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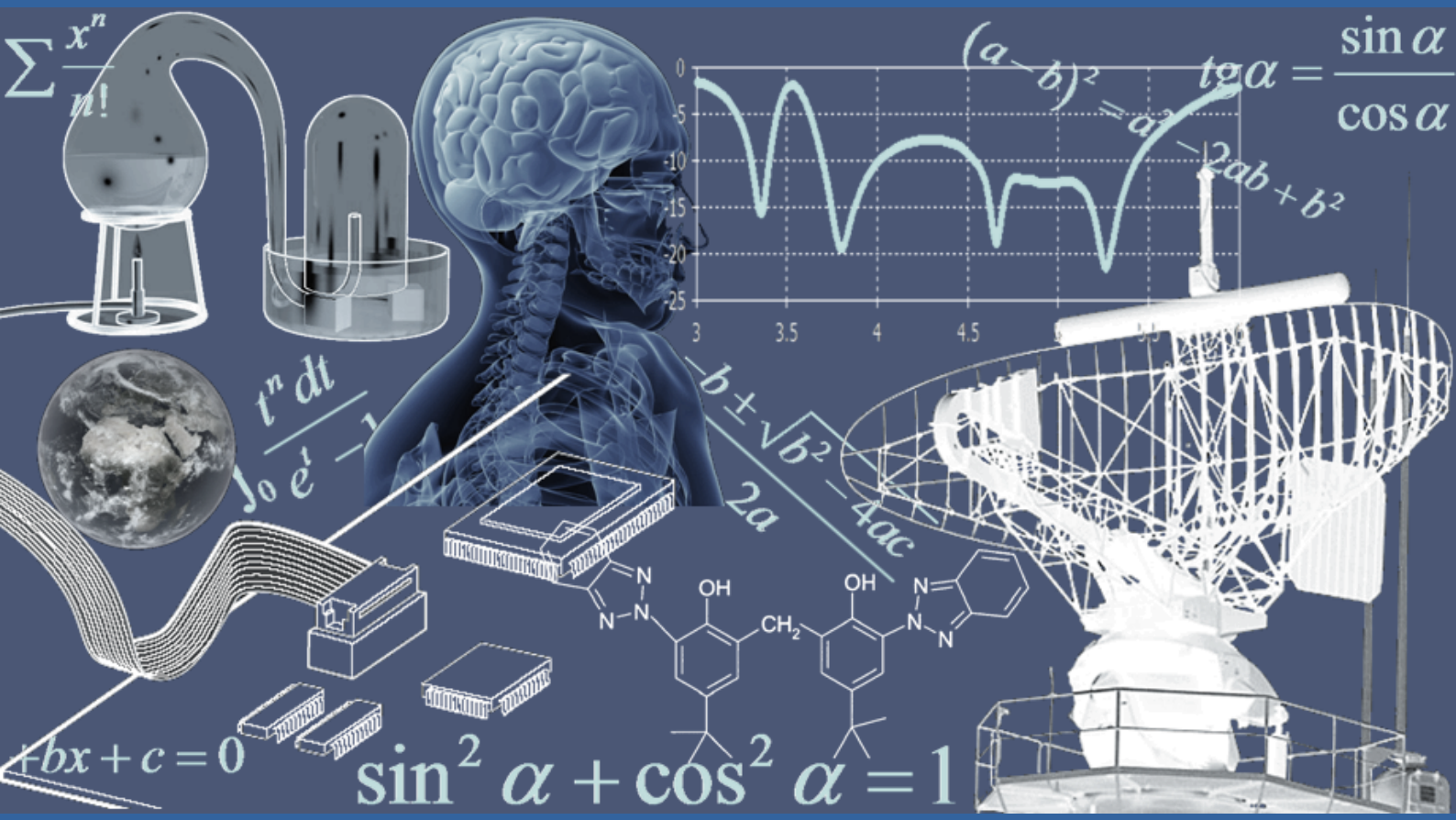

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Table of Contents

Investigation of Corrosion of the Pipeline Using TOEFLT in Iran Refinery 153-159

Amir Samimi and Soroush Zarinabadi

Agricultural Marketing Information Usage among Soybean Farmers in Nigeria 160-170

Benjamin C. Asogwa, J. A. C. Ezihe, and F. O. Ogebe

Normal Paraffin Production Process of Kerosene in Oil Refinery Company 171-177

Amir Samimi

Towards a participatory E-learning 2.0 based on the use of Vwiki tool 178-185

Boubker Sbihi, Kamal Eddine El-Kadiri, and Noura Aknin

Use of Polyurethane Coating to Prevent Corrosion in Oil and Gas Pipelines Transfer 186-193

Amir Samimi

Variabilité climatique et productions de café et cacao en zone tropicale humide : cas de la région de Daoukro (Centre-est de la Côte d'ivoire) 194-215

Kanohin Fulvie epse Otchoumou, Mahaman Bachir Saley, Aké Gabriel Etienne, Savané Issiaka, and Djé Kouakou Bernard

Study an Analysis and Suggest New Mechanism of 3 Layer Polyethylene Coating Corrosion Cooling Water Pipeline in Oil Refinery in Iran 216-225

Amir Samimi

Offer a New Model to Prevent Formation of Hydrate in Gas Pipeline in Gas Refinery 226-231

Amir Samimi

Explotion of Resources Management in Iran 232-235

Marzieh Samimi and Amir Samimi

Performance Analysis of Cooperative Spectrum Sensing in Cognitive Radio 236-245

Mohammad Alamgir Hossain, Md. Shamim Hossain, and Md. Ibrahim Abdullah

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Investigation of Corrosion of the Pipeline Using TOEFLT in Iran Refinery

Amir Samimi and Soroush Zarinabadi

Department of Chemical Engineering,
Mahshahr Branch, Islamic Azad University,
Mahshahr, Iran

ABSTRACT: Corrosion, from long time before was a greatest problem in oil and gas industry and experts have always tried to combat this major problem. This has been given to the corrosion and inspection in oil and gas industry. Corrosion in oil and gas wells has the electrochemical mechanism, When the system reaches a temperature below the dew point, moisture is converted to liquid and many droplets occurs on the pipe's wall. In the electrochemical reaction, water plays role of the electrolyte. The water that creates was not corrosion by itself. When the acidic gases such as H_2S and CO_2 are dissolved in water create an acidic environment which in the vicinity of the steel will cause severe corrosion. Sometimes in oil wells, oxygen is one of the corrosive gases too. In the oil and gas industries, corrosion may be localized or uniform. Localized corrosion, can be create under the insulators, sediment and bacteria, was 10 to 100 times faster than uniform corrosion lead to destruction and there are many costs and risks associated with it.

KEYWORDS: Corrosion, Oil and Gas Industry, Temperature, Water.

1 INTRODUCTION

International Journal of Innovation and Applied Studies (IJIAS) is a peer reviewed multidisciplinary international journal publishing original and high-quality articles covering a wide range of topics in engineering, science and technology. IJIAS is an online journal having full access to the research and review paper [1]. It is published six issues per year in English, French and Spanish. The journal aims to give its contribution for enhancement of research studies and be a recognized forum attracting authors and audiences from both the academic and industrial communities interested in state-of-the art research activities in innovation and applied studies.

Corrosion, from long time before was a greatest problem in oil and gas industry and experts have always tried to combat this major problem. This has been given to the corrosion and inspection in oil and gas industry. Corrosion in oil and gas wells has the electrochemical mechanism, When the system reaches a temperature below the dew point, moisture is converted to liquid and many droplets occurs on the pipe's wall. In the electrochemical reaction, water plays role of the electrolyte. The water that creates was not corrosion by itself. When the acidic gases such as H_2S and CO_2 are dissolved in water create an acidic environment which in the vicinity of the steel will cause severe corrosion. Sometimes in oil wells, oxygen is one of the corrosive gases too. In the oil and gas industries, corrosion may be localized or uniform. Localized corrosion, can be create under the insulators, sediment and bacteria, was 10 to 100 times faster than uniform corrosion lead to destruction and there are many costs and risks associated with it. Suitable inhibitors can be added to the system to control the localized and uniform corrosion. To evaluate performance of inhibitor and determine the rate of corrosion, the system must be monitored regularly. There are various methods to corrosion monitor. For instance, could name of weight loss coupons, ophthalmic, acoustic emission, ER and LPR probes and hydrogen probes. To ensure of accurate monitoring, each of these methods are used as a complement to other methods. Recently, extensive researches on the use of this technique in the evaluation of corrosion interceptors were done.

Corresponding Author: Amir Samimi (amirsamimi1161@gmail.com)

2 COMMON METHODS OF CORROSION MONITORING

a) Weigh loss coupons: coupon (metal beam) made of the same material with pipeline is used to measure. These coupons are installed in the pipeline with various angles -depending on the circumstances - and after the period of time (one to three months) were removed. Then they are completely clean. With the weight less of coupons, the average corrosion rate is measured. The coupons, of the type of corrosion and microstructure are investigated thoroughly. Coupons, were measured the corrosion rate in the long term and with low cost but unfortunately, it is not suitable for fast and preventive measuring and include many human errors.

b) ER and LPR probes: The use of corrosion probes, possible the instantaneous measurements of the actual situation. Usually two types of probes used in direct monitoring: Polarization resistance probes (LPR) and electrical resistance probes (ER). The ER probes, even in systems with low water cut, are used. Probe wire loop resistance in corrosive environments consider as the corrosion rate. Electrical resistance of the wire is proportional to cross section of the wire.

$R = PL / A$ (1)

R = wire resistance

P = resistance of the wire material

L = wire length

A = wire cross section.

When the wire is fed, its cross section was reduced and its resistance was increased. Gauge resistance, was measured the wire resistance within the fluid and compared with the resistance wire was not fed. With determine the ratio of these two values, the corrosion rate is measured. However, temperature changes were influence the amount of resistance and should be considered. Wire resistance changes depending on the amount of time is plotted on a curve and latter become the corrosion rate versus time curve. This type of monitoring for very sour systems due to the formation of iron sulfide deposits on the wire, rarely used.

c) LPR probes: In the pipelines, the smoothly and quickly flow of fluid is low, the electrochemical methods such as LPR and EIS can be used. In the electrochemical system, whole of the system should be placed in a conductive electrolyte environment (water phase in the pipelines) to electrical circuit is established between the electrodes. However, can also be used these techniques in a water cut of less than 1%. In conditions of high turbulence, usually which is an oily layer on the electrode is caused by the oil phase, a bypass is used. The principles of LPR technique: Three electrodes are used in the LPR experiment. Reference electrode is the electrode that potential is measured relative to that and could be measured potential of the electrode working surface. Help electrode is the electrode that cathode reaction or recovery takes place on it. And the working electrode usually made of carbon steel 1018, is the electrode which corrosion (anode reaction) occurs on it. With the help of these three electrodes, TOEFL curve is draw and polarization resistance is measured. TOEFL curve include the potential change curve in terms of flow changes of a sample in the desired environment. This curve is obtained of a polarizing one sample at about 300mV in the both corrosion potential, i.e. 300 mV at the anode and 300 mV at the cathode. In this way, the potential was change in significant speed and flow changes was study. This amount is usually optimization. The flow values obtained was plotted as logarithmic in the curve. In figure 1 a TOEFL curve. Polarization resistance: This technique is usually used for determining the corrosion rate with units in m inches in year. This technique that is also called linear polarization, is very quick (less than 10 minutes), and had applicable results to weight loss methods. Figure 1 shows several samples of probe. Linear polarization measurement is done with change in the potential in the range of 25mV higher and lower than corrosion potential and results are plotted as TOEFL curves, and corrosion flow is proportional to the slope of the lines.

$$\frac{\Delta E}{\Delta i} = \frac{\beta_A \beta_C}{2.3 \; i_{corr} \; \beta_A \beta_C} \qquad *$$

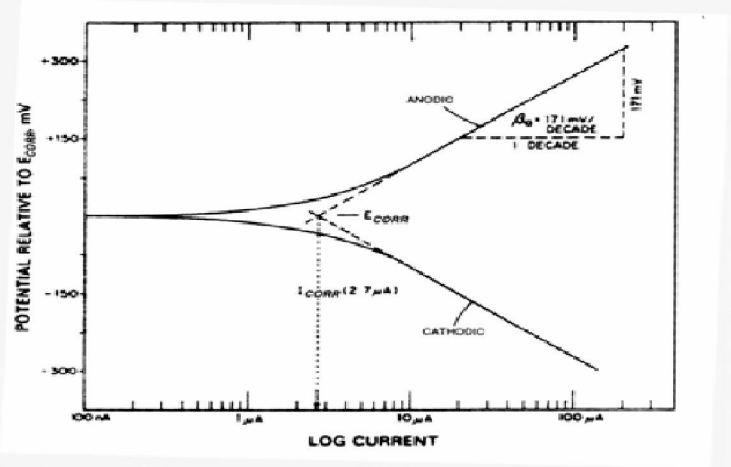

Fig. 1. TOEFL Curve and Anodic and Cathode Slope

(ΔE / ΔI) Slope is the polarization resistance and β_C, β_A are the anode and cathode pabet and I corr is the corrosion flow. Using the * relationship, the corrosion rate can be calculated easily. The basic principles of polarization resistance were established by Stern – Geary.

d) The electrochemical impedance method (EIS), electrochemical impedance method is a fast and accurate method for measuring the corrosion rate in certain conditions and is also localized corrosion rates. More than twenty years, the electrochemical impedance technique has been used for corrosion systems. For the first time, Mr. Apel Bowen presented his paper in which the iron - sulfuric acid system was studied stated that in this particular study the mechanism of chemical corrosion is more successful than other methods. One of the important benefits of this approach to other methods, it is possible to use low-amplitude signals. These signals without disrupting the system, could measuring its properties. Another advantage of this method is the possibility of its use in environments with low electrical conductivity. In the study of carbon steel corrosion in neutral water, this method has been used successfully. Principles of EIS technique: If the potential is applied to an electrochemical cell, the current value as output can be used for determining a reaction in progress. In this case, the chemical formation reaction of new chemical particles is draper moving of ions to the electrolyte. Ion motion due to the potential difference occurs and electric current is created. If the applied potential is a sinusoidal, the output signal will be sinusoidal. Interpretation of EIS results: A frequency analyzer connected to the system, allows get and simulation of potential values and flow cell. Using the facilities of the transfer function (FRA), the impedance and admittance is measured directly. As will be explained below, an impedance curve in terms of frequency makes it possible to check all properties of the system. A simple corrosion system with capacitor and parallel resistance and a series resistance, was shown in Figure 2. The results of this equivalent circuit were drawn as Argand diagram. Seri resistance R_Ω is relevant to resistance of the electrolyte, the surface film and the connecting wires. R_t Parallel resistance, known as load transfer resistance and is determiner of corrosion rate of reaction. Double layer formed on the surface of the electrolyte can be considered as a capacitor because in this layer, the number of electrical charges on both sides of layer was equal and have different sign. With reducing the frequency, asytans cup will be reduced so that stop flow of current from capacitor and current only passes through R_t. In the near zero frequency, impedance value is function of R_t and R_Ω.

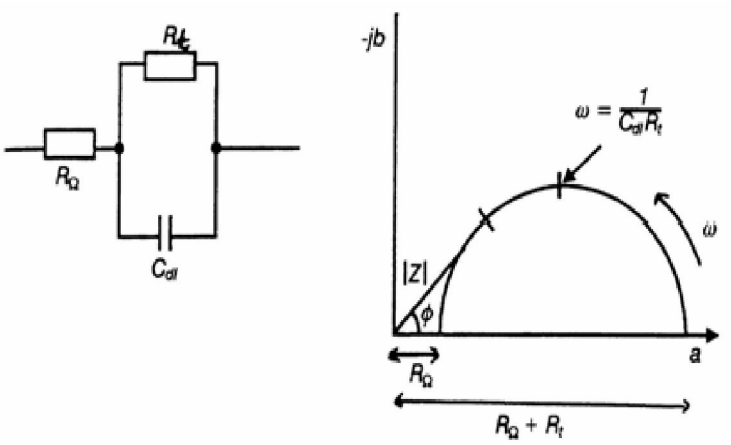

Fig. 2. Imaginary Impedance Curves: a Simplified Equivalent Circuit

In practice, this simple model is not enough to determine the reaction and other complex models used to explain the reactions. The equivalent circuit consists of components for the influence of ions and the imaginary component is associated with induction loops. It is clear that by such a curve, the main parameters of Mpl electrical resistance, and impact of dual-layer asytans cup in the corrosion reaction by simply changing the frequency range is measured. Frequency range, depending on the nature of the process can vary from 1 to 10 MHZ. Direct measurements of corrosion rates by electrochemical impedance: Despite the many advantages of the EIS method use this method for monitoring corrosion in the field simply is not possible. In this regard there are two fundamental problems: The first problem, the time required to draw a complete diagram of the impedance. The limitation due to the rapidly changing system conditions is of particular importance. The second problem is the interpretation of complex results of EIS. To overcome this problem, there is a way which consists of finding the geometric center of the three-point arc shaped of the imaginary impedance. This method is development of two-point method provided by Haryana and Tesoro. In this way, at high frequencies, the impedance will be equal to solution resistance R_S, and at low frequencies, equal to the sum of solution resistance and polarization resistance (R_S+R_P). With this new method of analysis, could use this technique that was used previously only in laboratories directly in the field.

3 EVALUATION OF EOR METHOD

EOR method evaluation is performing for petroleum gravity, stone type, and tank humectants and tank localities conditions for liquid injection. When the water inject to the tank the interaction could be performed in different ways, if the is humectants, penetrated water can exit petroleum from tank, which is because of capillary absorption. If the frame is humectants, petroleum exit will perform whenever the pressure is more than threshold; this is controllable by the height of tank block. Experiments and experimental data for recovery capillary absorption are according to data in 1950. Browns coble & Dyse (1952) studied the ability of water absorption in the sandstone lands. It will discuss about technical and economic condition, in the next year, it was performed by many of universities of United States in laboratory. Caspian sea is one of the good case for water injection and row petroleum recovery by capillary absorption, that is because of carbon in the tank`s stone. Row petroleum viscosity, is one of the limitation factor in the tank recovery. High viscosity in the petroleum leads to low recovery. In this article, it was performed many experiments on different stones by dense row petroleum and for comparison between dense petroleum and diluted petroleum on sand stones and lime stones. Whenever diluted and dense petroleum are comparing, lower final recovery of dense petroleum is because of its high incipient factor temperature and low humectants of tank is for coupling of water and dense petroleum. In any case, recovery is usually dependent to the petroleum viscosity. So, first is rapid production and Second point is increasing of find recovery. In this condition, it is evaluating the interaction between water phase and hemi cylindrical frame, and as we observe, recovery velocity and final recovery of dense petroleum is limited.

4 CHEMICAL MATTERS LEAD TO EOR

Polymer: Before these experiments, polymeric solution injection as aqueous phase was performed for tank petroleum recovery in the laboratorial condition, for diluted, petroleum. The only case about polymeric solution injection that leads to the high recovery was in the river basin in Vioming (2000). In this study, for both sandstone and limestone, the polymeric matter was as an aqueous phase. The results were shown in the figure 2, about injection on dense petroleum with

sandstone. One of the limitation factors in this method is: it is necessary to use very dense polymeric, for high viscous petroleum, clay increases the surface absorption of polymer will have good results, when the polymer injection begins before increasing the relation between water to petroleum. Polymeric solution injection leads to increasing of recovery velocity. But final recovery is not affected by adding polymeric solution. Fluids characters are noted in table pay attention that polymer injection leads to decrease of IFT. Everyone can see polymeric solution effects on dense petroleum recovery for limestone. Dense petroleum reaction is the same as limestone, without taking into that polymeric matter injected to the dense petroleum. When limestone and sandstone diluted petroleum are comparing with each other, evaluating of absorption effect become more logical. It expected that, because of higher surface absorption of polymeric matter on limestone than sandstone, recovery results decrease.

5 GAS INJECTION

It is able to inject gases into the pit as a gas phase. Gas phase is usually as a phase that leads to high recovery of pit, whenever, we have gas oil gravity drainage, that because of different gravity between fluids in the breaking point of mold and in the mold. This process will decrease the recovery than other mechanism, especially about dense oil, and it can lead to high recovery by heat and mixed gases injection. Many studied had performed on oil recovery from pit by mixed gases. They use Nitrogen gas for breaking tank because of it is available and cheap. If the mixed condition exits, it can increase the oil recovery of the tank. Methane is another gas that is used for this purpose. Morel et al. observed that oil recovery by methane is twice of nitrogen. Lately, Lenormand et al., purposed transfer subsidiary for diffusion between tank and breakage, in these studies diluted oil is used as a typical from in the oil tank. CO_2 injection is one of the most available ways about non-hydro carbonic gases that release industry about natural gas injection for grazing, CO_2 gas can exits diluted and medium components from oil, and if the pressure is high, it can exits oil from the tank by more mixing, so the viscosity become lower and oil turgid. This method is very valuable for dense oil with varicose type of solvents. In the current study, an experiment for increasing the recovery of pit by saluted gases was performed. So, part of this study is experimental. It is important to note that, availability to mixed methane and nitrogen with dense oil is so difficult, and we can use another solvent for that, and it is not economical, but it is successful way for technical aspect. Whenever, there is low humectant and permeability, the only substitute for heating method in the carbonate tank or tanks with dense oil is, saluted gas injection (CO_2), and the oil recovery increase. CO_2 limitations are: very low viscosity for CO_2, leads to low control on movement, so quick separation become difficult and other problems and limitation.

6 NITROGEN INJECTION

Nitrogen or combustion gas means: high injection of nitrogen, or other gases into the tank that it can mix with each other according to the pressure and it`s components. This method is used for diluted oil recovery that is able to absorbed added gas into the tank. This condition is low methane and at least 5000 feet depth that leads to resistant of rock tank on high pressure of injection, and it wouldn`t break. When nitrogen injects into the tank, we will have mixture phase, that`s because of light component evaporation. It forms a mixture or solution phase, by its movement from injection phase to the tank. Continuous injection leads to oil mass movement into the production pits. It is able to use water injection, alternatively, for higher recovery and high buoyancy index for oil. Nitrogen advantage that is, it doesn`t have corrosive effect. Because of its price that is cheap, we will have more injection. Nitrogen injection is usually after the carbonic. Gas or mixed hydro carbons. This method`s limitations are: mixing will performed in the diluted oil and high pressure, so it`s necessary to be more depth, slope excavation is suitable for decreasing unsuitable movement, that`s because it allows gravity to control movement.

7 EOR EXPLOITATION

In the EOR project: remains oil determinations in the tank, necessary mechanisms for better exploitation and in-use equipment are important factors, generally, if the purpose is to exit tank oil completely, it`s important to pay attention to the final recovery, but if the purpose is high production, it`s important to focus on the increasing recovery velocity methods, than final recovery. The best candidates for this strategy are low recovery factors (dense oil carbonates). Final recovery and its velocity are practical factors of recovery in this article. Following the experimental methods is not suitable for total expense analyze. That`s because of I statics nature of this method, but in reality, continuous injection in the abuse phase is possible. Understanding the injection velocity and it`s density is one way for determining method`s expense and chemical matter that`s necessary for injection and final recovery. It`s necessary to perform exact experiments in laboratories for determining Fluid`s amount for final recovery. This fact determines how the method is effective, and finally it leads to determine project expense. Beaver et al. performed exact analyze for determining exploitation amount of chemical matters injection in to the

homogeneous samples, they performed various experiments according to the absorption and salty water effects and analyzing different ways for chemical injection, for determining the best way. Results were useful in the same forms (breaking systems), but there`s no report about chemical injection into the breakage tanks, until now. Useful numerical and experimental studies were performed for fluid flow in the breakage environments. Expenses analyze for water injection, are an important factor because of low expense for its injection, and were performed studies about numerical dramatis tic to determine optimistic velocity of vapor injection for different tanks, according to breakage and days. Both two studies showed that, injection velocity is depending on tank type and penetration and its thermal capacity. In these studies, chemical absorption (especially for carbonate rocks), critical density (for chemical matters or gas injection), or thermal degree (hot water) were taken into consideration for optimize process.

8 CONCLUSION

In this study we studied EOR methods for dense oil recovery from mold in the breakage tanks. Analyze and comparison of recovery with capillarity of salty water, polymeric solution and hot water on different sample of rocks showed high recovery of dense row oil in the EOR methods, and it is more detected in the diluted row oil. Oil (diluted) can recover by water injection in the sand stone condition and with chemical matter and thermal methods. Hot water recovery is more rapid and higher than chemical recovery. For higher recovery of sand stone, hot water has higher and more rapid recovery than gas injection, polymeric matter can increase recovery velocity, but finally its recovery is as the same as salty water. Because of thermal breakage, hot water has the most rapid recovery of dense row oil for oil-wet carbonate. So, it`s possible to use hot water injection instead of mixed gas injection. To final exploiting, hot water degree and process optimize is technical and economical. Berea sand stone and Indiana lime stone were used as rock samples. They were cut in 2.5cm diameter and 7.5cm length from blocks and they have medium value in porosity and penetration is 17% and 8.5cm for lime stone. Each sample was examined once to avoid error. Experiments were performed in the statistical condition with oil injection, in the 100% saturated condition, and recovery than time, until when there is no oil from sample.

In oil and gas industries, corrosion monitoring was carrying out with different methods. In our country, corrosion coupons are typically used. While the growth of technology, suggests use of the probe. Probes, especially the electrochemical probes have the faster and more accurately results. Also EIS probes can help to extract the details of local corrosion. It is not possible with other monitoring methods. In this paper, only the monitoring methods and electrochemical techniques were introduced. Details of each of the techniques, described in used sources.

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Amir Samimi

(16/05/1983, Isfahan City, Isfahan Province, Iran)

Studied M.SC Chemical Engineering, Master at Islamic Azad University, The Member of IAENG, Have 2 Years Experience in Oil Refinery Company, Member of Young Research, and Have 17 Articles in the International Journal, Conference (U.S.A, France, Italy, Indonesia, India, Australia, Europe Chemical Engineering Conference) and More than 45 Articles in the National Journal, Conference in Iran.
Email: amirsamimi1161@gmail.com

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Agricultural Marketing Information Usage among Soybean Farmers in Nigeria

Asogwa, B. C., Ezihe, J. A. C., and Ogebe, F.O.

Department of Agricultural Economics,
University of Agriculture,
Makurdi, P.M.B. 2373,
Makurdi, Benue State, Nigeria

ABSTRACT: This study examined agricultural marketing information usage among soybean farmers in Nigeria using data from randomly sampled 150 soybean farmers in Benue State. The soybean farmers get agricultural marketing information mainly through other soybean producers (83.33%), family (70.00%), neighbours (67.33%), farmer's cooperative organization (65.33%) and extension agents (62.67%). Other soybean producers (83.33%), family (81.33%), neighbours (80%), farmer cooperative society (80%), extension agents (66.67%) were highly evaluated as USEFUL by the farmers. Other soybean producers, cooperative society, off-farm employment, extension services and access to markets significantly influenced the probability of producers evaluating their agricultural marketing information as adequate. The greatest constraint to access to agricultural marketing information by soya bean farmers included inadequate access to extension services (22%), ineffective communication (20%), distance from other soya bean producers (16.67%), middlemen (16%), lack of capital (13.33%) and illiteracy (12%). Information sources and marketing information usefulness were not independent of one another among the respondents. Information sources and marketing information adequacy are not independent of one another among the respondents. More extension agents should be deployed to where the farmers are residing so as to reach a large number of the farmers and teach them on their areas of critical needs. Other methods of extension information dissemination should be used to transfer current, adequate and useful marketing information to the farmers. It should be ensured that any extension method being used to disseminate marketing information to the farmers is such that the farmers understand the message and marketing information being communicated to them.

KEYWORDS: Agricultural marketing, information sources usefulness, information utilization, information adequacy, soybean, farmers.

1 INTRODUCTION

Information is an indispensable factor in the practice of farming and it is the basis of extension service delivery. It is defined by [1] as data that have been put into a meaningful and useful context which is communicated to recipient who uses it to make decisions. [2] opined that information can also be described as power which an individual in every society should have easy access to.

Agricultural information, as suggested by [3], is defined as all published or unpublished knowledge in all aspects of agriculture. He classified agricultural information into four categories namely, technical, commercial, socio-cultural and legal information.

According to [4], market information is of great importance to the farmers, merchants and governments as well. Price information is very vital for farmers in their decision of timing the sales. Merchants require market information to carry on their routine transactions like buying, storing and selling. This information facilitates them in planning their strategies like quantities to be purchased, quantity to be sold immediately and quantity to be stored in the market, where they should plan

Corresponding Author: Asogwa, B. C. (bcasogwa@yahoo.com)

their sales (local markets or distant markets). Government too needs this information to keep an eye on the price trends and for market intervention, maintenance of buffer stock.

The quality of information rests solidly on three pillars which are accuracy, timeliness and relevance. Adereti et al. (2006) stated that accuracy implies that information is free from bias; timeliness means that recipients can get information when they need it, while relevance implies whether the piece of information specifically answers the users' question of what, why, when, who and how? An individual consciously or unconsciously engages in information search in order to find appropriate information which can fill the information gap thereby regaining physiological and psychological balance. Access to adequate information is very essential to increased agricultural productivity [5] and marketing efficiency [6].

The ultimate aim of the farmer is to sell the fruit of his labour at a fair price and to be paid quickly enough to enable him pay his bills and buy inputs for the next season. But this remains a dream for many, especially for small-scale farmers, who after many years of being protected by the State marketing bodies, have found themselves left to face the vagaries of the free agricultural market, following the liberalization in the eighties. According to [7], farmers were not able to adjust quickly to the structural changes of the Nigerian economy brought about by the Structural Adjustment Program (SAP) and the abolition of the Commodity Marketing Boards in 1986. This led to their inability to find market for their produce and to acquire agricultural inputs in the subsequent years. The consequence was market glut and the attendant low producer price and in some cases, poor production for lack of adequate input. The government intervention by placing a ban on importation of commodities like grains created a local market for the selected commodities and increased the producer price, which varied from one season to another. The seasonality of the price variation encouraged the activities of speculative middle men who would buy at low prices from the farmers immediately after harvest, and resell to consumers (sometimes including the farmers) at very high prices during period of scarcity. These challenges coupled with poor access to credit caused by a weak and inadequate banking system, together with insufficient storage facilities and absence of tools that might cushion price volatility, have for a long time hampered the development of small-scale and medium-sized agricultural enterprise.

