ezi-Ani), NVS/06/016(Iyi-Isiejuonma at Umuamuna Nrobo Nsukka), NVS/06/015 as shown in Fig.7. At Ajanogbo hill in Umudieto Nrobo Nsukka) and NVS/06//017 (Iyi-Oheghie at Ozi-Edem). This unit lies conformably on top of the fine coarse sandstone facies. A good exposure of this was encountered at location NVS/06/014 and NVS/06/016 of the study area Fig.5. The facies consists of about 6.9m of pebbly, sharp sandstone in clay matrix. Immediately on top is 0.9m thick, laminated and dark grey shale. Overlying the shale is about 1m thick kaolimitic clay, with well preserved plant impression and bioturdated structures. The clay is locally dugged by tournelling at Ajanogbo hll in Umundieto Nrobo Nsukka location NVS/06/015 and the bedding plane of the sandy shale clay units is asymmetrically rippled. Overlying the clay bed is vesicular latertitc overburden of about 5m thick. At station NVS/06/014 this unit grades into conglomertic sandstone of about 1.2m thick.

The sandstone is moderately sorted, indurate and coarse grained at Iyi Adoka in Ezi-Ani, the sedimentary structures of this facies are well observed. The bioturbation from Scoyena and Ancorichnus ichnofossils are present. Also found are shallow trails of fossils. The Scoyena ichnofossils has a depth and diameters ranges of 1-3cm and 1-2cm respectively with bed thickness of about 7m. At other stations, this unit has been laterized into a vesicular laterite that caped the Nsukka Formation. The beds of this facies have a sharp contact.

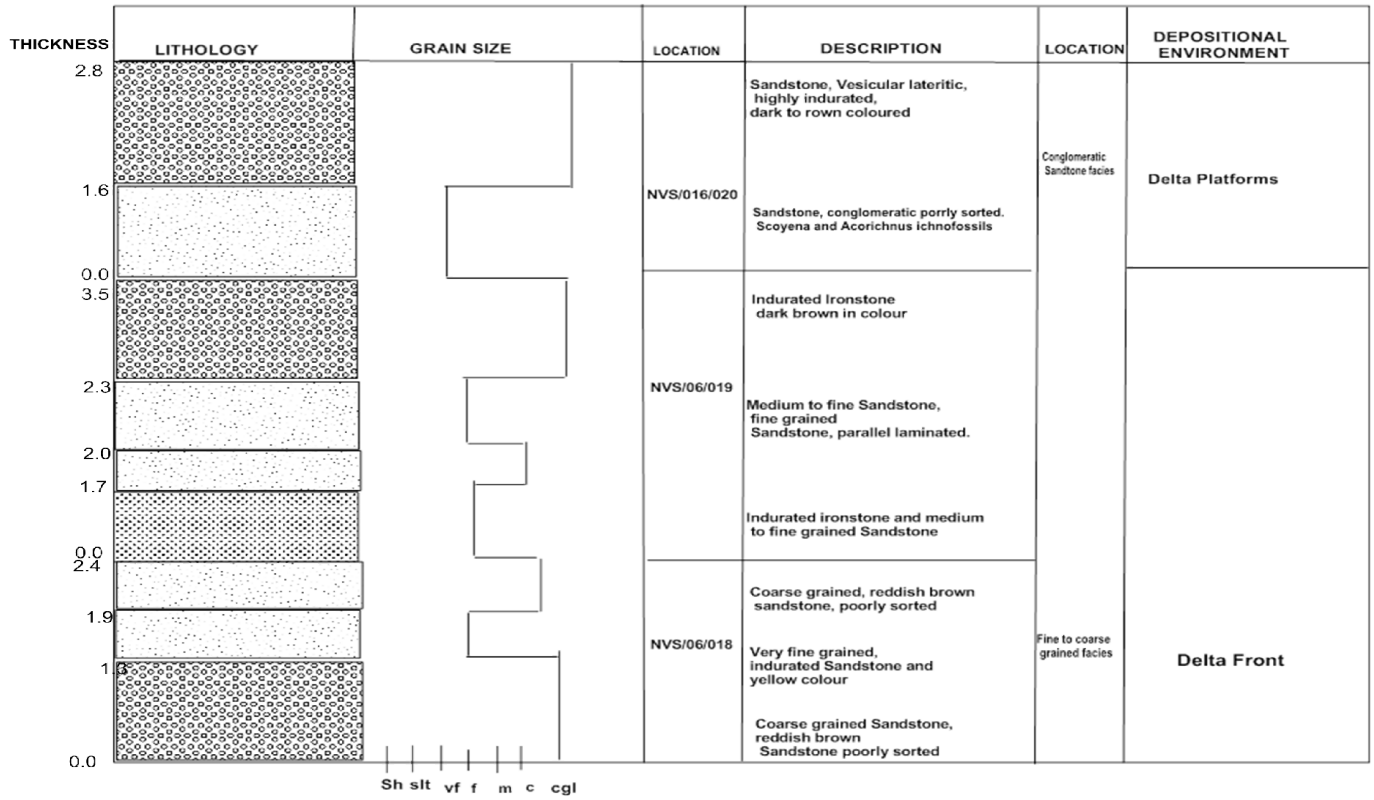

Fig.5: Lithology and Interpretation of Location NVS/06/020, NVS/06/019 and NVS/06/018, exposed outcrop.

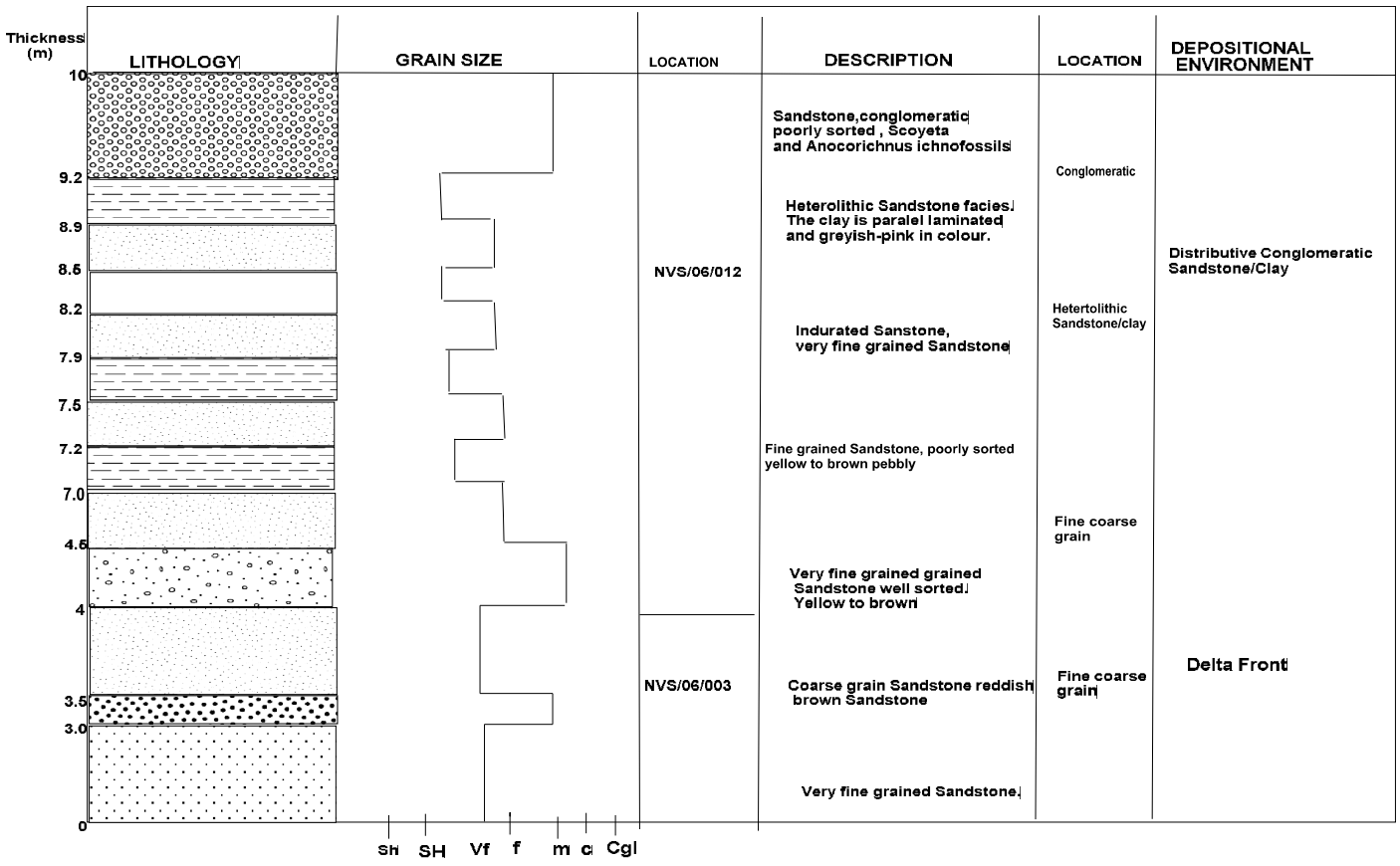

Fig.6: Lithology and Interpretation of Location NVS/06/012 and NVS/06/003, exposed outcrop.

At location NVS/06/012 Iyi-Ohe in Odoru Nsukka-Opoist Cyprain Special School, as shown in (Fig.5) there is stagnant dirty water surrounded by Agbani Odoru, Eburu Mmiri and Barrack town in Nsukka. The lithofacies are the same, the area of this water body measure about 40,000m. The bed strike at 2120SW and 320NE and dips at 296^0NW an amount of about 8^0.

4.7 Heterolithic Sandstone And Clay (Unit F)

This unit lies conformably on the conglomeratic sandstone facies and is the topmost of Nsukka Formation in the studied area Fig. This unit was observed at stations NVS/06/012 (Iyi-Ohe Odoru. Nsukka opposite St, Cyprain Special Science), as shown in (Fig.5).NVS/06/008 (Iyikalyi at Uwani-Akwu Okpuje) and NVS/06/009 (Iyi-Ayata by DIFRRI at Okpuje-Ani). At locations NVS/06/008 and NVS/06/009 dark grey coloured clay was found interbedded with medium grained that is white coloured. Their respective thickness is 0.2m and 0.8m respectively. The clay/shale is thickly laminated with two laminae of 0.01m of very fine-grained white sandstone. They are parallel laminated with an asymmetrically shaped lamine plane. At location NVS/06/012, as shown in (Fig.6) the facies grades into rapid succession of a heterolithic facies being made up of a succession of siltstone and clay. The siltstone group is about 0.3m thick while the clay is about 0.4m.

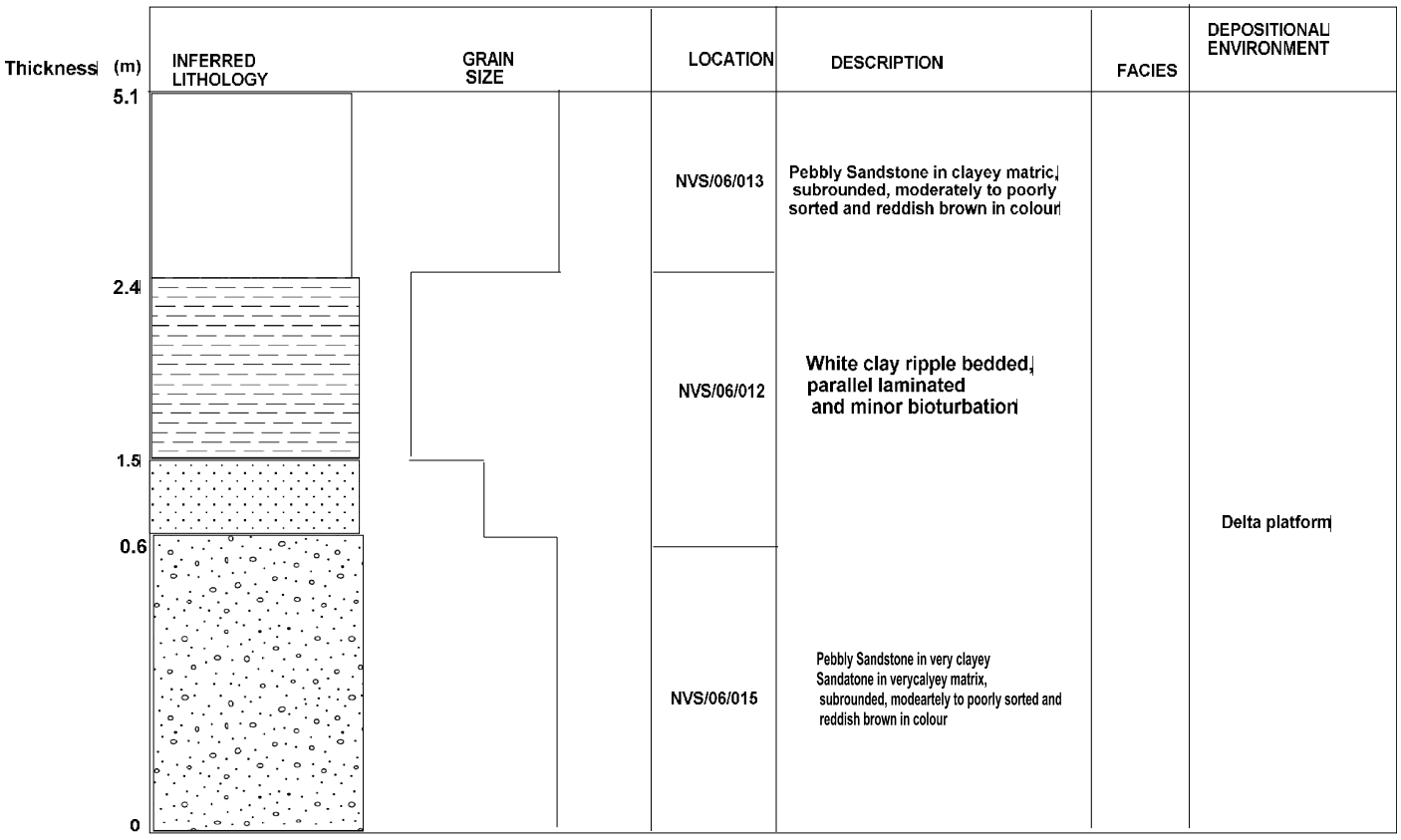

Fig.7: Lithology and Interpretation of Location NVS/06/013, NVS/06/012 and NVS/06/015, exposed outcrop.

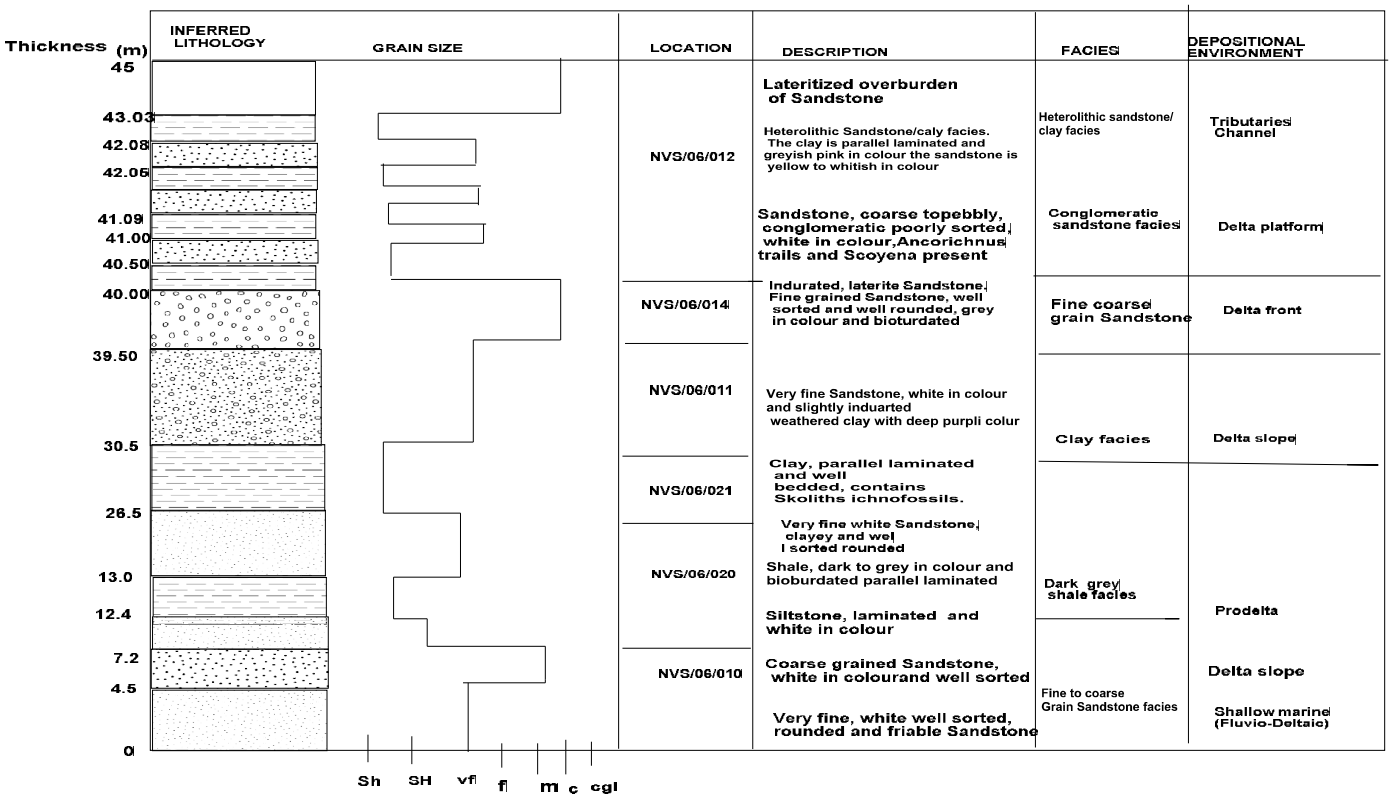

Fig.8. Generalized Lithosection for the Six Unit Encountered In the Two Formation in the Study Area Showing their Depositional Environment

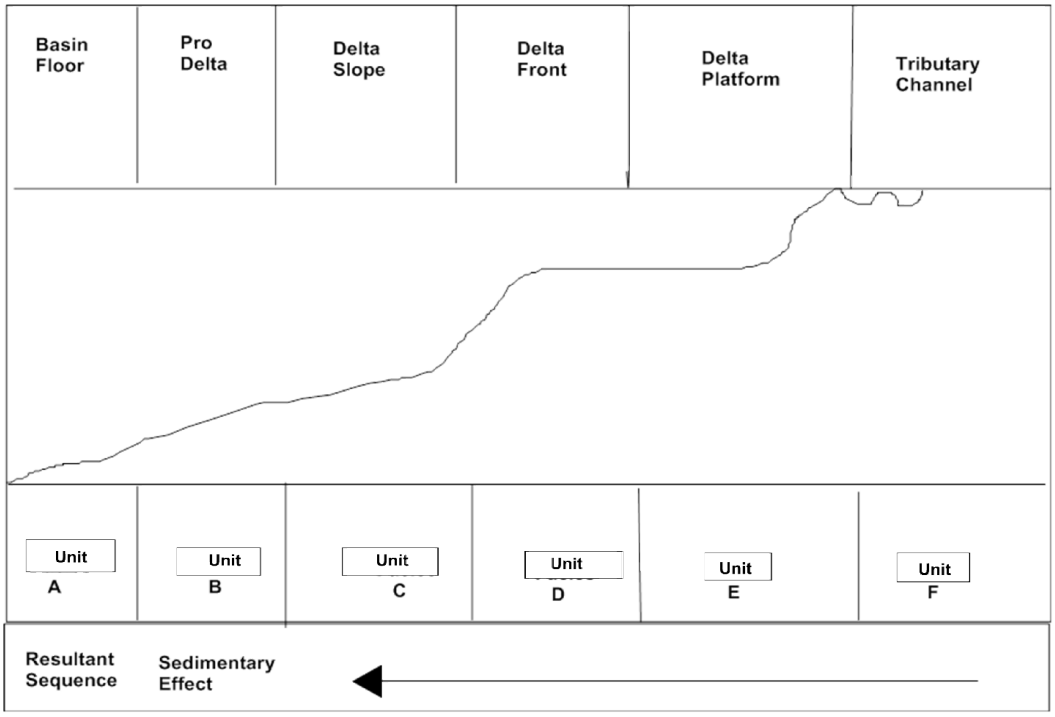

Fig. 9. Showing Relationship between Facies and Environment of Ajali and Nsukka Formation.