Recognizing this challenge the Federal Government of Nigeria has identified investments in agriculture and rural development as a major priority. Despite the articulation of these strategies and the commitment of Government and donors to the broader framework of pro-poor rural development, the income of farmers has continued to dwindle.

However, according to [8], a large number of marketing functions in Nigeria are poor, thus limiting the responsiveness of marketing processes. Given the role marketing and distribution play in the overall farm enterprise in terms of income generation and sustainability of enterprise, poor marketing activities pose a severe limitation to the growth of the agricultural sector and a huge constraint in the food and income chains of rural Nigerians. [9] and [10] identified the need for agricultural marketing information as a major tool for farmers to make economic decisions that would benefit them and thus enhance their market access. According to them, marketing has a connection to immediate income and is dependent on useful information and knowledge, which enables the farmer to make decisions on what to produce, where, when and the price to purchase inputs, as well as availability of transportation, and where and how to dispose of produce. It is in recognition of the importance of information for farmers agricultural business that governments of developing countries including Kenya and Tanzania [11], launched their Agricultural Marketing Information Systems often managed by agricultural organizations that create information to farmers so that farmers can make better decisions in order to take advantage of market opportunities and manage continuous changes in their production systems – market access [10].

According to [12], information has economic value if it helps estimate the value of something. Both individuals and society at large are interested in the extent to which information about an object value is contained in its market price. Apart from distributional issues, society's interest is that price guide resource allocation so as to maximize value-weighted production. Prices that would induce such efficient resources are themselves efficient.

Since the adoption of the Structural Adjustment Programme (SAP) in 1986, the Nigerian agricultural produce market has functioned under a deregulated system. The system has been subject of criticism for a long time. It has been described variously as inefficient and exploitative. Markets for agricultural products are imperfect with a few well organized traders dominating over large number of unorganized producers who dump their produce under seasonal pattern of production, while market imperfection and consequent loss in marketing efficiency are the common problems for agricultural products.

According to [13], agricultural commodity marketing in Benue State has not been as efficient and effective as it should be, mainly due to the ignorance of the farmers of the market environment and the ineffectiveness of past intervention strategies. Farm producers attempt to mitigate risk and uncertainty by utilizing accurate and reliable information [14]. Marketing efficiency is usually an underlying goal of most industries even when they are not faced with negative publicity [15]. Information can enhance efficiency if it is used to aid decision making and management of risk [16]. Farm producers often use information to minimize their risk exposure or increase their expected income [17]. When faced with a choice of

information sources, producers are expected to select those sources that yield the highest marginal benefits (Jones et al. 1990). It is commonly felt that the financial market achieve informational efficiency as traders with the best information and the most skilled make profits at the expense of those with inferior information or ability and come to dominate the market [18].

According to [19], adequate and accurate information about the supply and demand situation in the market place are necessary if the products are to be moved to consumers with minimum waste, confusion and cost. Long term market plans are also important. Information concerning future market potentials and its development are needed for wise production plans. Farmers, processors and other marketing agencies are continually in need of this information. The problem of product surplus or shortages can be attributed to lack of information, its lateness or incorrect evaluation of the available information.

Up to the early 1960s, Nigeria was self-sufficient in food production [20]. Nigeria experienced food and fibre shock after discovery of oil evidenced by appreciating exchange rate and rural-urban migration. Indeed, the demand for food far outstripped the domestic supply which led to an upsurge in food import. Benue State like other states in Nigeria has severe food crisis as a result of inadequate protein intake of nutritious food by the citizen.

Soya bean belong to the leguminous family and are widely grown and consumed all over the world and it contributes about 6.4 million tons of protein or 16.5 percent of the world's vegetable protein [21. According to [22], adequate protein intake helps the body to fight and maintain good health against burden of disease like malaria parasite found in blood plasma of most African people. The low protein intake could be attributed to the increasing high cost of traditional source of animal protein like livestock. Hence the research for an alternative source of protein has led to increased soya bean utilization both at home and at the industrial level. Soya bean consumption is still very low in spite of the realization that soya bean is virtually nutritious. It is widely believed that the rural farmer have not been made to reap the benefits of soya bean production on economic scale. Their individual smallness of scale coupled with inadequate access to agricultural marketing information has been a limiting factor for a better marketing and utilization of the crop. The focus of this study therefore is to examine agricultural marketing information usage among soya bean farmers in Nigeria.

Producers' perception of the value of information was measured as a qualitative response to a question regarding the adequacy of information. Producers' responses are likely to reflect the quantity and quality of their marketing information. Producers applied their own performance standards in their evaluations. While producers probably used different measures of rigor in their evaluations, it is such individual evaluations that form the basis for decisions regarding information sources. Furthermore, an existing body of literature describes the relationship between the performance of management information systems and user attitudes and perceptions [23]-[28], in a study of an industrial sales force, concluded that user perceptions of system performance (system usefulness or adequacy) were highly correlated with actual information systems use.

The broad objective of the study is to examine agricultural marketing information usage among soya bean farmers in Nigeria. The specific objectives are to:

(i) identify sources of agricultural marketing information usage among the soya bean farmers in Nigeria;
(ii) evaluate the usefulness of agricultural marketing information sources among soya bean farmers in Nigeria;
(iii) determine the factors that influence soya bean farmers' evaluation of their agricultural marketing information adequacy in Nigeria; and
(iv) identity constraints to agricultural marketing information accessibility among the soya bean farmers in Nigeria.

The following null hypotheses were stated and tested:

(i) There is no significant relationship between information sources and the usefulness of marketing information among soya bean farmers; and
(ii) There is no significant relationship between information sources and marketing information adequacy among soya bean farmers.

2 METHODOLOGY

2.1 THE STUDY AREA

Benue State is one of the 36 states of Nigeria located in the North-Central part of Nigeria. The State has 23 Local Government Areas, and its Headquarters is Makurdi. Located between Longitudes 6^0 35'E and 10^0E and between Latitudes 6^0 30'N and 8^0 10'N. The State has abundant land estimated to be 5.09 million hectares. This represents 5.4 percent of the

national land mass. Arable land in the State is estimated to be 3.8 million hectares [29]. This State is predominantly rural with an estimated 75 percent of the population engaged in rain-fed subsistence agriculture. The state is made up of 413,159 farm families [30] and a population of 4,219,244 people [31]. These farm families are mainly rural. Farming is the major occupation of Benue State indigenes. Popularly known as the "Food Basket" of the Nation, the State has a lot of land resources. For example cereal crops like rice, sorghum and millet are produced in abundance. Roots and tubers produced include yams, cassava, cocoyam and sweet potato. Oil seed crops include pigeon pea, soybeans and groundnuts, while tree crops include citrus, mango, oil palm, guava, cashew, cocoa and *Avengia spp*.

2.2 SAMPLING TECHNIQUE

Benue State is divided into three agricultural zones. Local Government Areas with high concentration of soya bean production in Benue State were purposively selected for the study. Based on this, one local government area with high concentration of soya bean production in Benue State was purposively selected from each of the three agricultural zones in Benue State thereby bringing the total to three local government areas selected for the study. From each of the selected local government areas, 50 soya bean farmers were randomly selected giving a total of 150 respondents.

2.3 DATA COLLECTION

Primary data were mainly used for the study. The primary data were obtained through the use of a structured questionnaire, copies of which were administered to the 150 respondents selected for the study.

2.4 METHOD OF DATA ANALYSIS

Data collected were analysed using both descriptive and inferential statistics. Descriptive statistics such as frequency distribution and percentages were used for the analysis of specific objectives i, ii and iv while Binary Logistic Model was used for the analysis of specific objective iii. Hypotheses i was tested using Chi-Square test while hypothesis ii was tested using Binary Logistic regression.

2.5 MODEL SPECIFICATION

In order to determine the factors that influence soya bean farmers' evaluation of their marketing information adequacy, the Binary Logistic Regression model that was used is expressed as follows:

$$\text{LOG } \frac{P}{1-P} = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \mu$$

Where:

LOG $\frac{P}{1-P}$ = Log of the probability (P) of postharvest information adequacy ranking relative to an inadequacy ranking

Adequate = 1; Inadequate = 0

X_1 = Age in years of the respondents

X_2 = Soya bean product sales in Naira

X_3 = 1 if print information sources are important; 0 otherwise

X_4 = 1 if extension sources of information are important; 0 otherwise

X_5 = 1 if has access to markets; 0 otherwise

X_6 = 1 if other soya bean producers are important; 0 otherwise

X_7 = 1 if has formal education; 0 otherwise

X_8 = 1 if employed outside soya bean enterprise; 0 otherwise

X_9 = 1 if member of cooperative society; 0 otherwise

X_{10} = 1 if electronic information sources are important; 0 otherwise

μ = error term

3 RESULTS AND DISCUSSION

3.1 SOURCES OF AGRICULTURAL MARKETING INFORMATION

The result in Table 1 shows that the most common sources of marketing information usage among the respondents included other soya bean producers (83.33%), family (70.00%), neighbours (67.33%), farmer's cooperative organization (65.33%) and extension agents (62.67%). The implication of the foregoing results is that universities and research institutes have not put in enough efforts to carry out their function of information generation and delivery to farmers.

Extensions agents meet some members of the farmers' groups who then pass on the information to the others in the groups who are absent during meeting. Extension agents meet the farmers in the groups for group meetings or workshop.

Giving farmers access to a variety of information sources which are accessible, affordable, relevant and reliable is the ultimate aim of providing agricultural information services (Gibbon and Warren, 1991). This is the reason only very few of the farmers indicated print and electronic media as sources of information. These sources are not readily affordable, reliable, or reliable in the rural communities.

Table 1. Distribution of Respondents by Sources of Agricultural Marketing Information

Sources of information	*Frequency	*Percentage
Family	105	70.00
Extension agents	94	62.67
Middlemen	77	51.33
Farmer Cooperative Society	98	65.33
Other soya bean producers	125	83.33
Neighbours	101	67.33
Print media	11	7.33
Electronic media	10	6.67
Universities	0	0.00
Research Institutes	0	0.00
Total	**150**	**100**

Source: Field Survey, 2012
***Multiple Responses

3.2 USEFULNESS OF AGRICULTURAL MARKETING INFORMATION SOURCES

The result in Table 2 shows that the following information sources were highly evaluated as USEFUL or VERY USEFUL by the respondents: other soya bean producers (83.33%), family (81.33%), Neighbours (80%), farmer cooperative society (80%), extension agents (66.67%).

From the foregoing result, it can be inferred that the farmers in most cases found more useful agricultural marketing information sources that cost them less to access. This probably explains why information sources such as print media (30%) and electronic media (23.33%) enjoyed very low patronage and low evaluation among the respondents. Furthermore, these sources are not readily available, affordable, relevant and reliable in the rural communities. The middlemen (53.33%) provided less useful information to the farmers probably to enable them carry on with their exploitative activities against the rural farmers.

Giving farming access to a variety of information sources that are accessible, affordable, relevant and reliable is the ultimate aim of providing agricultural information services [32]. To the extent that expenditures for information sources are a measure of information gathering and selection from among information products, soya bean producers' information acquisitions are consistent with the assertion of [33] that there is little demand for expensive information products. Also, the observed pattern of information acquisition seems consistent with the proposition that producers no longer subscribe to an information source whose net value (gross value less cost) has been assessed as inadequate [14]. Only 45.33 percent of the soya bean producers evaluated their marketing information as adequate.

Table 2. Distribution of Respondents by Usefulness of Agricultural Marketing Information Sources

Sources	Very useful		Useful		Not useful		Do not receive/use		Total	
	N	%	N	%	N	%	N	%	N	%
Family	57	38	65	43.33	13	8.67	15	10	**150**	**100**
Farmer Cooperative Society	65	43.33	55	36.67	10	6.67	20	13.33	**150**	**100**
Extension agents	45	30	55	36.67	25	16.67	25	16.67	**150**	**100**
Middlemen	35	23.33	45	30	35	23.33	35	23.33	**150**	**100**
Other soya bean producers	65	43.33	60	40	10	6.67	15	10	**150**	**100**
Neighbours	60	40	60	40	15	10	15	10	**150**	**100**
Print media	20	13.33	25	16.67	40	26.67	65	43.33	**150**	**100**
Electronic media	15	10	20	13.33	45	30	70	46.67	**150**	**100**

Source: Field Survey, 2012

3.3 Determinants of Soya Bean Farmers' Evaluation of their Agricultural Marketing Information Adequacy

The result in Table 3 shows that at 5% level of significance, the hypothesis that the specified (selected) explanatory variables have no significant influence on soya bean farmers' evaluation of their marketing information adequacy is rejected as a result of the significant change in -2 Log likelihood, suggesting that there is a significant cause and effect relationship between soya bean farmers' evaluation of their marketing information adequacy and the selected explanatory variables. The Cox and Snell R square (coefficient of determination) (R^2) is 0.691. This indicates that 69.1% variation in soya bean farmers' evaluation of their marketing information adequacy is accounted for by variations in the selected explanatory variables, suggesting that the model has explanatory power on the changes in soya bean farmers' evaluation of their marketing information adequacy. The Nagelkerke R square (adjusted R^2) also supported the claim with a value of 0.923 or 92.3%. This implies that the selected explanatory variables explain the behavior of soya bean farmers' evaluation of their marketing information adequacy at 92% level of confidence.

The result in Table 3 further shows that the probability of evaluating marketing information as adequate increases with age. Since producers generally become more risk-averse with age, this parameter estimate suggests that more and better information is probably acquired to diminish risk. This is because older producers are expected to have more time to develop a satisfactory marketing information system. Likewise they accumulate many years of experience which partly substitute for external market information. Older producers may also have lower demand for information for risk-management reasons. Further, older producers often have more diversified operations. Additionally, it seemed reasonable to conjure that older and more experienced producers have better marketing relationships with commodity buyers. More specifically, forward contracting is likely to be positively correlated with age and experience and, as a result, marketing price risk can be diminished for older producers.

Table 3. Determinants of Soya Bean Farmers' Evaluation of their Agricultural Marketing Information Adequacy

Variables	B	S.E.	Wald	Exp(B)
Age (years)	0.610	0.347	3.09*	0.941
Sales (Naira)	0.002	0.001	4.000*	0.804
Print media	0.532	0.994	0.286	0.703
Extension service	0.681	0.222	9.410*	0.605
Access to markets	0.746	0.358	4.342*	0.597
Other soya bean producers	0.615	0.214	8.259*	0.902
Education	0.556	0.39	2.032*	0.078
Off-farm employment	-0.824	0.411	4.019*	0.279
Cooperative society	-0.791	0.422	3.513*	0.734
Electronic media	0.679	0.852	0.6351	0.455
Constant	-0.424	0.514	0.6805	0.000
-2 Log likelihood				30.689
Cox & Snell R square				0.691
Nagelkerke R square				0.923

Source: Field Survey, 2012

*Wald statistic is significant at 5% level.

*Change in -2 Log likelihood is significant at 5% level.

Sales have a positive and statistically significant impact on the probability of producers evaluating their marketing information as adequate. This suggests that the risk associated with increased production is offset by experience in managing risk. That is, rising sales suggest more risk exposure (greater potential losses) and a possible need for more accurate and reliable information. This is because risk and uncertainty increase with farm size (sales). Such increases in production risk are likely to be somewhat offset by producers' ability to manage risk or their willingness to bear risk as size increases. That is, size is undoubtedly related to producers' past success in managing the operation.

Availability of extension services/agricultural information and access to markets positively influence the probability of evaluating marketing information as adequate. This implies that soya bean farmers with access to extension and access to markets have higher perceptions of their marketing information adequacy. This is because on the one hand they provide the incentive and means for farmers to access improved agricultural information and on the other hand they improve farmers' liquidity and the affordability of quality and useful marketing information. In other words, the availability of an extension worker in the community and the usefulness of the extension messages (as perceived by the respondents) lead to higher evaluations of their marketing information adequacy.

Other soya bean producers have a positive and statistically significant impact on the probability of producers evaluating their marketing information as adequate. The high significance of other soya bean producers could have been because this information source is likely to be most relevant to the decision at hand than many of the listed information sources. Additionally, other soya bean producers are likely to provide information that is timelier than that provided by the other information sources.

The probability of evaluating marketing information as adequate is shown to rise with education. This suggests that education raises producers' knowledge and awareness of the complexity of the marketing system and leads them to demand more accurate and reliable information. This is because education is a form of human capital that should serve to enhance producers' understanding of the complexities of the marketing system and lead them to demand improved marketing information.

Producers with off-farm employment are revealed to have lower perceptions of their marketing information adequacy. The parameter estimate is statistically significant and has negative sign and this suggest that off-farm employment raises producers' opportunity cost of time and their subsequent demand for more useful information. This is because part-time employment outside the soya bean enterprise is likely to constrain producers' available time for information assimilation and lead to lower evaluations of their marketing information adequacy. Alternatively, producers with off-farm employment may face lower enterprise risk from inefficient marketing decisions and therefore may be less concerned about the overall quality of their marketing information.

Cooperative society negatively influences the probability of evaluating marketing information as adequate. This is attributable to the high profitability that results from adequate organization of farmers into collective farmers' institutions that can provide opportunities for risk sharing and improved bargaining power. This is because collective farmers' institutions provide farmers with the opportunities for sharing risk from inefficient marketing decisions and also provide opportunities for improved bargaining power that are not available to individual farmers and therefore farmers may be less concerned about the overall quality of their marketing information.

3.4 CONSTRAINTS TO SOYA BEAN FARMERS' ACCESS TO AGRICULTURAL MARKETING INFORMATION

The result in Table 4 shows that the greatest constraint to access to agricultural marketing information by soya bean farmers included inadequate access to extension services (22%), ineffective communication (20%), distance from other soya bean producers (16.67%), middlemen (16%), lack of capital (13.33%) and illiteracy (12%).

Communication, is ineffective because most of the time, farmers find it difficult to comprehend information they get through an intermediary. Noise is always there when such information is disseminated by an intermediary among the target groups. The use of contact farmers is characterized by message distortion [3]. Some farmers are disadvantaged by distance from others and find themselves in such a situation which makes it difficult for them to have easy access to information. Owing to illiteracy, some of the farmers cannot read and only understand the local language. Extension contact is poor because the ratio of extension agents to farmers is far from adequate. Middlemen hoard marketing information to enable them carry out their exploitative activities against the farmers.

Table 4. Distribution of Respondents by Constraints to Accessing Agricultural Marketing Information

Problem	Frequency	Percentage
Inadequate access to extension	33	22.00
Ineffective communication	30	20.00
Distance from other farmers (km)	25	16.67
Illiteracy	18	12.00
Lack of capital	20	13.33
Middlemen	24	16.00
Total	**150**	**100**

Source: Field Survey, 2012

3.5 Relationship between Information Sources and Agricultural Marketing Information Usefulness among Soya bean Farmers

The result of the Chi-square test in Table 5 rejects the null hypothesis that there is no significant relationship between information sources and marketing information usefulness among the soya bean farmers. This suggests that information sources and marketing information usefulness are not independent of one another among the respondents.

The Chi-square test analysis of no significant relationship between information sources and marketing information usefulness among the soya bean farmers gave a Chi-square calculated value of 21.49. At 5% level of significance, Chi-square tabulated at 7 degrees of freedom is 14.07. From the p-value (0.0031), it is therefore inferred that at this level of significance information sources and marketing information usefulness among the soya bean farmers have significant relationship. This is based on the ground that the Chi-square calculated (21.49) is greater than the Chi-square tabulated (14.07).

Table 5. Relationship between Information Sources and Agricultural Marketing Information Usefulness among Soya Bean Farmers

Sources of information		Adequate	Inadequate	Row Total
Family	$(O-E)^2/E$	0.07	0.06	0.13
Extension agents	$(O-E)^2/E$	0.02	0.02	0.04
Middlemen	$(O-E)^2/E$	0.70	0.65	1.35
Farmer Cooperative Society	$(O-E)^2/E$	1.09	1.02	2.11
Other soya bean producers	$(O-E)^2/E$	1.45	1.36	2.81
Neighbours	$(O-E)^2/E$	0.02	0.02	0.04
Print media	$(O-E)^2/E$	3.70	3.47	7.17
Electronic media	$(O-E)^2/E$	4.06	3.79	7.85
Column Total	**$(O-E)^2/E$**	**11.10**	**10.39**	**21.49**

Source: Field Survey, 2012
Chi-Square (X^2) tabulated at 0.05 level with 7 degree of freedom = 14.07
P-value = 0.0031

3.6 Relationship between Information Sources and Marketing Information Adequacy among Soya bean Farmers

The result of the Chi-square test in Table 6 rejects the null hypothesis that there is no significant relationship between information sources and marketing information adequacy among the soya bean farmers. This suggests that information sources and marketing information adequacy are not independent of one another among the respondents.

The Chi-square test analysis of no significant relationship between information sources and marketing information adequacy among the soya bean farmers gave a Chi-square calculated value of 32.84. At 5% level of significance, Chi-square tabulated at 7 degrees of freedom is 14.07. From the p-value (0.0000284), it is therefore inferred that at this level of significance information sources and marketing information adequacy among the soya bean farmers have significant relationship. This is based on the ground that the Chi-square calculated (32.84) is greater than the Chi-square tabulated (14.07).

Table 6. Relationship between Information Sources and Agricultural Marketing Information Adequacy among Soya Bean Farmers

Sources of information		Adequate	Inadequate	Row Total
Family	$(O-E)^2/E$	0.07	0.06	0.13
Extension agents	$(O-E)^2/E$	0.03	0.03	0.06
Middlemen	$(O-E)^2/E$	0.10	0.99	2.10
Farmer Cooperative Society	$(O-E)^2/E$	1.73	1.55	3.28
Other soya bean producers	$(O-E)^2/E$	2.33	2.10	4.43
Neighbours	$(O-E)^2/E$	0.03	0.03	0.06
Print media	$(O-E)^2/E$	5.82	5.23	11.06
Electronic media	$(O-E)^2/E$	6.17	5.55	11.72
Column Total	**$(O-E)^2/E$**	**17.29**	**15.54**	**32.84**

Source: Field Survey, 2012.
Chi-Square (X^2) tabulated at 0.05 level with 7 degree of freedom = 14.07
P-value = 0.0000284

4 CONCLUSION AND RECOMMENDATIONS

The study showed that the soya bean farmers get marketing information mainly through other soya bean producers, family, neighbours, farmers' cooperative organization and extension agents. Only very few of the farmers indicated print and electronic media as sources of information because sources are not readily affordable, reliable, or reliable in the rural communities. However, research institutes and universities have not put in enough efforts to carry out their function of information generation and delivery to farmers.

Other soya bean producers, family, neighbours, farmer cooperative society, extension agents were evaluated as USEFUL or VERY USEFUL by the farmers. Information sources with low evaluation included middlemen, print media and electronic media.

Farm sales, age, other sorghum producers, education, cooperative society, off-farm employment, Availability of extension services and agricultural information and access to markets all had significant influence on the probability of producers evaluating their marketing information as adequate.

The major constraint to access to marketing information by soya bean farmers in the study area included inadequate access to extension services, ineffective communication, distance from other farmers, middlemen, lack of capital and illiteracy.

The result of the study showed that information sources and marketing information adequacy are not independent of one another among the respondents. It is therefore inferred that information sources and marketing information adequacy among the soya bean farmers have significant relationship. Furthermore, the result of the study showed that information sources and marketing information usefulness are not independent of one another among the respondents. It is therefore inferred that information sources and marketing information usefulness among the soya bean farmers have significant relationship.

Extension agency should encourage all soya bean farmers to subscribe to the various soya bean farmers' groups that abound in the state. This will make information easily accessible to them.

Extension agents should intensify their efforts so as to spend much time to teach farmers on the areas of needs. Other method such as mass media should be used regularly to disseminate marketing information to soya bean farmers in such a manner that the farmers will understand the message and information being communicated to them. Universities and Research institutes should double efforts to ensure that research results and relevant marketing information are passed on to the rural farmers in a much more accessible manner.

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Towards a participatory E-learning 2.0 based on the use of Vwiki tool

Boubker Sbihi[1], Kamal Eddine El Kadiri[2], and Noura Aknin[3]

[1]Laboratory LIROSA,
Ecole des Sciences de l'Information,
Rabat, Morocco

[2]Laboratory LIROSA,
Ecole Nationale des sciences appliquées,
Tétouan, Morocco

[3]Laboratory LASIT,
Faculté des Sciences,
Tétouan, Morocco

ABSTRACT: The main objective of this article is to adapt the Vwiki, tool proposed by our research laboratory, as a solution to the submergence of obsolete, unstructured wikis with wrong contents that are spreading through the web. Thus is for the e-leraning environment purpose. Due to the mechanism of the content validation by pairs, such as Wikipedia, and the dynamic evaluation by the community after the publication of the its content, the Vwiki is proposed as a collaborative educational tool 2.0 , which is centered on the learner and supervised by the teacher.

For realizing a collaborative course, learners will create the collaborative contents, the teacher will play the role of the content validators, while the tutor will represent the monitoring committee of the publication and will be in charge of the course process publication from the creation of the information until its final disposal or archive.

In this context, we propose a collaborative strategy 2.0 to adopt as a tool for the E-learning. Thus will provide a formal and collaborative education project at lower costs that provides collaborative courses and takes advantage of not only the collective intelligence, but also of the community and content evaluation by the learners.

KEYWORDS: Web 2.0, Vwiki, learning, participation, collaboration.

1 INTRODUCTION

Since its appearance in 2005, Web 2.0 has suggested a new vision of the web that considers the user as a potential actor and producer of the web content rather than a simple consumer of information [7]-[8]. This fundamental change has significantly not only increased the range of information, but it has also facilitated the collaboration and the involvement practices as well. It has also enables users to produce, communicate, share information, and collaboratively edit online knowledge content [6]. In this context, the web has become a free platform of tools and services for publication, information sharing, collaboration and communication between users regardless of Geographic locations. It has also involved users in various fields such as education and collaborative learning. Due to its simplicity, openness and wide usage especially by the young people, Web 2.0 has provided a new wave of informal learning which is closed to a social network and where users interact, learn together and articulate around an area of interest. Furthermore, Web 2.0 can be used by learners to complement formal learning experiences [2]. This new educational approach reinforces the user's position and creates a dynamic community. It also enables migration from the transmissive and the unidirectional media to a community and

Corresponding Author: Boubker Sbihi (bsbihi@hotmail.com)

collective learning. The following figure reveals a symbolize the actors and tools involved in the informal e-learning by using Web 2.0 tools:

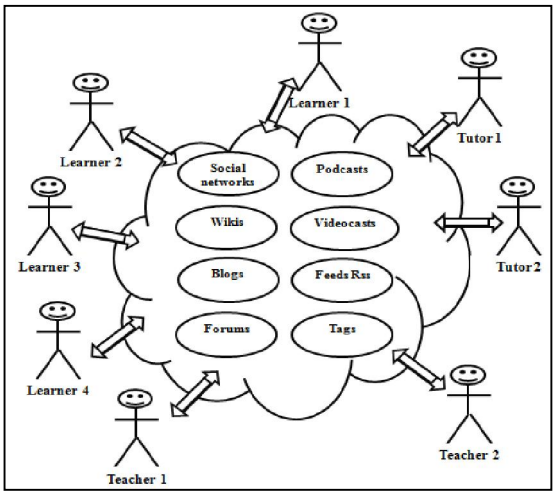

Fig. 1. The actors and tools involved in the informal e-learning using Web 2.0 tools

A closer look at Figure 1 shows that each actor uses one or more Web 2.0 tools to respond to a specific need of education; for example, the tutor can inform learners through a social network while the teacher may place his course materials (or a part of his course) in the class blog. He may also propose a collaborative project and publish the content on the wiki. In the following paragraph, we present the concept of E-learning 2.0. Then, in paragraph 3, we expose the elements of our approach to Vwiki before introducing the static validation and the dynamic content's evaluation in the context of a collaborative educational content. In the last paragraph we present the strategy of E-learning which is adopted by using web 2.0 tools. We then present a general conclusion and providing some general recommendations and perspectives forward a set of perspectives to address these issues.

2 E-LEARNING 2.0

E- Learning or traditional distance teaching is a type of teaching supported by electronic features. This type of teaching comes not only from the broad diffusion of information through the networks, but it also comes from facilities of telecommunication in education as well. It defined by the American Society for Training & Development [Horton 2001] as the use of the Internet and digital technologies to support the active learning experience. It is based on the transmissive teaching approach using a learning platform LMS (Learning management system) or LCMS. Contrary to the approach focused on teachers, E-learning 2.0 is centered on learners and based on the user's collaboration by using Web 2.0 tools to provide the educational content [10]. Moving to E-learning 2.0 offers not only greater interactivity and autonomy but it equally enhances involvement in the making and broadens the spectrum of engagement and collaboration between users. In other words, Web 2.0 provides powerful and good opportunities to the learner to create his/her content in where he/ she can exchange practices between and among the community and experts outside the boundaries of classrooms. The difference between E-Learning 2.0 and E-Learning 1.0 are shown in the following table:

Table 1. Difference between E-Learning 1.0 and E-Learning 2.0

E-Learning 1.0	E-Learning 2.0
PlatformLMSetLCMS	Web 2.0 tools
Based onteacher	Based on learner
TheTeacher produces	Theteacher validates
Learner is aspectator	Learner is aproducer
Exchange with theclass	Exchange with thecommunity

The new educational wave is interactive due to Web 2.0. More importantly, web 2.0 environment offers not only a simple and popular area, but it also provides polyvalent and open collaborative tools as well; it is based specially on the user engagement in a more participatory defined learning environment. The purpose is to provide a collaborative informal knowledge and put into practice a model of E-learning approach. Furthermore, the features of Web 2.0 technology will allow everyone to advance learning environments because they do not require specific knowledge or technical skills which will constantly facilities their spreading through all over word especially among younger generations. In this context, web 2.0 will enhance a real form of interaction and create collective learning environment centered on the learner. It will also redefine the role of teacher in the E-learning2.0 environments which is actually limited to supervising and supporting learners. The rapid transformation processes going on, raises critical questions regarding the improvement of classical distance learning and therefore enables migration from the transmissive learning in particular to a collective approach. Web 2.0 tools can be categorized into eight main types that can be used by one or more actors to support E- learning 2.0. The following table shows the role of web2.0 tools in the E- learning collaborative environment:

Table 2. Role of E-learning 2.0 tools

Social Tools	Role
Blogues	Publication of courses, pedagogical coaching
Wiki	Creation of Common documents
Forum	Exchange between learners and tutors
Social network	Communal Learning
Tags	Improving research by involving the learner
Feed RSS	Improving the dissemination by notifying the actor
Podcast	Learning by listening the audio files
Videocast	Learning by watching the video files

Since the appearance of web 2.0, the learning based on the use of web2.0 collaborative tools has appeared and took the name of E-learning 2.0. Despite several advantages of Web 2.0 applications, there are some limitations that need to be dealt with. For example, Web 2.0 does not provide specific tools for online learning which consequently enhance to adapt the current tools to the learning area. Several researches related to the educational 2.0 environment has been emerged; For example: the study through the blogs [3], podcasts and video casts [13], social networks [1] [15] as well as the study related to online learning by using blogs and podcasts [9] and games [14].