5 CONCLUSION

The study area which has six lithofacies was recognized as shown in (Fig.8). This includes fine-grained friable sandstone (A), dark grey shale unit (B) white and pink clay unit (C), fine to coarse grained sandstone unit (E) and the heterolithic sandstone unit (F). Two formations were encountered in the area studied: Ajali Sandstone and the Nsukka Formation. The fine-grained friable sandstone unit belong to Ajali Sandstone unit belong to Ajali Sandstone while the rest five other unit belongs to Nsukka Formation. From each of the units analysis result indicates that the top of Ajali Formation encountered were fluvio-deltaic in origin, while the Nsukka Formation was deposited in fluvio- deltaic environment but essentially pro-deltaic tributary channel. The result from the sieve analysis extrapolates that Nsukka Formation was deposited in parallic environment in a predominantly euxinic condition which accounts for the red earth colouration of the lithologies. In addition, indication by the presence of Scoyena and Skoliths. Ichnofossils. From the trace fossil analysis shows a deltaic environment ranging from delta platform to delta slope realm respectively.

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Motivational Factors, Trust and Knowledge Sharing in Organizations

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ABSTRACT: By sharing knowledge, organizations are able to enhance their efficacy, decrease cost of training and moderate risks due to lack of certainty. In the age of knowledge, find a way to motivate employee for sharing knowledge with others is the most difficult issue in term of managing knowledge. Therefore, factors influencing knowledge sharing are particularly vital. This paper was conducted to encompass understanding of the trust and motivational factors that influence knowledge sharing behavior in organizations. It is important that no known study examined the influence of motivational factors onto knowledge sharing behavior through trust as a moderator. In this research we proposed a theoretical framework that combined motivational factors with Theory of Reason Action (TRA) to describe the relations among two types of motivation (extrinsic and intrinsic), trust and worker's intentions and attitudes toward knowledge sharing.

KEYWORDS: Trust, Knowledge Sharing, TRA, Intrinsic Motivation, Extrinsic Motivation, Organization.

1 INTRODUCTION

Sharing knowledge is transmission of knowledge (implicit or tacit) from an organization, group, or person to another one. By knowledge sharing organization are able to enhance their efficacy, decrease cost of training and moderate risks due to lack of certainty. For instance, organization can reduce their budget, by sending a number of people to workshops or any others seminars and conferences and then they will share their knowledge with their coworkers. Knowledge sharing, for an organization, does not merely mean to exchange information between the high level managers and their employees. In fact knowledge is shared to guarantee that the effectiveness can be enhanced and the business can take advantages of the shared knowledge. Knowledge and information are needed to be shared so that organizations can be supported and improved to achieve advancement, be modernized and decrease the unneeded endeavors for acquiring knowledge (Calantone, Cavusgil, & Zhao, 2002).

If the organizations can organize the knowledge sharing properly, the performance will be better with higher quality and better decisions will be made. Also problem solving skills and effectiveness will improve. Therefore, the organization can take advantages (Zawawi & Zakaria, 2011). Any organization essentially needs to motivate its employee to exchange information and share knowledge to make knowledge sharing a good habit and a style in that workplace. When employees believe that the information they give to their colleagues are advantageous for their organization, they are encouraged to practice it more and more and share information. According to Wasko & Faraj (2005), the staff whose knowledge was shared by them agreed that through exchanging their information, coworkers can take advantages. In the age of knowledge, finding a way to encourage to sharing knowledge with others is the most difficult issue in term of managing knowledge. Hence, it is crucial to find out which factors influence sharing knowledge between coworkers (Hung & Chuang, 2009).

Since a majority of the existing empirical and theoretical research in this area point to trust as an influencing factor for knowledge sharing behavior, trust was included as a central factor to this study. The most important role of trust between members is its ability to support or facilitate knowledge sharing. Past research has shown trust to have this effect through an increase in willingness to share information and ideas with others (Hinds & Pfeffer, 2003).

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1.1 PURPOSE OF THE RESEARCH

To understand the relations among motivation, trust, and knowledge sharing behavior, following question guide this research: What are the significant correlations between motivational factors, trust and knowledge sharing behavior?

The paper was conducted with the following objectives:

1) To extend the understanding of the trust and motivational factors that impress knowledge sharing behavior.
2) To investigate the direct influence of motivational factors on knowledge sharing behavior and trust.
3) To propose a conceptual framework includes motivational factors influence knowledge sharing behavior through trust as a moderator.

2 LITERATURE REVIEW

2.1 MOTIVATION TO SHARING KNOWLEDGE

The bases of the majority of previous research are theories investigating the elements that have impacts on knowledge sharing. Based on Ajzen & Fishbein, (1980) every person's idea and valuation can influence their thoughts and manner, Whereas, normative ideas and incentives can have influences on personal standards. As Bock et al., (2005) stated, according to TRA, there are some attitudes and personal norms related to sharing knowledge and the environment of organization that have influence on every person's purpose of sharing their knowledge.

In fact, one of the most important aspects that identify general behavior, work-related behavior and information technology acceptance behavior, can be considered as motivation while some evidence shows that it is the major cause of transferring knowledge (Lin, 2007; Olatokun & Nwafor, 2012). Several research in different scopes explored and identified a couple of categories of motivation.

including intrinsic and extrinsic motivation (Gagné & Deci, 2005; Lin, 2007). Extrinsic motivation puts emphasize on the reasons such as advantages or prizes received to achieve the goal (Deci, Koestner, & Ryan, 1999), but intrinsic motivation reveals the joy and innate happiness or fulfillment resulted from a certain performance (H. F. Lin, 2007). Both types of motivation, together, have effects on a person's purpose of certain performance and real manners and actions (Ryan & Deci, 2000).

Hun & Chuang (2009) stated that intrinsic motivation is considered as involvement in a behavior or action to enjoy it, or because it is interesting and pleasant (Deci, Nezlek, & Sheinman, 1981). As an instance, sharing knowledge and exchanging information can improve members' knowledge self-efficiacy. It also can make them more sure about their capabilities of offering helpful knowledge to others (H. F. Lin, 2007). Also, those who exchange their information with other members of the team can assist other people. The studies conducted on alturism in past, proved that peole like to help other people (Baumeister, 1982). In some studies it was discovered that, intrinsic motivation the most importnt effect on a person's behavior in different behavioral fields (Gillet, Vallerand, Amoura, & Baldes, 2010), such as sharing their knowledge (Osterloh & Frey, 2000). In the present research, therefore, "*enjoyment in helping others"* and "*knowledge self-efficacy"* are presented as the intrinsic most significant ideas which can justify the action of sharing of knowledge.

Employees' behavior of knowledge sharing resulted from their extinctive motivation can be considered as the impact of the members' understanding related to the importance of the relationship with exchanging the knowledge (Lin, 2007; Kankanhalli et al., 2005; Osterloh & Frey, 2000). As an instance, considering the cost-benefit analysis, researchers involve in exchanging the knowledge. In the point of view of a socio-economist, if the amount of the benefits which is gained is same as or more than the amount of costs, the procedure to exchange the knowledge will be carried on or else it will end (Lin, 2007; Olatokun & Nwafor, 2012). In the scope where the knowledge is shared, the costs consist of elements that are associated with the attempts such as mental endeavors, the time spent and so on. Whereas the possible benefits consist of obtaining the prizes determined by the organizations or forcing co-workers to respond (Ko, Kirsch, & King, 2005). Hence the present research employs *"reciprocal benefits"*; "*expected organizational rewards";* and *"Reputation building"* as extrinsic most important determinants of action of sharing the knowledge by Employees.

In this study, both types of motivators that have influence on the sharing of knowledge by members are explored at the same time. Then, a theoretical model is suggested which mixes TRA and a motivational perception so as to depict the association of the two above mentioned types of motivation, trust and sharing the knowledge by employees as well as sharing approaches and purposes.

2.2 TRUST AND KNOWLEDGE SHARING

According to Schoorman et al., (2007) and Mayer et al., (1995), having strong negative influence on a number of highly important constructions and models that are created considering the interior atmosphere of trust such as person-to-person/leader/organization or team to-team, apparently, there are three wide-ranging groups of antecedents that are defined as: integrity, benevolence and ability. The biggest amount of antecedents that have been suggested as the fundamental issue in a vast number of literatures is related to one of the three categories named before (**Erreur ! Source du renvoi introuvable.**). Furthermore, through a new meta-analysis, ten models of trust were checked. The models are considered as those which had an influence on monitoring and checking trust (Ebert, 2007). As a result, the above mentioned antecedent groups that Meyer et al. (1995) suggested the first time, are utilized as a primary organizing system that make the explanation about antecedents easier (Mayer et al., 1995).

Table 1: Factors Influencing Trust

Authors	Focus	Integrity	Ability	Benevolence	Propensity	Additional
Butler, (1991)	Managerial Trust	fulfillment consistency, fairness, discreetness, integrity, promise,	Competence	Loyalty, availability, receptivity, openness,	No	No
Sitkin & Roth, (1993)	Trust in organization	Value Congruence	Ability	No	No	No
Mishra, (1996)	Trust in Organization Trust in leadership	Reliability, Openness	Competence	Openness, Caring	No	No
Whitener et al. (1998)	Managerial trustworthy behavior	Behavioral integrity, Behavioral consistency, Perceived similarity	Sharing and delegation of control, perceived competence, Communication,	Demonstration of concern	Propensity to trust	Task interdependence
Williams, (2001)	General trust/ groups	Integrity, affect	Ability, affect	Benevolence, affect	Motivation to trust	Organizational context (competition), in-group/out-groupmembership
Dirks & Ferrin, (2002)	Trust in leadership	No	Perceived organizational support , Unmet expectations	participative decision making, Interactional justice, transactional leadership, transformational leadership perceived justice, distributive justice, perceived organizational support, unmet expectations,	Propensity to trust	Length of relationship, indirect/direct leadership

In 1996, Mishra gives another definition referring four aspects or subcategories of trust including "reliability, concern, openness and competence". According to American Psychological Association (APA) "Concern" refers to an emotion of empathy and understanding other people or other things. They also considered the word "benevolence" as "an inclination to do kind or charitable acts". As well, in the same source, "Integrity" as well as "reliability" refer to "honesty and truthfulness" so both terms have the same meaning. Furthermore, "Ability" denotes to "competence" in occupation or an activity because of "one's skill, training, or other qualification" (APA). As a result, it might be suggested that "ability, integrity and benevolence" are reflected by the three other words "competence, reliability and concern". So, one more aspect of trust "openness" is remained which was explained by Mishra. According to Mayer et al., (1995), claimed that "openness" defined by Mishra should be estimated by some question related to the general openness of trustees towards other people and openness with trustor. So it partly covers benevolence and integrity aspects. So it is possible to associate it with, "respectively, integrity or benevolence". The overlap (mapping) of two meaning of trust is indicated in **Erreur ! Source du renvoi introuvable.**. Both Bakker et al., (2006) and Usoro et al., (2007) believed that dissimilar categorization of dimensions of trust are widely similar, in spite of the fact that a number of writers various trust dimensions have dissimilar names. Mishra's definition in the current paragraph can be an instance. Moreover, it can be said that Mayer et al.'s explanation is majorly cited and utilized for in non-dyadic research like the societies in which the research is conducted. For example, lately, in their research on sharing the knowledge in projects of product improvement, Bakker et al., (2006) utilized Mayer et al.'s explanation. According to what was explained in this section, and the attention to thriftiness, conceptualization presented by Mayer is preferred to be selected because it is related to the three features of a different party that might have trust (Usoro et al., 2007).

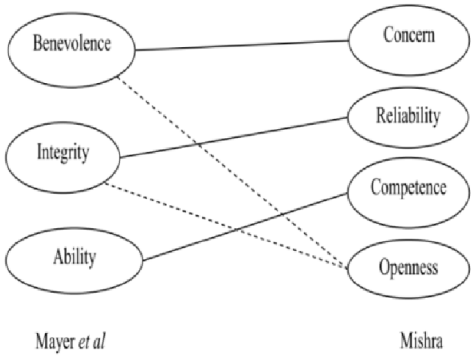

Figure 1: Components of Trust; Mishra, (1996)

3 CONCEPTUAL FRAMEWORK

This section presents the conceptual framework for examining the effect of trust and motivational factors on knowledge sharing behavior at the next our study. The conceptual framework is based on research studies explored various relationships between motivation, trust and knowledge sharing behavior in the organization. Since both of the motivational factors and trust have been found in the literature to have direct effect on knowledge sharing behavior, in addition to depicting these direct relationships, the conceptual framework also considers the indirect or mediating effect through trust onto knowledge sharing behavior. Each of the concepts explored in this study, and possible relationships between them are depicted in the conceptual framework (**Erreur ! Source du renvoi introuvable.**).

3.1 THEORY REASONED ACTION (TRA)

Theory Reasoned Action (TRA) as a well-known generic theory postulates that societal behavior is affected by belief, attitude, and intention. The theoretical model in this research follows the TRA (belief, attitude, intention relationship) and covers intrinsic and extrinsic motivational factors as the most important elements of member's intention to knowledge sharing. In TRA, the determinants of attitude have been examined and demonstrated to be considerable prophesier of behavioral intentions. For instance, Chang (1998) discussed that behavioral intention was significantly influenced by attitude toward behavior. In addition, Ryu et al., (2003) claimed that physicians' knowledge sharing attitudes, in individual skillful groups, have affected intentions toward knowledge sharing. Newly, Bock et al. (2005) have explored that attitude to knowledge sharing has positive impact on individuals' intentions toward share knowledge. According to TRA and the above contention on researchers' attitudes to sharing knowledge and behavioral intentions, the below hypothesis was formulated:

H7: Employees' knowledge sharing attitudes positively impact on intentions toward knowledge sharing.

3.1.1 INTRINSIC MOTIVATIONS VARIABLES

SELF-EFFICACY

From an intrinsic intensives aspect, behavior is extracted by employees' need to sense competency and autonomy (self-determination) in facing with their environment (Deci et al., 1999). Competency or self-efficacy is defined as the opinions of persons with regard to their abilities to organize and perform essential action's courses to reach particular levels of efficiency (Bandura, 1994). Competency or self-efficacy is able to assistance encourage workers to share knowledge with coworkers (A Kankanhalli et al., 2005a; M. Wasko & Faraj, 2005; Bock & Kim, 2002). Scholars have also discovered that those workers who have more confidence in their capability to prepare precious knowledge are more probable to do special tasks (Constant et al., 1994; Bock & Kim, 2002).

People's belief about their knowledge to be useful for solving issues related to a job and work efficacy improvement is called knowledge self-efficacy (Constant et al., 1996; Luthans & Youssef, 2004). Employees who believe that sharing their knowledge to others in an organization can enhance performance of the organization, show more positive attitude about knowledge sharing and consequently intend to share their knowledge more. Based on the above, we propose the following hypothesis:

H2a: Knowledge self-efficacy has a positive influence on employees' attitude about knowledge sharing.

H2b: Knowledge self-efficacy has a positive influence on employees' knowledge sharing intentions.

ENJOYMENT IN HELPING OTHERS (ALTRUISM)

This term came from the altruism concept which is defined as taking part in optional activities which help others to handle their organizational relevant issues or tasks (Organ, 1988). The desire of helping others motivates the knowledge workers (Constant et al., 1994; Lin, 2007b). Earlier researches claim that due to the challenges of solving problems and engaging in intellectual quest which are pleasurable, in addition to the desire of helping others, employees are basically interested in sharing their knowledge (M. Wasko & Faraj, 2005). Those who contribute to knowledge get satisfaction from helping others may be more happily engaged in knowledge sharing. Hence, bellow hypotheses are proposed:

H3a: Enjoyment in helping others has a direct positive influence on employees' knowledge sharing attitude.

H3b: Enjoyment in helping others has a direct positive influence on employees' knowledge sharing intention.

EXTRINSIC MOTIVATIONS VARIABLES

Knowledge sharing motivations rooted in personal gain which is derived from neoclassical economic theories and evolutionary biology that put emphasis on the impact of self-interest to economic advantages and survival (for example agency theory), biological and genetic (Dawkins, 2006). In this research, theories that define all human activities to be motivated only by self-interest is distinguished from those that suggest the probability of self-interested knowledge sharing (Witherspoon & Bergner, 2013). Previous theories propose hypotheses about human motivation which are testable. In this research the focus is on identification of three constructs from knowledge sharing literature that are related to rewards.

EXPECTED ORGANIZATIONAL REWARDS

An extrinsic motivational perspective suggests that benefits and perceived values of an action lead individuals' behavior. Mutual benefits or organizational rewards can promote behaviors which are the primary aim of extrinsically motivated behaviors (Gagné & Deci, 2005; Kowal & Fortier, 1999). In order to motivate people to perform requested behaviors, organizational rewards can play an important role (H. F. Lin, 2007). These rewards can vary in type ranging from non-monetary rewards including job security and promotions to monetary awards such as bonuses or salary improvements (Hargadon, 1998). In order to encourage knowledge sharing among employees, several organizations introduced systems of rewards. For instance, recognizing 100 top knowledge contributors a conference annually, Buckman Laboratories announce them at a resort. In addition a division of IBM which is Lotus Development sets a quarter of its evaluation of customer's support workers' performance on the degree of their knowledge sharing actions (Chiu, Hsu, & Wang, 2006). Hence, here, the

expectation is if employees believe that organizational rewards will be given to them, they will create positive intention and attitude toward knowledge sharing and they will offer their knowledge. Based on this, bellow hypotheses are proposed.

H4a: Employees' attitude toward knowledge sharing is affected positively by expected organizational rewards.

H4b: Employees' knowledge sharing intentions is affected positively by expected organizational rewards.

RECIPROCAL BENEFITS

One of benefits of persons' engagements in social exchange is reciprocal behaviors (Blau, 1964). It can provide a feeling of mutual indebtedness which leads contributors of knowledge to look forward for others' help which supports ongoing knowledge sharing (M. M. Wasko, Teigland, & Faraj, 2009) (Wasko et al. 2009; M. M.Wasko, et al., 2009). It is indicated by previous researches that strong sense of reciprocity facilitates knowledge sharing in online communities (M. Wasko & Faraj, 2005). In addition, it was observed that long term Reciprocity cooperation can be achieved by successful motivation of knowledge sharing which is provided by mutual benefits (A Kankanhalli et al., 2005; G.-W. Bock et al., 2005). So, to increase knowledge sharing intentions, employees need to believe that they can gain mutual benefits by sharing their knowledge with other members. Hence, bellow hypotheses are proposed.

H5a: Employees' attitude toward knowledge sharing is positively affected by reciprocal benefits.

H5b: Employees' knowledge sharing intention is positively affected by reciprocal benefits.