E-Learning 2.0 has introduced the concept of learning community [5] which focuses on supporting the development and solving educational problems through online collaboration. It also allows communication among learners and promotes the creation of a collective intelligence, recreating the traditional learning of the classroom and interaction between learners. In the framework of preserving the educational content of previous learning and opening up to learning communities, the pedagogical team has started to integrate contents of the previous learning into LMS such as the case of MOODLE platform which integrated blogs and social networks. However, the burden of this platform, the difficulty of its use by the public, in addition to the multitude of companies that develop software types, is major limitations. Different definitions of E-Learning 2.0 are possible. In this context, we define E-Learning 2.0 as a new distance learning environment which places the learner at the center of the formation by using web 2.0 tools and therefore migrating from the transmissive approach to collaborative one [11]. The following table outlines actors' roles in the context of E-learning 1.0 and E- learning 2.0.

Table 3. Actor's role in the context of E-Learning 1.0 and E-Learning 2.0

Actor	E-learning 1.0	E-learning 2.0
Learner	Attend classes, do homework	Use and Produce content
Teacher	Produce courses, exercises	Content validation
Tutor	Registration, monitoring learners	Followthe publications
Administrator	Management andsolution of technical problems	Has no role

In the context of E-learning 2.0, learners and their communities are engaged in creation a collaborative content by using free collaborative tools. This situation leads to the change of teacher functions. More clearly, teacher becomes a pedagogical supervisor of the learners rather than a holder of knowledge. While, the tutor is responsible for following the publication of his contents. However, the administrator will no longer be needed as an actor because web 2.0 tools are easy to use by any user without any computer knowledge or requirement.

3 VWIKI AND E-LEARNING 2.0

The Vwiki is a collaborative publication tool which has been created to answer the following question "who produces what when and how"?. It is presented as an extension of web2.0 wiki that requires not only a necessary identification and blog, social network and questionnaire as well, but it also provides the publication of relevant information. It is a new tool of publication which is based on the content validation by pairs and communal dynamic evaluation to ensure the quality of contents and therefore limit the publication of wrong information through web 2.0 wikis [12]. Despite advantages of the democratization of information which consists on the equal opportunities regarding the use of the web (the web allow everyone to easily read and write articles to be published online), there are limitations that needed to be dealt with; for example: there is a lack of control over the content which impacts the quality and reliability of the produced material. Furthermore, users have not the same age, the same specialties and the scientific qualifying as well. In addition and for the same category of user, we cannot consider equal:

- The one who produces and the one who only consume content ;
- The one how produces lot of information and the one how produces few one;
- The one how produces the right information and the one how produces the wrong one.

In this context, we propose four categories of users of the Vwiki:

- Consumers of information;
- Producers who consume and produce content;
- Valuators who validate the content;
- Experts who monitor the publication.

To make a relationship between the E-learning 2.0 actors, the following table presents different categories, roles and weightings of Vwiki users:

Table 4. Role and weighting of Vwiki users in E-Learning 2.0 context.

Vwiki actor	EAD actor	Role	Weighting
Consumer	Learner	Reading course content	1
Producer	Active learner	Reading and producing course content	5
Validator	Teacher	Validating of production	100
Expert	Tutor	Monitoring of publication	1

Web 2.0 wiki contains various types of information; they range from the most relevant to the worst and incorrect ones. However, Vwiki consists only of improving the right information due to its validation by valuator and teacher (or a group of teachers) in a pedagogical context. Our vision consists of creating committees to validate the information. They are composed of one or more teachers and supervised by the tutor who has the responsibility of not only monitoring the publication, but also selecting information and classifying content after elimination or final archive. In this context, we propose five types of information produced by learners. They are presented in the following table:

Table 5. Classification of the information on Vwiki

Symbol	Type of information	Meaning of the information	Weighting
G	Good	Validated and relevant information	100
A	Average	Moderately validated information	50
L	Low	Validated information after being corrected	10
W	Wrong	Not validated	-1000
C	Comments		**1**

The weighting of the quality of information consists of providing new and relevant information. The idea is to publish better information than the previous one in terms of its quality, and also publish information that completes it. This information serves as an indicator to the search engine to select information depending on its relevant degree.

The information produced on V wikis is in a various formats: text, images, podcasts and video casts.

4 STATIC AND DYNAMIC VALIDATION

As we noticed above, the wiki is based not only on the notion of validation of information before publication by teacher, but it also depended on the communal collaborative evaluation by all learners who are engaged in developing more participatory environments after the publication.

4.1 VALIDATION STATIC CONTENT IN A PEDAGOGICAL RESOURCES CONTEXT

The validation of content on the Vwiki covered the following steps: Firstly, teachers valid the content which is destined for publication. Secondly, the tutor publishes it after having not only the teacher agreement, but also after making sure that the weighting of the new content is better than the previous one in terms of quality. The following figure presents the process of publishing content on Vwiki:

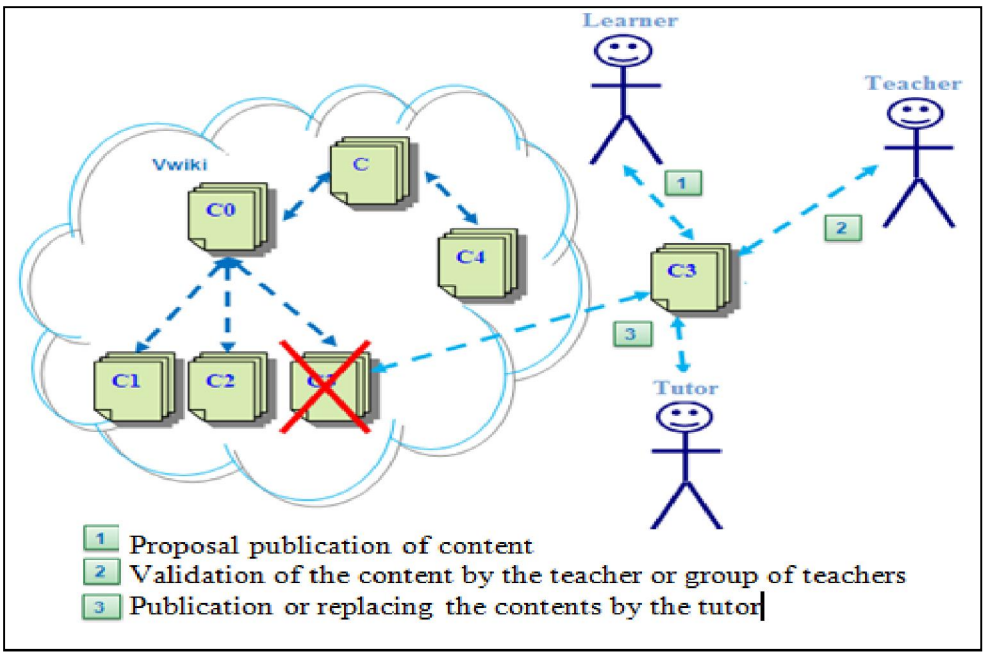

Fig. 2. Process of the static validation course content on Vwiki

In this context, the content can be modified after having the teacher agreement. The idea is to publish online version limited to the best or at least equal to the published information in terms of its quality. Therefore, the last information is the best one.

4.2 EVALUATION OF DYNAMIC CONTENT OF COURSE CONTENT

The Dynamic evaluation comes to complete the static one. It aims to measure dynamically the quality of information on the Vwiki and supports this tool evolution over the time. In this context, we propose to complete the teacher's static validation of information by users and learners dynamic collaborative evaluation. In this environment, the weighting that is proposed is equal to:

Table 6. Dynamic information weighting on Vwikis

∑weighting (content) =(initial weighting)+ ∑(user's weighting* weighting of the information)

We have two contents weighting: the first one is affected by teacher towards content; the idea is that the new content must be important or at least equal than the previous one in term of score. The second weighting is dynamic and it will be accumulated at every time when the users assign a score to the content.

This new approach will enhance the decrease of the initial content weighting regarding to the published information relevant as well. The instantaneous dynamic weighting permit to improve research; more importantly, enables to select information regarding its relevant and thereafter leads to the final storage or disposal.

5 THE STRATEGY OF TEACHING BY USING VWIKI TOOLS

The VWiki is based on the static validation content made by the teacher before the publication of course material and depended on the dynamic evaluation assigned by the learners after the content publication. However, the tutor has the responsibility of publishing the validated course content through the Wviki. The purpose of this process is to put the learning 2.0 project into practice. The idea is that in the first phase the teacher divides the course into several parts and distributes each part to learners. In the second phase, he puts a preliminary content on the blog of Vwiki through social networks. In this area, opinions, comments as well related to a specific relevant point regarding the course content, and questions-answers will be come out in the process of improving the quality of course content. In the third step, after the course validation and completion by teacher, the tutor will publish the course content on the educational Wiki. For the purpose of a collaborative course content created by learners and validated by teachers, learners and teachers are engaged together in contribution oriented pedagogy environments. Thereafter, this course content will be evaluated. To put this evaluation into practice, a questionnaire regarding each course material will be administered to learners. Based on the result of course evaluation made by learners, the course content will be kept by tutors if they find that it is affective and good. Otherwise, the tutors request new course material to be published on the class' blog. The vision of this process is providing an intended outcomes and effective quality of course content acceptable by learners. The following figure illustrates the process of course publication.

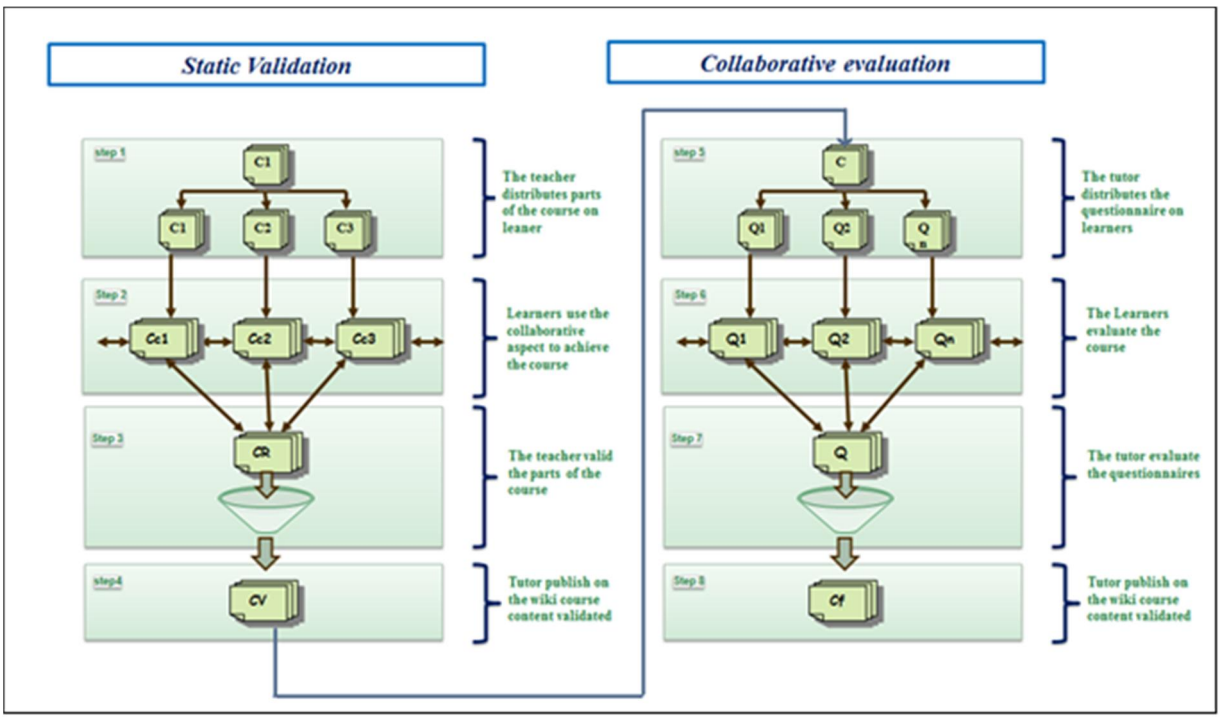

Fig. 3. The process of publishing the course content on Vwiki

The publication process in the context of Vwiki is recursive until extending the reach of better quality and reliability of produced material that is available for learners. Furthermore, the weighting depending on the type of learner, the score regarding the course content publication made by teacher and community are significant in terms of quality of information.

Vwiki in a pedagogical context is a participatory environment, centered on learners and supervised by teachers. The idea is not only to create learning communities, but it also makes a collaborative, interactive course content to help everyone to participate.

6 CONCLUSION

The purpose of this proposal is to adapt the Wviki on a pedagogical context. The idea is to publish only the quality course content on the web. In this context, Vwiki tools will be used to provide a collaborative project and enhance learning and teaching. It is based not only on the static validation, but it also depended on dynamic validation. The vision is to create quality course materials and make the learner to become involved on the process of creation the course content.

In this context, the information published on the Vwiki will be well identified and organized, not redundant as well, it will be eliminated or archived when it is not useful. Furthermore and due to its dynamic weighting, the information will be used as an indicator for search engines to select information depending on the degree of its relevance. As perspective, we propose the following elements:

- Elaborate a multi-languages wiki ;
- Elaborate an unified strategy toward learning 2 .0;
- Create tools for selective diffusion of information ;
- Create tools for automatic abstracts and synthesis;
- Create tools for brainstorming and collaborative projects.

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Use of Polyurethane Coating to Prevent Corrosion in Oil and Gas Pipelines Transfer

Amir Samimi

Department of Chemical Engineering,
Mahshahr Branch, Islamic Azad University,
Mahshahr, Iran

ABSTRACT: Corrosion is one of the major problems in the oil and gas industry is one that automatically allocates huge sums annually. Polyurethane is a thermoses polymer with various applications. Using form this polymer has spread for military applications by Otto Bayer in 1930. In one general look polyurethane is product of Iso Syanate and ploy with each other, So that: Iso + ploy = polyurethane. Spend large cost for application and launching oil and gas transitions, has cleared the necessity protection from them agonist corrosion. In this direction protection coating with specific properties such as high electricity resistance presented to market by various companies that each of them has special advantage and disadvantages. In this research has tried while analysis coatings specifications of gas and oil transitional pipelines, has compared properties and common qualities of them with each other.

KEYWORDS: Corrosion, Polyurethane, polymer Coating, Gas and Oil Pipeline.

1 INTRODUCTION

Steel pipelines are common device for transition of natural gas and raw oil all over the world, that with spending large costs perform and unchanging. Often this pipe passed (across) from earth corrosive environment or sea bad, repair and reconstruct. Of them is very expensive and its follow with many problems. According to this, protection from oil and gas pipes line is necessary that the most common. Various coatings for protection from oil and gas transitional pipe line have present. To market, that each of them has special advantage and disadvantage. In this research has tried (attempt), within analysis necessary specification for this coatings, compared the most common properties and specification with each other. Coatings specifications (properties) of oil and gas transition pipe lines. Due to electro chemical nature of corrosion pipes buried in earth or sea beds, and the most important specification of protection coatings. Is high electrical resistance and remain stable this specification during time? In addition to, due to implication sever intensions from soil stress, to buried pipes in them, especially in soil with high absorption ability and alternative weather burial, having high strength adhesion and cohesion and resistance to develop crack for protection coatings, is necessary. Whereas the existence of various chemical material such as salts, acids, material and many microorganism in soils and seas, cleared the necessity of chemical resistance of this coatings. The durability of coating during transportation storage and pipe installation mechanical properties (Stoke resistance abrasive Flexible and resistance against penetration of sharp edges of rocks and stones).Thermal resistance, easy repairmen of coating damages during installation and are as necessity specification (qualities) of protection coatings of oil and gas transition pipes. Beside, due to stimulate using from coating and catholic protection, also protection coatings resistance are very important to catholic disbanding. According to mention qualities, different types of protection coatings have produce and present for external. Coating of oil and gas transition pipeline, in the following has mention to their main and common groups of them, including for coatings, fusion bonded epoxy coatings and poly olefin coatings.

Tar Coatings: Tar coatings are the oldest coatings that used in oil and gas transition pipes. Some dominant qualities (specification) of them are lack of penetration against water and moisture and high resistance of corrosion, low price and easy operation. While fragility tracked and adhesion drop, in cold weather and flexible in hot weather less mechanical strength, maybe sustain loss or damage during transportation and installation, less resistance against unraveled rays are

Corresponding Author: Amir Samimi (amirsamimi1161@gmail.com)

considered as their disadvantages. Although combined tar coatings with fiberglass or mineral filling material such as silica, has solved solid disadvantages of them, but with become hard environmental regulations and increase acceptance of other coatings, has reduced the amount of tar coatings application. Although has spread using from improved tar coatings with all type of epoxy resin or your than.

Fusion Bounded Epoxy Coatings: Fusion bonded epoxy coatings are as powder coatings that often apply by electrostatic sprinkle on warm preparing pipes. This coating has good (suitable) mechanical and physical properties and follow with urethane coatings has used on installed pipes on earth surface. Fusion bonded epoxy coatings are naturally hard, fragile and tendency to absorption specific water in high temperature. Also, most of them has used for installed pipes coating in dry environment.

2 POLYOLEFIN COATINGS

Poly olefin coatings include polyethylene or poly propylene that has mechanical strength; fairly low pride and high resistance to carrion. The big problems of these coatings are less adhesion of them to steel pipes. For solve the problem has recommended to use three layer coating system including epoxy lining, middle layer, improved copolymer polyolefin and surface coating is polyolefin. In this systems cohesion and resistance to catholic disbanding by epoxy lining and penetration to water and oxygen, mechanical properties and chemical resistance has supply by polyolefin larger. Epoxy lining by spindle and middle coatings and polyolefin surface coatings has apply on pipes by extrusion methods. Low resistance against penetration sharp edge of stones and rooks especially in high temperature, mad crackup due to soil stress and low thermal resistance, has made some restrictions to using from polyethylene coating. While high stroke resistance in extensive range of temperature and resistance against penetration of sharp edge of stones and rocks even in temperature more than 100C, has spread largely using from there layer systems on base of polypropylene. Polyurethane is a thermoses polymer with various applications. Using form this polymer has spread for military applications by Otto Bayer in 1930. In one general look polyurethane is product of Iso Syanate and polyol with each other, So that: Iso + polyol = polyurethane. Term of "100% Solid" Used for Coatings that in them has been any Solvent for dissolve, carrying or reduce amount of coating resins. In addition to, Resins that usually are liquid, after implementation (use) completely change to Solid. Contrary to common coatings Such as epoxies that just limit number of them has been usable for coating, polyurethane coatings have large output from types and shapes; (forms).Tem (Statement) of polyurethane coating is general. Tem, because already contains all things, from wood Seal to building floor and underground tanks coatings. Nowadays, various type of polyurethane has used in money applications. Flexible polyurethane foams has used for make bed, pillow and car Seat. Hard foams has used for insulation of freezers, refrigerators and roofs. Many Sport Shoes manufactures, has used impact resistance and elastic polyurethane in make shoes surface. In automobile industry, parts such as dashboard and bumper cuttings has mad by polyurethane. In addition to, polyurethane coatings also has used as bridges, seals, surface or tanks lining. Tem "100% Solid" make a little short Range of all kind of polyurethane Bust yet there are hundred different types of Iso Syanate and polyol that by them has produced much polyurethane in this range. Another factor that could limit polyurethane by it is type of used Iso Syanate in them. The most common isomers that used in polyurethane production are aromatic. Polyurethane that make by aromatics, have economic profit, and doing their work well, But when put against sun light, become as chalky and dark. Corrosion feature and other physic features of aromatics a system has not affected by sunlight. But if required, are used these coatings in applications that their appearance are important, and cover surface of them should be coatings. Automobile colors named as dominate sample of this type of polyurethane.

3 POLYURETHANE COATINGS PROPERTIES

There are many reasons for tendency to using 100% solid polyurethane coating for pipeline coating.

First of that, using this material has excellent results and this material are famous. Due to harmless, these materials are more adjustment than anti corrosion traditional coatings with environment.

Secondly, due to quick rate of cooking this material, could be put coating pipes under holiday pores test and buried.

Third, this material has ability to cook in low temperature, this subject is impossible in other coatings at last, due to this coatings for application are not need to exothrimicity, and they are applied in any thickness or length and diameter of pipe.

Response nature of Iso Syanate and polyol for polyurethane production is exothermic. Due to this reason, the reaction itself provides needed heat. At last this coatings could be applied in any environment temperature, until apply this coatings

unlit 40C' temperature under zero without using extra heat, is not impossible. In spite of properties that mention, 100% solid polyurethane has other good properties, such as:

1- Without pothole

2- High hardness and impact resistance

3- Good flexibility

4- Strong adhesion to metal surface

5- Be resist against steam penetration

6- Separable resistance due to climate factors

7- Chemical resistance

The polyurethane coatings can be classification according to type and their additive quantity. But this additives, usually is added to reduce extra price. Also, should be attention additives that reduce price, will be reduce quality. Adding 10 to 20 percent filling material (especially tar) has effective impact on price reduction, but the impact on coating qualities is small. Increase 40 percent or more will reduce price intensively, but will reduce coating properties so much. The common usable filling in 100% solid polyurethane, are tar materials. In this state, usually is use raw oil, asphalt or tar pitch, although should be attention tar pitch is carcinogen.

Table 1. Example from Results of Effectiveness Tests in Some Type of Coatings, Gathering among Various Data of Manufactures

Value	Epoxy	Polyurethane Test
Higher	1/8 Joules	2/3 Jews
Lower	2 mandrill	1 mandrill
Lower	120 milligram pert	52 Milligram pert
Lower	9/7 Cm^2	3/2 Cm^2
Higher	705 N/Cm^2	1410 N/Cm^2
Lower	0/0041 perm. Cm	0/0041 perm. Cm

Recently two additives have added to 100% solid polyurethane coatings. One of them is ceramic powders. These powders have cause coatings with having. The same quantity of elasticity, stroke resistance, has more corrosion resistance. Other additive, are anti – microbial and in washing that cause more protection from coating and under surface from microbiology corrosion. 100% Solid polyurethane has used for internal coatings of cast iron pipes of water and disposal in America since 1988. The purpose from using polyurethane as internal coatings of swedge pipes is prevention from corrosion of internal coatings of pipes and also prevention from microbiology corrosion. The existence of much amount of sulfate in swedge cause to produce H_2s, as result, in state that speed of Swedes movement in pipes are low (level region) , produced sulfuric acid, and due to it , internal coatings pipes destroyed severely. Experience presented that iron case pipes without internal coatings, in this condition has corrode less than 3 years. In analysis has done in Virginia water and swedge research center, samples of cast – iron pipes with 100% solid polyurethane internal coatings has put in Acid sowphric 20% and evaluate internal surface resistance. This analysis has present high resistance of this coating. From 1988 until now, about 610 kilometer from internal coatings of pipes with 12 to 48 inch diameter has used in virginal swage network, and covered by 100% solid polyurethane and this usage has increase process. Covered swedge pipes, has not found any problem during work and operation (application) method of this coatings are very ideal.100% solid polyurethane coating, is non- toxin and has effect on smell or taste of drinking water and is not pollute it. For this reason, it used widely as internal coatings of water drinking pipes and has cover internal coating of water drinking tanks. With adding antibacterial factors to 100% solid polyurethane could be achieve coating that prevent from bacterial growth in the water. Also with adding special compound to 100% solid polyurethane, achieved coating that has high chemical resistance and used for internal coatings of chemical transaction pipes.

Stripe coat is a coating film of color which is applied before and after a full coating on the edge or weld lines of metal skeleton. This kind of coating is applied in order to create an appropriate structure and enough resistance against corrosion in these regions. Therefore SC has more protection for the edge of the coverage or weld line. It is applied before preparation of surface or before a full coating. Technical knowledge {number1} is relevant to community of protective coatings that has the following recommendations about SC {color usage, the shape of painted area and keeping of color of steels.

1. If SC has been determined for a project, it would have been before Primer or a complete coating in order to use for all corners, gaps, nails, screws, welds and sharp edges.

2. It should involve around the edges at least 2cm.

3. To prevent from peeling of Primer during the actions, it should reach to touch dry {it should be dry enough and non-sticky} and then use Primer {so this time should not be too long because it cause to regions without Primer become corrode.}

4. Maybe SC use once after Primer action, especially if much time is needed to dry.

Most SC is used for all edges, vertebrates and the weld because liquid colors move and flow in these parts. This phenomenon is the result of tension of surface and contraction of color film during drying. If this event happens, the color film will become thinner at location or close of edges. When color destroys in the regions of vertebrates, screws and welds can lead to crisis. Because these factors cause the continuity of skeleton become destroy. Overall SC has 2important advantages: the first one cause to cover small defects and differences of surface such as: porosity of welds, the second one: If enough time gave to SC for drying, it would have prevented from flowing of last coating on the edges and causes more problem for them. Colors with high percentage of solid toward colors with low percentage of solid are less apt to be thin in the edge of the regions because overall, colors with high solid have more curing time and against Viscosity are higher and have less tension on the surface. Frequently corrosion of environment clarifies that whether SC is necessary or not? Often SC is affordable in environments with high corrosion such as: inside the tanks, water storage tanks and chemical materials. In environments with low corrosion, by choosing suitable materials and also by strict quality of control without using SC, maybe it reaches to appropriate protection against corrosion.SC is not necessary for very weak corrosive environments which the moisture is very low in it.

Wholly low solid colors with low viscidity, have more advantages toward SC because fast self-stabilizing colors do not remove of the edges like non natural base of Zinks with high solid degree and high Viscosity such as{epoxy adhesives }. However SC is used for sharp regions and the edges which maybe have not suitable thickness for coating. We should remember that the first advantage of SC is reducing the thickness of coating. We can use SC for all the coating layers. Excess colors increase the residual tension of film of coating that leads to gap or become membranous. Operator of color and expert at first maybe choose the best method by quality of control. Overall quality requirement of SC is consisted of:

1. Filling defects and ups and downs regions on surface.
2. Make a suitable sticky surface for a complete coating.
3. Thickness should not make more than acceptable for the complete coating.

These two methods have quality cases like below:

1. coating with brush
2. coating with air spray

Coating with brush is used for little spaces that are consisting of weld edges, screws and vertebrates and spray for large areas.

The methods of using should be prevented from high thickness that destroys the film.

Overall, from desirable characteristics of stripe coating we can hint to below cases:

In view of capability, high percentage of sticky on the various length of proliferation) this coating can tolerate each strike and dimensional changes.

Very good resistance toward heat shocks to 110°C. It has resistance at immersed conditions at temperatures between 30°C and 80°C.

In cases which coating has sudden injury, it can be easily flexible.

Pollutions are not stick on this coating and can be easily clean.

Very low permeability (stream 0/0018perm/cm)

Existing this coating is increased on the surface of resistance against of transmission of electricity. (2mm thickness can be at dc flow with 15000 voltage)

Time of half-life of coating is 30years so that after this period mechanical and chemical properties reduce to half but it can service too.

It possesses high chemical resistance toward corrosive chemical materials with (PH=1-13)

4 CORROSION MECHANISM

Gases such as carbon dioxide or acetic acid and other short-chain aliphatic acids may be low or high production. The presence of these gases and acid corrosion control is making the complex problems for wells. Corrosion in oil and gas wells has electrochemical mechanism. When the system reaches a temperature below the dew point, moisture is converted to liquid and large droplets on the tube wall may occur. Water plays the role of electrolyte in the electrochemical reaction. The water itself is not corrosive, when acidic gases such as H2S and CO2 are dissolved in water, an acidic environment in the vicinity of the sets that severe corrosion of the steel. The corrosive gases other than oxygen, sometimes in oil wells to gas wells, but the problem are there is no oxygen. H_2S gas source can be found in the layers of sediment, oil and gas products of the reaction process or activity is bacteria. Further deterioration in gas wells due to localized corrosion occurs, the local corrosion under the insulation, the deposits or to be caused by bacteria and 10 to 100 times faster than the corrosion damage is uniform. Another type of corrosion is localized corrosion resulting from defects or FILC. The apparent deterioration in the situation is different. Presence of CO_2 as a needle shaped defects FILC or rupture occurs. CO_2 corrosion in gas wells can be divided into three temperature regions:

A) Temperature below 140 degrees Fahrenheit (C60) does not protect the product and the level of corrosion caused by severe corrosion exists.

B) Above 300 degrees F (C 150), Mgntayt is formed and the environment unless the presence of large amounts of salt water, is slightly corrosive.

C) Between 300-140 degrees Fahrenheit (C150 -60) has the ability to protect the metal carbonate product layer does not even need a deterrent. But in the presence of ions such as chloride or hydrogen sulfide, or the destructive effect of high velocity fluid layer may be destroyed. Circumstances of high-speed m / s 10 and turbulent fluid flow, creating a protective layer, it is unstable. Aykada Believes that the growth of iron carbonates ($FeCO_3$) crystals incomplete causes a small anodic area and the wounded are yellow corrosion.