REPUTATION BUILDING

Today, while the old kind of contracts between employees and organizations which are based on length of service erode, the impact of reputation in most of organizations is increasing (Davenport et al. 1998; Ba et al. 2001). In these kinds of working settings, showing to own valuable expertise, knowledge contributors can gain benefits of their knowledge sharing (Ba et al. 2001) through achieving a better image (Constant et al. 1996) and earning respect from other people (Constant et al. 1994). Hence, through a better self-concept, knowledge contributors can gain advantages when they share their knowledge (Kollock 1999; Hall 2001). Based on their desire to be considered as experts by their peers, employees found to share their best practice (O'Dell and Grayson 1998). In the workplace, those individual who provided high quality technical knowledge are enjoying better prestige (Kollock 1999).

H6a: Employees' attitudes toward knowledge sharing are positively influenced by reputation building.

H6b: Employees' knowledge sharing intentions is positively affected by reputation building.

3.2 TRUST AND MOTIVATION

According to study done by Osterloh & Frey (2000) and others (e.g., Kohn, 1993; Rempel et al., 1985) trust follows motivation and they indicate that trust is created by intrinsic motivation for sharing knowledge. Thus, while trust and motivation are not basically dependent, each may well moderate the other. In our view, higher levels of intrinsic motivation allow and tolerate the chance for trust. Therefore, individuals who are intrinsically motivated to have knowledge sharing with coworkers are likely to be behaving in a clear and "trustworthy" way. Glaeser et al., (1999) examined the connection between trust and measures of altruism *(enjoyment in helping others)*. They showed that this connection is real and that altruism might be one factor that encourages people to be trusting through a variety of settings. Prior researches has shown that there is a correlation between trust and self-efficacy (e.g., Pavlou & Fygenson, 2006; Cheung & Chan, 2000). In the other studies researchers also pointed out that self-efficacy is correlated with trust in sharing knowledge (Wu et al., 2012; Hsu et al., 2007). Therefore, we propose the following hypothesis:

H2c: Knowledge Self Efficacy will be positively correlated to Trust.

H3c: Enjoyment in Helping Others will be positively correlated to Trust.

Research has shown that reward has a strong influence on interactive behavior such as trust (Johnson & Johnson, 1989; Käser & Miles, 2002). Ferrin & Dirks (2003) recommended that trust is strongly influenced by reward structures, and also founded that the effect of reward system on trust is biased by employee's anticipations about their colleague's trustworthiness. So;

H4c: Expected Organizational Rewards will be positively related to Trust.

Prior studies investigated that trust and reciprocal behavior can reinforce each other (Bharadwaj & Al-Shamri, 2009; Kim & Phalak, 2012). Lin et al., (2010) recommend that reciprocal benefits significantly related with building trust which enables knowledge sharing behavior (Papadopoulos, Stamati, & Nopparuch, 2012). Thus;

H5c: Reciprocal Benefits will be positively related to Trust.

Kim & Phalak (2012) pointed out that trust represents the subjective degree of someone's belief toward a specified other person, reputation is an objective viewpoints of the specified person's experience. In several empirical researches the relation between reputation and trust is well established (Yang & Chen, 2008). Huhns & Buell (2002) claimed that individuals are more interested to trust something proved and cooperate with somebody with a good reputation. So, employees are more likely to trust a person with a good reputation. Based on above discussion:

H6c: Reputation building will be positively related to Trust.

From the reviewing of literature, as a finding, the relations between the dependent and independent variables were hypothesized. **Erreur ! Source du renvoi introuvable.** shows the questions of this research and associated hypotheses.

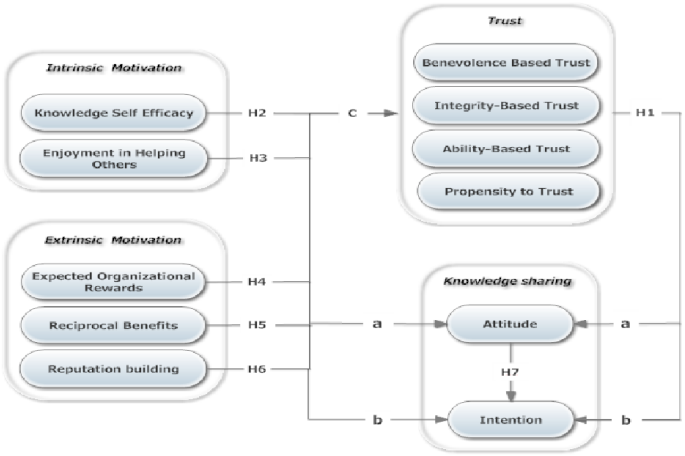

Figure 2: Research Model

Table 2: Research Questions and Associated Hypotheses

R. Questions	Associated Hypotheses
RQ1: What are the significant relationships between trust and Knowledge Sharing Behavior?	H1a: Trust will be positively associated to Attitudes on Knowledge Sharing. H1b: Trust will be positively associated to Knowledge Sharing Intentions.
RQ2: What are the significant relationships between motivational factors and Knowledge Sharing Behaviour?	H2a: Knowledge Self-Efficacy will be positively related to Knowledge Sharing Attitude. H2b: Knowledge Self-Efficacy will be positively related to Knowledge Sharing Intentions. H3a: Enjoyment in Helping Others will be positively related to Attitudes of Knowledge Sharing. H3b: Enjoyment in Helping Others will be positively associated to Knowledge Sharing Intentions H4a: Expected Organizational Rewards will be positively related to Attitudes of Knowledge Sharing. H4b: Expected Organizational Rewards will be positively related to Knowledge Sharing Intentions. H5a: Reciprocal Benefits will be positively associated to Attitudes of Knowledge Sharing. H5b: Reciprocal Benefits will be positively associated to Knowledge Sharing Intentions. H6a: Reputation building will be positively associated to Attitudes of Knowledge Sharing. H6b: Reputation building will be positively associated to Knowledge Sharing Intentions.
RQ3: What are the significant relationships between motivational factors and trust?	H2c: Knowledge Self Efficacy will be positively related to Trust H3c: Enjoyment in Helping Others will be positively related to Trust H4c: Expected Organizational Rewards will be positively related to Trust H5c: Reciprocal Benefits will be positively related to Trust H6c: Reputation building will be positively related to Trust

4 RESEARCH MEYHODOLOGY

Methodological paradigm and research methods are vital as they can lead the study and impact on quality of study outcome (Creswell, 2009). As a positivistic paradigm adopted in this research, consideration is given towards: i) quantification in data collection and analysis and ii) testing the relationships between theory and research (theory testing) (Bryman & Bell, 2007). A survey research method is approved for this study, since this method helps to prepare standardized information to define variables and relation between them (Malhotra & Galletta, 2004). Therefore, a survey study is proper to assist this research gather data from the participants, to test the relationships between Motivation, Trust, and knowledge sharing behavior. In reported by (Yin, 2003), a survey research method is the proper technique while it consist studies that endeavor to respond who and what kinds of questions.

4.1 PROCESS OF THE RESEARCH

From a general view of positivism, research is specified as a logical and systematic seeking for relevant data on a specific subject. According to (Kothari, 2004), it contains the proceeding of determining the problem of the study, formulating hypotheses; data gathering, organising and analysing data; deduction makings and achieving results; and lastly analysis the results to define as they provide the hypotheses. Figure3 represents the overall process of the research fulfilled in this study.

Figure 3: Research Process

As reported by Uma Sekaran (2003), through research design improvement, attentions have been given on the following six fundamental concept of research design; aim of the study, investigation types, interference of the researcher, analysis unit and time perspective. Then, this study implements a cross-sectional research that applies Web survey method to gather data from IT Organizations' members in Malaysia. Then, the hypotheses, model and questions for this study are accredited, evaluated and replied, due to individual's data source.

The research instrument in this study is expanded adopting measurement scales recognized from former works. Alterations are made to the carefully chosen elements to assure it fits into this study. Validity and reliability of the research instruments are accessed handling data come from a pilot study. The main data collection starts after fulfillment of the research instrument of this research is reached (regarding validity and reliability). Further, the sample for this study is chosen by using the convenience sampling method. The data is examined applying Partial Least Squares Structural Equation Modeling (PLS-SEM).

5 CONCLUSION

In theoretical terms, the present study contributes to earlier research on knowledge sharing behavior and trust by building a conceptual framework that includes motivational factors found to influence or inhibit knowledge sharing behavior and trust in previous empirical studies. This research covers earlier study by examining the direct effect of motivation factors on trust and knowledge sharing behavior. This study also will examine whether trust applies a mediating influence between motivation factors and knowledge sharing behavior at further our study. It is important, since few research studies deem trust as a mediating variable; and no known study examines the mediating influence of motivation factors through trust, onto knowledge sharing behavior.

In practical terms, this study helps managers of IT Organization to understand the factors that lead to affective knowledge sharing behavior and also suggests methods to promote, and expand them. It can be sumptuous and time consuming to perform strategies that promote trust and motivation factors to positively impact on sharing knowledge between members. The results of this research provide a direction regarding to which factors are most significant for top managers to emphasis its resources on.

The proposed conceptual model requires to be tested empirically, because of its helpfulness and usage in the accomplishment of knowledge sharing, as it is still at the theoretical phase. Hence, proposed model will be tested among employees in IT organization in Malaysia in the further our study.

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Estimate of fertility among *Bidi Workers* of Central India

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ABSTRACT: *Introduction:* Fertility is generally used to indicate the actual reproductive performance of women or group of female individuals. But generally fertility indicates the number of children, which were produced by women. In every society fertility is very essential to find out the birth rate and other factors which influenced this rate. Fertility is very important indicators of any society and family structure have its own important in demographic studies and planning the many of programs.

Methods: In a cross sectional study, study the unit for anthropological demographical date was ever married women. A socio-economic demographical house to house survey method used for collection of data was conducted by interview 112 females belong to 119 household of district Sagar of Madhya Pradesh. by using a pretested semi structure interview schedule. In semi structure interview schedule collected demographical data viz. age, sex, age at first birth, fertility detail such as total numbers of live births, numbers of children died, number of child surviving pregnancy experienced by mothers, reproductive wastage. The fertility history was arranged and developed for Bidi workers via. using the demographical and fertility measurements. By using these variable and measurements to estimate the fertility rates and ratio such as Child women ratio. Crude birth rate, general fertility rate, age specific fertility rate, general marital fertility rate, gross reproduction rat, total fertility rate.

Results: That a largest proportion of mothers 66.2% were given births at 15-19 years of age and 33.03% at the age of 20-24 years of age. It is indicated the prevalence of early marriage among Bidi workers of district Sagar of Madhya Pradesh. The CWR has been found 361.5 and comparatively low with other population of central India.CBR among Bidi workers were computed to be 24.6 General fertility rate was 100 and General marital fertility rate was 138.2, whereas total fertility rate was 5.5 and Gross reproduction rate was 2.69.

Conclusion: Bidi workers of District Sagar of Madhya Pradesh, a part of central India are one of the known occupational groups of state. Bidi workers who are low wage earner and lagging behind in socio-economic, health status and demographical indicators. The most of the Bidi worker are illiterate and passionate under socioeconomically backward condition. Among them the female literacy rate is very poor, which directly or indirectly influenced their fertility mortality rate and their reproductive performance. They are also lagging behind in awareness of the sanitation and their living condition. Under all of these circumferences, there for is urgently need a program which tackle and improved these aspects problem.

KEYWORDS: GFR, ASFR TFR, Married Female, GRR etc.

1 INTRODUCTION

In every society Fertility is very essential to find out the birth rate and other factors which influenced this rate. Fertility is very important indicators of any society and family structure have its own important in demographic studies and planning the many of programs.

"Fertility is generally used to indicate the actual reproductive performance of a women or groups ofa female individual." But a generally fertility indicates the number of children, which were produced by a women.

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"Fertility is a positive force through which the population expands, counteracting the force of attainment caused by mortality." Bhende & Kannikar (1992).

Fertility is used to measure the rate at which population adds itself by births and is normally assessed by relating the number of birth to size of some selection of population. Lewis & Thompson (1930). The growth of any population or group of people in a society or country entirely depended on human fertility. Jain AK (2006). The fertility of women is totally depended on physiological function and socio economic, Cultural aspect and many biological characteristics such as heredity ,health and disease, age at menopause, age at menarche, marital status, reproductive performance reproductive life span, age at mothers first births, biologically age, physiological factors have considerable influence on fertility potential of a population. Fertility is a biological phenomena affected by many factors like as genetically factors, environmental factors political factors, Demographical factors, socio-economically factors, and culturally factors, etc. the socio-economic cultural variable like Education, occupation, and economically meeting and fertility and births controls methods and family planning have their perspectives spheres of influencing on fertility. Some demographers used the word "Natality" instead of fertility. Most of demographer usually reassures the fertility differences by demographical social measurement viz. education, occupation, women's income family type, age at menarche, age at menopause, age at first birth and etc. Fertility is also indicted, among population or groups of population in a society or country or any specific groups of individuals such as Bidi workers, the every aspects of life from birth to death is being influenced by the prevalence of customs ,beliefs and nation ,which have been practiced in their day to day life. On the hands fertility and its related aspects a number of studied have been conducted by various researcher viz. Dandekan & Dandekan (1953); Dandekan (1959); Ray & Burman (1961); Nag (1962); Das (1973); Thompson & Lewise (1965); Vidhyarti & Rai (1977), Sahu (1994); jain (2000); Jain(2000); Sharma and Jain (2004); Basu & kshuatriya (1989); Hassian (2005) amd Nand (2005) etc.

The Madhya Pradesh is one of the largest states in India the in term of area and 6 th position in the population structure. It is a part of Central India which surrounded by seven state ,Uttar Pradesh, Chattisghar, Mahrashtra, Gujrat, Rajishthan. The Madhya Pradesh is situated in central region or point of country and lies between $26^0$52' and 17^0 46' north latitude and $74^0$1' and $84^0$23' east longitude.(Fig.1). Present study is located in heart of India which is fully dense forest area and full of naturallty. Madhya Pradesh is known as growing state of India with a large number of populations 7, 25, 97,565 as per census (2011). The population of Madhya Pradesh is showing diversity due to different environment, cultural, socio-economic factors and others factors. In present study area Madhya Pradesh *Bidi* manufacturing is one of the well known organized and unorganized occupation because the Madhya Pradesh is rich with raw material of country cigarette know as *Bidi.* The raw which is used in manufacturing the Bidi is Tendu leaves and soon. Bidi manufacturing trends in Madhya Pradesh is established in last 16th century. The worker who are engaged in the manufacturing of *Bidi* , are known as Bidi workers, they are well known occupation groups of central India . There are the different category of Bidi workers viz. Collector Of Tendu Leaves, Bidi Roller, Sattedar, Roster, Steamer and Packagers. All of these are constantly exposed to tobacco dust, but out of them a large proportion of female workers and child are more exposed to tobacco dust, which result is showed by multiple disorder on their health, nutritional status and demographical indicators, such as changes in population structure, biological characteristics, reproductive performance, fertility and mortality rate, and etc. And Bidi workers are also affected in their socio-economic condition, level of education, Daily sustainable life standers and so on. The objective of presented study was to assess the fertility, performance among Bidi workers, because a large proportion of female workers and their fertility and reproductive performance may be directly or indirectly effected viz. manufacturing of *Bidi,* and tobacco dust. So for fulfill these objective the sample were drawn from a district of Sagar of Madhya Pradesh a part of Central India.

2 MATERIAL AND METHODS

For the present study the unit for anthropological demographical date was ever married women. A socio-economic demographical house to house survey method used for collection of data was conducted by interview 112 females belong to 119 household of district Sagar of Madhya Pradesh. By using pretested semi structure interview schedule. In semi structure interview schedule collected demographical data viz. age, sex, age at first birth, fertility detail such as total numbers of live births, numbers of children died, number of child surviving pregnancy experienced by mothers, reproductive wastage. The fertility history was arranged and developed for Bidi workers via. using the demographical and fertility measurements. By using these variable and measurements to estimate the fertility rates and ratio such as Child women ratio. Crude birth rate, general fertility rate, age specific fertility rate, general marital fertility rate, gross reproduction rat, total fertility rate. Among Bidi workers all the confidential information relating to specific women have been collected from wives, corroborating with the presence of their husband or head female of these families, and these all information regarding to marital status, age first births and age at marriage, number of child births, number of child deaths, ferity related performance, and number of abortion ,stillbirth, premature delivery, numbers of last year births, etc., have been collected by cross examine the statements of wife with their own age, current age and age at marriage, age at first births, etc.

After collection of all demographical data, it was estimated in Ms-excel work sheet and converted in SPSS V.16.0 for statistical treatment and analysis of data for computing result.

3 RESULT AND DISCUSSION

The demographical data related to the fertility is reported in table form. The age of mother at first birth is very important parameter in demographical indicators and fertility performance. The age at first birth is used to determine the possibility of actively reproductive period and fertility rate of any population and society. The collected demographical data about age of mothers at first birth is represented in Table-1. It is apparent from the Table that a largest proportion of mothers 66.2% were given births at 15-19 years of age and 33.03% at the age of 20-24 years of age. It is indicated the prevalence of early marriage among bidi workers of district Sagar of Madhya Pradesh. Although there is a wide gap between the potential level of fertility (Fecundity) and actual performance of the potentiality (Fertility), in readily it has to rely upon the latter method for measuring the actual fertility performance. For obtaining the level of fertility in a population a various fertility measurement have been calculated such as number of pregnancy experienced by mothers, numbers of live births, numbers of children surviving, child loss, foetal loss, and estimated fertility rates and ratio like as GFR,ASFR, TFR,CWR,CBR,GRR,GMFR and etc. These are helpful in understanding the relation between the general condition and fertility level of individuals. The measure of fertility indicators among bidi workers of district Sagar of Madhya Pradesh a part of central India .is represented in Table 2.

For the present study, the child women ratio is a commonly used measured of fertility calculated from the age-sex distribution. The child women ratio reflects only the number of surviving children of less than 5 years or 9 years of age. Child women ratio was denoted by CWR. It is apparent from the table that among Bidi worker the CWR has been found 361.5 and its comparatively low with other population of central India. such as CWR of Khandha 695.0, Sabat &Dash (1996) ; Juhar Bhotia 734.46 Chachra &Bhasin (1998) and Kamar 1141.31 Biswas et al. (2001).

Crude birth rate is another important rate of fertility indicators and denoted by CBR. It is apparent from the table2 that CBR among Bidi workers were computed to be 24.6 which comparatively less than Bhil 43.5,Chaudhary & Kumar(1976); Gonds 43.0,Parsuram and Rajan (1990); Abujhariya 39.9, Pandey & Goel (1990); And Sahariya 43.76, Biswas & Kapoor (2003); and other. The Crude birth rate of any population is influenced by standard of education, medical facility, communication system, environmental condition, family size etc. Davis & Blkae (1956).

The similarly over all age limited measured is general fertility rate (GFR). The GFR is indicated that the number of women 15-49 age groups is less than as compared to the total population is high among them. From the Table 2. , that's, the general fertility rate was computed 100,which is higher than Lohar Gadiyas 76.17,Yadav et al(2001), and the total of age specific fertility rate has been recorded from 112 mothers of Bidi workers was 1105.1.

The Age specific fertility rate (ASFR) with specific period was represented in Table 3. It is apparent from table that the ASFR of 15-19 years of age was computed 400 and 333.3 ASSFR for mothers of 20-25 years of age groups, followed by 214.2(25-29 years), 43.3(30-34 years), 66.6 (35.39) years and 47.6 (40-46)years of age groups. The highest ASFR among Bidi workers was reported in 15-19 years of age groups. On comparison of ASFR among Bidi workers with others population of Central India, it was noticed that among bidi workers the ASFR of 20-24 years is higher than the highest ASFR of Sahariya population (a tribe of Madhya Pradesh.) was 328.5,Biswas & Kapoor (2003).

The total fertility rate present a single index o f total fertility for each of a from 15-45 years. It is a more effective measure of summarizing the frequency of birth of particular years. Among Bidi workers from the table it is apparent that TFR was found 5.5. which is than when compared with Lohar Gadiyas 4.60,Yadav et al (2001). Whereas is lower than many of previous study population such as Sahariya 6.70,Biswas & Kapoor (2003).Halba 5.89 Basu & Kshatriya (1989).Similarly among Bidi workers the gross reproduction rate (GFR) reported viz. age specific fertility rate(ASFR) and TFR .It is apparent from the table gross reproduction rate was found 2.69. and that's value is slightly lower than Sahariya population of Madhya Pradesh. On comparing with previously studied it was noticed that the TFR of present study was found to be higher than Kandh1.44 Sabat & Dash(1996); Bhotia 1.34, Chachra & Bhasin (1998); Thoti 1.84,Elizabeth et al (2000) and etc. from present study the last but most important Firtility indicators general marital fertility rate (GMFR) has been computed 138.2 which lower than previously studied population such as Sahariya (248.29) fallowed by other studied these are Bhutia, 154.93 Bhasin & Bhasin(1990); Kandh 213.11, Sabat & Dash (1996); But its also higher than Marcha 119.44, Chachra & Bhasin (1998).

Table: 1 Distribution of mothers according to Age at first birth.

Age group	N	Percentage
15-19	72	64.2
20-24	37	33.03
25-29	2	1.78
30-34	1	0.89
Total	**112**	**100**

Table :2 Fertility rate & Ratio among population of district of Sagar (M.P.)

Child women ratio	361.5
Crude birth rate	24.6
General fertility rate	100
General marital fertility rate	138.2
Total fertility rate	5.5
Gross reproduction rate	2.69

Table:3 Age specific fertility rate among women of district of Sagar (M.P.)

Age group	Number of women	Number of birth in last one year	Age specified fertility rate
15-19	5	2	400
20-24	15	5	333.3
25-29	14	3	214.2
30-34	23	1	43.3
35-39	15	1	66.6
40-49	21	1	47.6
Total	112	13	1105.1

4 CONCLUSION

From the present study that's point out come, Bidi workers of District Sagar of Madhya Pradesh, a part of central india are one of the known occupational groups of state. Bidi workers, who are low wage earner and lagging behind in socio-economic, health status and demographical indicators. The most of the Bidi worker are illiterate and passionate under socioeconomically backward condition. Among them the female literacy rate is very poor, which directly or indirectly influenced their fertility mortality rate and their reproductive performance. They are also lagging behind in awareness of the sanitation and their living condition. Due to paucity of proper medical facility among them the percentage of still birth, infant mortality rate are noticed as very high. In context of family planning and other modern methods of births control devices, they are aware but rarely adopted by them, because many of myths. A large proportion of Bidi worker are female and little proportion of child bidi workers, who are engaged in manufacturing Bidi are directly exposed to Tobacco dust that result is out come in form of chaning rate of fertility and mortality among them. All of these above present attributes reason of influence in their child women ratio, crude birth rate, general fertility rate, general marital fertility rate, gross reproduction rate and etc. Under all of these circumferences, there for is urgently need a program which tackle and improved these aspects problem.

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Micropropagation of *Vitex negundo* L. - A Significant Medicinal Plant

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ABSTRACT:

Introduction: *Vitex negundo* L. (Nisinda locally), belongs to the family Verbenaceae, found almost everywhere in Bangladesh is a medicinal aromatic shrub. *Materials and Methods:* An attempt was taken to its micropropagation from field-grown explants (shoot-tip) in Murashige and Skoog medium fortified with various concentrations of phytohormones. *Results:* Experimentally, the best shoot induction was observed in full strength MS medium supplemented with BAP 1.0mg/L and Kin 0.5mg/L. However, 0.5mg/L IBA in half strength MS medium was enabled to induce 80% root initiation with the highest root number and longest shoot length. Well-developed roots were successfully subjected to hardening process and acclimatized. *Conclusion:* Regenerated plantlets were same as the natural plants and showed 80.56% survival frequency with frisky and seductive appearances without any abnormalities.

KEYWORDS: *Vitex negundo*, micropropagation, Murashige and Skoog medium, acclimatized.

1 INTRODUCTION

Vitex negundo Linn. (Verbenaceae) is a woody, aromatic shrub found in different parts of the world including Bangladesh. It is used as a valuable medicinal plant in traditional and modern system of medicines. Leaf is used as aromatic, tonic and vermifuge [1]. Root is used in dyspepsia, colic, rheumatism, worms, boils and leprosy [1]. Fruit is nervine, cephalic and emmenagogue; dried fruit acts as a vermifuge as well as flowers are cool and astringent [1]. It has also been reported as an antitumoric [2] antimicrobial [3] antiinflamatory agent [4]. Conventional propagation method is not satisfactory to meet huge demand and may spread diseases. Therefore, biotechnological approach plays a vital role in search for alternative to production of desirable medicinal compounds from plants [5]. Therefore, keeping in the view of importance of *V. negundo*, the following studies were conducted to establish the optimum condition for *in vitro* propagation *V. negundo* plantlets using shoot-tip explants and acclimatized.

2 MATERIALS AND METHODS

The experiment was conducted at Plant Biotechnology Division of National Institute of Biotechnology (NIB), Bangladesh. Field grown explants were sterilized with 0.1% mercuric chloride (Merck, Germany) for 5 min and subsequently disinfected with 70% ethanol (Merck, Germany) for 30 sec. Murashige and Skoog (Duchefa, The Netherlands) media (1962) [6] supplemented with 3% (w/v) sucrose (Merck, Germany) and different concentrations of BAP, Kin, NAA, GA_3, (Duchefa, The Netherlands) coconut water (CW) (Locally Collected) were used for shoot and root initiation and multiplication. pH (Jenway 3520 pH Meter, Bibby Scientific Ltd., UK) was adjusted to 5.8. Autoclaved medium (ALP Co. Ltd., CL-40M, Japan) was used to inoculate sterilized explants and temperature of the growth chamber was maintained at 25 ± 2^0 C with a photoperiod of 16 hours lightand 8 hours dark (50 W, Philips Agro-Lite). 1:1 mixture of garden soil and farmyard manure (Locally Prepared) was

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used for hardening and acclimatization **(Figure 1)**. The percentage of initiation, days for initiation, length and number of shoots and roots and regeneration percentage during acclimatization of plants were recorded **(Table 1 and 2)**.

2.1 STATISTICAL ANALYSIS

Results were expressed as mean ± SD (Standard deviation of mean) **(Table 1 and 2)**. The statistical program used was Microsoft Office Excel 2007. Photos were taken with (SANYO, Japan) camera.

3 RESULTS AND DISCUSSION

3.1 INDUCTION AND PROLIFERATION OF SHOOTS FROM SHOOT-TIP EXPLANTS

Concerted effects of BAP 1.0mg/L and Kin 0.5mg/L showed the maximum 95% induction, also the number of shoots per explants (19.33±1.25) and shoots length (6.6±0.22 cm) were maximum **(Table 1 and Figure 1)**. Synergistic effects of BAP and Kin also demonstrated in other plants by Biradar et al. (2012) [7] and Sen et al. (2013) [8]. BAP in combination with GA_3 gave 87% initiation and shoots number were 13.33±1.25 per explants. Concerted effects of BAP and GA3 for shoot proliferation was also reported by Haque et al. (2009) [9]. Coconut water was used as phytohormone and it showed 80% shoot inducing frequency **(Table 1)**. Addition of coconut water to the media stimulated more multiple axillary shoots growth also demonstrated by Kwapata et al. (1999) [10].

Table 1. Effect of shoot induction media on shoot-tip of V. negundo

Treatments	Composition	Shoot inducing frequency (%)	Number of shoot per explant	Shoot length (cm)
S_1	MS+BAP (0.5mg/L+5% coconut water	70	2.33±0.47	2.4±0.08
S_2	MS+BAP (1.0mg/L)+5% coconut water	80	6.0±0.0	3.47±0.11
S_3	MS+BAP (2.0mg/L)	65	4.33±0.47	2.13±0.17
S_4	MS+BAP (1.0mg/L)+ NAA (0.5mg/L)	85	6.67±0.47	4.07±0.12
S_5	MS+BAP (0.5 mg/L)+ NAA (1.0 mg/L)	87	7.33±0.47	5.25±0.02
S_6	MS+BAP (0.5mg/L) + Kin (0.2mg/L)	90	11.67±1.25	5.74±0.13
S_7	MS+BAP (1.0mg/L)+ Kin (0.5mg/L)	95	19.33±1.25	6.6±0.22
S_8	MS+BAP (1.0mg/L)+ Kin (0.5 mg/L)+GA_3 (0.5mg/L)	92	17.0±0.81	6.2±0.08
S_9	MS+BAP (1.0mg/L)+ Kin (0.5mg/L)+NAA (0.5mg/L)	90	14.33±1.25	5.77±0.08
S_{10}	MS+BAP (1.0mg/L)+ GA_3 (0.5mg/L)	87	13.33±1.25	4.88±0.08
S_{11}	MS+BAP (0.5mg/L)+ NAA (1.0mg/L)	89	12.0±1.62	3.77±0.09

3.2 GENESIS AND PROLIFERATION OF ROOTS FROM SHOOT-TIP DERIVED SHOOTS

In **Table 2**, IBA (0.5mg/L) in half strength MS medium showed the highest root inducing frequency (80%). Number of root per microculturing was also the maximum (15.0±0.82) and the highest root length was recorded (6.77±0.58 cm). Similar result also illustrated by (Lalitha et al., 2013) [11]. The highest root number (9.0±0.82) was found when half strength MS medium was fortified with 1.0mg/L NAA and it took 24-26 days to initiate root. The lowest root length was 1.53±0.41 cm when only half strength MS medium was used without auxins supplementation. Rooting of elongated shoots were successfully achieved (90%) in half strength MS with 1.0mg/L NAA [12].IBA was found more effective rooting hormone comprising 80% rooting efficiency compare with NAA **(Figure 1)**. Velayutham et al. (2006) [13] also documented nearly similar result.

Table 2. Effect of root induction media on shoots of V. negundo

Treatments	Composition	Root inducing frequency (%)	Days taken to root initiation	Number of roots per micro culturing	Root length (cm)
R_1	½MS	50	28-30	2.33±0.47	1.53±0.41
R_2	½MS+NAA (0.2mg/L)	60	26-28	3.0±0.0	2.6±0.43
R_3	½MS+NAA (0.5mg/L)	70	24-26	7.33±0.94	5.0±0.82
R_4	½MS+NAA (1.0mg/L)	60	24-26	9.0±0.82	5.56±0.47
R_5	½MS+IBA (0.2mg/L)	70	22-24	11.33±0.94	5.67±0.42
R_6	½MS+IBA (0.5mg/L)	80	22-24	15.0±0.82	6.77±0.58
R_7	½MS+IBA (1.0mg/L)	70	23-25	13.33±0.47	5.67±0.47

Figure 1. Micropropagation of V. negundo from shoot-tip

A. Shoot initiation and proliferation in MS+BAP (1.0mg/L) + Kin (0.5mg/L) after 15 days of culture.

B. Shoot proliferation on the same medium after 32 days of subculture.

C. Rooted shoots on ½MS+IBA (0.5mg/L) after 30 days of culture.

D. Hardened plants of *V. negundo* in potted soil after 20 days of transplantation.

3.3 Acclimatization and Hardening

Plastic pots containing garden soil and farmyard manure (1:1) were used for hardening. The pots were covered with porous polyethylene bags and removed after 2 weeks and transferred to normal room temperature. Almost 80.56% plants survived as shown in **Figure 1**.

4 Conclusion

The findings from this experiment pointed to the possibility of consistent mass production of *V. negundo* L. from shoot-tip as a reliable planting material.

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RE-RANKING OF IMAGES USING KEYWORD EXPANSION BASED ON QUERY LOG & FUZZY C-MEAN CLUSTERING

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ABSTRACT: Image re-ranking, Image Search engines mostly use keywords and they rely on surrounding text for searching images. Ambiguity of query images is hard to describe accurately by using keywords. Eg: Apple is query keyword then categories can be “red apple”, “apple laptop” etc. In this paper, we have a tendency to propose a completely unique image re-ranking framework. Four steps: A query image is 1st classified into one in every of many predefined intention classes, and a particular similarity live is employed within every class to mix image options for re-ranking supported the query image. Query keywords are enlarged to capture user intention, through the visual content of the question image hand-picked by the user and the image agglomeration victimization fuzzy c mean algorithm, Image pool is enlarged to contain additional relevant pictures. The query image is additionally enlarged by victimization keyword growth. The Experimental analysis shows that our approach considerably improves the exactness of top-ranked pictures and conjointly the user expertise.

KEYWORDS: image reranking, keyword expansion, Keyword expansion based on query log, Fuzzy c- means algorithm, visual query expansion, and adaptive similarity.

1 INTRODUCTION

The Internet getting available to more and more people in the last decade and with the rapidly growing number of web pages, the Internet is a vast resource of information and images. How to find just the right bit of images that user need from the Internet is a big challenge in image retrieval. Even though there are a lot of well-known search engines like Google or Bing, still it is sometimes not easy to find the images one is interested in. One reason for this is that many users search the internet with keyword and with the huge amount of data on the internet, Almost all of these keywords will be ambiguous to a certain degree, e.g., someone searches for information about the Apple and queries a search engine with the keywords “Apple” he or she will get belonging to different categories, such as “red apple”, “apple logo”, and “apple laptop”. Within every main category, there can be several distinct sub classes’ images that are visually similar. Also, there are images that can be labeled as noise (irrelevant images) or neglect (hard to judge relevancy).

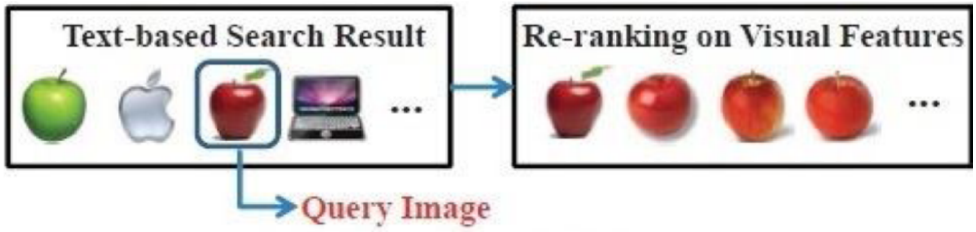

Fig. 1. Re-ranking of visual feature images

In order to solve the uncertainty, supplementary information has to be used to confine users' search purpose. One way is text based keyword expansion, producing the textual description of the query added information. Existing linguistically-connected methods find either synonyms or other linguistic-connected words from thesaurus, or find words repeated co-occurrence with the keyword queries. For instance, Google image search provides the "Related Searches" feature to suggest likely keyword expansions. However, for the similar query keywords, the purpose of users can be extremely diverse and cannot be accurately captured by these expansions.

Another way is content-based image retrieval with relevance feedback [1]. Users label multiple positive and negative image instances. A visual similarity metric for query-specific is learnt from the selected instance and used to rank images. The necessity of more users' attempt makes it inappropriate for web-scale industrial schemes like Google image search and Bing image search in which users' feedback has to be reduced.

2 RELATED WORK

Various Internet scale image search methods [2], [3], [4] are text-based which are restricted by the statement that query keywords cannot explain image content precisely. Content-based image retrieval [5] uses visual features to assess image similarity. Numerous visual features [6], [7], [8] were extended for image search in recent years. In [9] Yimeng Zhang et.al presented geometry preserving visual phases which considered the local and long range spatial layouts of visual words. This [9] work presents an method that can encode spatial information into BoV representation and that is proficient enough to be used to huge databases. This encodes additional spatial information through the geometry-preserving visual phrases (GVP). Still this method uses increased memory usage or computational time.

In [10] Jia Deng et.al presented visual similarities from a hierarchical structure described on semantic attributes of training images. As web images are extremely diversified, describing a set of attributes with sequential relationships for them is demanding. Generally, learning a common visual similarity metric for generic images is still an unlock problem to be solved. [11] Yuchi Huang et.al presented probabilistic hyper graph ranking in the semi-supervised learning structure. This used both labelled and unlabelled images in the learning system. Relevance feedback is essential for extra users' attempt. For a web-scale business system, users' feedback has to be restricted to the minimum, namely one-click feedback.

In [12] Shuang Liu et.al presented Thesaurus-based methods which lengthened query keywords with their linguistically connected words such as synonyms and hypernyms. This method made use of WordNet to differentiate word senses of query conditions. Every time the sense of a query term is decided, its synonyms, hyponyms, words from its definition and its compound words are measured for probable additions to the query. [13] Yossi Rubner et.al presented Online Algorithm for Scalable Image Similarity learning that discovers a bilinear similarity computation over sparse illustrations. It is an online dual method using the passive-aggressive group of learning algorithms with a great margin principle and a well-organized hinge loss cost. Conversely, this method is not supportive even for problems with a small hundreds of samples

3 PROPOSED WORK

3.1 KEYWORD EXPANSION

The keywords offered by users are usually shortened. They unable to explain the information of pictures correctly. The query keyword's meaning is sometimes richer when compared with users opinions. For example, the meanings of the term "apple" may include apple fruit, apple computer, and apple iPod. The user does not have sufficient understanding on the textual explain of target images in our technique, query keywords are enhanced to catch users browse objective, inferred from the visible information of search images that are not regarded in standard keyword expansion techniques. A phrase w is recommended as an extension of the search when a cluster of images are visually identical to the query image and also most

consist of the similar phrase w. The extended keywords much better get users research purpose because the uniformity of both of those visual information and textual explain and also explanation is assured.

3.2 KEYWORD EXPANSION BASED ON QUERY LOG

This category explains the log-based keyword query expansion really, the test out of approach is created that the search term used for queries and in pictures are totally very different. This approach has made consistently been built, yet infrequently checked by a quantitative estimate. The present perform ensures that you can find a great variance between the keyword query words and also retrieved pictures. Subsequently few types are important to fill the gap, which is, to configure up the associations between keyword query search terms and also retrieved pictures.