5 FACTORS IN THE CORROSION OF GAS WELLS

Temperature: Effect of fluid temperature corrosion in oil and gas industry in similar chemical environments, Corrosion rate is increased at higher reaction temperature corrosion so often that every 20 degrees Fahrenheit

(C_{11}) increasing temperature, the corrosion rate is doubled.

Corrosion of steel in corrosive CO_2 gas in the vicinity there are three temperature diets:

A) Low temperature and non-protective iron carbonate C 60 and the corrosion rate is a function of CO_2 partial pressure.

B) Between temperature and C150-C60 almost protective iron carbonate layer is formed and the corrosion rate reaches an acceptable value.

C) C150 Mgntayt top layer is formed which completely cover and It is also resistant to high velocities and extreme turbulence and Is only sensitive to chloride ions.

Pressure: High pressure gas wells in the gas solubility in liquid corrosive effects. Gas pressure can reach psi 12000. Partial pressure of corrosive gases is an important point. The amounts of corrosion of a well produced by CO_2 are as follows:

- Partial pressure of CO_2 is Less than 7 psi → non-corrosive environment.
- Partial pressure of CO_2 between 7-30 psi → corrosive environments.
- Partial pressure of CO_2 is 30 psi → highly corrosive environments.

The Role of Fluid in the Corrosion: Experience shows that the wells have corrosion problems when Water cut in the total amount of fluid in them is more than 85 percent. Of course, it has plenty of exceptions. Fluid emulsion of water in the fluid conductivity and efficiency as a conductor affects. Mode of the large amount of water wells (without emulsion) produce more corrosive than water wells with Less water cut and more emulsions . Many studies have been conducted to determine the corrosive fluid within the well. Brad Bern 20 different wells of the contract and amounts of water and acidic gas CO2 produced as the variables considered. He found that the amount of water is more productive; the amount of CO2 is more soluble in the vicinity of the wall and creates more corrosion.

Fluid Velocity: Fluid velocity in the fluid regime and the regime's fundamental role in determining the type of fluid are corrosive and performance inhibitors. Experiments have shown that a diet supplemented fluid and field tests are equal,

Mechanism and the corrosion rate was similar in both conditions. Regardless of diet, fluids, in order to evaluate the effect of corrosion rate in the temperature range considered three, The corrosion of CO_2 at low temperature has a range of corrosion depends on the hydrolysis rate of CO_2 And is independent of the speed . Range 20 to 60 ° C. The rate of corrosion is very little because the phase of the reaction is CO_2.

Results and Discussion: In this part, the results are obtained from experiments.chart1 shows physical and mechanical results. The results are obtained in comparison with available standards shows that Poly urethane coating has favorable properties.

Chart 1. The Results of Physical and Mechanical Experiments

Column	experiment	Coating with absence of SC	Coating with presence of SC
1	Transmission of electricity ohm/m^2	4*10^2	4*10^{12}>
		To	
		4*10^{10}	
	Result	Good	Excellent
2	Permeability	7/6-8*10^2	./262
	Gms. 24hr/$m10^2$		./0025
	U.S.Perms		
	Result	Very Good	Excellent
3	(mm) tear of beam		
	-1.5V,20-25®C	-	6
	3% NaCl 30 days	13-21	-
	-6.0V,20-25®C		
	3%NaCl 30 days		
	result	Weak	Very Good

Chart 2 shows the resistance of corrosion of using coatings in different corrosive environments. Also this chat states how to applying mentioned coatings that this kind of coating is whether suitable or not? As can be seen chart 2, Polyurethane has good resistance with 100% solid in most corrosive environments and use of this coating is recommended.

Chart 2. Resistance to Corrosion and How to Apply in Different Environments

Column	experiment	Coating with absence of SC	Coating with presence of SC
1	Resistance to corrosion in temperature of room	Weak	Very good
2	50% average 10% weak acid	R	R
	50%<dense	NR	R
		NR	R
3	10% weak base	R	R
	50%average	NR	R
	50%<dense	NR	R
4	salts	R	R
5	Solvents		
	1 alcohol	NR	NR
	Variety of Ketones	NR	NR

In oil and gas industries, corrosion monitoring was carrying out with different methods. In our country, corrosion coupons are typically used. While the growth of technology, suggests use of the probe. Probes, especially the electrochemical probes have the faster and more accurately results. Also EIS probes can help to extract the details of local corrosion. It is not possible with other monitoring methods. In this paper, only the monitoring methods and electrochemical techniques were introduced. Details of each of the techniques, described in used sources.

Study of Reference list of the companies such as Socothern (Italy) and Corinth pipe work (Greece) and Jotun powder coating (UK), which is include pipe diameter, type of coverage and other data, indicate that mainly pipes are covered under 24 inches 3 layer polyethylene coating. In panel that recently was formed by experts of corrosion in Britain and America, and resulting is published in an article titled US & UK Industry discusses key challenges: in the Journal of Pipeline & gas journal monthly. John T Oshea former chairman of the British Institute of corrosion, after pose of status of gas network in Britain and its coverage in the high pressure line (164000 km) says: These lines are constantly developed for responsibility to the increased demand and new lines of high diameter are protected against corrosion by use of coatings with high integrity coating. Oshea in answer to the question of what kind of high integrity coating is this coating? Says: Examples of these are fusion bonded epoxy and multi component liquid coating (polyurethane) and don't pointing to use of coating 3 layers polyethylene for coating of pipe diameter. Also in response to the question of what percentage of the 164,000 km of country's pipelines are 3 layer polyethylene coating? Says: very little amount of these lines have this coverage and currently used of cover in the middle pressure pipes with a diameter of 36 inches. He is noted about separated the 3 layer polyethylene coating in Britain lines: they have little experience about 3 layers cover in their country.

6 CONCLUSION

100% Solid polyurethane coatings due to suitable properties such as: high adhesion, high resistance to corrosion especially microbial corrosion, suitable flexibility, very good frication and stroke resistance, high chemical resistance and good resistance in high temperature , have various application in external and internal coating of different equipments such as pipes. In addition to suitable (proper) properties, not be toxin and harmless, more adjustment with environment in comparison with traditional cold coatings , high speed of cooking and in result quick use ability and cooking low temperature of these coatings and lack of need to exothrimicity has cause.

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Amir Samimi

(16/05/1983, Isfahan City, Isfahan Province, Iran)

Studied M.SC Chemical Engineering, Master at Islamic Azad University, The Member of IAENG, Have 2 Years Experience in Oil Refinery Company, Member of Young Research, and Have 17 Articles in the International Journal, Conference (U.S.A, France, Italy, Indonesia, India, Australia, Europe Chemical Engineering Conference) and More than 45 Articles in the National Journal, Conference in Iran.
Email: amirsamimi1161@gmail.com

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Variabilité climatique et productions de café et cacao en zone tropicale humide : cas de la région de Daoukro (Centre-est de la Côte d'ivoire)

[Climate variability and production of coffee and cocoa in wet tropical zone: The case of Daoukro region (east-central Côte d'Ivoire)]

Kanohin Fulvie epse Otchoumou[1], Saley Mahaman Bachir[2], Aké Gabriel Etienne[2], Savané Issiaka[1], and Djé Kouakou Bernard[3]

[1]Laboratoire Géosciences et Environnement,
Université Nangui Abrogoua,
Abidjan, Côte d'Ivoire

[2]Laboratoire des Sciences et Techniques de l'Eau et de l'Environnement,
Université Felix Houphouet Boigny,
Abidjan, Côte d'Ivoire

[3]Société d'Exploitation et de Développement Aéroportuaire, Aéronautique et Météorologique,
Direction de la Météorologie Nationale,
Abidjan, Côte d'Ivoire

ABSTRACT: This study aims to show the effect of the climatic variability on the productions of coffee and cocoa of the area of Daoukro which is the principal producing area in the Ivory Coast. The methodological approach is summarized in two steps: first, the characterization and analysis of the impact of climate variability on water resources second monitoring developments in the production of coffee and cocoa (1964-2005) through statistical analysis. The centered and reduced index shows a great interannual variability of rainfalls which is organized in two climatic periods, a humid period (1956-1970) and a dry period (1971-2009). The rainfall deficit evaluated in the area of Daoukro reaches an average of 11% and fluctuated between 5% and 15%. Analysis of the average rainfalls of the wettest four months (March-June) every 10 years during five decades of Daoukro station shows that the period of the great season of rains fell from 4 months to 3 months. The decrease of the rainfall consecutive with the effects of the dryness involved a decrease of the agricultural production (the production of coffee and cocoa). The climate variability from 1964 to 2005 caused interannual fluctuation of the production of coffee and cocoa. Cocoa production in 2004-2005 is only 36% of that of 1981-1982 and that of coffee 43% of the production of 1981-1982.

KEYWORDS: Climate variability, production of coffee and cocoa, tropical zone, Côte d'Ivoire.

RESUME: Cette étude a pour objectif de montrer l'effet de la variabilité climatique sur les productions de café et de cacao de la région de Daoukro, ex-boucle du Cacao de la Côte d'Ivoire. La démarche méthodologique adoptée se résume en deux étapes : d'abord l'analyse des fluctuations pluviométriques suivies de l'évolution de la production de café et de cacao (1964-2005) à travers des analyses statistiques. L'analyse de la pluviométrie moyenne mensuelle par décennie au cours de la période 1956-2009 à la station de Daoukro et des stations environnantes permet de constater que la période de la grande saison des pluies est passée de 4 mois à 3 mois. La baisse de la pluviométrie consécutive aux effets de la sécheresse a entraîné une baisse de la production de café et de cacao. Ainsi, la variabilité climatique de 1964 à 2005 a entraîné une fluctuation interannuelle de la production de café et cacao. La production cacaoyère ne représente en 2004-2005 que 36% de celle de 1981-1982, celle du café 43% de la production de 1981-1982.

MOTS-CLES: Variabilité climatique, production de café-cacao, zone tropicale, Côte d'Ivoire.

Corresponding Author: Kanohin Fulvie epse Otchoumou (atchoful@yahoo.fr)

1 INTRODUCTION

Depuis 1970, un intérêt soutenu se manifeste pour l'étude du climat et sa variabilité, compte tenu des conséquences parfois dramatiques que celle-ci peut entraîner. Les implications de cette variabilité sur les ressources en eau sont particulièrement fortes et touchent, à leur tour, de très nombreux secteurs d'activités telles que l'agriculture et l'élevage [1]. De nombreuses études sur la variabilité climatique à l'échelle de l'Afrique de l'Ouest [2], [3] [4], [5] et de la Côte d'Ivoire [6] montrent qu'une tendance à la sécheresse s'est manifestée à partir de la fin de la décennie 1960. Cette évolution des précipitations se traduit par des variations qui se manifestent par la baisse des hauteurs de pluie au sein des séries chronologiques pluviométriques [3]. Ces variations ont entraîné un tarissement de la majorité des points d'eau de surface ainsi que de nombreux puits et par conséquent une baisse importante du niveau piézométrique des nappes [7]. Ce déficit pluviométrique observé sur plusieurs années consécutives s'est répercuté sur la production des cultures de rentes que sont le café et le cacao en provoquant une baisse considérable des productions agricoles. Des études ont été menées par différents chercheurs afin d'évaluer l'effet de la variabilité climatique sur les ressources en eau et la production agricole. Ainsi les références [4] et [8] et [3] se sont penchés sur la variabilité climatique et son impact sur les activités humaines, notamment les productions agricoles. Notre étude vise à évaluer l'ampleur de l'évolution de la pluviométrie dans la région de Daoukro et son influence sur la production de café et de cacao. Cette approche concerne à la fois la variabilité interannuelle évaluée en utilisant les indices centrés réduits, ainsi que l'évolution de la production de café et de cacao (1964-2005) à partir de la méthode statistique, Analyse en Composantes Principales (ACP).

1.1 LOCALISATION DE LA ZONE D'ÉTUDE

Le département de Daoukro est situé dans la région du N'zi Comoé, au Centre-Est de la Côte d'Ivoire (fig. 1). Il est compris entre les longitudes 3°29'et 4°34' Ouest et les latitudes 6°55' et 7°32' Nord. Le département a une superficie de 3745 km^2 et comprend 4 sous-préfectures (Daoukro, Ouéllé, Ettrokro et Ananda). La population est estimée à 112188 [9], soit une densité de 38 habitants/km^2. Cette population essentiellement agricole est constituée d'Agni, de Baoulé et d'une communauté d'étrangers en provenance des pays limitrophes et servant de main-d'œuvre dans les plantations. Le relief de la région est dominé par une succession monotone de bas plateaux dont l'altitude décroît de 350 m au centre à 200 m vers les extrêmes. Ce paysage se développe dans des flysch éburnéens formant de petites collines allongées et à pentes très faibles, constituant des interfluves à sommets soit cuirassés soit en forme de plan-convexes [10]. Les sols de la région sont des sols ferralitiques remaniés moyennement désaturés et dérivés de schiste quartzitiques riches en argile avec un bon pouvoir de rétention en eau. Ils portent des forêts très dégradées et sont bien adaptés à la production agricole (café, cacao, hévéas, palmier à huile, banane plantain et igname) [11]. Le département de Daoukro appartient au secteur forestier mésophile et il bénéficie d'un régime équatorial de transition atténué. C'est un régime climatique à 4 saisons comprenant une « grande » saison des pluies de mars à juin avec le maximum des pluies en juin (205 mm), une « petite » saison sèche de juillet à août marquée par une baisse des précipitations qui atteint 61 mm en août, une « petite » saison pluvieuse de septembre à octobre avec un pic en octobre (116,36 mm) et une « grande » saison sèche très marquée de novembre à février avec une très forte baisse des précipitations. Les mois de décembre et février sont les mois les plus secs avec respectivement 10,76 mm et 20 mm de pluie. La pluviométrie moyenne annuelle calculée sur la période de 1956 à 2009 à la station de Daoukro est de 1103,53 mm.

2 MATÉRIEL ET MÉTHODES

2.1 MATÉRIEL

Cette étude a nécessité l'utilisation des pluies annuelles et mensuelles couvrant la période 1956-2009 de la station de Daoukro et des stations environnantes afin d'estimer les caractéristiques de la variabilité de la pluviométrie de la région (fig. 2). Les températures et l'humidité relative sont celles de la station synoptique de Dimbokro. Ces données climatiques proviennent de la Société de Développement Aéroportuaire et Météorologique (SODEXAM). Les données agricoles (Cacao et café) couvrant la période 1964-2005 ont été obtenues auprès du Bureau National d'Etudes Techniques et de Développement (BNETD) et de la Caisse de Stabilisation (CAISTAB). Les productions de café et de cacao issues des différentes plantations sont collectées et regroupées dans des entrepôts locaux où se fait la pesée afin d'estimer le tonnage par région.

2.2 MÉTHODES

- Indice pluviométrique

En vue d'apprécier l'évolution de la pluviométrie au cours des différentes années de la période d'étude, la méthode de l'indice pluviométrique de Nicholson a été appliquée. Cette méthode a l'avantage de mettre en évidence les périodes excédentaires et déficitaires pluviométriques. Cet indice se définit comme une variable centrée réduite exprimée par l'équation 1 [4] :

$$I = \frac{x_i - \bar{x}}{\sigma} \quad \text{(Eq.1)}$$

Avec x_i : pluviométrie de l'année i ;

$\bar{x}$: pluviométrie moyenne interannuelle sur la période de référence ;

σ : écart-type de la pluviométrie interannuelle sur la période de référence.

La représentation graphique des indices pluviométriques annuels ainsi calculés traduit l'évolution dans le temps de la variable étudiée, soulignant les périodes tantôt excédentaires tantôt déficitaires.

- Le Filtre Passe-bas de Hanning

La méthode filtre passe-bas de Hanning d'ordre 2, appelée aussi moyenne mobile pondérée, permet d'éliminer les variations saisonnières dans une série chronologique. Le calcul des totaux pluviométriques pondérés est effectué au moyen des équations présentées par [12] dont le principal est:

$$X_{(t)} = 0{,}06\,X_{(t-2)} + 0{,}25\,X_{(t-1)} + 0{,}38\,X_{(t)} + 0{,}25\,X_{(t+1)} + 0{,}06\,X_{(t+2)} \quad \text{(Eq.2)},$$

$$\text{Pour } 3 \le t \le (n-2)$$

où $X_{(t)}$ est le total pluviométrique pondéré du terme t, $X_{(t-2)}$ et $X_{(t-1)}$ sont les totaux pluviométriques observés de deux termes qui précèdent immédiatement le terme t, et $X_{(t+2)}$ et $X_{(t+1)}$ sont les totaux pluviométriques observés de deux termes qui suivent immédiatement le terme t. Les valeurs pluviométriques pondérées sont ensuite centrées et réduites pour mieux visualiser les périodes d'excédent et de déficit pluviométriques.

- Méthode des isohyètes

Le tracé des isohyètes est un élément complémentaire aux méthodes précédentes pour mieux visualiser la variation spatio-temporelle des précipitations sur l'ensemble de la région. Les isohyètes permettent de connaître les limites des secteurs où la pluviométrie est sensiblement homogène. Les données d'entrées sont les pluviométries moyennes annuelles des 7 stations pluviométriques de la région (Daoukro, Dimbokro, Bocanda, M'bahiakro, Agnibilékrou, Bongouanou et Abengourou) et les coordonnées des points de mesures. Les points représentant les pluviométries moyennes annuelles des différentes stations ont été interpolés grâce à la commande « interpolate grid » du logiciel Surfer 8.0 Les isohyètes ont été tracés sur les 5 dernières décennies (1956-2009).

- Variabilité climatique mensuelle et saisonnière

L'analyse du régime mensuel des pluies porte sur la hauteur moyenne mensuelle interannuelle. Elle s'est portée sur les quatre mois de la grande saison des pluies (mars, avril, mai et juin) et sur les cinq dernières décennies de la période 1956 - 2009, au niveau de chaque station afin de mieux percevoir les variations. Elle a pour objectif d'observer les variations saisonnières de la pluviométrie.

- Analyse statistique de la production agricole

Pour mieux apprécier l'influence des variations pluviométriques sur la production du café et du cacao, nous avons procédé à une analyse statistique (l'ACP). L'analyse en composantes principales (ACP) est une méthode statistique (initialement de statistique descriptive) qui a pour but de comprendre et de visualiser comment les effets de phénomènes a priori isolés se combinent [13]. Les variables étudiées dans ce travail sont la pluviométrie de la station Daoukro, la

température et l'humidité relative de la station de Dimbokro, la production annuelle (en tonnes) de café et de cacao du département de Daoukro. Les données (44 individus par variable) sont traitées par le logiciel *Statistica*. Le choix de ce logiciel est justifié par son mode d'utilisation simplifié, son interface enrichie par les logiciels Excel pour l'entrée des données et l'édition des résultats. Le cercle des corrélations permet d'apprécier, les groupes de variables très corrélées entre elles. L'angle entre 2 point-variables, mesuré par son cosinus est égal au coefficient de corrélation linéaire entre les 2 variables: cos *a* = r(X1, X2). Ainsi :

- si les points sont très proches (*a* peu différent de 0) : cos *a* = r(X1, X2) = 1 donc X1 et X2 sont très fortement corrélés positivement. Si *a* est égal à 90°, cos *a* = r(X1, X2) = 0 alors pas de corrélation linéaire entre X1 et X2 ;
- si les points sont opposés, *a* vaut 180°, cos *a* = r(X1, X2) = -1 : X1 et X2 sont très fortement corrélés négativement.

Le choix des axes principaux tient compte de la réduction du nombre de facteurs. Lorsque deux variables sont corrélées, la variation de l'une implique celle de l'autre. Le choix du module Analyse en Composantes Principales du logiciel *Statistica*, a permis de visualiser les résultats suivants :

- une statistique sommaire des variables étudiées (moyenne, écart type, minimum, maximum);
- le tableau des valeurs propres ainsi que le pourcentage d'explication de chaque valeur propre ;
- le tableau des coordonnées des variables actives ;
- un plan de projection des variables.

3 RÉSULTATS ET DISCUSSIONS

3.1 RÉSULTATS

3.1.1 INDICES PLUVIOMÉTRIQUES ANNUELS

L'étude de la variabilité pluviométrique à partir des valeurs de l'indice de Nicholson et du filtre passe-bas de Hanning a permis de suivre les grands changements qui se sont opérés dans la région depuis 1956 jusqu'à l'année 2009. Les indices pluviométriques des stations de Daoukro, Bocanda et Agnibilékrou, M'bahiakro et Abengourou ont été analysés.

L'étude menée à la station de Daoukro (fig. 3a) a permis d'observer deux périodes. La période humide (1956-1979) est caractérisée par une moyenne pluviométrique de 1121,8 mm et est supérieure à la moyenne pluviométrique des 53 ans d'observation qui est de 1094,28 mm ; la période sèche (1980-2009) est caractérisée par une rareté des pluies. Pour cette période, la moyenne pluviométrique est de 1070,46 mm.

La fluctuation interannuelle de la pluviométrie à Bocanda (fig. 3b) se caractérise par une période humide de 1956 à 1975 suivie d'une période déficitaire de 1976 à 2009. Le filtre passe-bas permet de distinguer nettement les différentes périodes. La période humide à Bocanda comporte une année remarquable: 1968 avec 1949,2 mm soit 75% d'excédent par rapport à moyenne de la période d'étude (1111,5 mm). La période déficitaire comporte également des années de sécheresse très marquées (1986 et 1992 avec respectivement 857,1 mm et 827,2 mm de pluie) soit un déficit respectif de 26% et 28% par rapport à la moyenne de la période d'étude (1111,5 mm).

Les indices centrés réduits de la pluie annuelle à la station d'Agnibilékrou (fig. 4a) caractérisent l'alternance entre une période humide de 1956 à 1972 et une période déficitaire de 1973 à 2009. La période humide est marquée par une année exceptionnelle : 1968 avec 2017,6 mm soit un excédent de 67% par rapport à la moyenne de la période d'étude (1203 mm). La période sèche observée de 1973 à 2009 à une moyenne interannuelle de 1130 mm. Cette période sèche comprend des années de sécheresse très marquées (1982, 1983 et 1986) qui enregistrent respectivement 964,4 mm, 668,6 mm et 864,9 mm soit 20%, 28% et 45% de déficit de pluie par rapport à la rapport à la moyenne de la période d'étude (1203 mm)

La ville d'Abengourou (fig. 4b) est la plus arrosée de la région avec une hauteur de pluie moyenne annuelle de 1287 mm. Elle comporte également une période humide (1956-1975) marqué par deux années à forte pluviométrie : 1963 et 1968 avec respectivement 1994 mm et 1976,7 mm soit un excédent de 54,87% et 53,53% par rapport à la moyenne de la période d'étude. Une période sèche de 1976 à 2009 avec des années de sécheresse très marquées : 1977, 1978 et 1991 avec respectivement 896,1mm, 898,8 mm et 893,1 mm soit un déficit de 30% de pluie par rapport à la moyenne de la période d'étude (1287,49 mm).

La station de M'bahiakro (fig. 5a) présente une période humide (1956-1975) et une période sèche (1976-2009). Cette station est la moins arrosée de la région avec une pluviométrie moyenne de 1053,70 mm (1956-2009). L'année 1968 est la plus arrosée de la période humide avec 1784,9 mm de pluie soit un excédent de 69,39 %. La période sèche comprend de nombreuses années de sécheresse très marqués : 1983, 1987, 1998 et 2001 qui enregistrent respectivement 735,3 mm,

698,3 mm, 653,3 mm et 707,2 mm soit 30%, 33%, 38% et 33% de déficit de pluie par rapport à la moyenne de la période d'étude (1053,7 mm).

Les représentations graphiques des indices annuels, au niveau de ces différentes stations sur les périodes 1956-2009, ont montrés des périodes d'excédent et de déficit pluviométriques. La rupture dans les différentes stations s'observe dans la décennie 1970-1980, ainsi les déficits pluviométriques varient entre 5% et 15% (tableau 1).

3.1.2 VARIABILITE SPATIO-TEMPORELLE DES PRECIPITATIONS.

L'examen des courbes d'isovaleurs des hauteurs de pluie permet de connaître la répartition de la pluviométrie sur l'ensemble de la région. L'analyse de la variabilité spatio-temporelle des hauteurs de pluie moyennes annuelles au cours des différentes décennies, de 1956 à 2009 montre l'évolution des classes délimitées par les isohyètes 1000 mm, 1200 mm et 1360 mm. Les isohyètes ont été construites à partir des pluviométries moyennes annuelles des 5 dernières décennies. Au cours des 5 (cinq) dernières décennies, la pluviométrie annuelle a baissé de façon notable sur l'ensemble de la région. L'analyse de ces valeurs moyennes fait apparaître une inégalité dans la distribution spatiale de la pluviométrie dans la région de Daoukro, avec une décroissance des hauteurs annuelles de pluie observée, du sud vers le nord de la région.

La décennie 1956-1965 est la plus humide. La région est limitée par les courbes isohyètes 1400 mm au sud et 1200 mm au nord. Seule la station de M'bahiakro enregistre une pluviométrie inférieure à 1200 mm. Les autres stations reçoivent des précipitations comprises entre 1400 mm et 1200 mm.

La décennie 1966-1975 est également humide avec une légère diminution des quantités de pluies. Cette décennie est marquée par un élargissement de la zone de pluviométrie inférieure à 1200 mm. Celle-ci occupe au cours de cette décennie une bande allant du sud-ouest au nord. Cette baisse de la pluviométrie touche les stations de Daoukro et Bongouanou.

Au cours de la décennie 1976-1985 la baisse de la pluviométrie prend une importance particulière dans toute la région. Cette diminution concerne la quasi-totalité des stations. La zone de pluviométrie inférieure à 1200 mm s'évase fortement et occupe plus des 3/4 de la région. Seules les stations de Bongouanou et d'Abengourou reçoivent des précipitations comprises entre 1160 mm et 1200 mm.

La décennie 1986-1995 est également sèche mais elle est marquée par une remontée des isohyètes 1160 mm et 1200 mm au sud de la région. La décennie 1996-2005 est la plus sèche avec la disparition de l'isohyète 1200 mm et l'éloignement de l'isohyète 1160 mm qui se trouve désormais aux confins sud-est de la région. La moyenne pluviométrique de toute la région est de 1079 mm.

3.1.3 VARIATIONS MENSUELLES ET SAISONNIERES DES PRECIPITATIONS

L'analyse des variations de la pluviométrie moyenne mensuelle montre que la variabilité pluviométrique se manifeste par une modification importante de la pluviométrie mensuelle. La décennie 1956-1965 a été la plus humide pour l'ensemble des stations d'étude. Les décennies 1976-1985 et 1986-1995 ont été déficitaires par rapport à la période de référence (1956-1965) sur l'ensemble de la région. On constate qu'une période de forte pluviométrie (> 200 mm), qui s'étendait sur quatre mois pendant les décennies 1956-1965 et 1966-1975, se réduit à trois mois pendant les trois dernières décennies avec une baisse très marquée pour le mois de Mars. Le mois de mars (début de la grande saison des pluies) semble être très affecté par la récession pluviométrique. Le mois de juin demeure le mois le plus arrosé. A Daoukro et à M'bahiakro (fig. 9), Les mois les plus humides (mars, avril, mai et juin) ont connus une régression des hauteurs de précipitations. Le mois de mars a été le plus affecté, car la pluviométrie de ce mois pour les deux stations est passée respectivement de 135,38 mm et 140,04 mm (1956-1965) à 80,25 mm et 54,25 mm (1995-2005) soit un déficit respectif de 39,70% et de 61,26%. L'analyse de la fig. 9 permet de constater que la période des grandes saisons des pluies est passée de 4 mois à 3 mois.

A Bocanda, la décennie 1986-1995 a été la plus sèche. Au cours de cette décennie, les hauteurs de pluie de tous les mois de la grande saison de pluie ont diminué. La baisse de la pluviométrie du mois de juin (le mois le plus arrosé) est assez remarquable avec un déficit de 22% par rapport à la décennie précédente (1976-1985). A Agnibilékrou et Abengourou le mois d'avril a été le plus affecté au cours de la décennie 1976-1985. A Abengourou au cours de cette même décennie le mois de mai a été le arrosé avec 203,96 mm contre 194,01 mm en juin. Cette variabilité saisonnière de la pluviométrie a, bien entendu, des conséquences importantes sur les cultures pluviales du fait que l'agriculture dans la zone d'étude est encore basée sur les systèmes agraires pluviaux et donc toujours tributaire des aléas climatiques.

3.1.4 IMPACT DE LA VARIABILITE CLIMATIQUE SUR LES PRODUCTIONS AGRICOLES

Les modifications environnementales constatées ces dernières années en Afrique de l'ouest ont considérablement affectées le monde rural [6]. La dégradation des sols liés à leur surexploitation et les contraintes climatiques rendent vulnérables certaines cultures, conduisant à des diminutions des rendements agricoles [14]. Dans l'Est comme dans les autres régions forestières, le régime des précipitations a connu une diminution par rapport aux années 1960-1970 [15]. A Daoukro comme dans toute la région du N'zi-comoé, les mois les plus humides (mars, avril, mai et juin) ont connus une régression des hauteurs de précipitations suivie de la réduction de la période des grandes saisons des pluies qui est passée de 4 mois à 3 mois et on observe une baisse progressive des rendements de café et de cacao. Cette étude a pour objectif de relever l'impact des baisses de pluie sur les productions agricoles. Une analyse en composante principale (ACP) a été faite afin d'obtenir l'influence des paramètres climatiques sur la production de café et de cacao dans la région de Daoukro. Les variables (moyennes annuelles) sont la pluviométrie, la température, l'humidité relative et la production de café et de Cacao (en tonne). Les statistiques élémentaires sur les variables sont données dans le tableau II. Le paramètre écart- type montre que les valeurs des différentes variables sont dispersées autour de leur moyenne respective. Les facteurs F1, F2 et F3 expliquent à eux seuls 78 % des variables exprimées (tableau III). Ils peuvent donc permettre d'interpréter les résultats obtenus. Les valeurs ayant servi à la réalisation de ces graphes sont consignées dans le tableau IV. Les cercles de corrélations F_1-F_2 et F_1-F_3 (fig. 11) permettent de voir, parmi les variables, les groupes de variables corrélées entre-elles. L'angle entre 2 point-variables, mesuré par son cosinus est égal au coefficient de corrélation linéaire entre les 2 variables. Ainsi le tableau V donne les coefficients de corrélations entre les paramètres climatiques et les productions agricoles.

L'analyse des plans factoriels et du tableau V révèlent une corrélation entre les paramètres climatiques et les productions de café et de cacao. Ainsi, le facteur F1 dans le plan factoriel F1-F2 est déterminé par café et cacao. Ce facteur exprime la production du café et du cacao. Quant au facteur 2, il est déterminé par P et Hr (figure 10). Ce facteur exprime les facteurs climatiques (pluviométrie et humidité relative). L'humidité relative varie dans le même sens que les précipitations dans l'axe porté par le facteur F2. Le facteur F3 (plan factoriel F1-F3) est principalement déterminé par la pluviométrie. La température et l'humidité relative se trouvent en opposition de la production agricole dans la partie positive du facteur 1. L'humidité relative représente le rapport entre la quantité de vapeurs d'eau contenue dans l'air et la capacité d'absorption de l'air à une température donnée. En période pluvieuse (Mars à juin) l'humidité relative monte jusqu'à 80% pendant que la température passe de 27°c (saison sèche) à 24°c en période humide. Nous avons également une corrélation positive (R= 0,64) entre les précipitations et les productions de café et de cacao. Ce qui signifie que les paramètres climatiques contrôlent en partie la production du café et du cacao. Pour que le cacaoyer et le caféier cultivés aient une croissance régulière, une floraison et une fructification abondante, des poussées foliaires normale et bien réparties au cours de l'année, de nombreux facteurs climatiques et écologiques interviennent dont une bonne alimentation en eau, une température optimale de 25°c, une humidité relative comprise entre 75 et 80% et un sol qui assure une bonne rétention de l'eau [16]. Les pluies doivent être bien reparties au cours de l'année et la saison sèche ne doit pas excéder trois mois.

Introduite au début du XXe siècle dans les régions forestières de Côte-d'Ivoire, la culture du café et du cacao a connu un développement sans précédent après les années 1950 [17]. Daoukro fait partie de l'ex-boucle du cacao qui, dans le processus du développement économique de la Côte d'Ivoire, a connu une expansion économique remarquable ; expansion liée à l'introduction des cultures d'exportation (café, cacao). Dans la période 1956-1970, la production de café était estimée à 15000 tonnes et cette production a baissé de 30% dans la période 1970-1980. Les causes principales de la chute de la production sont la baisse de la pluviométrie et le vieillissement des plantations (âgées de plus de 30 ans). A cela s'ajoute, l'exode rural vers les régions de l'ouest (nouvelle boucle du cacao) à la recherche de forêt vierge car l'ex-boucle du cacao a épuisé ses réserves de forêt. Cette émigration a eu pour conséquence l'abandon des plantations [14]. Ce déclin de l'activité de plantation s'observe aussi bien au niveau des superficies qu'au niveau des productions. Au niveau de la superficie, la boucle du cacao perd sa première place à partir de 1973 (pour le cacao) et de 1980 (pour le café) ; aujourd'hui, cette région ne détient plus que **7** % des superficies des cacaoyers et 5 % de celles des caféiers. Elle n'est plus la première productrice depuis 1970 et représente à peine 8 % de la production du cacao et 3 % de celle du café. Parallèlement à ce déclin de la production, les plantations déjà créées vieillissent, à défaut d'actions de régénération, et les rendements déjà faibles baissent d'année en année [17].

3.2 DISCUSSION

La baisse de la pluviométrie déterminée au cours de cette étude se situe en général après 1970 et s'intègre dans l'intervalle défini par les études antérieures. En effet, les résultats obtenus sur les données pluviométriques au cours de ce travail sont en accord avec les conclusions des travaux antérieurs réalisés en Afrique de l'Ouest en général [18], [19], [20] et en Côte d'Ivoire en particulier [11], [15]. L'analyse des séries pluviométriques annuelles montrent une alternance de périodes

humides et sèches comme l'ont souligné les travaux de [1], [2], [11], [15]. Les déficits pluviométriques calculés sont généralement inférieurs à 14%. En Afrique de l'Ouest, ces déficits pluviométriques sont de l'ordre de 20%. Comme l'ont signalé la référence [20], les années 1970 constituent une période très représentative de l'importante chute de la pluviométrie en Côte d'Ivoire. L'analyse des isohyètes dans la région de Daoukro a également montré la baisse de la pluviométrie sur l'ensemble des stations de la région. L'examen des pluies mensuelles montre que les trois dernières décennies sont déficitaires. Les fluctuations pluviométriques enregistrées ces dernières années en Côte d'Ivoire ont affecté la production nationale du café et du cacao. A Daoukro, les périodes sèches, longues et répétitives ont entraîné le déclin de la production cacaoyère qui ne représente en 89-90 que 36% de la production de 81-82. Aujourd'hui, la production cacaoyère connaît une variabilité interannuelle importante causée en partie par la baisse et la mauvaise répartition des pluies au cours de l'année. Selon la référence [21], l'intensité et la répartition des chutes de pluies, la température ainsi que l'humidité relative sont les principaux facteurs contrôlant l'émission des fleurs dans les principales zones de culture du cacao. La floraison obéit à un rythme saisonnier car les fleurs n'apparaissent qu'à la reprise des pluies. Selon la référence [16], les facteurs gouvernants la floraison et donc le poids moyen des fèves fraîches par cabosse de cacao sont essentiellement le régime hydrique et thermique. Le cacaoyer (plante ombrophile) exige pour son développement des conditions climatiques humides (hauteurs de pluie minimum 1200 à 1500 mm). La région de Daoukro bénéficie certes, d'une pluviométrie inférieure à 1200 mm, mais les sols de cette région issus du schiste (relativement plus argileux que ceux issus de granite) ont une capacité de rétention en eau élevée [22], donc permettent une bonne alimentation en eau de la plante. L'utilisation des eaux de pluie par la plante dépend beaucoup des caractères physiques des sols, liés à la rétention en eau. De nombreux auteurs ont travaillés sur d'autres cultures et ont observés également les conséquences de la baisse de la pluviométrie sur la production agricole. Sur le palmier à huile par exemple, la référence [23] a montré que les variations du poids du régime sont expliquées en partie par le déficit hydrique enregistré 36 mois avant la récolte. La référence [24], quant à lui, observe une diminution de 4 tonnes de régimes à l'hectare quand le déficit hydrique moyen passe de 200 à 400 mm soit 10% à 20% de déficit. La référence [25], pour la culture de l'hévéa ont mis en évidence l'incidence néfaste de la baisse de la pluviométrie et de l'évolution de la longueur de la saison sèche sur la production du caoutchouc.

4 TABLEAUX ET FIGURES

4.1 TABLEAUX

Tableau 1. Déficits pluviométriques des stations de la région de Daoukro

		Avant rupture	Après rupture	
Station	**Référence**	**Moyenne**	**Moyenne**	**Déficit**
Daoukro	1979	1123,8	1070,66	5%
Abengourou	1975	1362,82	1240,41	9%
Agnibilékrou	1972	1276,01	1122,17	12%
Bocanda	1975	1221,35	1046,87	14%
M'bahiakro	1975	1162,62	989,63	15%

Tableau 2. Caractéristiques statistique des variables

Variables	Effectifs	Moyenne	Ecart-type	Minimum	Maximum
Pluie (mm)	41	1094,54	216,67	712,2	1694,2
Température (°c)	41	26,82	0,42	26	27,7
humidité	41	75,12	1,45	71	78
prod.café (tonne)	41	6175,42	2687,1	686	12864
Prod.cacao (tonne)	41	4856	5058,73	211	17889

Tableau 3. Tableau des valeurs propres

Valeur n°	Val Propre	% Total variance	Cumul val propre	Cumul %
1	2,101333	42,02666	2,101333	42,0267
2	1,363073	27,26145	3,464406	69,2881
3	0,719442	14,38885	4,183848	83,6770

Tableau 4. Coordonnées des variables actives

Variables	Fact. 1	Fact. 2	Fact. 3
P	-0,346434	-0,673807	0,639403
T	0,792334	0,263662	0,234429
H	0,315673	-0,831533	-0,303928
Cacao	-0,793331	0,360589	0,189488
Café	-0,790254	-0,134413	-0,356891

Tableau 5. Corrélations entre les paramètres climatiques et les productions agricoles

Point-variables	Angle a	Cosinus a
Café -pluie	50	0,64
Café -Température	170	-0,98
Cacao-pluie	50	0,64
Cacao-Température	150	-0,86
Cacao-humidité relative	150	-0,86
Pluie-humidité relative	50	0,64

4.2 FIGURES

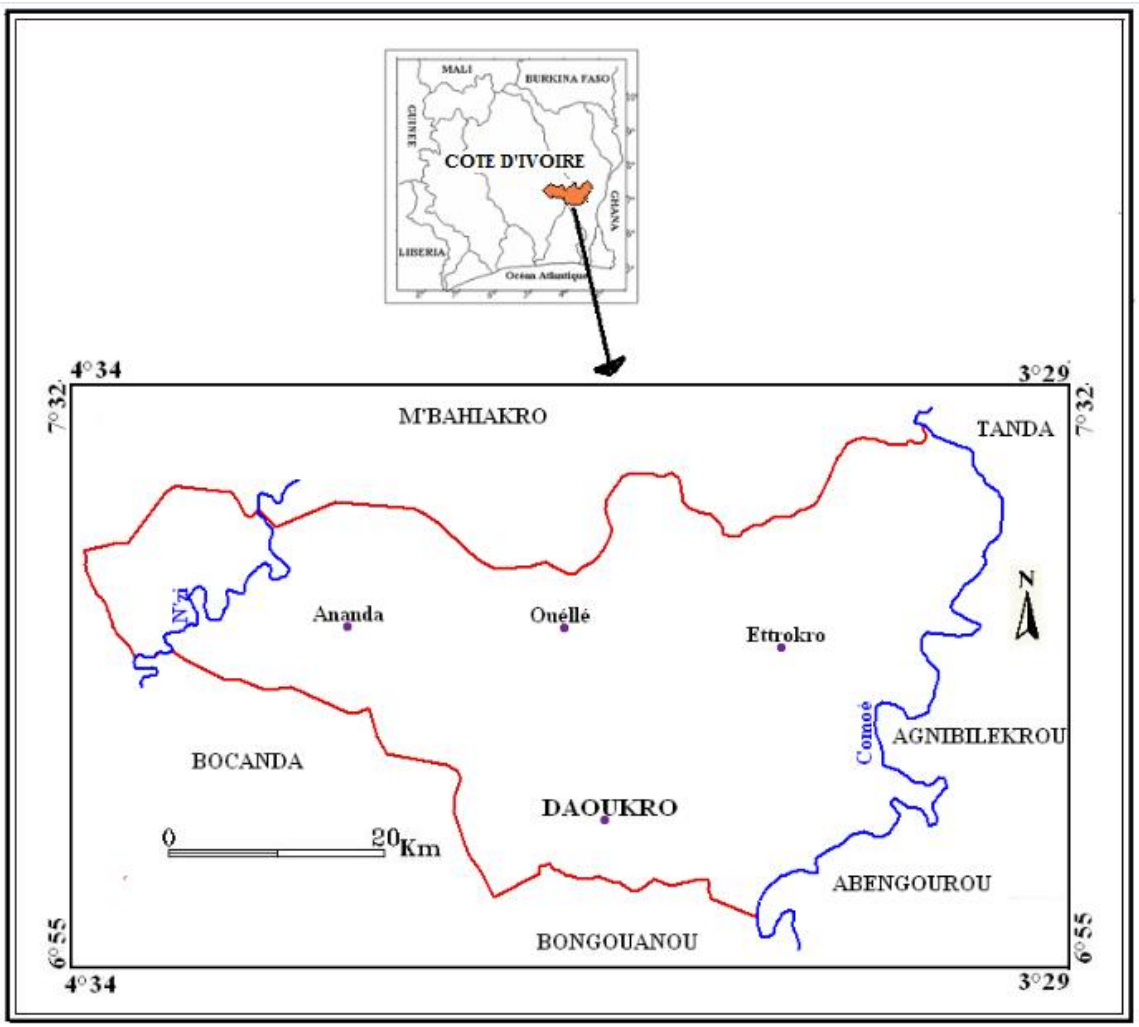


Fig. 1. Localisation de la zone d'étude

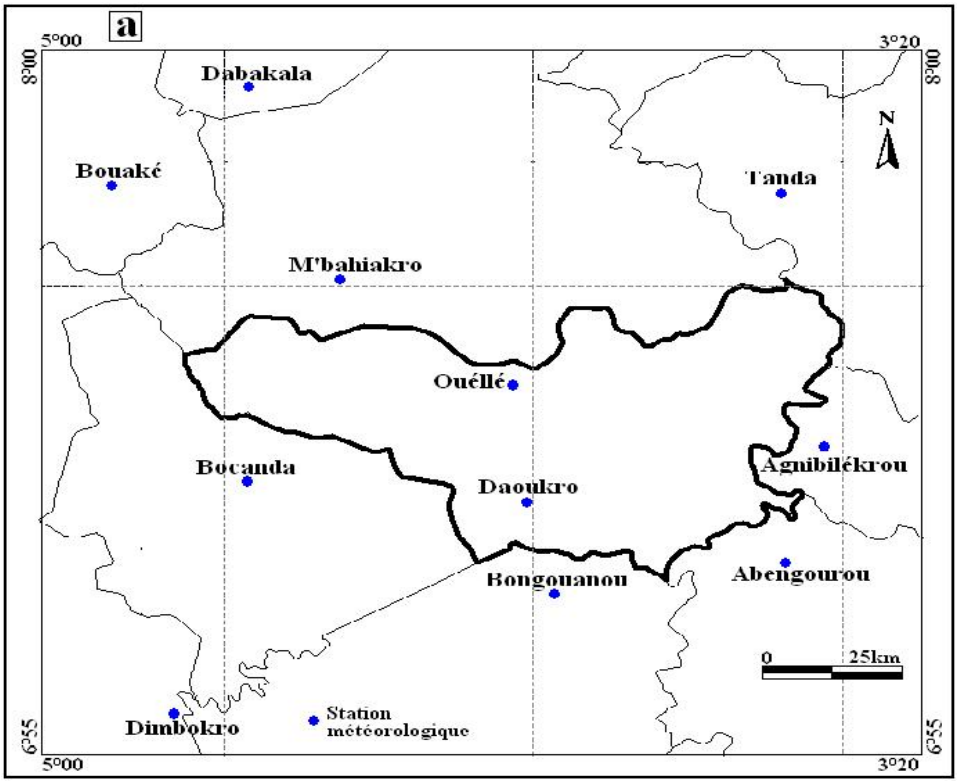
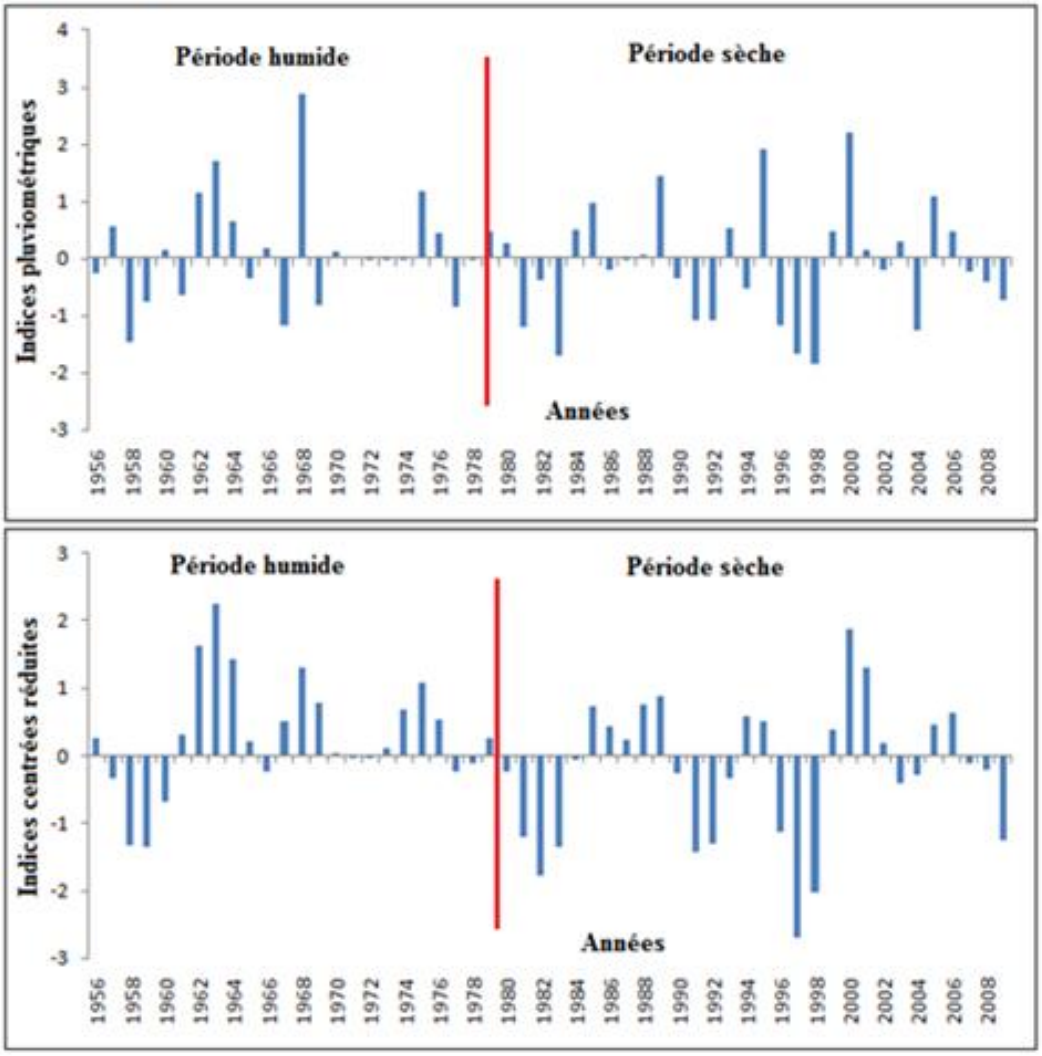


Fig. 2. Localisation des stations météorologiques

a) Station de Daoukro



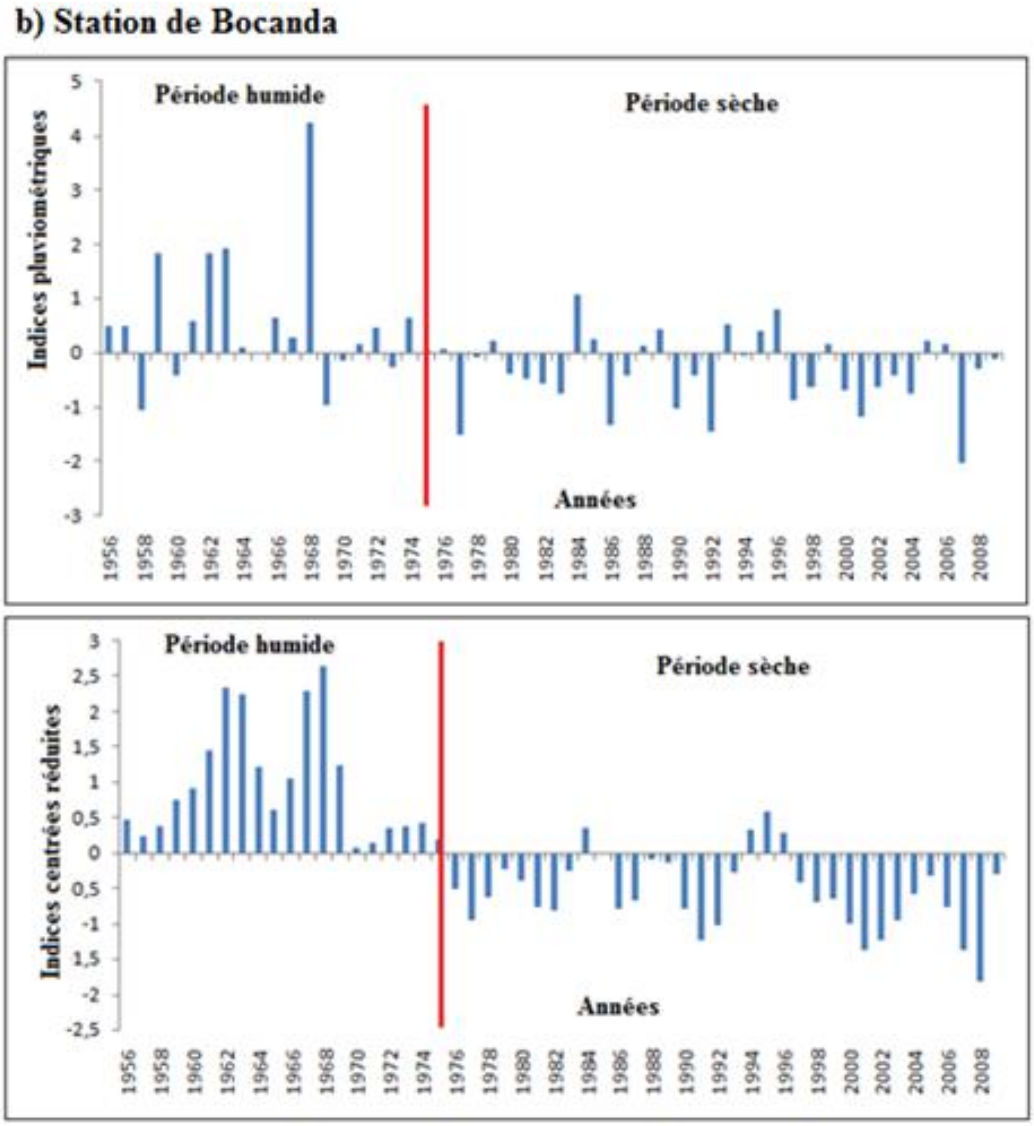
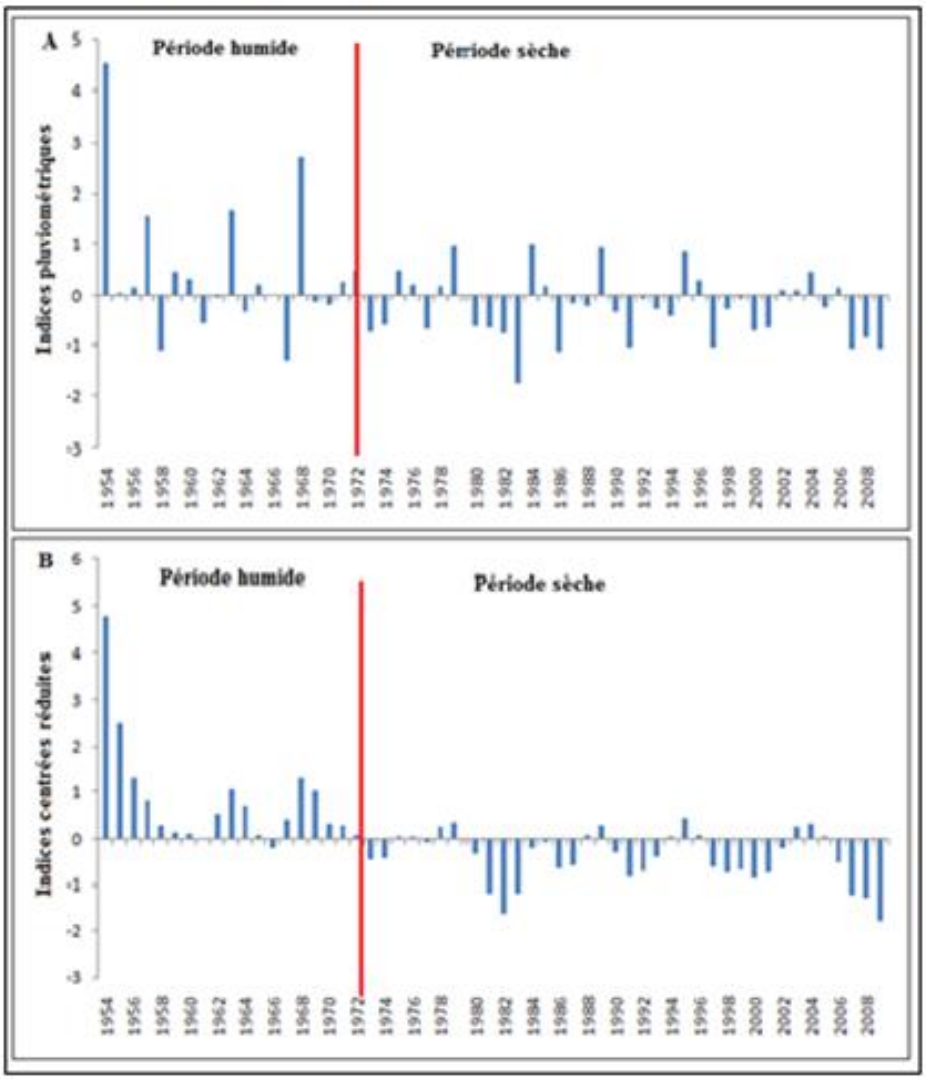


Fig. 3. Evolution de l'indice pluviométrique annuel des stations de Daoukro (a) et de Bocanda (b) (1956-2009)

C) Station d'Agnibilékrou



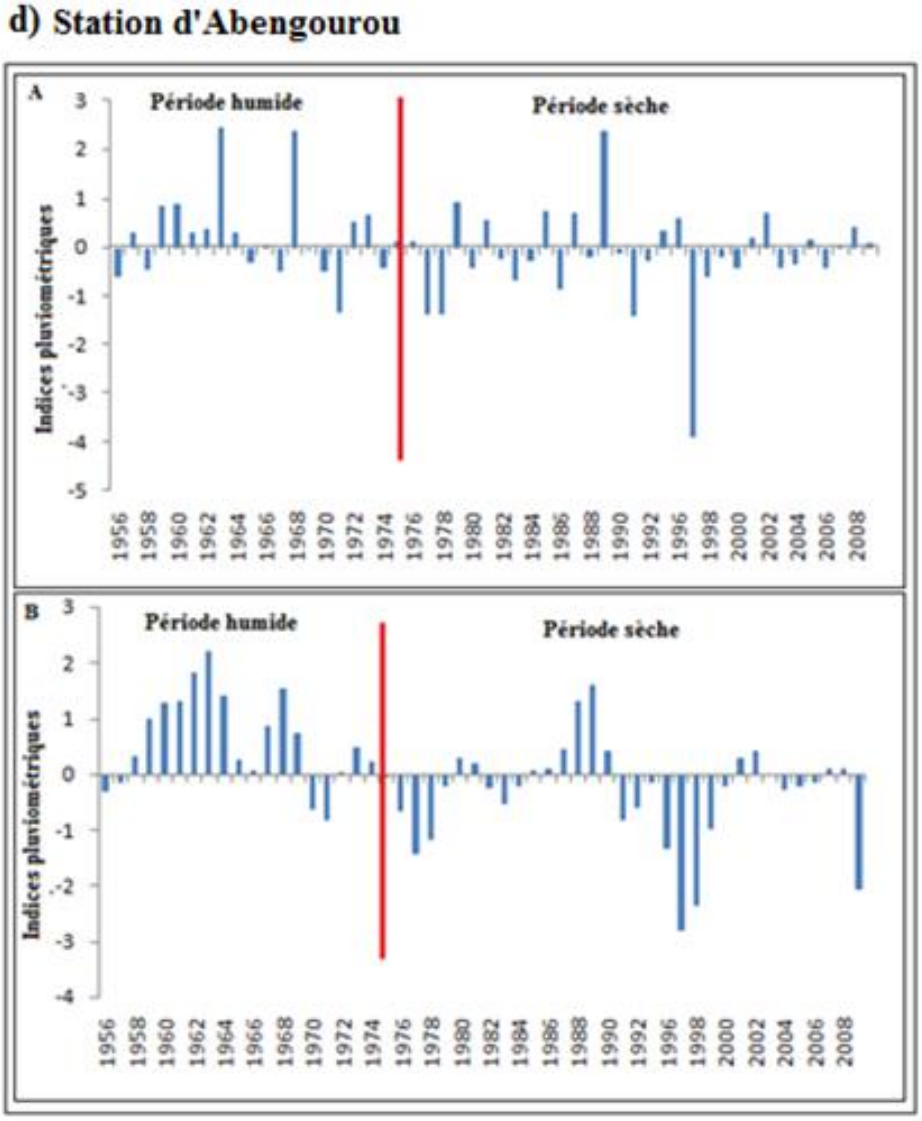


Fig. 4. Evolution de l'indice pluviométrique annuel des stations d'Agnibilékrou (c) et d'Abengourou (d) (1956-2009)

e) Station de M'bahiakro

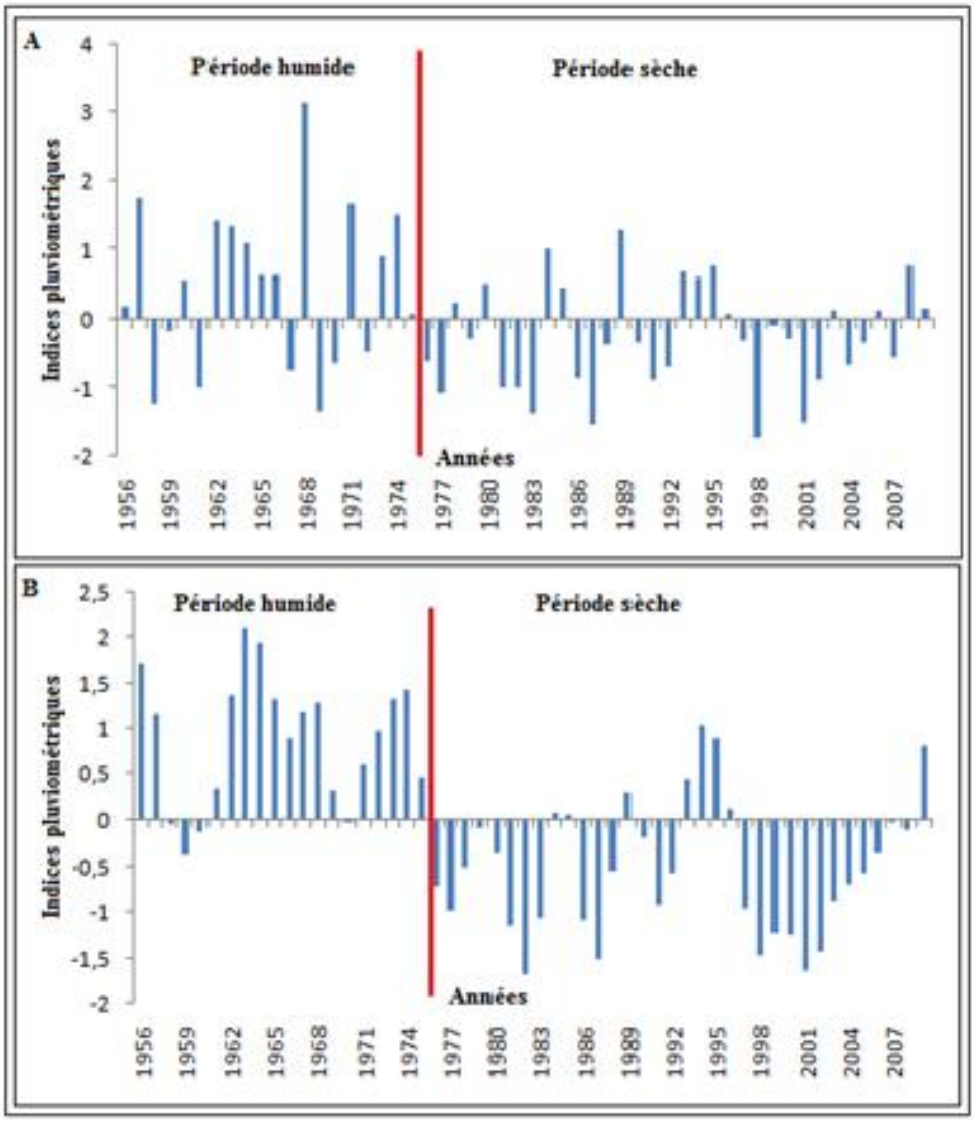


Fig. 5. Evolution de l'indice pluviométrique annuel à la station de M'bahiakro (1956-2009)