Each Image can be represented as vector { $W_1^{(I)}, W_2^{(I)}$ ... ... W_n^I}in the retrieved image space, where $W_i^{(I)}$ is the weight of the ith term in a document and is defined by the traditional TF-IDF measure in (1)

$$W_i^{(I)} = \frac{\ln(1+ tf_i^{(I)}) \times idf_i^{(I)}}{\sqrt{\sum ln^2(1+tf_i^{(I)}) \times \sum (idf_i^{(I)})^2}} \rightarrow (1)$$

$$idf_i^{(I)} = \ln \frac{N}{n_i}$$

Where $tf_i^{(I)}$s the frequency of the ith term in the Image I , N is the total number of Image in the retrieved collection, and $\mathbf{n_i}$ the number of Images containing the ith term of keyword. For each Image, construct a consequent Image in the query space by gathering all the queries for which the Images has been clicked on.To evaluate the keyword query space and Image space, the similarity between the image vector and its corresponding query vector is need to be measured. Particularly, the similarity of each pair of vectors can be calculated by using the following Cosine similarity in (2):

$$\text{Similarity} = \frac{\sum_{i=1}^{n} W_i^{(q)} W_i^{(I)}}{\sqrt{\sum_{i=1}^{n} W_i^{2(q)}} \sqrt{\sum_{i=1}^{n} W_i^{2(I)}}} \rightarrow (2)$$

3.3 FUZZY C-MEANS CLUSTERING

The FCM algorithmic rule tries to partition a finite assortment of n parts $X = \{x_1, ..., x_n\}$ into a set of c fuzzy clusters with relevancy some given criterion. Given a finite set of information, the algorithmic rule returns an inventory of c cluster centers $C = \{c_1, ..., c_c\}$ and a partition matrix $W = w_{i,j} \in [0, 1],\ i = 1, ..., n,\ j = 1, ..., c$, wherever every element wij tells the degree to which element xi belongs to cluster cj . just like the k-means algorithmic rule, The FCM aims to reduce an objective perform the quality perform is:

$$w_k(x) = \frac{1}{\sum_j \left(\frac{d(\text{center}_k, x)}{d(\text{center}_j, x)} \right)^{2/(m-1)}}.$$

Which differs from the k-means objective perform by the addition of the membership values uij and the fuzzier m. The fuzzier m determines the amount of cluster indistinctness. an oversized m leads to smaller memberships wij and hence, fuzzier clusters. Within the limit m = one, converge to zero or one, which means a crisp partitioning. Within the absence of experimentation or domain information, m is often set to two. The fundamental FCM formula, given n knowledge points (x1, . . ., xn) to be clustered, variety of c clusters with (c1, . . ., cc) the middle of the clusters, and m the amount of cluster indistinctness with. In fuzzy cluster, each purpose encompasses a degree of happiness to clusters, as in formal logic, instead of happiness utterly to only one cluster. Thus, points on the sting of a cluster, could also be within the cluster to a lesser degree than points within the center of cluster. an summary and comparison of various fuzzy cluster algorithms is obtainable.[1]

Any purpose x encompasses a set of coefficients giving the degree of being within the k th cluster wk.(x). With fuzzy c-means, the center of mass of a cluster is that the mean of all points, weighted by their degree of happiness to the cluster

$$c_k = \frac{\sum_x w_k(x)^m x}{\sum_x w_k(x)^m}.$$

The degree of belonging, wk(x), is expounded reciprocally to the gap from x to the cluster center as calculated on the previous pass. It additionally depends on a parameter m that controls what quantity weight is given to the nearest center. The fuzzy c-means algorithmic program is incredibly the same as the k-means algorithmic program.

3.4 VISUAL QUERY EXPANSION

The objective of visual query enlargement is to achieve multiple positive example pictures to find out a visible similarity metric that is stronger and a lot of definite to the query image. Visual question enlargement develops a picture reranking technique, that solely desires one click on the question image and so positive examples got to be earned repeatedly. The chosen image cluster has the nearest visual distance to the query instance and has reliable linguistics meanings. Therefore, they're used as more positive instances for visual query enlargement. Then one category SVM is adopted to boost the visual similarity. This takes the reranked image as input to the one-class SVM classifier and similarity to the query image is uses as output.

3.5 IMAGE POOL EXPANSION

In Image pool growth, the image pool retrieved by text-based search holds pictures with an outsized vary of linguistics meanings and therefore the numerous pictures connected to the query image is little. In such cases reranking pictures within the pool isn't terribly economical. Therefore, a lot of precise query by keywords is important to fine the intent and retrieve a lot of relevant pictures.

3.6 ADAPTIVE VISUAL AND TEXTUAL SIMILARITIES

In this section a query specific textual similarity metric is learnt from the positive examples obtained by visual query expansion and combined it with the query specific visual similarity metric. For a selected query image, a keyword probability model is trained from positive examples and used to estimate the textual distance distT for an image k its textual distance to the positive example is described by cross-entropy function in (5):

$$\text{distT}(k) = -\sum_w p(w|d_k) \log(w|\theta) \qquad \rightarrow (5)$$

Finally, the textual distance can be combined with the visual similarity sim_v to rerank images:

$$-\alpha \cdot \text{sim}_v(k) + (1-\alpha) \cdot \text{distT}(k)$$

α is a fixed parameter and set as 0.5

4 EXPERIMENTAL RESULTS

This section empirically evaluates the proposed system with the existing system. Performance metrics such as Accuracy, precision and recall is measured for image re-ranking with keyword expansion and image re-ranking with Fuzzy c-means algorithm.

4.1 ACCURACY

The Accuracy of the retrieval rate is measured with the values of the True Negative (TN), True Positive (TP), False Positive (FP), False negative (FN) of the actual class and predicted class results it is defined as follows

$$\text{ACCURACY} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{TN} + \text{FP} + \text{FN}}$$

The comparison graph for the proposed and existing is shown in following graph:

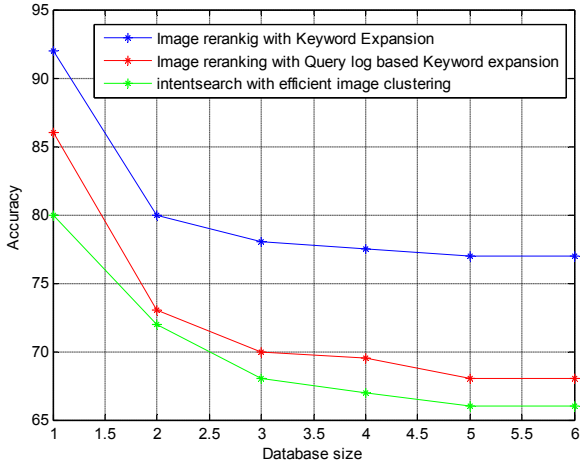

Figure 1. Accuracy comparison graph

The above graph in Figure 1shows that the accuracy comparison of the methods namely image re-ranking with K-Means keyword expansion and image re-ranking with Fuzzy C-Means keyword expansion. The accuracy is measured in % at Y-axis as algorithm and considered the datasets in the X-axis. The Accuracy of the re-ranking rate is measured with the values of the True Negative, True Positive, False Positive, False negative. True positive defines a positive test result that accurately reflects the tested-for an activity is analyzed. True negative measures the incorrect data in training and testing, true negative rate is accomplished. False positive result that indicates for a given condition is present when it is not. False negative results indicate that the result appears negative when it should not. From this result re-ranking accuracy is measured with the values of the True Negative, True Positive, False Positive, and False negative with the actual and predicted classes. As a result, the accuracy value of the proposed image re-ranking with Fuzzy C-Means keyword expansion is higher than image re-ranking with k-Means keyword expansion.

4.2 PRECISION

Precision value is calculated is based on the retrieval of information at true positive prediction, false positive. The data precision is calculated the percentage of positive results returned that are relevant.

$$\text{PRECISION} = TP/(TP+FP)$$

The comparison graph for the proposed and existing is shown in following graph:

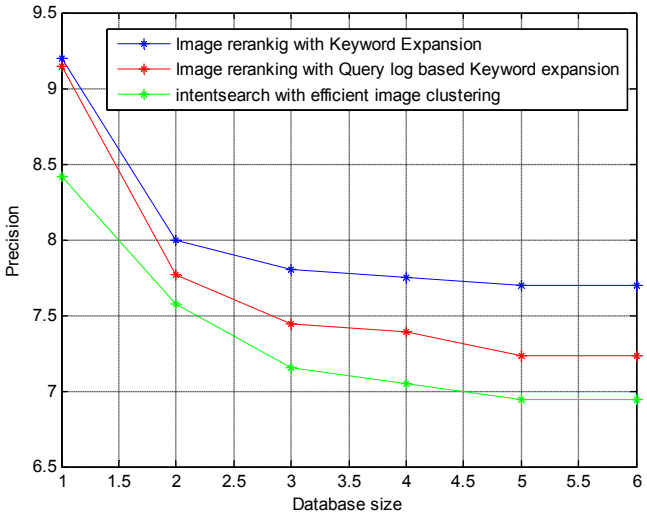

Figure 2: Precision comparison graph

The above graph in Figure 2 shows that the Precision comparison of the methods namely image re-ranking with K-Means keyword expansion and image re-ranking with Fuzzy C-Means keyword expansion. The Precision can be measured at Y-axis as algorithm and considered datasets in the X-axis. Precision value is calculated is based on the retrieval of images at true positive prediction, false positive. In the dataset the value is calculated for these data's provides positive result and those result has been considered as relevant. As a result, the Precision value of the image re-ranking with Fuzzy C-Means keyword expansion is higher than image re-ranking with K-Means keyword expansion.

4.3 RECALL

Recall value is calculated is based on the retrieval of information at true positive prediction, false negative. Recall is calculated with the percentage of positive results returned that are Recall in this context is also referred to as the True Positive Rate. Recall is the fraction of relevant instances that are retrieved,

$$\text{RECALL} = TP/(TP+FN)$$

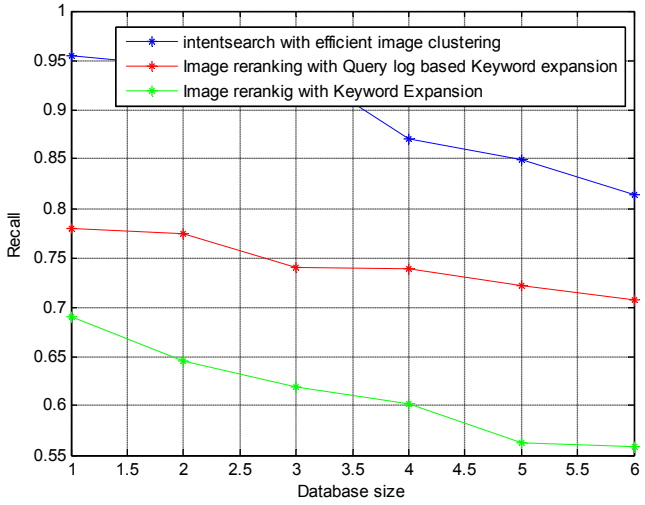

Figure 3.Recall comparison graph

The above graph in Figure 3 shows that the Recall comparison of the methods namely image re-ranking with K-Means keyword expansion and image re-ranking with Fuzzy C-Means keyword expansion. The Recall can be measured at Y-axis as algorithm and considered datasets in the X-axis. Recall value is calculated is based on the retrieval of information at true positive prediction, false negative. In the dataset recall is calculated the percentage of positive results returned that are Recall in this context is also referred to as the True Positive Rate. Recall is the fraction of relevant instances that are retrieved. As a result, the Recall value of the image re-ranking with Fuzzy C-Means keyword expansion is higher than image re-ranking with K-Means keyword expansion

5 CONCLUSION

The present work proposes keyword query expansion based on Fuzzy logic approach. The image search only requires one-click user feedback. Query expansion provides an effective way to improve the performance of information retrieval systems by adding additional relevant terms to the original queries. The result estimates the quality of the keyword query and decides the expanded length of the keyword query. Efficient analysis of the keyword query and retrieved images are obtained by using correlations of the queries. Expanded keywords enlarge the image pool to incorporate more relevant images. This proposed phase makes it possible for large scale image search by both text and visual content. Thus the experimental analysis of proposed system achieves better result in terms of accuracy, precision and recall metrics

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CARACTÉRISATION PHYSICO-CHIMIQUE DES EAUX USÉES D'ABATTOIR EN VUE DE LA MISE EN ŒUVRE D'UN TRAITEMENT ADÉQUAT : CAS DE « ELAKAT » BUKAVU RD CONGO

[PHYSICO-CHEMICAL CHARACTERIZATION OF SLAUGHTERHOUSE WASTEWATER FOR A SUITABLE TREATMENT: CASE STUDY OF « ELAKAT » BUKAVU D.R.C]

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ABSTRACT: The goal of our study is to characterize the effluent of the municipal slaughter-houseof the Bukavu city and to recommend a suitable treatment, thus reducing the harmful effect which undergoes the receiving environment (Ruzizi River) and to also mitigate the loss of this hydrous resource in recoverable matter. The physicochemical characterization of raw wastewaterrevealed that this liquid rejection is very charged of organic matter expressed in termsof COD (Avg.= 219.52 mg/L), in BDO_5(Avg.= 181.34 mg/L), in Suspend Matter (Avg.= 482 mg/L) and mineral matter expressed in terms of Chlorides (Avg.= 237 mg/L), Electric Conductivity (Avg.= 1360.5 µs/cm) and Alkalinity expressed in $CaCO_3$(Avg.= 201 mg/KL) with a pH of 7.5. The average content of Nitrates isabout 1.74 mg/L. Although this wastewater presents a high organic load (BDO_5/COD report = 0.83 and SM/BDO_5= 2.66), it has a satisfactory bio deterioration. The COD/BDO_5 report examination = 1.21 underlines well the biodegradable character of mixed wastewater of the Bukavu city municipal slaughterhouse to which, a biological treatment appears completely suitable.

KEYWORDS: Slaughter-house wastewaters, characterization, treatment.

RESUME: Notre objectif principal est de caractériser les eaux usées d'abattoir municipal de la ville de Bukavu (RD Congo) et de recommander un traitement adéquat, réduisant ainsi les nuisances que subit le milieu récepteur (Rivière Ruzizi) et de remédier aussi à la perte de cette source hydrique en matières valorisables. La caractérisation physico-chimique des eaux usées brutes a révélé que ce rejet liquide est très chargé en matière organique en termes de DCO (Moy. = 219,52 mg/L), en DBO_5 (Moy. = 181,34 mg/L), en MES (Moy. = 482 *Afrique* SCIENCE *05(2) (2009) 153 – 216* 200 mg/L) et en matière minérale exprimée en terme de Chlorures (Moy. = 237 mg/L), en Conductivité électrique (Moy. = 1360,5 µs/cm) et en Alcalinité exprimée en $CaCO_3$ (Moy. = 201 mg/L) avec un pH de 7,5. La teneur moyenne en Nitrates est de l'ordre de 1,74 mg/L. Malgré que ces eaux usées présentent une charge organique élevée (rapports DBO_5/DCO = 0,83 et MES/DBO_5 = 2,66), elles présentent une biodégradabilité satisfaisante. L'examen de rapport DCO/DBO_5 = 1,21 souligne bien le caractère biodégradable des eaux usées de l'abattoir municipal ELAKAT auxquelles un traitement biologique paraît tout à fait convenable.

MOTS-CLEFS: eaux usées, abattoir, paramètres physico-chimiques, traitement.

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1 INTRODUCTION

L'eau est un des éléments essentiels de la plupart des grandes entreprises de transformation de produits alimentaires d'origine animale. Après avoir été utilisée, la plus grande partie de cette eau usée de procédé est retournée à l'environnement. Comme cette eau est habituellement chargée en matière organique, elle devient dès lors une source de pollution importante pour le milieu récepteur qui la reçoit.

Les abattoirs constituent sans doute l'exemple-type de ces industries où l'eau est utilisée pour le lavage des sous-produits (abats) et l'élimination des déchets (matières fécales, débris de panse et de sang). En Europe, les volumes d'eau usée rejetés sont évalués entre 6 et 9 litres par kg de carcasse de bovins, et de 5 à 11 litres par Kg de carcasse de porcins [1]. Les effluents, de ces abattoirs sont caractéristiques et nécessitent des traitements adaptés (séparation des déchets solides et des graisses, traitements spécifiques). Plusieurs études se sont intéressées à la caractérisation et au traitement de ce type d'eaux usées par le biais des stations d'épuration soit par des procédés aérobies [2,3]. Soit par de procédés anaérobies [4-7]. D'autres procédés de traitement sont adoptés pour l'épuration des eaux usées d'abattoir à savoir l'infiltration sur sable [8] et l'électrocoagulation [9].

La plupart des données sur la qualité des eaux usées d'abattoir ont été produites enEurope [10-13], Australie [14], les Etats-Unis [15] et l'Afrique [16-18] et peu d'information existe sur la caractérisation et le traitement des eaux usées d'abattoir à Bukavu.

Vu sa proximité à la rivière Ruzizi, les effluents de cet abattoir sont rejetés directement dans la rivière Ruzizi sans traitement préalable. Ces eaux usées constituent une source de pollution pour les eaux de surface et le lac. Elles peuvent être responsables d'un déséquilibre écologique irréversible ainsi que de l'eutrophisation des eaux de milieu récepteur.

Le présent article consiste à faire une caractérisation physico-chimique par la détermination de certains paramètres majeurs et globaux de la pollution des eaux usées et de décrire les mesures de protection du milieu récepteur et par la proposition d'un moyen de traitementconvenable de ces effluents.

2 MATÉRIEL ET MÉTHODES

Les paramètres physico-chimiques sont déterminés à partir de prélèvements bimensuels (entre Février et Juin 2014) effectués au niveau de l'exutoire de rejet d'abattoir municipal deBukavu. La conservation des prélèvements d'eaux usées aété faite selon le guide général pour la conservation et la manipulation des échantillons d'après ISO 5667/3 [21].

Le pH, la température, la conductivité électrique, l'oxygène dissous sont déterminés à l'aide d'un multi-parameter analyser Type CONSORT - Modèle 835. La DBO_5est déterminée par la méthode respiratoire à l'aide d'un DBO-mètre marque WTW, modèle 1020T selon la technique décrite par DIN [22]. La DCO est déterminée par l'oxydation en milieu acide par l'excès de dichromate de potassium à la température de 148°C des matières oxydables dans les conditions de l'essai en présence de sulfate d'argent comme catalyseur et de sulfate de mercure [23]. Les chlorures et l'alcalinité exprimée en $CaCO_3$ sont déterminés par la méthode de comptage des pastilles pré dosées. Les matières en suspension sont déterminées par filtration d'un volume d'eau usée sur filtre cellulosiques (de 0,45 µm) selon Rodier [24]. Les Nitrates sont dosés par la méthode photométrique avec 2,6 - diméthylphénol selon DIN [26] et enfin la détermination des Nitrites a été effectuée par la méthode photométrique selon DIN [27].

3 RÉSULTATS

L'évaluation de la pollution d'une eau usée brute se fait d'après la détermination d'un certain nombre de paramètres physico-chimiques caractérisant cette eau usée. Les caractéristiques physico-chimiques des eaux usées de l'abattoir ELAKAT sont regroupées dans le **Tableau 1**.

Tableau 1 : Paramètres physico-chimiques des eaux usées de l'abattoir ELAKAT

Paramètres	Moy.	Max.	Min.	Ecart type	Nombre de prélèvements
T^o C	21.5	26	16.8	6.5	10
pH	7.5	8.2	7.1	0.8	10
C.E (µs/cm)	1360.5	1945	360	1120.8	10
Alcalinité (mg/l de $CaCO_3$)	201	240	135	74.2	10
Oxygène dissous (mg/l)	1.8	2.42	1.05	1.0	10
MES (mg/l)	482	670	355	222.7	10
DBO_5 (mg/l)	181.34	220.5	30.04	136.52	10
DCO (mg/l)	219.52	307.2	51.07	101.65	10
Nitrates (mg/l)	1.742	4.125	0.349	2.7	10
Nitrites (mg/l)	0.029	0.036	0.023	0.0	10
PO^3_4mg	0.089	0.147	0.059	0.1	10
Chlorures mg/l	237	315	160	109.6	10

La température des eaux usées de l'abattoir municipal ELAKAT est comprise entre 16.8°C et 26°C comme valeurs extrêmes minimales et maximales et 21.5°C comme valeur moyenne (**Tableau 1**). D'une manière générale, les échantillons des eaux usées analysées ont un pH relativement neutre. Pour la conductivité électrique, les valeurs moyennes enregistrées se situent entre 360µs/cm et 1945µs/cm avec 1360,5µs/cm comme valeur moyenne (**Tableau 1**). Les valeurs de Chlorures dans les eaux usées se situent entre 160mg/L et 315mg/L avec 237mg/L comme valeur moyenne (**Tableau 1**). Alors que, les valeurs trouvées de l'alcalinité montrent que les eaux usées de l'abattoir sont caractérisées par une concentration moyenne en bicarbonates de calcium ($CaCO_3$) de l'ordre de 201mg/L (**Tableau 1**). Les Nitrates comme les autres formes azotés évoluent très rapidement dans le milieu naturelselon le cycle d'azote. Les valeurs de Nitrates enregistrées au niveau des rejets du collecteur principal présentent des variations considérables pendant la période d'étude. Les teneurs en Nitrates des effluents de l'abattoir municipal varient entre 0,349mg/L et 4,125mg/L avec une concentration moyenne de 1,742mg/L. En revanche, les valeurs de Nitrites enregistrées dans les rejets d'abattoir ne présentent pas des variations considérables. Les teneurs en Nitrites des eaux usées analysées varient entre 0,023mg/L et 0,036mg/L avec une valeur moyenne de l'ordre de 0,029mg/L (**Tableau 1**).