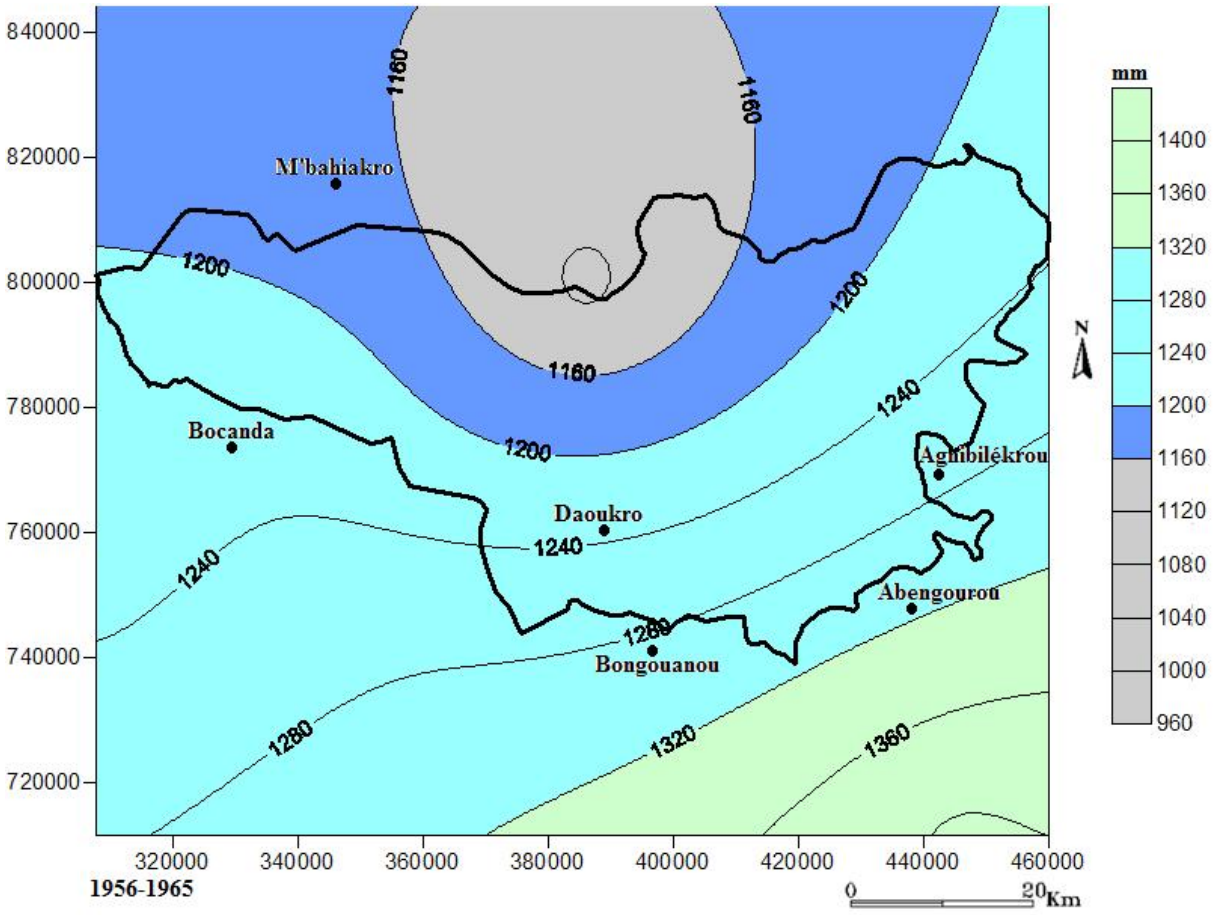


Fig. 6. Hauteurs pluviométriques moyennes interannuelles de la décennie 1956-1965

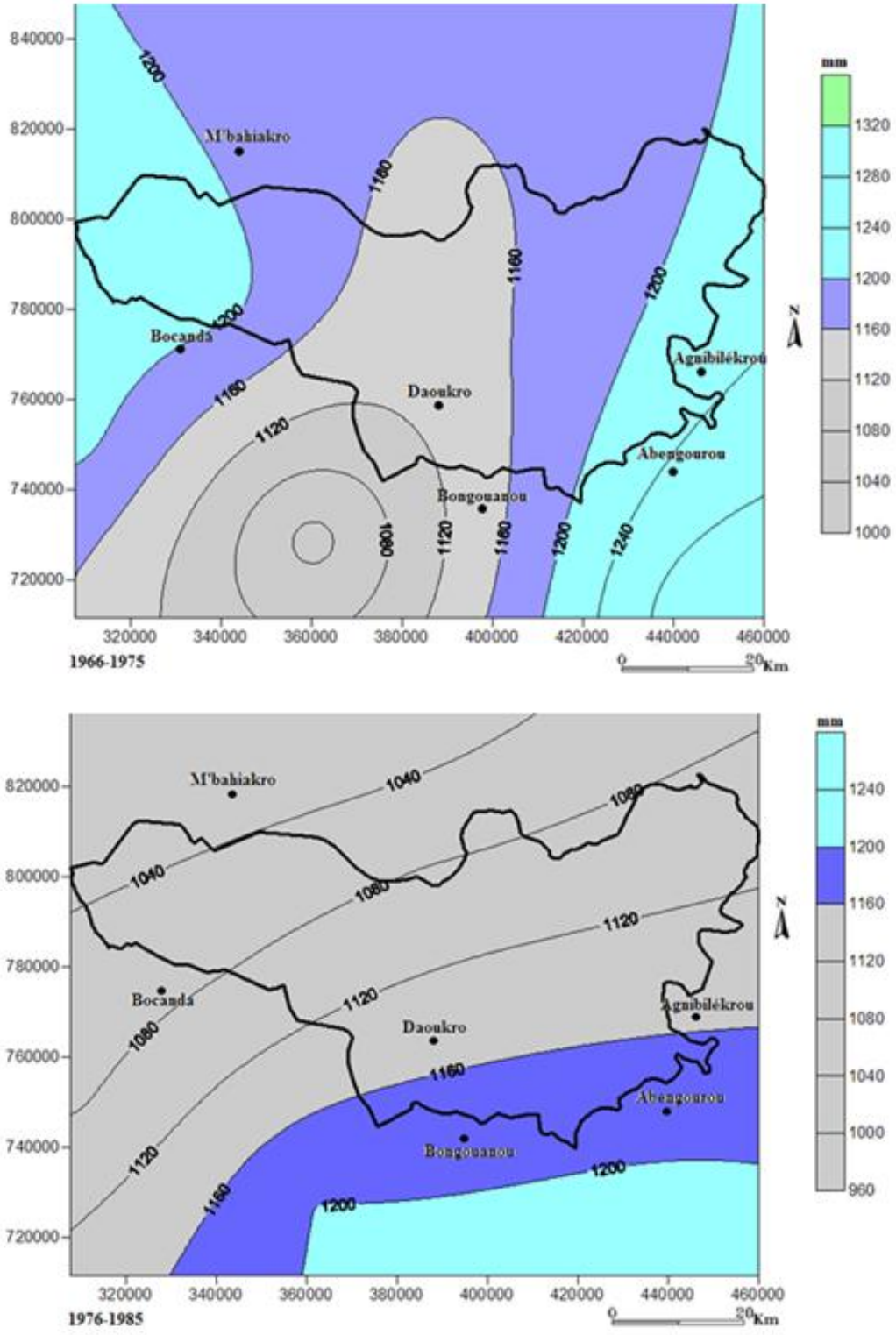


Fig. 7. Hauteurs pluviométriques moyennes interannuelles des décennies 1966 -1975 et 1976 -1985

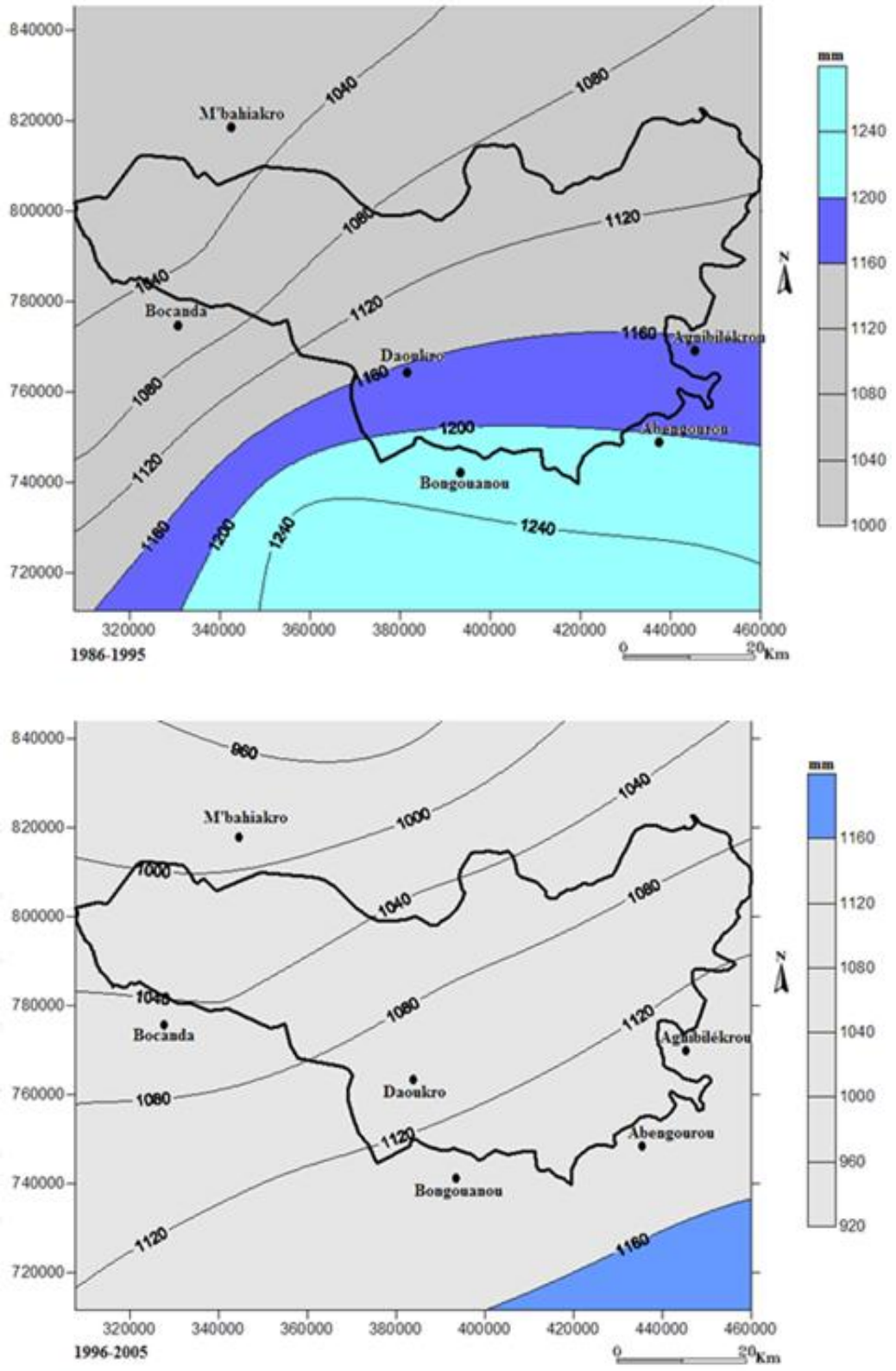
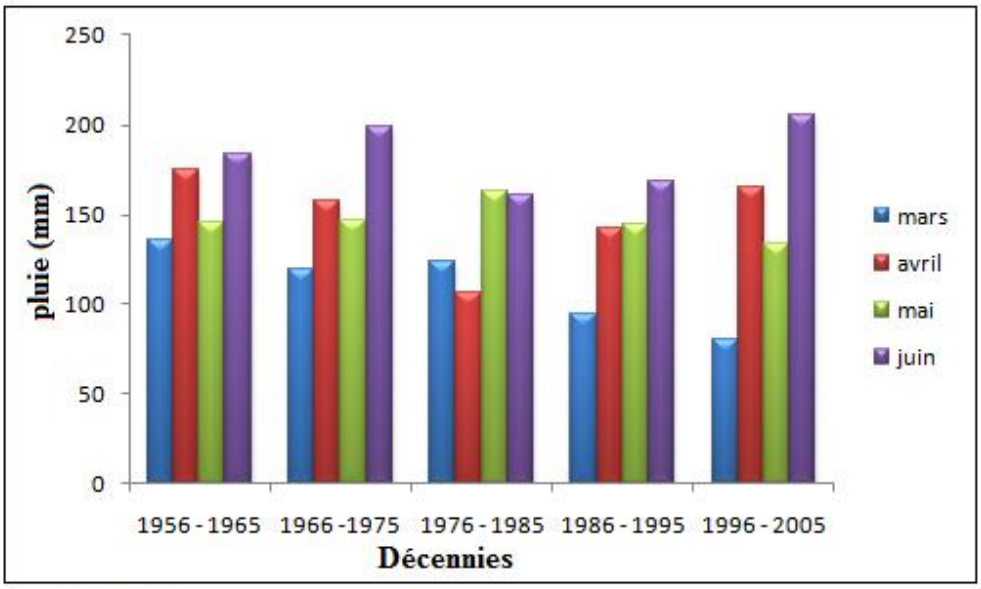


Fig. 8. Hauteurs pluviométriques moyennes interannuelles des décennies 1986 -1995 et 1996

a) Daoukro



b) M'bahiakro

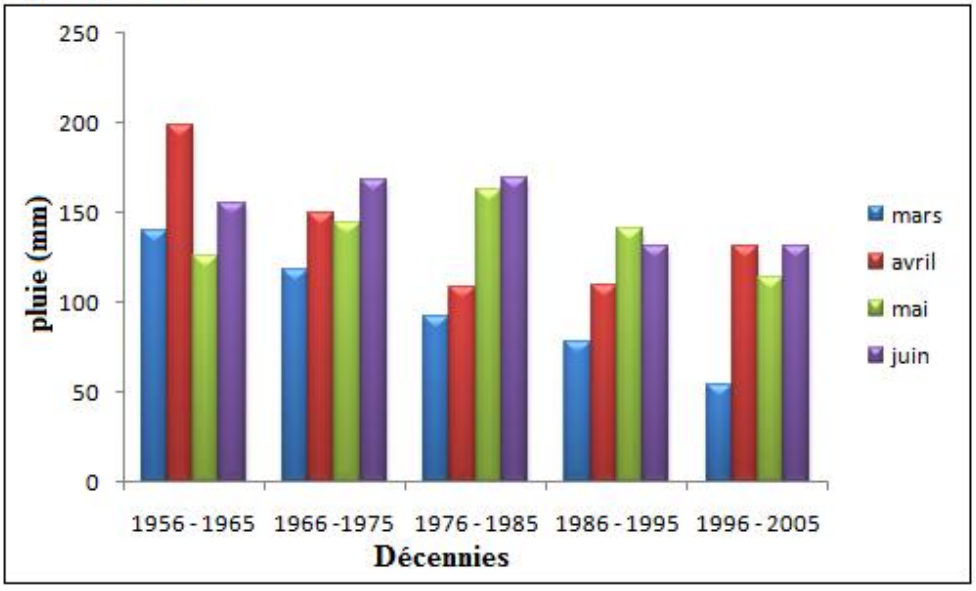


Fig. 9. Variation de la pluviométrie mensuelle (1956-2005). a- Daoukro ; b- M'bahiakro

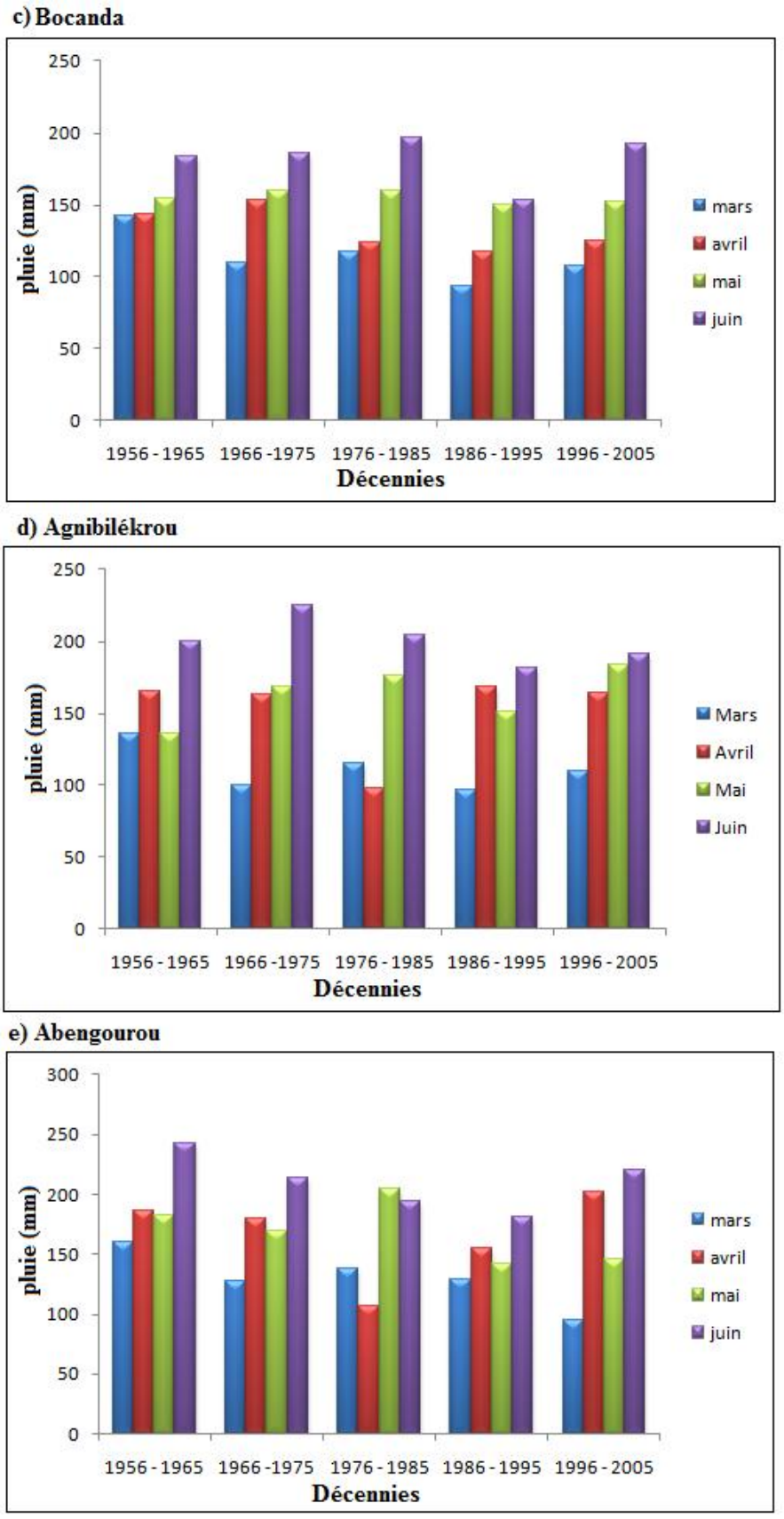


Fig. 10. Variation de la pluviométrie mensuelle (1956-2005). c-Bocanda ; d- Agnibilékrou ; e-Abengourou

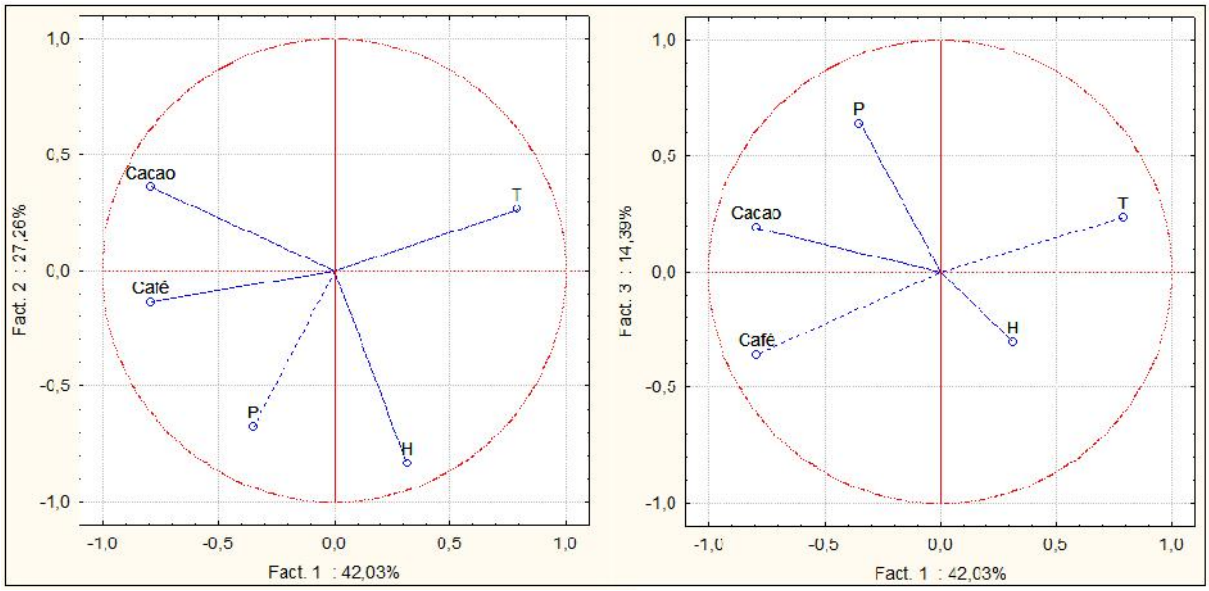


Fig. 11. Cercle des corrélations F1-F2 et F1-F3

5 CONCLUSION

Le déficit pluviométrique évalué dans la région de Daoukro atteint une valeur moyenne de 11% et fluctue entre 5% et 15%. La variabilité pluviométrique saisonnière s'est manifestée par une baisse importante de la pluviométrie mensuelle. Les différentes saisons ont des durées plus courtes qu'auparavant. En effet, la durée de la saison des pluies est passée de 4 mois à 3 mois. La production cacaoyère et caféière a connu une variabilité interannuelle importante causée en partie par la baisse et la mauvaise répartition des pluies au cours de l'année. Daoukro fait partie de l'ex-boucle du cacao qui a connu une expansion économique considérable. Les récessions pluviométriques de ces dernières décennies, le vieillissement des plantations et l'épuisement des réserves forestières ont entraîné une chute de la production de café et de cacao ainsi qu'une forte migration des populations et le déplacement de la boucle du cacao vers le Sud-ouest.

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Study an Analysis and Suggest New Mechanism of 3 Layer Polyethylene Coating Corrosion Cooling Water Pipeline in Oil Refinery in Iran

Amir Samimi

Department of Chemical Engineering,
Mahshahr Branch, Islamic Azad University,
Mahshahr, Iran

ABSTRACT: The corrosion of pipelines' coatings is one of the main problems in oil and gas industries for which a large amount of money is spent each year. Coating is the first defense line in front of a corrosive environment in which pipes have been buried. Good function of coating depends on its adhesiveness rate to the metal surface. Initial adhesiveness and its durability in the contact conditions are among those factors that enhance coating efficiency in long term. Coverage in line pipes include of high costs. For this selecting cover and how apply is high important. Three fold polyethylene's include of epoxy layers, adhesive and polyethylene. Each other from layers having attributes that increasing its application for long term. Polyethylene layer is good shelter for prevent of physical damages. In attention to corrosion in lower temperature is an electrochemical reaction and rate of a electrochemical reaction is very impress of a element or very reactor from surface.

KEYWORDS: Polyethylene Cover, Epoxy Layer, Outer Corrosion, Initial Adhesiveness.

1 INTRODUCTION

The corrosion of pipelines' coatings is one of the main problems in oil and gas industries for which a large amount of money is spent each year. Cessation of production creates a very high loss in terms of hydrocarbon production or maintenance costs. Therefore equipment faultless during their shelf life is considered as a basic problem. Those studies which result in compilation of effective strategies, laws, protocols and methods for preventing and removing corrosion effects are studied as; corrosion management. Corrosion problem in Canada has resulted in ten times pipelines' leakage and twelve times explosions in the period of 1977 to 1996, and in our country investigating this phenomenon and its management is of extraordinary higher importance due to the fact that oil, gas and petrochemical industries have been located in corrosive environments. The reports of malfunctions due to corrosion indicates that the reason for this phenomenon is mainly due to tragic carelessness in plumbing and equipment manufacture and installation which result in explosion, fire and spread of toxic materials in living environment. besides it has some costs such as replacement of corroded equipment, shut down of plants due to replacement of corroded equipment, disturbance in processes due to equipment corrosion and impurity of processing products due to corrosion related leakage and waste of the products of those vessels which are attacked by corrosion, all of these problems make the most important costs and losses created by corrosion. The studies show that 70 percent of losses can be prevented by observing related principles and instructions. According to the report of Bartel institute one third of industries 'corrosion costs are prevented by simple applying of existing knowledge and technology. Another point which is ignored is that indirect corrosion damages are much more than direct ones. Corrosion management has the responsibility of corrosion control and installations in all respects for preserving capital and always uses advanced tools and methods in enhancing this purpose. Corrosion process is managed since the very beginning of planning installation until their servicing by corrosion management. For example a planning engineer gathers enough information from corrosion management to design structures with long and useful shelf life or amends the following work steps by using enhanced information from occurred corrosions.

Corresponding Author: Amir Samimi (amirsamimi1161@gmail.com)

2 UNDER COATING CORROSION MECHANISMS

Under Coating Corrosion is started in presence of water and oxygen. When water and oxygen are present on the surface of a metal, corrosion occurs due to metal dissolution (anodic effect). This chemical process is balanced by oxygen reduction. Under Coating Corrosion rate depends on the kind of insulation, the amount of oxygen, the amount of impurities in the water, temperatures and the heat transfer properties of metal surface or the conditions of metal surface being wet or dry. In the absence of oxygen the amount of corrosion rate can be ignored .Although low alloy and carbon steels have the lowest corrosion rate in alkali environments but chloride ions create localized pitting under coating.

Corrosion Control Methods: Corrosion in industries is controlled by one of the following methods.

A-Corrosion-resistant alloys

B- Corrosion inhibitors

C-Stabilization method

D- Corrosion-resistant alloys

3 COATING AND THEIR ROLES IN COUNTRY'S ECONOMY AND INDUSTRY

It is quite clear that any of the coating systems have their own advantages and limitations, and that is why one of them is preferred over the other in most of the conditions. But in most other conditions both two systems can be used and it makes selection difficult. In these occasions there must be a suitable method for investigation and comparison that is a reliable guide in selecting proper system. One of the important factors in selecting proper system is cost. The importance of cost factor is such that it is dominant over other parameters and cause selection of a system based on cost. The coating of pipelines exposes a lot of items during operation such as moisture, pressure, bacteria and etc….. Applying coating over pipelines has a lot of costs, for this reason selection of coating is of much importance.

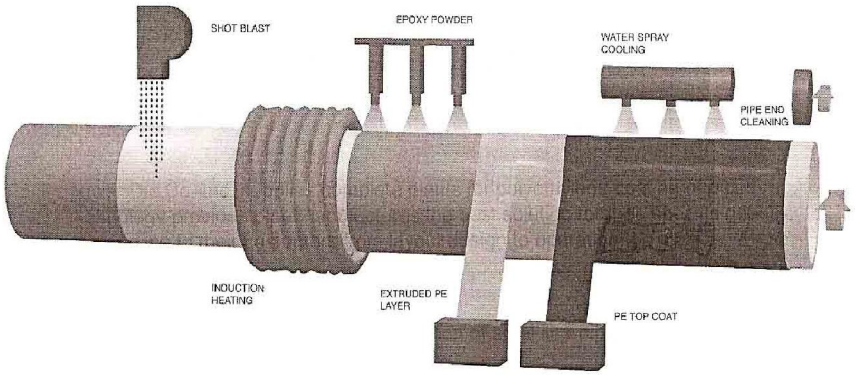


Fig. 1. View of Cover Process

Also for buried pipes underground there is the possibility that their coating must be replaced in short durations like other structures and the coating must last at least for more than 20 years. For this purpose the properties a coating needs is as follows:

1. Resistant against water and moisture: even dry soils have a little moisture and pipeline coating is often wet, for this reason coating mustn't absorb moisture because it results in weight increase and electrical resistant reduction.
2. Resistant against variable pressures: placement of pipes underground results in pipes being under pressure. Also the presence of gravel, movement of soil due to moisture and also other existing particles in the soil causes the above mentioned variable and unharmonious pressure. In fact coating must be a physical protection and not separate from surface.
3. Resistant against bacteria and mushrooms: There are a lot of bacteria in the soil which attack different materials and cause their extinction. Of course bacteria and mould attack is not so prevalent.
4. Resistant against water capillary effect: Water penetration due to capillary effect causes separation of coating from steel. Any fine crevice or gap causes the capillary effect unless the contact between coating and pipe is strong and

very sticky. In fact primer color has the duty of creating a strong adhesiveness between pipe and coating and prevents water penetration and coating separation.

5. Suitable with temperature variations: Temperature variations can be influential because the rate of steel expansion and coating is different. Expansion and shrinkage result in movement in the pipe but this movement is uniform and slow. For this reason coating must be resistant against temperature variations and not separated from the pipe.
6. Resistant against being solved: Water is capable of solving some of the materials but the coatings are insolvable in water. Also it must be investigated that coating be resistant against other solvents besides being insolvable in water especially against oil and its derivatives.
7. Resistant against absorbing soil: Soil may absorb some materials. Clay, silica gel, charcoal and some other combinations have the absorbing property. Soil always is completely in the contact with coating and absorption of some elements from coating by the soil may make coating fragile, perforated or reduce its resistance against soil.
8. Resistant against mechanical damages: besides the aforesaid items in part 2, coating must be resistant to mechanical stresses during installation or storage.

First layer: Immediately after the pipe one form of film of liquid or gum of epoxy is created, Minimum dryer thickness must be between 20-60 micron, Based on ISO 2808, epoxy powder has some materials which are used against heat that is used for three-layered poly ethylene coatings for steel pipes and must be specially formulated and designed and this is for electrical application and corrosion improvement from coating system and also providing unlimited cathode maximum resistance is suitable. Epoxy powders used in three –layered coatings is classified in two different groups. The first group has primer property and the second group has coating quality. These two materials have remarkable differences in applying, temperature and thickness; there is a tendency in industries to use epoxies with coating quality. Epoxy layer must have such an enough thickness that prevents holiday formation.

According to Dennis Neal, the manager of Harding and Neal Company of USA having experience in coatings and corrosion recommends minimum thickness of 250 micron for the epoxy layer. Time is a sensitive and critical factor in creating adhesive and poly ethylene layers. First the adhesive develops a very strong chemical bond with chemical groups in epoxy powder which is uncured therefore into this stage the epoxy must not completely cure. On the other hand adhesive and poly ethylene are connected physically which is done by rollers' pressure and time being critical and sensitive is because of epoxy for bond with adhesive must not completely cure on one hand and must get jelly condition on the other to be able to resist against rollers' pressure, in the other words all operations of these steps are done in less than a second.

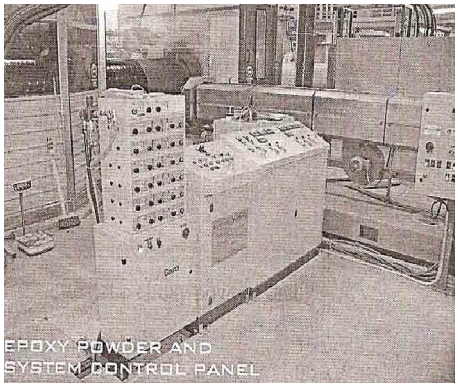


Fig. 2. View of Epoxy Controller

Coating appliers must be careful that applying a solution for three-layered coating doesn't result in another problem for example separation in the seams is reduced by lowering applying temperature of epoxy from 239.4 'C to less than 232.2'C, but although FBE is cured in lower temperature, high viscosity of molten in this temperature does not allow epoxy flow and complete wetting of metal surface on coating adhesiveness in warm condition.

Flexibility: Flexibility should be measured according to DIN 53152.

Pressure Resistance: Pressure resistance of the epoxy film should be minimum 120 kg / cm at 20 ° C was performed.

Second layer: Second layer polymer creates adhesiveness between layers 1 and 3 and must be compatible with both layers. Minimum thickness must be between 160-200 micron Thickness may increase or reduce according to the mutual agreement with customer but minimum thickness must be investigated safely.

Third layer: Polyethylene coating must be formed in this layer. Thickness must be uniform in all through the pipe and minimum general thickness must be acceptable.

Table 1. Physical Properties of Adhesive

PROPERTY	UNIT	VALUE
1) Density	g/cm^3	0.900-0.950
2) Melting index (2.16 kg/190˚C)	g/10min	0.5-8 or as suitable for application as PE (top coat)
3) Elongation	%	95 (min)
4) Melting point	˚C	9 (Typical)
5) Co monomer content	%	

Note: The test for raw epoxy power properties is under the responsibility of manufacturer.

4 ADVANTAGE BETWEEN THE SECOND AND THIRD LAYER OF COATING

Additional adhesion and chemical resistance properties are obtained by mixing epoxy. (First Layer - Corrosion Protection)

The physical and chemical force obtained by Copolymers corrosive formed (middle layer) and polyethylene (top layer)

A) Burning Process of Pipes in the Initial Stage

- Removal of surface contaminants (salts, soil, plants, oil and other contaminants)
- Minimize surface layers
- Removal the moisture

B) Methods

New air with high-pressure to remove salts and soils

Hydrocarbon solvents (family of toxic aromatic flammable hydrocarbons or minerals) to remove organic contaminants

Heating of the surface layer to remove moisture and burning the organic contaminants in dredged to clean up the temperature of 75 ° C

5 TESTS

Contractor must export the test required for all tests production covered include the company. This test should be performed 3 times over 8 hours of product. At any time in accordance with DIN 30670 standards is performed.

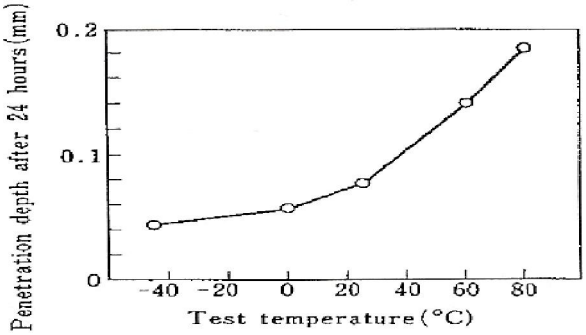
The Thickness of the Test: This test should be performed 3 times over 8 hours of product. At any time in accordance with DIN 30670 standards is performed.

Testing of Surface Tension: This test should be performed 3 times over 8 hours of product transformation, Test should be performed at room temperature and 2 purposes include of pipe lining and check of it with items on the table is desired.

Corrosion of the pipe coating layer cause to explosion of equipment so if the process do not complete for paint and coatings to be back again

Leaking water test: Leakage test (style: DIN 30670) had done in basic of heavy particle test from coverage polyethylene pipes (three fold cover). Relation between leak of water after 24 hours and temperature is shown this follow.

Chart 1. Relation between Temperature and Leakage Test after 24 Hours



Have seeing that with increasing temperature, also leakage increased.

Table 2. Physical Features of High Coating Polyethylene

Physical Properties of Top-coat Polyethylene

Physical properties	Unit	Test Method	SK ET509B (typical)
Melt Flow Rate at 190℃/2.16kg	dg/min	ASTM D1238	0.30
Density	g/cm^3	ASTM D792	0.949
Tensile Strength at yield	kg/cm^2	ASTM D638	180
Tensile Strength at Break	kg/cm^2	ASTM D638	300
Ultimate Elongation	%	ASTM D638	800
Hardness	Shore D	ASTM D2240	60
Vicat Softening Point	℃	ASTM D1525	120
Brittleness Temperature	℃	ASTM D746	< -70
Melting point	℃	ASTM D3418	128
ESCR (F50 , 10% Surfactant)	Hr	ASTM D1693	>1,000
Water Absorption	wt %	ASTM D570	< 0.01
Carbon Black Content	wt %	ASTM D1603	2.0
Oxygen Induction time at 220℃	min	ASTM D3896	15
Volume resistivity	Ω.m	ASTM D257	>10 ^{16}
Dielectric withstand	kV/mm	ASTM D149	38

The unique Rheological features of these polymers are specific that have ability of coating form in temperatures below 500 Fahrenheit.

The Relationship between Temperature and Tension: The test of tensile based on a method, has been done from simple test of polyethylene film.

Effect of Temperature : Metal surface temperature also plays an important dual role in the occurrence of corrosion under the coating. Control of corrosion under the hot coating is organizer than cold coating; the cause of this phenomenon is water vaporization under the insulation and increases the concentration of impurities with water. In closed systems, increasing the temperature, cause to accelerates the rate of electrochemical reactions and increases the corrosion rate. But in open systems, raise the temperature can increases the corrosion rate. However in open systems, raise the temperature can cause to vaporize the water, destroy the corrosive environment and reduce the corrosion rate. Also, the high temperature reduces the useful life of protective coatings. Underground pipeline of new phase wells, are with Collar coating or polyethylene strips from AL TENE that in the right performance of coverage, the problem of corrosion is not observed. Corrosion in underground pipelines is the major problems that strategic industries of oil and gas and petrochemical are facing with this. Since the pipelines in the industry play a vital role, protection and control of these structures is vital. Failures caused by corrosion in steel and other metals covered, as corrosion under coating occurs when the insulation is in proximity of moisture. Corrosion under coverage in addition to lead the costs of repair and the production is stopped; it can also jeopardize the safety of staff and facilities. Insulation and coating of pipes and tanks can be done to prevent, maintain temperature, process stability and energy efficiency. However, the dry cycles and continuous to become soggy of material under the insulation, can provide initial conditions for stress corrosion cracking or pitting corrosion.

Corrosion Mechanisms under Coating : Corrosion under coating begins in the presence of water and oxygen. When water and oxygen are present in the metal surface, corrosion occurs as a result of metal dissolution (the anode effect). This chemical process balance by reducing the oxygen, The rate of corrosion under the coating depending on the sort of insulation, the amount of available oxygen, the amount of impurities in the water, temperature and heat transfer properties of the metal surface and dry or wet conditions of metal surface. In the absence of oxygen, corrosion rate to be negligible. However, carbon steels and low alloy have typically low corrosion rate in alkaline environments, but the chloride ions (CL^-) can cause to localized pitting below of covered. If the soulphuor and nitrogen acids, which are acidic, from impurities in the water and air penetrate into the insulation, or if the water is acidic, occurs general corrosion. Sometimes, air and water impurities, especially the nitrate ion (NO_3^-) cause to outbreak of stress corrosion crack (SCC) external, under coating in carbon steels or low alloy that are not tension. Mentioned phenomenon is more significant, when the process of alternating dry and wet environment, cause to increase the concentration of impurities.

Effect of Coverage: Corrosion under insulation types is possible. Sort, only play a role in the speed and quality. The main effect of coating in this type of corrosion is to assemble annular space for gathering and remaining the water. Water can be supplied from external sources of rain or the fluids condensate.

Chemical composition and properties of coating have the role in corrosion. Covering material can absorb water and supply the proper water environment for electrochemical reactions. In addition, chemical compositions into the coating such as chloride can play a role in the electrolyte, which can accelerate corrosion.

Performed Experiments: Potantiometric experiments: To determine the properties of cathode protection Galva true, Potantiometric test adopted according to standards ASTM G 71-81, ASTM G 3-89, ASTM G 82-98, and result of this, is confirmation of properties Galva true catholic protection.

Experiments study of Mechanical Behavior: study of mechanical behavior of the coating includes measure of adhesion to the surface, test of hitting, weather tolerance, study of tolerance of thermal expansion and contraction.

Strategies for Corrosion Management: Corrosion management proceeds to offer preventative strategies in two technical and no technical domains. The topics of no technical domain as preventative strategies are as follows:

1. Enhancing the employees' awareness about the high costs of corrosion and saving costs result in correct applying of existing technologies and corrosion costs. Thus a lot of corrosion problems are due to lack of awareness about corrosion management and accountability of people in exchanging operations, inspection and maintenance of management system.
2. Changing guidelines, protocols, standards and management methods to reduce corrosion costs by correct corrosion management resulting in effective control of corrosion and safe operation and increase in shelf life of equipment.
3. Amending and generalization of employees' instruction to introduce and identifying corrosion control.

4. Changing and amending wrong belief about not being able to do anything about corrosion and making new decisions in preventing this phenomenon, also preventive strategies in technical domains are of a very high importance. Some of these strategies are as follows.
5. Upgrading planning methods and using advanced planning ones to better managing corrosion which prevents avoidable corrosion costs. In this vein planning methods must change and the best corrosion technologies must be available for planners.
6. Improving corrosion technologies via research and development. Corrosion can be controlled in most industries by using scientific methods and new technological achievements.

6 AN ANALYSIS OF REASONS FOR THREE-LAYERED POLY ETHYLENE COATING SEPARATION.

Good function of coating depends to a high extent to its adhesiveness rate to metal surface. Initial adhesiveness and its durability in contact condition are of those factors that result in high efficiency of coating in long term. The extent of initial adhesiveness has a very high relationship with coating flow and its wetting when applying coating and also with cleanliness of surface and its readiness. Durability of adhesive depends on coating properties such as its resistance against moisture penetration and also its endurance against catholic disbandment.

The most leading coatings having more consumption than other kinds are as follows:

1-FBE (fusion bonded epoxy)

2-Poly urethane (from technical view poly urethane materials are of the best coatings used since 1970 on).High cost of this coating has resulted in using it just for special cases such as when temperature is very high. Three-layered poly ethylene coating includes epoxy, adhesive and poly ethylene. Any of the layers provides coating with properties to lengthen its efficiency for a long term. Epoxy layer has a very good adhesiveness due to its transverse bonds and has a very high resistance against corrosion and oxygen penetration. But it is vulnerable to the mechanical hit when storing and line performance. Poly ethylene layer is a very good protection to prevent physical damages. A main problem with this coating is that poly ethylene does not have adhesiveness with the metal and for this reason an adhesive layer being a kind of reduced polymer is used for pasting poly ethylene to epoxy.

A) Main factors in coating separation are as follows

1. The manner three-layered poly ethylene coating (quality) of applying coating in the factory
2. Exposure Conditions and properties

Three-layered poly ethylene is one of these coatings with high efficiency, although it seems that it is used in the field in a very limited extent (comparing other coatings) and more laboratory studies and field experiences are needed to investigate if they have aforesaid properties.

7 CONCLUSION

A) Study of Cause Separation of the Coating 3-layer Polyethylene Pipeline

Pipes coating technology is developed with advanced oil and gas transmission lines. 40 years ago coal tar was the best protection for the tubes. Today, from synthesis resins used for coating and in the factory during the processes that are controlled with high precision, can be applied on the tube. The first line coating of deafens is against a corrosive environment where the pipe is buried. Second line of deafens is cathodic protection that is a vital element to keep and integrity of the lines. On the other hand, excessive protection current cause to decline of coating, to the reason for keeping the protection current in safety level, the increase efficiency of coating from the correct apply on metal surface that is fully prepared is important. Good performance of coating depends heavily on the amount adhesion to the metal surface. Initial adhesion and durability in contact situations are factors that are cause to high efficiency in the long term. The quantity of initial adhesion has the relationship with flow of coating and wetting of the surface by applying a coating and depends on clean and ready of the pipe surface.

Polyurethane (from a technical point of view and the polyurethane substance is the best type of coating that used from1970 and standards of the Draft recommended, DIN 30677-1998, DIN-30617-1992, ANSI/AWWA-C222-99 practice NACE-TG281-2002 is written for this coating. The high cost of this coverage is that, it is mainly used in special cases, such as locations with high heat.

Three-layer polyethylene coating is containing epoxy layers, adhesive and polyethylene. Each layer provides properties for cover to increased performance for long life. Epoxy layer, which provides cross-links have very good adhesion, and show high resistance against corrosion and the oxygen penetration, but against the mechanical impacts at the time of stored, is vulnerable run and transport of the line. Layer of polyethylene is a very good protective to prevent physical damage. The major problem that is with this coverage, there is no adhesion between polyethylene and metal, so that used to adhesive layer that is a polymer modified for bonding of epoxy to the polyethylene.

B) Compared to Existing Standards and Specifications for the 3 Layer Polyethylene Coating

3 layer polyethylene coating are described on the distinct national standards. The oldest and most common of those is the German standard DIN 30670 (two layers) , French standard NF A49-710 which is used in smaller scale and the Canadian standard CSA Z7245.21 which first appeared in the early 90 and in the past few years gradually find international confirmation . These standards not only are different in the specification, how to process control and testing procedure, but they have their own philosophy. The major weakness in the DIN standard is that provider of coverage don't required to use of primer (epoxy), also are not called for cathode disbandment test, and clear value to peal adhesion is very low. French standard NF has identified many weaknesses.

Canadian CSA Standard for polyethylene provides thickness of 2 to 3 times narrower than the DIN, because it is denser than of polyethylene that is used in Canada.

C) Major Factors in Coating Disband in Tubes Coated with Polyethylene

The separation depends on the following factors:

1. How (quality) factory applied coating
2. The conditions and characteristics of coating exposure, the epoxy powders that are used in three layers of coatings, classified in two different groups. First group that has the property of the primer and second group that has coating quality, these materials have significant differences in terms of apply and thickness and temperature, and generally in the industries is tend to use of high quality epoxy coating. Because the final consumer can be determine higher thickness that will result better properties for system. Study of reference list of company Jotun Powder Coating, UK demonstrates the use of epoxy layer with thickness higher of 150 microns, especially is in pipes at higher size. Epoxy layer must have sufficient thickness so should be avoided as to create holiday. Early experiences and experiments that having done in the field show increase more than 40 holidays of 40 feet for a layer with thickness of 150 microns. According to Dennis Neal advice, President Company U.S.A Harding & Neal that has a long history in the field of coatings and corrosion should be considered a minimum thickness of 250 micron for epoxy layer. Time is important and sensitive factor in the run- layers of adhesive and polyethylene on epoxy. At first adhesive with the chemical groups in the epoxy powder that are still uncured to establish a strong chemical bond, so at this stage epoxy should not be fully trained. On the other hand the adhesive and polyethylene connected physically. This is done by pressure through rollers and being sensitive of time is for this reason that from one side epoxy for bonding with adhesive should not be thoroughly cooked and the other hand should be get gel-like state, so can resistance against pressure of rollers, on other words, all of these steps must be performed in less than a few seconds. Users of coating should be careful that applying a solution for resolve the issues three layers do not cause another problem. For example, the separation at the seams with lower the temperature epoxy decreases of 239/ 4 degrees C to less than 2 / 232 ° C3i, but while the FBE at lower temperatures to be cultivated, but the high viscosity of the melt in the heat doesn't allow to flow epoxy and complete wetting of the metal surface, and this cause will be to opposite effect in terms of heat and moisture on the adhesion of coatings and too catholic voltage. Below context is from Dennis Neal, one of the exporters in coating.

Disbandment occurs on 3layer coating at STEEL/FBE interface. The extent of disbandment depends on exposure conditions and quality of the coating.

Two problems are quite widespread:

i) The FBE layer is under cured because the application temperature is low to allow the adhesive to chemically bond to FBE.

ii) There is no adhesion between the FBE and the adhesive because the temperature is higher and the FBE is fully cured before the adhesive is applied. In article from one of the company's CEPA (Canadian Energy Pipeline Association) result of experience in this company is expressed to prevention of a SCC by system covered. In this article mentioned: the best proven method for reducing SCC in a new pipeline, is use of high-efficiency coatings and effective catholic protection. Coatings must necessarily possess the following characteristics.

3. Pipe surface must be separate from contact with the electrolyte or environment that causes. (Covered with a metal surface has durable adhesion)
4. The separation of the coating, the cathode protection can with cross of coating carrying to metal surface
5. During the preparation of surface for coating, pipe so the change that is less susceptible to SCC
6. 3 layers polyethylene is one of the coatings with high efficiency. Although it appears that the limited (compared to other coatings) has been used in fields
7. Study of Reference list of the companies such as Socothern (Italy) and Corinth pipe work (Greece) and Jotun powder coating (UK), which is include pipe diameter, type of coverage and other data, indicate that mainly pipes are covered under 24 inches 3 layer polyethylene coating. In panel that recently was formed by experts of corrosion in Britain and America, and resulting is published in an article titled US & UK Industry discusses key challenges: in the Journal of Pipeline & gas journal monthly. John T Oshea former chairman of the British Institute of corrosion, after pose of status of gas network in Britain and its coverage in the high pressure line (164000 km) says: These lines are constantly developed for responsibility to the increased demand and new lines of high diameter are protected against corrosion by use of coatings with high integrity coating. Oshea in answer to the question of what kind of high integrity coating is this coating? Says: Examples of these are fusion bonded epoxy and multi component liquid coating (polyurethane) and don't pointing to use of coating 3 layers polyethylene for coating of pipe diameter.

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Amir Samimi

(16/05/1983, Isfahan City, Isfahan Province, Iran)

Studied M.SC Chemical Engineering, Master at Islamic Azad University, The Member of IAENG, Have 2 Years Experience in Oil Refinery Company, Member of Young Research, and Have 17 Articles in the International Journal, Conference (U.S.A, France, Italy, Indonesia, India, Australia, Europe Chemical Engineering Conference) and More than 45 Articles in the National Journal, Conference in Iran.
Email: amirsamimi1161@gmail.com

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Offer a New Model to Prevent Formation of Hydrate in Gas Pipeline in Gas Refinery

Amir Samimi

Department of Chemical Engineering,
Mahshahr Branch, Islamic Azad University,
Mahshahr, Iran

ABSTRACT: Water molecules by making hydrogen joint with its molecules creates holes in which quest molecules will be trapped and by creating van deer Waals joint with water molecules, hydrates crystals will be produced. Natural gas and crude oil in natural exist in underground reservoirs are in contact with water. Hydration needs condition which consists of having water in pipe line, high pressure (pressure always is high because of reinforcing gas pressure in gas transportation pipe lines), low temperature (temperature is always low in cold seasons of year), and presence of hydrate-making substances like methane, carbon dioxide, and... There are four methods to prevent hydration. This article will focus on analyzing synthetic inhibitors, and their function the task orders are as followed: 1. Synthetic investigation of hydrate formation with and without presence of inhibitor. 2. Using Kashchiev- Firozabad model and experimental data of gas transporting pipe lines for drawing synthetic graphs of gas hydrates formation with presence of synthetic inhibitors.

KEYWORDS: Water Molecule, Hydrogen, Hydrate-Making Substances, Kashchiev- Firozabad model.

1 INTRODUCTION

Understanding the phenomenon of hydrate formation goes back to the early nineteenth century. Humphrey Davy the first person was in 1810 AD, when tested by cooling an aqueous solution saturated with chlorine at temperature 9the formation of chlorine hydrate gas was. After Dewey, researchers found that between 1850 and 1890 Hydrates also discovered. Hydrates double ingredient which has a definite melting point and a simple Hydrates are different, because the double hydrate degradation temperature may vary with temperature degradation of Hydrates simple. Forkrond in 1897 AD found that carbon tetrachloride and acetylene are formed of a double hydrate. They also double Hydrates of acetylene, ethylene, sulfur dioxide, and carbon dioxide with ethylene chloride, ethylene bromide, methyl iodide, methyl bromide, ethylene chloride, and ethylene iodide reported. And similar compounds such as carbon dioxide and ether reported. Methyl *MERCAPTAN* and water will form a crystalline hydrate. Many studies in the field of hydrate formation by several people, including Frost and Dayton, Kobayashi, Katz, Pelatiand Van deer waltz, Davidson and Makogon done. Water molecules by making hydrogen joint with its molecules creates holes in which quest molecules will be trapped and by creating van deer Waals joint with water molecules, hydrates crystals will be produced. Hydration needs condition which consists of having water in pipe line, high pressure (pressure always is high because of reinforcing gas pressure in gas transportation pipe lines), low temperature (temperature is always low in cold seasons of year), and presence of hydrate-making substances like methane, carbon dioxide, and... There are four methods to prevent hydration:

1- Controlling pressure (the lower pressure the less hydration but in gas transporting lines it's impossible because of reinforcing gas pressure for transporting it).
2- Controlling temperature (heating the system by electrical heating so as to prevent from reaching hydrate formation point).
3- Removing water (water in pipe lines should be removed. In spite of this, there is always some water along with gas).
4- Injecting chemical inhibitors (these inhibitors prevent.

Corresponding Author: Amir Samimi (amirsamimi1161@gmail.com)

Hydrate formation and are prior to other methods).there are two important groups of chemical inhibitors; thermodynamic and synthetic inhibitors, Thermodynamic inhibitors affect on thermodynamic balance of aquatic phase [1] and they consist of methanol, de ethylene glycol, some salt (salt is not used because of its corrosion effect on transporting pipe lines). These inhibitors are very expensive, poisonous and harmful for environment. They also have high volatility. Synthetic inhibitor induces crystal growth and trapping hydrocarbons in ice crystal net, they affect by being adsorbed on water molecules and prevent making chemical connection between gas and water molecules. These inhibitors are added with low density to gas lines. Analyzing amount of gas hydrate formation (using methane) along the time and also induction time in gas hydrate formation in different pressures because of synthetic effect of these inhibitors is the most important event to do. In this article All efforts has been done to draw the methane diagram along with passing of time using modeling for hydrate formation synthetic with and without inhibitors for gas hydrate. Also induction time in gas hydrates is analyzed with and without inhibitors. Synthetic analysis of hydrate formation with and without inhibitor: for synthetic analysis of gas hydrate formation, suppose one current line of gas in high pressure and low temperature in which gas hydrate is formed. While forming hydrate, pressure falls a little and temperature raises a little.gas hydrate formation using methane gas molecules is according to follows crystallization reaction along with water:

$$H_2O + \lambda 2G \rightarrow G_{\lambda 2}\, H_2O \qquad (1)$$

In which λ_2 are gas molecules? Current line consider as below:

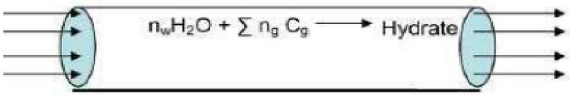

Fig. 1. Current Line Consider

A. Hydrate Formation in Respect of Synthetic is Two Stages

1. Nucleation in holes is a stage in which hydrate forming molecules reach holes and reach stability.

2. Growth stage after nucleation stage, hydrate crystals gradually grow .in this stage there are experimental equations which are as fallow.

2 MODEL

There are different models for synthetic analysis of hydrates formation. Two models are mentioned as follow:

ESBERGON MODEL: This model introduces velocity of used methane mol in stable pressure during hydrate growth, In this equation V_{1*} is dissolvent volume, ρ_W is water density, MW_W is water molecular weight, $X^i_{G\text{-}L}$ is formed hydrate partial molar in shared surface between gas and liquid, and $X^i_{H\text{-}L}$ is formed hydrate partial molar in shared surface between hydrate and liquid. K^* in this equation is calculated as follows:

$$(1/K) = (1/K_1A_i) + (1/K_rA_P) \qquad (2)$$

$(1/K_1A_i)$: surface resistance of gas molecules when their sediment in liquid surface starts K_1: velocity constant of influence in liquid.A_{i1}: gas-liquid shared surface area, $(1/K_rA_P)$: surface resistance of gas molecules when they react with each other and hydrate particles are formed. K_r: velocity constant of hydrate film, A_P: surface area of hydrate particle. In this model hydrate formation with inhibitor is divided into three areas: A: related to nucleation and no mechanism is analyzed for it. Area B: it is hydrate growth area and is not linear because inhibitors are absorbed to hydrate surface and available surface for hydrate growth is reduced by them then A_P will be reduced consequently $K^*= K_r.\ A_P$ that K_r is a constant amount because is dependent on temperature and tem. During growth area is nearly constant. But A_P changes with time in square.

Area C: hydrates have been formed after area C and hydrate growth is not possible by this inhibitors then their function is dependent on time. This model analyzes the process of hydrate formation with inhibitor like increase and decrease process; there is no consequence in respect of amount.

Kashchiev and Firozabad: This modeling is based on theories as followed:

1. Constant temperature.

2. Disturbed gas current.

3. Clogging pipe lines by gas hydrate because of growth and joint of crystals together.

4. Sudden fall of pressure which is a sign for gas hydrate formation.

5. Gas compounds will dissolve in water then hydrate crystals will be formed.

2.1 APPLYING KASHCHIEV AND FIROZABAD'S MODEL

Experimental Data of Gas Transporting Pipe Lines for Drawing Synthetic Diagram of Gas Hydrate Formation with Synthetic Inhibitors: velocity diagram of hydrate formation is very important for synthetic inhibitors against time. Then this diagram using above equation will be achieved for different inhibitors. They are considered for calculations of north-south roomier line because hydrate formation has been reported several times in this area. Growth rate is different dependent on kind of inhibitors. For example in this calculation tow inhibitors have been Chosen in which growth rate in L_ Tyrosine is more than PVP. Density of inhibitor also affect son growth rate. For example in this diagram two densities, 100ppm and 200ppm have been chosen for two inhibitors which shows that whatever density increases, growth will decrease. Of course this amount of density has an optimum rate.