Les concentrations en MES des eaux usées analysées varient entre 355mg/L et 670mg/l avec une moyenne de 482mg/L (**Tableau 1**). L'état d'oxygénation de ces rejets montre que, les valeurs extrêmes minimales et maximales de la teneur en oxygène dissous sont de 1,05mg/L et 2,42mg/L avec une concentration moyenne de 1,8mg/L (**Tableau 1**). Les valeurs de pollution organique exprimée en DBO_5présentent des variations négligeables entre les différentes campagnes de prélèvements. Les valeurs de DBO_5 enregistrées varient entre 30,04mg/L (valeur minimale) et 220,5mg/L (valeur maximale) avec une valeur moyenne de 181,34mg/L (**Tableau 1**). Les valeurs de la DCO présentent une variation non négligeable au cours de la période d'étude. Les valeurs varient entre 51,07mg/L et 307,2mg/L avec une moyenne de 219,52 mg/L (**Tableau 1**).

4 DISCUSSION

4.1 PARAMETRES PHYSICO-CHIMIQUES DES EAUX USEES MELANGEES D'ABATTOIR

Les valeurs de la température des eaux usées enregistrées sont inférieures à 30°C considérée comme valeur limite de rejet direct dans le milieu récepteur [28]. De même, ces valeurs sont inférieures à 35°C, considérée comme valeur limite indicative pour les eaux destinées à l'irrigation [28] (**Tableau 2**).

Le pH, indique l'alcalinité des eaux usées, son rôle est capital pour la croissance des microorganismes qui ont généralement un pH optimum variant de 6,5 à 7,5. Lorsque le pH est inférieur à 5 ou supérieur à 8,5, la croissance des microorganismes est directement affectée. En outre, le pH est un élément important pour l'interprétation de la corrosion dans les canalisations des installations de l'épuration. Les valeurs depH mesurés varient peu et restent autour de 7,5 en moyenne. Les valeurs obtenues sont comparables à celles trouvées ailleurs pour les eaux usées d'abattoirs qui présentent généralement un pH neutre à légèrement basique [29-31,7]. En revanche, elles ne sont pas en accord avec ceux trouvées par Wéthé et al, [16] au niveau des eaux usées d'abattoir de Burkina Faso.

La conductivité électrique est probablement l'une des plus simples et des plus importantes pour le contrôle de la qualité des eaux usées. Elle traduit le degré de minéralisation globale, elle nous renseigne sur le taux de salinité. C'est une expression numérique de la capacité de l'eau à conduire un courant électrique mesurée en millisiemens par centimètre. Les résultats obtenus mettent en évidence une variation plus ou moins importante de la minéralisation exprimée en conductivité moyenne. Ces résultats pourraient être expliqués d'une part par le rejet des eaux usées résiduaires des quartiers surplombant l'abattoir ELAKAT et d'autre part au rejet des déchets d'abattoir municipal fortement minéralisés. Nisbet [32] a signalé que des valeurs moyennes, comprises entre 449,7µs/cm et 1037,3µs/cm, mettent en évidence une forte minéralisation des eaux usées. La comparaison des valeurs de la conductivité électrique au niveau des eaux usées analysées avec les normes de qualité des eaux destinées à l'irrigation permet de déduire que ces eaux usées sont acceptables pour l'irrigation des cultures.

De même, ces valeurs moyennes sont inférieures à 2700µs/cm, considérée comme valeur limite de rejet direct dans le milieu récepteur [28] (**Tableau 2**).

Tableau 2 : Valeurs limites pour les différents rejets que ce soit directs (eaux pluviales), indirects (eaux usées) ou les eaux destinées à l'irrigation des cultures. [28]

Paramètres	Rejet direct	Rejet indirect	Eau destinée à l'irrigation
T^{o} C	30^{0}C	35^{0}C	35^{0}C
pH	6.5-8.51	6.5-8.51	6.5-8.5
DBO_5	100mg/l	500mg/l	-
DCO	500mg/l	1000mg/l	-
MES	50mg/l	600mg/l	2000mg/l
Conductivité	2700µs/cm	-	8.7 µs/cm

Les variations de l'alcalinité des eaux usées sont rapprochées de celles du degré de minéralisation (conductivité électrique, dureté totale, pH) qui donne aussi une indication sur le degré d'oxydation des composés organiques (cas des eaux résiduaires). La concentration des carbonates ($CO_3$2-) et des bicarbonates (HCO3-) dans l'eau est fonction de la teneur en CO_2 car ce dernier est très soluble dans l'eau (200 fois plus que l'oxygène) et sa solubilité dépend de la température et la pression atmosphérique. La concentration légèrement élevée de $CaCO_3$au niveau des échantillons analysés pourrait être attribuée aux rejets des eaux usées moins chargées en matières organiques fermentescibles susceptibles d'être oxydées et ayant pour conséquence, une production élevée de CO_2 [33]. Le $CaCO_3$peu soluble dans l'eau; cependant, la présence du CO_2 confère à l'eau une force de dissolutionbien plus importante en transformant le Carbonate de calcium en bicarbonate de calcium, lesquels sont plus solubles dans l'eau. Au niveau des effluents d'abattoirs de Canada, Massé et al., [5] ont rapporté des valeurs moyennes entre 83 et 900 mg/L en $CaCO_3$. Les mêmes auteurs ont signalédes valeurs très élevées entre 667 et 1056 mg/L dans une autre étude au Canada [5]. Les normes marocaines [28] recommandent une concentration en HCO3- de 250 mg/L pour les eaux destinées à l'irrigation des cultures (**Tableau 2**). Les valeurs de la conductivité indiquent une forte minéralisation de ces eaux usées pendant toute la période de prélèvement et permettent de constater que les variations temporelles de ce paramètre sont plus importantes.

L'azote présent dans l'eau usée peut avoir un caractère organique ou minéral.

L'azote organique est principalement un constituant des protéines, des polypeptides, des acides aminés et de l'urée. L'azote minéral qui comprend l'ammonium (NH4+), les Nitrites (NO2-) et les Nitrates (NO3-) constitue la majeure partie de l'azote total. Des valeurs très élevées de l'azote total (Nt) ont été enregistrées dans les eaux usées d'abattoirs du Brésil (entre 133 et 179g/l) par Miranda et al., [31] et une teneur moyenne en NH4+ de 163,7 mg/L [7]. Qu'au niveau des eaux usées d'abattoir d'El Jadida (Maroc), Chennaoui et al. [31] ont rapportés une teneur moyenne de 12g/L. Les teneurs en Nitrates dans les effluents de l'abattoir ELAKAT varient entre 0,349mg/L et 4,125mg/L avec une concentration moyenne de 1,742mg/L.L'accroissement de leur teneur peut provenir des effluents riches provenant des quartiers surplombant l'abattoir. Les teneurs restent dans la majorité des cas inférieurs à 2 mg/L à l'exception d'un pic observé au mois d'avril. Ces résultats sont comparables à ceux observés par Khamar [34] et Zerhouni [35]. Pour les Nitrites, qui constituent une étape importante dans la métabolisation des composés azotés, ils s'insèrent aussi dans le cycle d'azote entre l'ammonium et les nitrates. Les Nitrites proviennent généralement soit d'une dégradation incomplète d'Ammoniac soit d'une réduction des Nitrates, ils ne représentent qu'un stade **$CaCO_3$ + CO_2 Ca (HCO3)2 Ca ++ + 2 HCO3-**intermédiaire et facilement oxydés en nitrates (par voie chimique ou bactérienne).Les faibles concentrations en Nitrites rencontrées au niveau des eaux usées del'effluent étudié, pourraient être expliquées par le fait que l'ion Nitrite (NO2-) est uncomposé intermédiaire, instable en présence de

l'oxygène, dont la concentration estgénéralement très inférieure à celle des deux formes qui lui sont liées, les ionsnitrates et ammonium [33]. La comparaison des concentrations moyennes en Nitratesdans les eaux usées analysées avec la norme de qualité des eaux destinées àl'irrigation montre que, ces concentrations sont inférieures à 50mg/L, ce qui permetde déduire que ces effluents sont acceptables pour l'irrigation des cultures [28]

Les composés phosphorés existent dans les eaux naturelles et les eaux usées sous différentes formes à savoir les orthophosphates solubles, les phosphateshydrosolubles et les dérivés organophosphorés [24]. Les teneurs enregistrées enorthophosphates ne présentent pas de variations considérables au cours du cycle deprélèvement effectué. Les valeurs enregistrées varient entre 0,059mg/L et0,147mg/L avec une valeur moyenne de 0.089mg/L. Chennaoui et al., [31] ontrapporté une teneur moyenne en Orthophosphate de l'ordre de 1,8g/L. Au niveau deseaux usées d'abattoir de Canada, Massé et al., [29] ont trouvé des valeurscomprises entre 25 et 42 mg/L.D'une manière générale, la MES intervient dans la composition de l'eau par son effetd'échanges d'ions ou d'absorption aussi bien sur les éléments chimiques à l'état detraces que sur les microorganismes. Par ailleurs, ces valeurs moyennes en MES dans les eaux uséesanalysées sont supérieures à la valeur fixée par certaines normes environnementales [28]. Ces valeurs trouvées sont moins élevées par rapport aux résultatstrouvés par Massé et al., au Canada [5]. Par ailleurs, Chennaoui et al., [30] ontsignalé une concentration moyenne de 13,1g/L.La signification de paramètre de l'oxygénation des eaux est très claire puisque laprésence d'oxygène dissous conditionne les réactions de dégradation -aérobie- de lamatière organique et plus généralement l'équilibre biologique des milieuxhydriques. Dans les réseaux d'assainissement des eaux usées, sa disparitioncomplète s'accompagne généralement de l'apparition d'H_2S dans l'air, provenant dela réduction des composés soufrés présents dans les effluents, et corrélativement duphénomène d'attaque acide du béton des canalisations [33]. Par contre sa présence*Afrique* SCIENCE *05(2) (2009) 153 – 216*inhibe les activités dénitrifiantes de la flore spécialisé. La comparaison des valeursen oxygène dissous dans nos échantillons d'eaux usées analysées avec la grille dequalité des eaux de surface permet de déduire que ces eaux usées sont de qualitémoyenne très mauvaise [28] (**Tableau 2**).

Les valeurs élevées de la DBO_5, pourraient être expliqué par l'abondance de lamatière organique (débris de panse), et par la concentration de cet effluent par le sang des rejets de l'abattoir municipal drainés. Pour la DCO, les valeurs sont moinsfaibles que celles des eaux urbaines. Ces valeursmoyennes sont inférieures à 500 mg/L, considérée comme valeur limite de rejetdirect [28]. Par ailleurs, ces eaux usées sont classées comme de très mauvaisequalité selon les normes de qualité des eaux de surface [28] (**Tableau 2**).

Les valeurs de la DCO présentent une variation non négligeable au cours de lapériode d'étude Cette observation est similaire à celle faite par Khamar [34] etZerhouni [35]. La charge polluante des eaux usées, telle que mesurée par sa DCO,est un des plus importants critères utilisés dans la conception d'un traitement deseaux usées afin de déterminer le degré de traitement nécessaire. La charge à traiterest la DCO des eaux usées qui y sont amenées [37]. En outre, ces valeurs sont moinsélevées et ne concordent pas avec celles reportées par Sachon en France [11]; deTritt et Shuchard en Allemend [13]; de Gnagne et al. au Burkina Faso [8-18] et lestravaux de Miranda et al., [31], Reginatto et al. [7] au Brésil.

4.2 EVALUATION DE LA POLLUTION ORGANIQUE DES EAUX USEES

Pour une meilleure appréciation de l'origine des eaux usées de ces effluents étudiésde l'abattoir ELAKAT, le calcul des rapportsDCO/DBO5, DBO5/DCO, MES/DBO5 et l'estimation de la Matière Oxydable (MO) présente des intérêts très importants

Tableau 3 : Rations des eaux usées de l'abattoir ELAKAT

	Moy	Max	Min	Ecart type
DCO/DBO5	1.21	0.63	1.70	0.8
DBO5/DCO	0.83	1.60	0.59	0.7
MES/DBO5	2.66	1.37	11.82	7.4
Matières oxydables (mg/l)	227.4	429.07	37.05	277.2

L'utilisation de ces paramètres de caractérisation constitue un bon moyen pourdonner une image du degré de pollution des effluents bruts d'abattoir et aussi pouroptimiser les paramètres physico-chimiques de ces eaux usées afin de proposer unmode de traitement convenable.

4.2.1 RATIO DCO/DBO5

Le rapport DCO/DBO5 permet de déduire si les eaux usées rejetées directement dansle milieu récepteur ont des caractéristiques des eaux usées domestiques (rapportDCO/DBO5 inférieur à 3) [36]. Les résultats de ce rapport constituent une indication del'importance des matières polluantes peu ou pas biodégradables [24]. Les eauxusées de l'abattoir municipal présentent un ratio DCO/DBO5 variant de 0,63mg/L à1,70mg/L (**Tableau 3**) conforme avec celui des eaux usées urbaines à dominancedomestique présentant un rapport DCO/DBO5 inférieur à 3 [36]. Donc, on peutconclure que même si les eaux usées de ce rejet urbain présentent une chargeorganique élevée, elles sont facilement biodégradables. L'examen de ce rapportsouligne bien le caractère biodégradable des eaux usées mélangées de l'abattoirmunicipal auxquelles un traitement biologique paraît tout à fait convenable. Cesrésultats concordent avec celles reportés par Gnagne et Brissaud [18] et Zerhouni[35].

4.2.2 RATIO DBO5/DCO

Pour caractériser une pollution industrielle, on considère souvent le rapportDBO5/DCO, qui donne des indications très intéressantes sur l'origine d'une pollutiondes eaux usées et ses possibilités de traitement. Pour notre étude, ce rapport estrelativement élevé de l'ordre de 0,83 (**Tableau 3**). C'est le cas général pour lesrejets chargés en matière organique. Cette charge organique rend ces eaux uséesassez instables, c'est à dire qu'elles évolueront vite vers des formes "digérées"avec le risque de dégagement d'odeurs. En effet, les eaux usées de ce collecteur sontà dominante organique.

4.2.3 RATIO MES/DBO5 ET MATIERES OXYDABLES (MO)

Au niveau des eaux usées de l'abattoir municipal, le rapport DBO5/DCO est élevé(0,83), ce qui confirme que les eaux usées drainées par ce collecteur sont fortementchargées en matières organiques (**Tableau 3**). Ce résultat obtenu est confirmé parl'estimation de la Matière Oxydable, qui est de l'ordre de 227,4 mg/L avec un rapportmoyen de MES/DBO**5** de 2,66. Par ailleurs, le rapport DCO/DBO**5** est faible (1,2), ce quinous permet de déduire que la charge en matières organiques dans les eaux uséesde ce collecteur est facilement biodégradable selon Henze et al. [38].

Au niveau de ce rejet urbain, la charge organique est marquée par des valeurs trèsfortes de la DBO5, de la DCO, des matières oxydables (OM) et de faibles teneurs enoxygène dissous (Moyenne de 1,8 mg/L). La pollution parles matières organiques, dégradables ou non, est essentiellement due aux rejets del'abattoir ELAKAT, des effluents venant des quartiers surplombant le collecteur.

5 CONCLUSION

Les eaux usées de l'abattoir municipal de la ville de Bukavu présentent des valeurs desparamètres physico-chimiques majeurs de pollution qui dépassent relativement lesvaleurs limites générales des rejets directs et indirects dans le milieu récepteur, ce qui représente un risque de pollution environnementale pour cedernier d'où la nécessité d'un traitement de ces eaux usées brutes.Au terme de l'évaluation de degré de pollution organique, on peut constater quel'ensemble des paramètres étudiés (en particulier avec la DBO_5, la DCO et les MES)situent les eaux usées analysées dans la tranche à concentration moyenne à élever[39]. Par ailleurs, selon la classification des effluents urbains réalisée par l'OfficeNational de l'Eau Potable, ces eaux usées sont 5 à 7 fois plus chargées en matièreorganique [36]. En plus de la matière organique,elles contiennent les quantités adéquates d'azote organique pour subvenir aux besoinsdes microorganismes épurateurs des systèmes biologiques, cependant, lesorthophosphates avec des concentrations faibles peuvent présenter un problème pour letraitement biologique [40]. On peut conclure que les eaux usées de ce rejet sontfacilement biodégradables même si les rapports DBO5/DCO et MES/DBO5 sont élevés.L'examen du rapport DCO/DBO_5 souligne bien le caractère biodégradable des eaux uséesde l'abattoir auxquelles un traitement biologique paraît tout à fait convenable.Le traitement de ces eaux usées est nécessaire afin de produire un effluent qui respecteles normes de rejets directs et indirects selon le Ministère de l'Environnement [28]. L'abattoir ELAKAT génère une eau usée qui convient au traitement biologique entermes de DBO_5, MES, et substances nutritives (nitrates, nitrites et orthophosphates).Cependant, il faut tenir compte les caractéristiques physico-chimiques etmicrobiologiques des eaux usées domestiques mélangées avec les effluents de l'abattoir.

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Etude de l'activité antifongique des huiles essentielles de trois plantes aromatiques marocaines

[Study of the antifungal activity of essential oils of three moroccan aromatic plants]

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ABSTRACT: The work we have done has been devoted to study the antifungal activity of essential oils of three moroccan aromatic and medicinal plants towards of three strains of dermatophytes responsible for superinfection of a contact dermatitis. The essential oils of the three plants studied: *Thymus vulgaris*, *Mentha spicata* and *Citrus limonum*, showed significant inhibitory activities on the three fungi tested. The antifungal activity is linked to inhibition of mycelial growth with particularly high concentrations of essential oils. Thus, the essential oil of *Thymus vulgaris* showed the greatest activity against dermatophytes compared to other oils. According to their sensitivity, the *Trichophyton mentagrophytes* species showed a high sensitivity to essential oils more than other dermatophytes.

KEYWORDS: Thymus vulgaris, Citrus limonum, Mentha spicata, essential oil, Trichophyton mentagrophytes, Trichophyton rubrum, Epidermophyton floccosum, the antifungal activity.

RESUME: Le travail que nous avons réalisé a été consacré à l'étude de l'activité antifongique des huiles essentielles de trois plantes aromatiques et médicinales marocaines vis-à-vis de trois souches de dermatophytes responsables de la surinfection de l'eczéma de contact. Les trois essentielles des plantes étudiées : *Thymus vulgaris*, *Mentha spicata* et *Citrus limonum*, présentent des activités inhibitrices significatives sur les trois champignons testés. Cette activité antifongique est liée à l'inhibition de la croissance mycélienne notamment avec de fortes concentrations en essentielles. Ainsi, l'huile essentielle du *Thymus vulgaris* a montré l'activité la plus élevée contre les dermatophytes par rapport à celle des deux autres huiles. Selon leur sensibilité, l'espèce *Trichophyton mentagrophytes* a montré une sensibilité aux huiles essentielles plus importante que les autres dermatophytes.

MOTS-CLES: Thymus vulgaris, Citrus limonum, Mentha spicata, huile essentielle, Trichophyton mentagrophytes, Trichophyton rubrum, Epidermophyton floccosum, l'activité antifongique.

1 INTRODUCTION

Historiquement, l'homme a utilisé son environnement et en particulier les plantes médicinales pour traiter différentes maladies. On estime que les deux tiers des médicaments actuels sont d'origine naturelle, obtenue par hémisynthèse ou par modification d'un produit naturel et seulement un tiers des médicaments commercialisés ont une origine purement synthétique.

Le Maroc est doté d'une biodiversité végétale, avec un très grand nombre de plantes utilisées comme herbes, et à des fins thérapeutiques. De nombreuses substances naturelles ont été identifiées et beaucoup d'entre elles sont utilisées en

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médecine traditionnelle, pour la prophylaxie et pour le traitement des maladies. Des études récentes ont montré que les HEs et leurs constituants ont un potentiel considérable en tant qu'agent antimicrobien et elles sont utilisées dans de nombreux domaines [3], [7].

Les HEs ont trouvé leur place dans l'aromathérapie, la pharmacie, la parfumerie, la cosmétique et la conservation des aliments. Leur utilisation est liée à leur large spectre d'activités biologiques [14], [5], [6], [13], [12], [4]. L'objectif de notre travail est d'étudier l'activité antifongique des HEs de trois plantes aromatiques Marocaines: *M. spicata*, *T. vulgaris* et *C. Limonum* vis-à-vis de trois souches de dermatophytes: *Trichophyton mentagrophytes*, *Trichophyton rubrum*, et *Epidermophyton floccosum*.

2 MATÉRIEL ET MÉTHODES

2.1 MATÉRIEL VÉGÉTAL

Les plantes médicinales testées ont été recueillies dans différentes régions du Maroc. Les échantillons de *T. vulgaris* ont été récoltés dans la province de Tafilelt, ceux du *C. limonum* dans la province d'Agadir et ceux du *M. spicata* dans la province de Settat (Guisser). Le choix de ces plantes médicinales, a été pris à la suite d'une enquête et étude statistique menée dans différentes villes du Royaume. Les échantillons de la partie aérienne ont été utilisés pour l'extraction des HEs.

2.2 MODÈLE BIOLOGIQUE

Le choix des souches fongiques: *T. mentagrophytes*, *T. rubrum* et *E. floccosum* comme modèle pour l'étude est basé sur le fait que ces souches sont le plus souvent associées à une surinfection de l'eczéma de contact.

2.3 MILIEUX DE CULTURE FONGIQUE

Pour réaliser notre étude, nous avons utilisé deux types de milieu de culture:

2.3.1 MILIEU SABOURAUD [19]

Les souches fongiques sélectionnées ont été cultivées sur milieu Sabouraud afin d'avoir suffisamment de spores. La composition de ce milieu (pour 1 litre) est:

- Peptone ..... 10 g
- Glucose massé ..... 20 g
- Agar …… 15 g
- Eau distillée …….. 1000 ml
- Vitamines et facteurs de croissance
- pH = 6

2.3.2 MILIEU DEXTROSE DE POMME DE TERRE [2]

La culture finale des souches a été effectuée sur de l'agar de dextrose de pomme de terre contenant les HEs à des proportions différentes. Ce milieu de culture a été préparé de la manière suivante:

L'infusion de pomme de terre a été préparée en faisant bouillir 200 g de tranches de pommes de terre (lavées mais non pelées) dans un litre d'eau pendant 30 minutes à 1 heure. Le filtrat du bouillon résultant est ensuite dilué avec de l'eau distillée jusqu'à un volume final d'un litre. On y ajoute 20 g de dextrose et de gélose sous forme de poudre avant de stériliser à l'autoclave à 100 kPa pendant 15 minutes.

2.4 EXTRACTION DES HUILES ESSENTIELLES

L'extraction des HEs a été réalisée par hydrodistillation en utilisant un appareil de type Clevenger. Les rendements en HEs ont été déterminés par rapport à la matière sèche, estimée à partir d'échantillons séchés pendant trois jours à température ambiante. Les HEs obtenues ont été stockées à 4°C dans un réfrigérateur jusqu'à l'analyse.

2.5 CHROMATOGRAPHIE EN PHASE GAZEUSE COUPLEE A LA SPECTROMETRIE DE MASSE (CPG/SM)

Les HEs ont été caractérisées en utilisant un chromatographe en phase gazeuse « Trace GC Ultra » équipé d'un auto-injecteur « Triplus » directement interfacé avec un spectrophotomètre de masse muni d'un détecteur à ionisation de flamme (Pdains Q), d'une colonne capillaire DB-5 (à 5% de diphényle et 95% de diméthylpolysiloxane) de 30 m de longueur et 0,25 mm d'épaisseur. La température du four a été programmée comme suit : 50 ° C pendant 2 min, ensuite un gradient de 5 ° C / min jusqu'à 200 ° C. La température du détecteur est maintenue à 220 ° C. Le volume injecté est de 0,1µl. Le gaz vecteur est l'hélium avec un débit de 1,4 ml.min-1.

2.6 TECHNIQUE D'ETUDE DE L'ACTIVITE ANTIFONGIQUE [18], [21], [22], [23]

Pour évaluer l'activité antifongique des trois HEs, nous avons adopté la technique de contact direct sur gélose. Les champignons ont été cultivés sur milieu Sabouraud afin d'avoir suffisamment de spores. La culture finale des souches fongiques a été réalisée sur de l'agar de dextrose de pomme de terre (PDA) supplémenté d'huiles essentielles à différentes proportions. Les huiles essentielles ont été utilisées sous forme d'émulsions pour pouvoir être manipulées comme des solutions. L'agar-agar à 0,2 % a été choisi comme agent émulsionnant à la place du Tween 80 du fait qu'il est dépourvu de toute influence sur l'activité des HEs. Les différentes dilutions ont été préparées dans une solution d'agar dans l'eau distillée stérile pour obtenir différentes concentrations en HEs, puis elles étaient rajoutées au milieu de culture dextrose agar contenu dans les tubes.

La solution mère d'huile essentielle doit être au 1/10 et elle a été préparée dans une solution d'agar 0,2 %. À partir des différents tubes contenant des concentrations différentes en HEs, nous avons prélevé 2 ml qu'on a rajouté aseptiquement à 18 ml du milieu dextrose agar. Ainsi, nous avons obtenu différentes concentrations en HEs. Les tubes sont agités au Vortex puis le contenu est coulé dans les boîtes de Pétri. Les concentrations finales obtenues (V/V) d'HEs sont représentées dans le tableau 1.

Tableau 1. Les différentes concentrations en HEs dans les milieux de culture

N° du Tube	Concentration en HEs (%)
S0	10
S1	4
S2	2
S3	1
S4	0,1
S5	0,01

L'ensemencement a été réalisé en utilisant une pipette Pasteur au niveau de la surface du substrat. L'inoculum se présente sous forme d'une suspension dans l'eau physiologique de spores provenant d'une culture de sept jours dans le PDA. Chacune des boîtes a été ensemencée par trois espèces différentes qui ont été testées préalablement par d'autres auteurs quant à l'absence d'effets antagonistes entre elles. Enfin, l'incubation a été réalisée à température ambiante pendant quinze jours. La température d'incubation est de 25°C. Chaque essai est répété trois fois afin de minimiser l'erreur expérimentale.

3 RESULTATS ET DISCUSSION

3.1 LES RENDEMENTS EN HUILES ESSENTIELLES

Le tableau 2 montre les rendements en huiles essentielles des trois plantes étudiées.

Tableau 2. Rendements en huiles essentielles des trois plantes aromatiques

Plantes médicinales	Rendements (%)
Citrus limonum	0.75
Mentha spicata	0.72
Thymus vulgaris	0.65

3.2 PRINCIPAUX COMPOSANTS CHIMIQUES DES TROIS HUILES ESSENTIELLES

Les huiles essentielles ont été analysées par chromatographie en phase gazeuse couplée à la spectrométrie de masse (CPG/SM) afin d'identifier leurs principaux composants chimiques. Les résultats obtenus sont présentés dans les tableaux 3, 4 et 5.

Tableau 3. Principaux composants chimiques de l'huile essentielle du M. spicata

Principaux composants chimiques	Composition en pourcentage massique (%)
Alphapinène	0.32
Sabinène	0.32
Bétapinène	0.60
Myrcène	0.38
Limonène	9.14
1,8 cinéole	3.80
Linalol	0.21
Alphaterpinéol	1.98
Cis carvéol	1.17
Carvone	57
Pipériténone	0.14
Bétabourbonène	2.79
Bétacaryophyllène	2.96
Germacrène-D	8,12
Delta cadinène	0.29
Oxyde de caryophyllène	0.65

Tableau 4. Principaux composants chimiques de l'huile essentielle du C. limonum

Principaux composants chimiques	Composition en pourcentage massique (%)
Alpha pinène	2.66
Alpha thujène	2.66
Bétapinène	13.80
Sabinène	2.17
Myrcène	1.59
Limonène	66
Bétaphellandrène	0.29
Gamaterpinène	9,10
Para cymene	0.76
Citronellal	0.06
Linalol	0.15

Tableau 5. Principaux composants chimiques de l'huile essentielle du T. vulgaris

Principaux composants chimiques	Composition en pourcentage massique (%)
Bornéol	5,1
Terpinène-4-ol	1.4
Alphaterpinèol	0.5
Thymol	42
Carvacrol	2.4
Alphapinène	1.2
Camphène	1.2
Sabinène	0.6
Myrcène	0.4
p-Cymène	23.7
Gamaterpinène	15.5

Les résultats de l'analyse des trois huiles essentielles sont globalement en accord avec la littérature [10], [8], [16], on note une légère différence dans la composition chimique des principaux composants, ceci peut être dû à des facteurs abiotiques tels que le climat spécifique des régions d'origine des échantillons, des facteurs géographiques comme l'altitude, le type de sol et la saison de la cueillette.

3.3 ACTIVITE ANTIFONGIQUE DES HUILES ESSENTIELLES

Pour évaluer l'activité antifongique des trois huiles essentielles, nous avons adopté la technique de contact direct sur gélose. Les résultats ont montré que les HEs ont une activité significative contre les dermatophytes testés. Les trois champignons ont continué de croître sur les milieux sans essences et aussi sur les milieux dont la concentration en HEs est de 0,01%.

- L'HEs de thym inhibe complètement la croissance des dermatophytes à des concentrations égales ou supérieures à 2% ;
- L'HEs de la menthe inhibe totalement la croissance à des concentrations égales ou supérieures à 4% ;
- L'HEs du citron inhibe la croissance de la totalité des dermatophytes à des concentrations égales ou supérieures à 10%.

Les tableaux 6, 7 et 8 résument les résultats de l'inhibition de la croissance des dermatophytes par les HEs. Ainsi, en fonction de leur sensibilité, l'espèce *T. mentagrophytes* a montré la sensibilité la plus importante par rapport aux autres dermatophytes étudiés, tandis que la souche *E. floccosum* a montré une sensibilité plus faible aux HEs.

Tableau 6. Activité d'inhibition de l'HE du thym sur la croissance des dermatophytes

Concentration en HE (%) / Dermatophytes	0,01	0,1	1	2	4	10	Témoin
T. rubrum	+ + +	-	- -	- - -	- - -	- - -	+ + +
T. mentagrophytes	+ + +	-	- - -	- - -	- - -	- - -	+ + +
E. floccosum	+ + +	+ + +	- -	- - -	- - -	- - -	+ + +

Tableau 7. Activité d'inhibition de l'HE de la menthe sur la croissance des dermatophytes

Concentration en HE (%) / Dermatophytes	0,01	0,1	1	2	4	10	Témoin
T. rubrum	+ + +	+ + +	- -	- -	- - -	- - -	+ + +
T. mentagrophytes	+ + +	-	-	- -	- - -	- - -	+ + +
E. floccosum	+ + +	+ + +	- -	- -	- - -	- - -	+ + +

Tableau 8. Activité d'inhibition de l'HE du citron sur la croissance des dermatophytes

Concentration en HE (%) / Dermatophytes	0,01	0,1	1	2	4	10	Témoin
T. rubrum	+ + +	+ + +	-	-	- -	- - -	+ + +
T. mentagrophytes	+ + +	-	- -	- -	- -	- - -	+ + +
E. floccosum	+ + +	+ + +	+ + +	-	- -	- - -	+ + +

- : inhibition faible; - - : inhibition moyenne ; - - - : inhibition forte; + + + : forte croissance.

Plusieurs études ont été effectuées sur l'activité antifongique des HEs de *T. vulgaris*, *M spicata* et *C. limonum* [1], [9], [17], [20]. Cependant, rares sont ceux qui ont été consacrés à leur activité contre les dermatophytes responsables de la surinfection de l'eczéma de contact.

Les résultats obtenus dans cette étude ont montré une inhibition significative des HEs sur la croissance des dermatophytes. L'HE du thym a montré l'activité la plus élevée par rapport à celle des deux autres espèces, cette activité antifongique est liée à la substance active: thymol. Tandis que l'HE du citron a montré l'activité la plus faible. Ces résultats sont cohérents avec la classification établie par plusieurs auteurs [11], [15].

L'évaluation de l'activité antifongique de ces HEs a montré que les variations d'inhibition est en fonction de nombreux facteurs, notamment la nature et la concentration de l'huile essentielle, ainsi que la souche fongique étudiée. Ainsi, les différences observées entre les activités antifongiques des différentes HEs étudiées peuvent être attribuées à des différences dans leurs fractions actives. En outre, les concentrations d'HEs nécessaires pour inhiber la croissance sont très faibles. Cependant, il convient de noter qu'il existe une sensibilité différentielle des dermatophytes testés vis-à-vis des trois HEs étudiées.

4 CONCLUSION

Ce travail a été consacré à l'étude de l'activité antifongique des huiles essentielles de trois plantes aromatiques et médicinales marocaines vis-à-vis de trois souches de dermatophytes impliqués dans la surinfection de l'eczéma de contact. Les trois huiles essentielles testées présentent des activités inhibitrices significatives sur la croissance des dermatophytes testés.

Toutefois, les différences entre les résultats peuvent être expliquées par la composition des huiles essentielles et la nature des dermatophytes. Sur la base de l'efficacité contre les souches fongiques, le thym a montré l'efficacité la plus élevée par rapport aux autres plantes étudiées.

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Social and Cultural dimensions of Development through Amartya Sen's lens

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ABSTRACT: Sen's capability approach differentiates between "being and doing"- with doing defined as what individual is capable of doing. And since individual's capability is dependent on as diverse factors as political voice, education, health, and social facilities, in this way culture turns out to be one of the primal factors affecting behaviors and capabilities of individuals, and that in turn can lead to economic and social development.

KEYWORDS: Social and Cultural dimensions, Development, Amartya Sen's lens.

From Charles Darwin's theory of evolution examining the shifting patterns of social organization to Herbert Spencer's theory of naturalism, Emily Durkheim's retribution to those who disengage from the well-integrated societies, Talcott Parson's technocratic social divide of individuals, Max Weber's theory of rationalism and Protestant ethics, and Asia's or more precisely Confucian ethics, all have explained the importance of social and cultural dimensions of development. Sen highlights the importance of not only the culture but also the ways through which culture can influence development. Going beyond the limited views of defining development on GNP/Capita thresholds, he encapsulates culture with all its interconnections and intricacies to complement the technocratic measures of development. Sen's capability approach differentiates between "being and doing"- with doing defined as what individual is capable of doing. And since individual's capability is dependent on as diverse factors as political voice, education, health, and social facilities, in this way culture turns out to be one of the primal factors affecting behaviors and capabilities of individuals, and that in turn can lead to economic and social development.

Sen, rather than jumping onto the conclusions, though implicitly but averts the ways through which cultural values and resulting behavioral norms can adversely affect the social and economic development as well. He is quite right because if cultural pluralism, and tolerance defines the term ethno development for Malaysia and Singapore then anti-territorialism, overtly disdainful nationalistic approach and most importantly cultural singularism also give birth to horrendous examples of genital mutilation and tearing out of fetus from expected Muslim women's bellies in Gujarat pogrom (India-2002) and premeditated killing of Chittagong hill tract people by military coups in Bangladesh.

Sen's analysis of culture influencing behaviors, and both in turn influencing development is the main crux of the subject matter. Weber's Western ethics provides us with insights into the German Capitalism proliferations. According to Max Weber there is a rationale or reasoning to everything that a person does or thinks. Despite the importance of reason and power to analyze, a person never undermines the importance of religion in his life. According to which if a person puts aside his own benefits for the sake of God-human eternal relationship; he will be rewarded with the long term economic progress. Severely denounced by most of the contemporary theorists who see religion as an impediment to development and more importantly with the emergence of non-Protestant and Catholic countries showing good economic performance, avenues for Asian ethics (Buddhism, Hinduism, Islam, and Confucianism) were viably opened. Again criticizing the Weber's social evolution as

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sanctimonious and self-reinforced, Asian ethics in general and Confucian ethics in particular explained the unprecedented success that Japan has shown. Releasing itself from the hard clutches of historical hardships Japan, soon after independence, inclined towards ways through which development could be ensured. With good governance, excellent entrepreneurship, trust worthy financial markets, and effective macroeconomic policies, Japan joined the club of highly industrialized countries. But, as Sen explains, behind these successes were the close harmony between the cultural values and behavioral norms- that few people link with Samurai code of honor, others with radical educational movements, and most with the Confucian ethics. But if these culturally (ethically) influenced strong forces provide an explanation of the "then" known Japanese strong position then why "present" Japan is criticized for its inefficiency and corruption. Presumed influence of Confucian ethics over the rapid industrialization in Japan provides interesting insights. Capricious nature of variable cultural values (based primarily on trust), providing a reason for Japan's economic growth can be the result of varying ethical influences as well.

Sen's assertion is apt that if Protestantism is subject to criticism for its eurocentricism then why the influence of Confucian ethics is so heavily concentrated over the Asian ethics. Sen's critical innuendo is quite conspicuous because if Confucian ethics highlight emphasis on education, saving, grassroots progress, and business ethics (all factors contributing to good performance of economic institutions) for long term development, then Confucianism also upsurges hierarchy, and despise for merchants and craftsmen (detrimental to the good performance of economic institutions) leading to under-development. China is also a Confucian society but the way it has modified its cultural values and ethics, and kept its pace steady with the pace of the ever changing time is remarkable. Hence if culture influences development, then development also influences culture- a binary relationship.

Perhaps that is why Sen highlights the importance of investment in development projects for culture uplifting programs that not only provide with income/employment generating opportunities to poor people but also encourage cultural indigenousness and pluralism (Sen's reference to Nalanda University for which he is named its first chancellor in July-2012). It can be exemplified with sustainable tourism or what we usually call the "ecotourism"; it focuses on promoting indigenous cultural practices providing job opportunities in such an enabling atmosphere where no environmental degradation takes place. Bunun Cultural and Educational Foundation, in Taiwan, promote Bunun indigenous group providing entertainment and information to the foreign and local visitors through dance performances and traditional craft techniques. Similarly, Annapurna Conservation Area Project (ACAP) in Nepal, adding on to the social and economic development through absorbing more people in jobs, also brings forth the issue of deforestation by the local and foreign mountain trekking groups, for that reason ACAP charges entrance fees to trekking tourist which are then used for the betterment of local people and environment. Sen also expounds how cross country movement of goods, services, people, and even ideas adversely affect the roots of any culture. Rightly said so because mcdonaldization and coca-colaization (to name a few) have seriously put the relevance, integrity, decorum, and authenticity of various deep rooted cultural values and traditions into jeopardy.

In doing so Sen does not explicitly consider the economic and environmental aspects (read issues) related to Globalization. The relevant example we can think of in this particular dimension is the destruction of Mangrove forest in Thailand due to shrimp farming. As a result of rise in international demand (USA, China, and Europe) for shrimps, 11500 new shrimp farms were formed in a period of ten years. On one hand it led to absorb many people in labor market and increase foreign exchange earnings (economic gains), but on the other hand the replacement of major forest area for shrimp farming also led to disturb the Mangrove ecosystem by complex aquaculture, and soil erosion (environmental issues). Though environmental concerns were shown by the government but again the economic gains through trade were so accentuated that whatever perceived to be done for environmental up gradation proved out to be quite antithetical to what actually happened (the loss of 191000 hectares area of mangrove forest in three decades).

In complacency with what Sen cites, individuals who make social decisions should never forget the depth and intensity that culture, with all its share of positives and negatives, presses upon them, particularly in the context of democratic states. Just for instance when he clarified the untrue but mostly believed notion of higher growth associated with the non-democratic states (South Korea, Singapore, China to name a few) and lower growth associated with democratic states (India, and Jamaica), Sen explained factors other than conventional economic ones that define economic growth.

Particularly in the context of democratic systems, political and civil rights define socio-economic fabric of the society on one hand, and gives people the chance to have their own say, on the other hand (DEMOCRACY AS A CORE VALUE- UNICEF (1999), SEN). And for that people need to be well informed and educated. Perhaps, for that reason, Sen purposefully stresses upon the need for infusing cultural dimensions into development for the fact that in West, Asian cultural values are seen as stiff, skeptical, and defiant to political freedom in general, and individual (ultimately social) choice in particular.

Sen always treads the untrodden path, from incorporating freedom, equality, gender, ethnicity, and political voice into development to the main thrust behind Alkire -Foster measure of multidimensional poverty, Sen has always taken the unconventional path and broken away the shackles of monolithic and polylithic economic orthodoxies. Capitalism (Sen refers

to Montesquieu- a philosopher who staunchly advocated the good deeds resulting from Capitalism) or anti-Capitalism (again Sen's incredibly original didactic allusion is breezy when he refers to Jerry Rubin (a social worker who advocated social evils like greed and corruption as a result of Capitalism)), he stresses on the need of pulling the most disadvantaged out of the quagmire of issues they all are in, and trickling the benefits from the advantaged down to the disadvantaged. And if it all happens keeping the cultural dimension of development intact, it will complement the economic, political, and ecological dimensions of development with minimum divergent views and conflict.

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Assessment and Identification of Insect Pests on Sweet Oranges (Citrus sinensis) in Tony Farm, Dire Dawa, Ethiopia

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ABSTRACT: *Aims:* This study focused on the assessment and identification of key insect pests on sweet oranges (*Citrus sinensis*) plantation in Tony farm of Dire Dawa town. It was also explain the abundance of key pests and effective controlling methods.
Methodology and Results: The farm lands of sweet oranges stratified in to nursery stage and adult stage by using stratification method technique. Then random sampling method of data collection was carried out in both strata. By this method direct observations were taken place and the data collected from this area were analyzed. The larvae and adult stages of key insect pests of sweet oranges were identified by using the dissecting microscope. Citrus leaf miners, leaf dogs and cottony cushion scale are key insect pests of sweet oranges in this area. From these citrus leaf miners are highly dominant where as orange dog is less in abundance.
Conclusions: Citrus sinensis plants in Tony farm are highly damaged by these key insect pests particularly nursery stages of plants are devastated.

KEYWORDS: Citrus leaf miner, Cottony cushion scale, Leaf dog, dissecting microscopy, larvae.

1 INTRODUCTION

Citrus orange (*Citrus sinensis*) is a high value crop grown in the tropical and sub-tropical regions of the world. Currently citrus is cultivated in more than 130 countries with Brazil, China and USA being the biggest producers; Spain and South Africa the most important exporters (Ismail and Zhang, 2004) as stated in Mekbib *et al.,* 2006). It is among the most important fruit crops of Ethiopia. Its cultivation started in Upper Awash Valley and Malkessa areas in South East Ethiopia (Kassahun. *et al*., 2006). Sweet orange cultivation covers 82% of the total citrus areas surveyed in the country. This represented under government ownership 97%, individual 2.6% and association farm 0.4% (Mekbib *et al*., 2006).

Numerous fruit crop pests have been recorded in Ethiopia. Forinstance, in Arbaminch (South Eastern) lost the production of citrus up to 80% (Mekbib *et al*., 2006). Red scale, leaf miner, Mediterranean fruit fly, false codling moth, thrips, aphids and budmites were identified as a major pest on all citrus farm of Ethiopia (Sundari and Santhi, 2006). Production of sweet orange is also threatened by the devastating of leaf and fruit spot disease caused by *Phaeramularia angolensis* (Kassahun *et al*., 2006).

Ethiopia is a new comer in citrus trade (Seifu, 2003). Over past 30 years exports amount have dropped due to poor quality delivered on to the market, which is mainly due to lack of improved production practices and technology transfer has hampered industry growth (Tamesse, 2009). Due to the most common pests of plants such as aphids, white fly, fungus, worms, leaf miner, snails and scale insects; qualities of product released to the market become decreased (Armizage, 1994). Some pests have explosive burst of population increases, rapidly reaching a level where vast damage is caused (rats and

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locusts). However, other pest species cause huge damage and yet their population growth rate is relatively small such as codling moth (*Cydia pomonella*) (Stansly *et al*., 2011). One important characteristic of pests is the degree to which they are normally regulated by their natural enemies such as predators and parasites (Mackenzie *et al*., 2002).

2 MATERIALS AND METHODS

STUDY SITE DESCRIPTION

This study was carried out in Tony farm. The location of Tony farm is $09^0$26'00" of latitude and $41^0$05'00"E longitude in Dire Dawa town. Its altitude is 1160 m and the rainfall of this area is 500 mm per year. The mean monthly maximum temperature range between 31-34^{o}C while the mean monthly minimum temperature range between18-22^{o}C.The farm land characterized by loam, sand and alluvial soil types occupied by many farming activities such as production of fruits, vegetables and cereal crops.

SAMPLING DESIGN

Citru sinensis plants were stratified into nursery stage and adult stage depending on their stage of growth. Badawi and Al-Ahmed (1990) and Sauza and Carvelho (2002), used simple random sampling method on stratified farm land. Insect pests of sweet oranges were brought to the laboratory and they were identified by dissecting microscope (Cherry and Stansly, 2011). The stage and characteristics of the insect pests of sweet oranges were identified while the morphological features study was conducted in the laboratory.

Calculation on number of sample in the population and in each stratum:

N = 3100 (population)

NH1 =1000 (number of nursery stage or non over lapping units in nursery stage)

NH2= 2100 (number of adult stage or non over lapping units in adult stage)

d = absolute error (0.57 by assumptions depending on my study

S2 =sample variance (10.24 from previous researchers)

n = sample size

Z (α/2)2 =1.96 (from table of normal distribution)

α=0.5,

nh = number of sample units in stratum

Sample size of the population: $n=\frac{Z_{\frac{\alpha}{2}}^2 s^2}{d^2}=\frac{1.96\ (10.24)^2}{(0.57)^2}=120$

Number of sample units in each stratum (nh) = $\frac{\mathrm{n}}{\mathrm{N}}\mathrm{NH}$

Let, number of sample unit of nursery stage is nh_1 and number of sample unit of adult stage is nh_2

$nh_1 = \frac{n}{N}NH1$, $nh_1 = \frac{120}{3100}(100)$, $nh_{1=39}$

$nh_2 = \frac{n}{N}NH2$, $nh_2 = \frac{120}{3100}(2100)$, $nh_{2=81}$

The sample size was calculated by $\mathbf{n=\frac{Z_{\frac{\alpha}{2}}^2 s^2}{d^2}}$, where $\alpha = 0.5$, n= sample size, s^2= sample variance, d=absolute error and $\boldsymbol{Z_{\frac{\alpha}{2}}^2}$= obtained from table normal distribution (1.96). Also $\boldsymbol{s^2 = 10.24}$, which gained from previous researchers and d= 0.57 by assumptions. From this the calculated number of sample size is 120. When the size of stratum is given, proportion allocation is the only available and there is difference in size between strata. So the number of sample units in the stratum (nh) was calculated by $\boldsymbol{\frac{n}{N}NH}$, where NH=total number of non over lapping units in stratum, n=total sample size and N=total population size. Generally, from the 3100 populations of sweet oranges, which include 2100 adult stage and 1000 nursery stage, the study was conducted on 39 and 81 sweet oranges of nursery stage and adult stage, respectively.

DATA ANALYSIS

Quantitative and qualitative information, which collected from the laboratory activities and field observations were grouped, tabulated and interpreted in terms of percentages. Finally, possible definitions, conclusions and recommendations were forwarded.

3 RESULTS

FIELD ANALYSIS

Field work was done on insect pests of sweet oranges found in the Tony farm in Dire Dawa town. Daily observation was carried out to handle good information from the pests (morning, mid day, and afternoon). Three types of key insect pests were described from the farm land. These are: Leaf dogs (Orange dogs), Cottony cushion scale, and Citrus leaf miner. Then their presences and abundances were checked by using parameters such as time of feeding and parts of plant they feed. Finally, some control methods are applied to identify necessary method to control the influence of these pests. Cultural, Chemical and Mechanical methods are applicable for all of them except chemical method were not workable for citrus leaf miners in Tony farm.

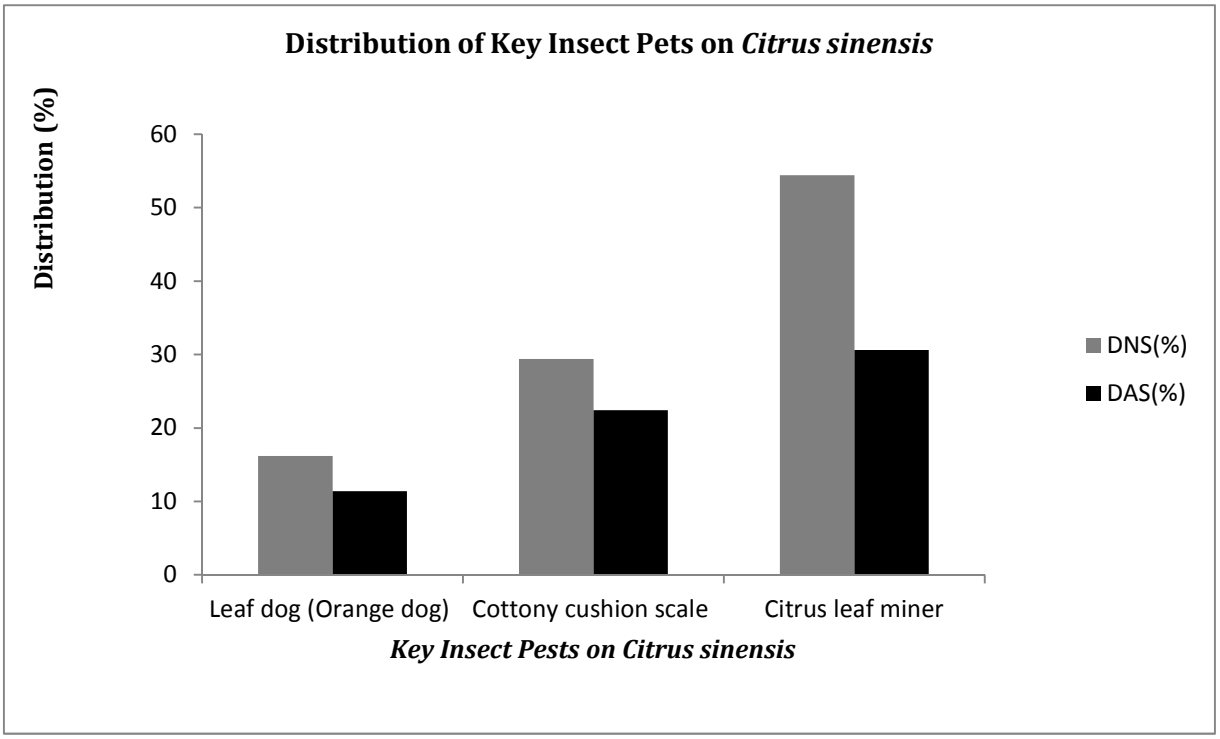

Figure1: Shows Distribution of Key Insect Pests on Sweet Oranges (Citrus sinensis) in Tony farm, Dire Dawa Town, Ethiopia. Abbreviation: DNS - Distribution on nursery stage in % and DAS - Distribution on adult stage in %. From this analysis Citrus leaf miner is highly distributed on both adult and nursery stage of sweet oranges

Table 1: This table shows three key insect pests with their time of feeding, parts of sweet orange they influence and control methods.

No.	Key Insect Pests	Time of feeding	Parts of plant they influence	Control method
1	Leaf dog	Morning and afternoon	Leaves Stem	Cultural Chemical
2	Cottony cushion scale	Every time	Leaves Branches Stem	Cultural Chemical Mechanical
3	Citrus leaf miner	Every time	Young leaves Stem	Cultural Chemical mechanical

Table 2: This table describes morphological characteristics of key insect pests of Sweet oranges at larvae and adult stage from Tony farm, Dire Dawa Town, Ethiopia. These morphological characteristics were done by using dissecting microscopy.

No.	Key Insect Pests	Morphological Characteristics	
		Larvae Stage	**Adult stage**
1	Leaf dog	Dark brown with creamy white Mottled markings Segmented body parts Many prologs (false legs) Large head region One pair of antennae like structure on head region	Largest swallow tail Wings are black with yellow markings near wing margins Spots on fore wings One pair of antennae Two pairs of wings Three pairs of legs
2	Cottony cushion scale	Covered with whitish, cottony substance Segmented body part	Varies in color : orange, yellow, red or brown Segmented body part One pair of antennae Three pairs of legs No wing Body part divided in to three part(head, thorax and abdomen) White sac attached to its body
3	Leaf miner	Very small Seems like maggots Segmented body part Straight in shape	Brownish grey Hind wings fringed with long hairs One pair of antennae Two pairs of wings Smaller than butterfly

4 DISCUSSIONS

This study revealed three key insect pests of sweet oranges in Tony farm land: leaf dog (orange dog), cottony cushion scale, and citrus leaf miner. Under this work field observations and laboratory analysis are managed. As the result their distribution, time of abundance, their influence, control methods and morphological characteristics of key insect pests are explained. Citrus leaf miners are the most abundant from key insect pests of nursery stage and adult stage of *Citrus sinensis* found in Tony farm. As a result both stages are highly affected by citrus leaf miners.

LEAF DOGS (ORANGE DOGS): *PAPILIO CRESPHONTES* CRAMER

Caterpillar stage is commonly known as orange dog caterpillars or orange dogs (Pherson and Goodwin, 2008). The orange dog caterpillars feed on new leaves and young stem of sweet oranges. While they feed on the plant, they devastate the leaves and stem parts of plants. The adult stage of these larvae is called butterfly. Adult butterfly is one of the largest swallow tail species, with a wing span of wings are black with yellow markings near wing margins and spots forming a diagonal across the fore wings. The adult stage feed on nectar of plants while the caterpillars feed on leaves of sweet oranges.

Caterpillars are highly dominant on the sweet orange species at the morning and afternoon because they need less power of sunlight for their feeding time. At the mid-day when the temperature increases they move down to the stem of the orange under the leaf to escape from direct light rays. Therefore, the ability of their feeding at the mid day is less than other times.

Orange dog caterpillars can be controlled on small trees by finding, crushing eggs and caterpillars. This method is highly practiced in Tony farm and they are benefited from this method. Also they use chemical control method to reduce the abundance of orange dog caterpillars. For instance, *Carbosulfon* and *Dimethonate* are known chemicals, which they used to control these pests. Generally, cultural control method is the most dominant method in Tony farm rather than other control methods.

CITRUS LEAFMINER: *PHYLLOCNISTIS CITRELLA* STAINTON

The adult stage of citrus leaf miner is called moths (Sundari and Santhi, 2006). It is brownish- grey in color, with hind wings fringed with long hairs. The citrus trees are not damaged by the adult months. The damage is caused by larvae when they feed on the leaves. The cater pillars mine in between the epidermal layers of the leaf, which results in distortion of leaf lamina. Similarly, citrus leaf miners affect young stem of *C. sinensis* plants. These larvae do not kill the adult stage of the plant, but can cause unsightly damage (Williams, 2010). However, they highly attack the nursery stage or excessive feeding can retard growth of sweet oranges, because, they are highly dominant on nursery stages. Citrus leaf mines larvae are found in leaf parts of sweet oranges throughout the day, but the adults are seldom seen. This is because; they are nocturnal type of insects (Sundar and Santhi, 2006). Larvae of citrus leaf miners always cause the damage which characterized by silver or yellowish or lines on the surface of the leaf.

Generally, the problem caused by these larvae hold up the growth of the sweet oranges. When the lamina part of the leaf twisted, the photosynthetic process which takes place in the leaf part became blocked. Due to this, the necessary food provided by photosynthesis is decreased. Thus the metabolic rate in the plants body became low (Manner *et al*., 2006). As result, the plant growth decrease from time to time and retarded.

Cultural and mechanical control method is effective for citrus leaf miners larvae. Simple the heavily affected part of plant pruned and burned. Also the affected part of plat can be damped into the ground. Then it became decomposed and changed to soil by micro organisms or decomposers. Chemical control methods are not applied for citrus leaf miner in Tony farm. Since the larval stage of this insect pest usually lives in internal part of the leaves it needs expert to manage it. Heppner and Fasulo (2010) stated that, chemicals such as *Dimethonate, Carbosulfan, Malathion Phosphamidon and Profenophes* are imperative to control citrus leaf miners.

COTTONY CUSHION SCALE: *ICERYA PURCHASI* MASKELL

The cottony cushion scale is now widespread throughout the world wherever citrus is grown (Ebeling 1959). The body of the cottony cushion scale is orange, red, yellow or brown. However, it is most easily recognized by the fluted, cottony white egg sack that is attached to its body. Its larvae stage is called nymphs (Hamon and Rasulo, 2010) and is covered with a whitish, cottony substance. Cottony cushion scales affect by sucking the sap from the leaves, stem and branches of sweet oranges. This insect damages the sweet orange gradually by spreading on the parts of the plant. They usually found on plant parts in groups by condensing on particular area; as the result the food demand by insect pest became increase. Hence, they suck the sap from the body part of the plant and retard growth of plants (Badawi and Al-Ahmed, 1990).

The damage is caused by both larvae and adult stage of cottony cushion scale. As a result they highly affect the sweet oranges next to the leaf miners. That means, they are highly dominated nursery stage of sweet oranges. They can affect the adult stage, but they cannot highly affect due to the hardness of the adult stage (Hamon and Rasulo, 2010). Cultural, mechanical, and chemical methods were most dominant used for this pest. By mechanical method they remove the larvae and adults from the plants and kill them. Also chemicals such as malathion and carbosulfon were used.

OUTPUT OF THE STUDY

Three key insect pests (Citrus leaf miners, cottony cushion scales and leaf dogs) of sweet oranges are identified in Tony farm. Also cultural, chemical and mechanical control methods are applied and positive feed backs are achieved.

5 CONCLUSIONS

Citrus leaf miners, cottony cushion scales and leaf dogs are most dominant key insect pests of sweet orange species in Tony farm. Citrus leaf miners are most dominant in both nursery and adult stage of sweet oranges, where as leaf dogs less in number. The damage is caused by the larvae stage of these insects. The adult Stage of cottony cushion scale can cause damage to the sweet oranges. Generally, these insect pests of sweet oranges are very known and dominant in tony farm of Dire Dawa town.

RECOMMENDATIONS

For interrupting the growth of insect pests of sweet oranges in tony farm, it is better if they use integrated pest management methods. Also increasing the water sources for this farm land is one solution for this problem because this farm land has scarcity of water. Plants can easily grow and resist the damage of pests while the water source is sufficient. In addition to these, they have to make the border between the beds of plants land to reduce the trans-boundary of insect pests from one to other plants. As a general to minimize the effect of insect pests of sweet oranges in this area, the integrated pest management is the essential one.

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