3 APPLICATIONS OF GAS HYDRATE

Hydrates is the first time as a factor in understanding the gas tubes are blocked, but now many studies done on these compounds and has found many applications. Absorb carbon dioxide from the air Separation of mixed gases Storage and transmission of natural gas 64% increase in CO_2 emissions of the greenhouse phenomenon. One method of reduce of CO_2 is separation from the environment and sent them in the depths of the seas and oceans. At depth below 400 m, CO_2 gas is injected and trapped by dissolving in water. Between 100-2000 m, CO_2 is liquid and the water will penetrate. CO_2 hydrate at 500 -900 meters of sea water is formed. With the Injection of cold sea water, hydrate crystals are formed. After their separation, and warm, fresh water is achieved. Because of the high cost of this method still has not found industrial application. Another application is the separation of carbon dioxide from the mixtures of combustion gas. Another separation process that called separation hydrate method, is tetra hydro jet used as a propellant of formed hydrate. Equilibrium pressure of hydrate formation lowers and the hydrate stability zone will expand. Gas hydrates capability to storage natural gas, which creates attractive about using it for storage and transportation of natural gas and other gases as a rival for the liquefy and condensation will be. At 1960 gas hydrate that as a factor interfering in a gas pipeline, the idea of using natural gas hydrate formed in the minds of many scientists. Because the temperature of formed hydrate is more than temperature of transport liquid natural gas (LNG), the gas hydrate can be moved easily, hence making it hydrate vessels, much less complexity than LNG vessels. Hydrate production facility can be designed much easier than LNG sites. But the basic problem, the gas volume is less. Studies in this case show each cubic hydrate, 175 cubic meters of gas in their place offers. If the LNG technology, the reduced to a six hundredth size and economic issue in the design of gas transmission, especially over long distances is important, however, there is still hope to use hydrate as a very economic safe solution for the transport gas. British Petroleum Company in collaboration with other scientific centers such as University Godson building a small plant that can produce 100 kg per day to hydrate. Gas hydrates can be used in the separation processes. Gas hydrate formation has only a limited number of materials.

If want separate the material of the mixture that can be form the hydrate, use hydrate is seen as an opportunity. For example, you can thicken the rich streams of water, providing drinking water from sea water or gas flow separation point. The discovery of large amounts of gas hydrates in northern Alaska Range and down the East Bay, United States of America, gives strength to the idea that gas hydrates, a very important source of energy in the future are considered. However, the important technical and technical issues must be resolved to possible gas hydrate as an energy source in the world, was introduced. Hydrate in natural gas to form a crystalline material composed of water and gas are. In the hydrate, a solid network of water, keep molecules of the gas in a cage-like structure. Hydrates usually in the polar and sea ice and sedimentary layers are present. However, methane, propane and other gases can be trapped in the cage-like, but the probability is much higher methane hydrate. The amount of methane trapped in gas hydrates is very high and the estimate is more guesswork and assumption. The amount of gas hydrate deposits in the world is much more than the volume of other sources of energy. Although the access to and production of gas hydrate research has been done by many [1].

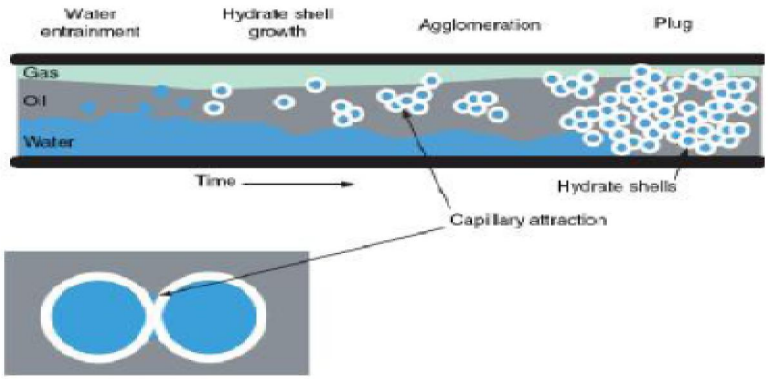

Fig. 2. Eclipse Pipes in Oil Pipes

4 PRODUCING GAS FROM GAS HYDRATE

Proposed methods of gas recovery from hydrates usually involve separation or melting of gas hydrates has the following methods:

Heating tank, the temperature of hydrate

Reducing the pressure below the equilibrium Hydrate

Injection inhibitors such as methanol or glycol into a reservoir to decrease hydrate stability conditions.

Currently, the recovery of gas hydrates to be postponed because it hydrates rough areas usually polar and deep-sea areas have been expanded. Recently, a series of simple thermal model for stimulating the production of gas hydrate and streams of water heater use has shown that gas hydrate can be produced is enough to allow gas hydrates to become technically a renewable resource, although the high cost of advanced recycling techniques, cause recycling not use. The gas hydrate inhibitors for the production of gas hydrate is physically possible, however, the use of large volumes of chemicals such as methanol, economic and environmental costs are high. Among the various techniques of produce natural gas hydrate, the best economic and most economical plan is to de-stress.

5 CONCLUSION

In this article first synthetic analysis of hydrate formation which consists of two stages was considered. It was also said that from these two stages, controlling growth stage is necessary and possible. then two common models in synthetic hydrate formation were considered an it was determined that the first model explains qualitative and relative velocity of hydrate formation and second model considers velocity of hydrate formation .at the end growth velocity with and without inhibitor was calculated using second model and experimental data in one part of district 8 gas transporting pipe line that in which hydrate formation had been reported and based on them it was concluded that hydrate growth velocity with inhibitor decreases and this decrease is different based on kind and density of inhibitor.

Because gas hydrate layers are present in the Polar Regions and marine sediments, can be considered as a potential energy source, the predictions for the amount of natural gas from gas hydrate layers in the 5.1020 to 1.1062 trillion cubic feet for the Polar Regions and 1.1051 to 2.1087 trillion cubic feet for the sedimentary layers of the ocean. Estimation about the gas hydrate resource is showing considerable fluctuations. Recent predictions of the amount of methane gas hydrate in global accumulated about 1,057 trillion cubic feet, but it seems that the sedimentary layers of the ocean has more resources and larger natural gas to continental sedimentary layers. The job evaluation and estimation of the Research Institute for Earth Cognitive America, estimating the gas hydrate resource in America's coastal and marine areas. Assessment of gas hydrates on the basis of an analysis, the state by state. We all gas hydrate regardless of their technical issues, define, describe and evaluate. We, therefore, this evaluation, only the volume of the gas hydrate resource concerned, the amount of gas within the gas hydrate, regardless of its recycling there. In one method of analysis, potential hydrocarbon accumulation, are grouped according to their geological characteristics of the geological conditions of occurrence of hydrocarbons in the modeling. In this evaluation, the geologists, the geological factors necessary for the formation and accumulation of hydrocarbons and geological factors determining their size, are discussed. In an assessment of 11 areas of gas hydrate, offshore and onshore oil discovery in four states and the amount of gas hydrate was estimated. Predictions made for each of

these 11 areas collected from gas hydrate resources in the United States of America is estimated. The gas hydrate resources in the United States of America between 112.765 trillion cubic feet of gas to the 676.110 level course with 0.05-0.95. Although these statistics, along with a high percentage of the doubt, but it represents a very large amount of gas stored in gas hydrates. The total value of the gas hydrate was in America for about 222 to 320 trillion cubic feet of gas. Necessary Naval Research, noted that recent excavations within the Special Economic Zone along the eastern area of this country is America, there are significant amounts of methane stored as solid gas hydrate and free gas, gas hydrates under arrest, confirms . In the past few years, government agencies in Japan, India and South Korea began to develop research programs to recover gas from oceanic hydrates have. One of the most important gas hydrate projects is underway in Japan, a 5-year project to assess the internal resources Potential natural gas hydrates. The articles have been published: Institute executive, has announced that methane hydrates can be integrated to produce the next generation energy source

In 1996, geological and seismological research programs on the continent of North and Southeast regions of Japan have been conducted. According to the research, has discovered that about 1,800 trillion cubic feet of gas within the gas hydrate zone is stored Nankay. Studies show that between India and Myanmar, the Andaman Sea, a huge source of gas hydrates, which is conjectured, with 211 trillion cubic feet of gas. The government of India has announced that it's important to answer for needs energy in this Country. Although our information about the underground gas hydrate is very low, but can expect with the development of new technologies in order to hydrate as an energy source for future generations to see. The output lines that move of the sweet gas from refineries to consumers in major cities and industrial plants to move, despite all the measures foreseen in the design and implementation of the pension regulations, such as leak detection and measurement of the voltage period and ... that it applies during the operation, which is due to a large extent and distribution can't ignore the possibility of leakage. In fact, due to high pressure pipelines operating any minor leaks can be quickly learned and their surroundings in the wake of the explosion and fire are burning. If the water drops already formed crystals and destroyed the company is, I will re-hydrate formation induction time is less; seen that if a drop in the presence of the hydrate memory is added to water droplets, the hydrate formation time for a new water droplets time, the water droplets time memory effect is the phenomenon called Paul. Methods to prevent formation of gas hydrate Although Hydra hay high pressure gas and low temperature, but this situation occurs for each line pipe for oil and gas used may arise. To avoid blocking pipes hydrate formation should be prevented. Different methods to prevent hydrate formation include:

A) Maintenance of low pressure gas flow in the hydrate formation pressure, temperature and composition at a specified percentage of vapor phases.

B) Keeping the temperature higher than the flowed gas hydrate form and pressure in a combined percentage steam.

C) To prevent water in liquid phase by reducing the amount of water pipelines in the system.

D) Injection inhibitors that are divided into two categories: thermodynamic inhibitors and specific inhibitors.

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Amir Samimi

(16/05/1983, Isfahan City, Isfahan Province, Iran)

Studied M.SC Chemical Engineering, Master at Islamic Azad University, The Member of IAENG, Have 2 Years Experience in Oil Refinery Company, Member of Young Research, and Have 17 Articles in the International Journal, Conference (U.S.A, France, Italy, Indonesia, India, Australia, Europe Chemical Engineering Conference) and More than 45 Articles in the National Journal, Conference in Iran.
Email: amirsamimi1161@gmail.com

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Explotion of Resources Management in Iran

Marzieh Samimi[1] and Amir Samimi[2]

[1]Department of Agriculture Engineering,
Arsenjan Branch, Islamic Azad University,
Arsenjan, Iran

[2]Department of Chemical Engineering,
Mahshahr Branch, Islamic Azad University,
Mahshahr, Iran

ABSTRACT: The management of the car the water exposes to some serious crisis and problems such as inadequacy of water, The lack of access to the clean and health water, The quality of controlling the water sources, The disruption in the management of water sources, decreasing the financial source, The lack of Knowledge in the decision makers, and The security of the society being exposes to the danger considering the happened problems and crisis, different methods of managing the water sources such as The management based on the supply of water, the integral management of water sources and effective ways has grown up by passing of time. For the present time, safe guarding the water sources is one of the aims of the regimes of water sources management in agriculture, as one of the biggest consumers of water sources, The management of water sources is performed in two parts of supply and demand and according to the available limitations, special attention is paid to the of consumer's request.

KEYWORDS: Water, Sources, Management, Agriculture.

1 INTRODUCTION

At present time, water is a scare element. The any metric distribution of precipitation in different areas leads to dry and semidry areas in different areas although. These areas enjoy from potential abilities but they face many limiter factors. We should consider the way closed if we want to become succeed, we should have an exact program and these areas can testify the cultural, social and economic dehiscence by a prefect management. Today water isn't considered as an abundant affluence. But the governments and the scientists have found that the water sources should be exploited at the most with the least wasting and losses. The management of water sources is a part of program for improving the countries and each country according to the available sources of water perform a special strategy and program to have an optimize exploitation from the water sources. Since farming has a direct relation with water and environment, it is affected intensively by the water stresses. Generally the dry areas that suffer from the drought in comparison with the rainy areas have different agricultural condition.

The Condition of Water Sources in the Earth: The salt water of oceans comprises 97% percent of the water in the earth, and the remained water which is about % 30 percent. 2/3 of it has been accumulated in the poplars and in mountainous regions. So, The sweet running water comprises one percent of earth and the underground water comprises 98 percent of it in western and industrial countries, every person needs to at least 2000 square meter to enjoy from a desired standard. If every body's per capita is between 1000 to 2000 meter square that country is under the stress of water. But if the per capita is less than 500 meter annually, so the mentioned country will be face with the droughty. At present time. The available sources of water can annually provide 700 meter square of water for everybody. Although there is enough water for 3 times of earth population but inequality between population distribution and precipitation has caused the shortage of water in

Corresponding Author: Marzieh Samimi (marziehsamimi68@gmail.com)

some regions. Today, about 26 countries in the world are considered the droughty countries and as a result of them. The rate of population growth is high. 9 out of 26 countries are in Middle East. Africa includes the most number of dry countries. The dry districts include about 1/3 of earth surface and 15 percent of population. 3/4 of day regions are located in Asia, Africa and Australia.

2 THE SITUATION OF WATER SOURCES IN IRAN

At present time , 88.5 billiard meter square of whole revived water sources is used in agriculture , industry and drinking and about 83 billiard meter square is used in agriculture , 4.5 billiard sq is used for health and drinking and the rest of it is used in other parts. Iran by average 252 mile meter precipitation per year is considered as one of the dry regions in the world. The available crisis and problems about water sources: Today, the world for providing the required water has many problems the environment and the ecosystems which are based on the sweet water sources have faced with crisis and problem which are due to numerous droughts and irregular uses from the water sources. The problems in water systems

1) Unequal distribution of water sources
2) Population growth
3) Water stresses
4) The wide rareness in water sources
5) Controlling the water quality
6) Flood and drought

3 THE MANAGEMENT OF WATER SOURCE

According to the above mentioned problems. The optimum use from the water source is one of the main programs of countries. Programming for the optimum use from the water sources needs to its special principles:

*solutions and the procedures of water sources management

Management Based on Water Supply: The governments considering population growth from 2-3 billiards during 1900 to 1960 years and the abundant of water sources emphasized on using from water sources for meeting the water needs. In fact, this approach emphasizes on water supply in a reaction to the demands.

Integrated Management of Water Sources: In this method, the economic, social and environmental dimensions should be considered. The purpose of this method is the maintenance of source stability and ecosystems through an integrated management.

Efficient Solutions: In this method, there are 3 aims.

1. The main tenancy of efficiency of ecosystems of sweet water sources
2. The management based on ecosystem
3. Considering the methods of allocating water in future

One important subject in managing the water sources is using the methods of integral management of water sources. The integral management of water sources includes the following cases:

1. Water quality
2. Water quantity
3. Underground water
4. Super facial water

The politics in this method is based on 3 principles:

1. Water 2. Programming 3. Environment

Today an important subject in water management is maintaining the stability of these sources. The stable water sources systems are managed for archiving to perfect aims of society in future and present time. These systems are designed in a manner that can react against different changes.

4 THE MANAGEMENT OF WATER SOURCES IN AGRICULTURE

Since agriculture has a biological nature and is very dependent on the environment. So, it is one of the biggest consumers of water in most of the countries, in Iran 93.5 of water sources id used in agriculture. Today, the management of water sources in agriculture is done in two parts. The first part includes the management of water supply and the second part includes the management of water demand. The restriction of water sources has caused that move attention be padded to water sources management. The supply management includes some operations such as transferring water through the channels, the use of underground water in irrigation, the international use of underground of channel water. We can increase the water efficacy as the following four methods:

1. Decreasing some part of water sources which have been evaporated and the use of saved water in other parts.
2. We can produce the most products by performing the better methods of irrigation and performing the correct operation of farming by the same amount of water which is used in farming.
3. We should use from the unused water which is pouring into sea.
4. We should use from water in places with high efficacy

5 THE METHODS OF OPTIMUM FROM FARMING WATER

1. The admission and performing the integrated programming water sources and ground.
2. The important of providing water and providing water and irrigation system for efficient use from the available water.
3. The admission of leaving water policy which causes the optimum use meant from this source.
4. Valuing water as economic social and environmental goods.
5. Some actions for increasing the available water sources such as the reuse of waste water and drainers. The following methods are for increasing the water efficacy

1. The technical solution it includes land leaving, making use of rainy irrigation methods in irrigation in a manner that it prevents from wasting the running water.
2. The managerial solution: It includes the correct programming for irrigation, and irrigation when the plant from the view point of production needs to water. Perform agriculture operation for saving water in soil, better protection from the channels and irrigation equipments.
3. Organizational solution such as nongovernmental organizations for popular participation decreasing the water subsidy and pricing, providing suitable and efficient market of water with in the frame work of law.

6 CONCLUSION

As the statistics and figures show our country is a dry country. The optimum management and the correct management of water in our country, we need to a great revolution if the current situation continues, we will lose against some events like the recent year's drought. Today, in water sources management especially in agriculture, the environmental, economic and social dimension, are considered. The integral management and systematic management have obtained a high place in programming the leader of countries for providing the stability. The world tries to have an optimum use from water sources. Increasing the level of knowledge and the active participation of users in water policy making using from new technologies and applying the methods for decreasing. The dryness is the foundations of managing the demand section in agriculture, the views and the thoughts should be released from the traditional attitude toward water sources. We shouldn't consider it as abundant sources we need to methods which need to the least amount of water.

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Marzieh Samimi

(03/05/1989, Abadeh City, Fars Province, Iran)

Studied M.SC Agricultural Engineering, the Member of IAENG, Member of Young Research, and Have 2 Articles in the International Journal in France and More than 12 Articles in the National Journal, Conference in Iran.
Email: marziehsamimi68@gmail.com

Amir Samimi

(16/05/1983, Isfahan City, Isfahan Province, Iran)

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Performance Analysis of Cooperative Spectrum Sensing in Cognitive Radio

Mohammad Alamgir Hossain[1], Md. Shamim Hossain[2], and Md. Ibrahim Abdullah[3]

[1]B.sc (Hons) & M.sc in CSE, Islamic University,
Bangladesh

[2]Lecturer, Dept. of CSE, Islamic University,
Bangladesh

[3]Associate Professor, Dept. of CSE, Islamic University,
Bangladesh

ABSTRACT: Cognitive radio is a new and exciting technology that, among other applications, has the potential to unlock the spectrum necessary for the deployment of next generation high data rate systems. Spectrum sensing is the key component of cognitive radio technology. However, detection is compromised when a user experiences shadowing or fading effects. In such cases, user cannot distinguish between an unused band and a deep fade. Thus, cooperative spectrum sensing is proposed to optimize the sensing performance. We have studied performance analysis of cooperative spectrum sensing in Cognitive Radio. This paper presents a simulation comparison of cooperative with non-cooperative spectrum sensing over Rayleigh fading channel based on AND, OR and MAJORITY rules. Comparing the non-cooperative curve with the cooperative curve over Rayleigh fading channel, we observed that spectrum sensing is better in presence of cooperation. We also observed that the OR rule has the better performance than AND and MAJORITY rule.

KEYWORDS: cognitive radio, fusion rules, cooperative spectrum sensing, fading channels, energy detection.

1 INTRODUCTION

Cognitive radio (CR) enables much higher spectrum efficiency by dynamic spectrum access [1], [2]. Therefore, it is a potential technique for future wireless communications to mitigate the spectrum scarcity issue. As unlicensed (secondary) users of the spectrum band, CR operators are allowed to utilize the spectral resources only when it does not cause interference to the primary (licensed) users, which entails continuous spectrum sensing in CR networks. Therefore, it becomes a critical issue in cognitive radio to reliably and quickly detect the presence of the primary users. The existing spectrum sensing techniques can be broadly divided into three categories [3]: energy detection, matched filter detection, and cyclostationary detection. Among them, energy detection has been widely applied since it does not require any prior knowledge of the primary signals and has much lower complexity than the other two schemes. Therefore, we only consider energy detection for spectrum sensing throughout this letter. Spectrum sensing is a tough task because of shadowing, fading, and time-varying natures of wireless channels. To combat these impacts, cooperative spectrum sensing schemes have been proposed to obtain the spatial diversity in multiuser CR networks [4-6]. The performance of single CR user based spectrum sensing in fading channels such as Rayleigh, Nakagami, Weibull has been studied in [7]. In cooperative spectrum sensing, all CR users sense the PU individually and send their sensing information in the form of 1-bit binary decisions (1 or 0) to Fusion center (FC). The hard decision combining rule (OR, AND, and MAJORITY rule) is performed at FC using a counting rule to make the final decision regarding whether the primary user present or not [8]-[13]. In this paper, we have studied cooperative spectrum sensing over Rayleigh fading channel.

Corresponding Author: Mohammad Alamgir Hossain (alamgirlovely@yahoo.com)

The rest of this paper is organized as follows. In Section II, the system model is introduced. In Section III, detection and false alarm probabilities of non-fading AWGN and Rayleigh fading channel is described. Cooperative spectrum sensing over Rayleigh fading channel is derived in Section IV. The simulation result and discussion are presented in section V. Finally, we draw our conclusion in Section VI.

2 SYSTEM MODEL

We assume that energy detection [14] is applied at each CR user (fig.1). The energy detector consists of a square law device followed by a finite time integrator. The output of the integrator at any time is the energy of the input to the squaring device over the interval *T*. The noise pre-filter serves to limit the noise bandwidth; the noise at the input to the squaring device has a band-limited, flat spectral density.

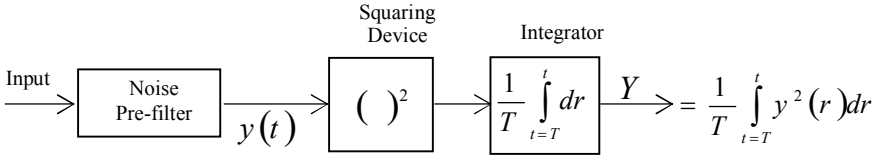

Fig. 1 Energy Detection

The local spectrum sensing is to decide between the following two hypotheses,

$$y(t) = \begin{cases} n(t) & H_0 \\ hs(t) + n(t) & H_1 \end{cases} \tag{1}$$

Where x(t) is the signal received by secondary user and s(t) is primary user's transmitted signal, n(t) is the additive white Gaussian noise (AWGN) and h is the amplitude gain of the channel. We also denote by γ the signal-to-noise ratio (SNR). The received signal is first pre-filtered by an ideal band-pass filter with transfer function [15] [16]

$$H(f) = \begin{cases} \frac{2}{\sqrt{N_{01}}}, & |f - f_c| \le W, \\ 0 & |f - f_c| > W, \end{cases} \tag{2}$$

to limit the average noise power and normalize the noise variance. The output of this filter is then squared and integrated over a time interval *T* to finally produce a measure of the energy of the received waveform. The output of the integrator denoted by *Y* will act as the test statistic to test the two hypotheses H_0 and H_1. According to the sampling theorem, the noise process [17] can be expressed as

$$n(t) = \sum_{i=-\infty}^{\infty} n_i \sin c(2Wt - i) \tag{3}$$

Where $\sin c(x) = \frac{\sin(\pi x)}{\pi x}$ and $n_i = n\left(\frac{i}{2W}\right)$

One can easily check that $n_i \approx N(0, N_{01}W)$, for all i. Using the fact that [17]

$$\int_{-\infty}^{\infty} \sin c(2Wt - i)\sin c(2Wt - k)dt = 1/2W, \ i = k \\ = 0, \qquad i \neq k \tag{4}$$

We may write

$$\int_{-\infty}^{\infty} n^2(t)dt = \frac{1}{2W}\sum_{i=-\infty}^{\infty} n_i^{\,2} \tag{5}$$

Over the time interval $(0,T)$, $n(t)$ the noise energy can be approximated by a finite sum of 2*TW* terms as

$$n(t) = \sum_{i=1}^{2TW} n_i \sin c(2Wt - i), \quad 0 < t < T \tag{6}$$

Similarly, the energy in a sample of duration *T* is approximated by 2*TW* terms of the right-hand side:

$$\int_{0}^{T} n^2(t)dt = \frac{1}{2W}\sum_{i=1}^{2u} n_i^{\,2} \tag{7}$$

Where *u*=*TW* . We assume that *T* and *W* are chosen to restrict *u* to integer values. If we define

$$n_i^{\,'} = \frac{n_i}{\sqrt{N_{01}W}} \tag{8}$$

Where N_{01} =one-sided noise power spectral density. Then, the test or decision statistic *Y* can be written as

$$Y = \sum_{i=1}^{2u} n_i^{\,'2} \tag{9}$$

Y can be viewed as the sum of the squares of 2*u* standard Gaussian variates with zero mean and unit variance. Therefore, *Y* follows [15] a central chi-square (χ^2)distribution with *2u* degrees of freedom. The same approach is applied when the signal *s(t)* is present with the replacement of each n_i by $n_i + s_i$ where $s_i = s\left(\frac{i}{2W}\right)$. The decision statistic *Y* in this case will have a non-central χ^2 distribution with 2*u* degrees of freedom and a non-centrality parameter 2λ . Following the short-hand notations mentioned in the beginning of this section, we can describe the decision statistic as

$$Y \approx \begin{cases} \chi_{2u}^{\,2} & H_0 \\ \chi_{2u}^{\,2}(2\gamma)' & H_1 \end{cases} \tag{10}$$

The probability density function (PDF) [15] of *Y* can then be written as

$$f_Y(y) = \begin{cases} \dfrac{1}{2^u \Gamma(u)} y^{u-1} e^{-\frac{y}{2}} & H_0 \\ \dfrac{1}{2}\left(\dfrac{y}{2\gamma}\right)^{\frac{u-1}{2}} e^{-\frac{2\gamma+y}{2}} I_{u-1}\left(\sqrt{2\gamma y}\right), & H_1 \end{cases} \tag{11}$$

Where $\Gamma(.)$ is the gamma function. The probability of detection and false alarm can be generally computed by [14-20]

$$P_d = \Pr(Y > \lambda \mid H_1) \tag{12}$$

$$P_f = \Pr(Y > \lambda \mid H_0) \tag{13}$$

Where λ is the final threshold of the local detector to decide whether there is a primary user present. Using (11) to evaluate (13) yields

$$P_f = \frac{\Gamma\left(u, \frac{\lambda}{2}\right)}{\Gamma(u)}, \tag{14}$$

Hence,

$$P_d = Q_u\left(\sqrt{2\gamma}, \sqrt{\lambda}\right) \tag{15}$$

Where $\gamma = \frac{\sigma_x^{\,2}}{2\sigma_n^{\,2}} = \frac{\sigma_x^{\,2}}{2}$ denotes the signal to noise ratio [21] (SNR), Q_u is the generalized Marcum's Q function.

3 DETECTION AND FALSE ALARM PROBABILITIES

In this section, we give the average detection probability over Rayleigh fading channel and in closed form [15]. In communications theory, Rayleigh distributions are used to model scattered signals that reach a receiver by multiple paths.

3.1 NON-FADING ENVIRONMENT (AWGN CHANNEL)

In non-fading environment the average probability of false alarm, the average probability of detection, and the average probability of missed detection are given, respectively, by [15]

$$P_d = P\{Y > \lambda \mid H_1\} = Q_u\left(\sqrt{2\gamma}, \sqrt{\lambda}\right) \tag{16}$$

$$P_f = P\{Y > \lambda \mid H_0\} = \frac{\Gamma(u, \lambda/2)}{\Gamma(u)} \tag{17}$$

and

$$P_m = 1 - P_d \tag{18}$$

where λ denotes the energy threshold. $\Gamma(.)$ and $\Gamma(.,.)$ are complete and incomplete gamma functions respectively [22] and $Q_u(.,.)$ is the generalized Marcum Q-function defined as follows,

$$Q_u(a,b) = \int_0^\infty \frac{x^u}{a^{u-1}} e^{-\frac{x^2+a^2}{2}} I_{u-1}(ax)dx \tag{19}$$

where $I_{u-1}(.)$ is the modified Bessel function of (u−1)th order. If the signal power is unknown, we can first set the false alarm probability P_f to a specific constant. By equation (17), the detection threshold λ can be determined. Then, for the fixed number of samples 2TW the detection probability P_d can be evaluated by substituting the λ in (16). As expected, P_f is independent of γ since under H_0 there is no primary signal present. When *h* is varying due to fading, equation (16) gives the probability of detection as a function of the instantaneous SNR, γ. In this case, the average probability of detection P_d may be derived by averaging (16) over fading statistics [10],

$$P_d = \int_x Q_u\left(\sqrt{2\gamma}, \sqrt{\lambda}\right) f_\gamma(x)dx \tag{20}$$

Where *fγ(x)* is the probability distribution function (PDF) of SNR under fading.

3.2 RAYLEIGH FADING CHANNELS

When the composite received signal consists of a large number of plane waves, for some types of scattering environments, the received signal has a Rayleigh distribution [23]. If the signal amplitude follows a Rayleigh distribution, then the SNR γ follows an exponential PDF given by

$$f(\gamma)=\frac{1}{\bar{\gamma}}\exp\left(-\frac{\gamma}{\bar{\gamma}}\right),\ \gamma\geq 0 \tag{21}$$

In this case, a closed-form formula for P_d may be obtained (after some manipulation) by substituting $f_\gamma(x)$ in (19),

$$\bar{P}_{dRay}=e^{-\frac{\lambda}{2}}\sum_{k=0}^{u-2}\frac{1}{k!}\left(\frac{\lambda}{2}\right)^k+\left(\frac{1+\bar{\gamma}}{\bar{\gamma}}\right)^{u-1}\times\left(e^{-\frac{\lambda}{2\left(1+\bar{\gamma}\right)}}-e^{-\frac{\lambda}{2}\sum_{k=0}^{u-2}\frac{1}{k!}\left(\frac{\lambda\bar{\lambda}}{2\left(1+\bar{\gamma}\right)}\right)}\right) \tag{22}$$

4 COOPERATIVE SPECTRUM SENSING OVER VARIOUS FADING CHANNELS

Let *N* denote the number of users sensing the PU. Each CR user makes its own decision regarding whether the primary user present or not, and forwards the binary decision (1 or 0) to fusion center (FC) for data fusion. The PU is located far away from all CRs. All the CR users receive the primary signal with same local mean signal power, i.e. all CRs form a cluster with distance between any two CRs negligible compared to the distance from the PU to a CR. For simplicity we have assumed that the noise, fading statistics and average SNR are the same for each CR user. We consider that the channels between CRs and FC are ideal channels (noiseless). Assuming independent decisions, the fusion problem where *k* out of *N* CR users are needed for decision can be described by binomial distribution based on Bernoulli trials where each trial represents the decision process of each CR user. With a hard decision counting rule, the fusion center implements an *n*–out-of-*M* rule that decides on the signal present hypothesis whenever at least *k* out of the *N* CR user decisions indicate H_1. Assuming uncorrelated decisions, the probability of detection at the fusion center [24] is given by

$$P_d=\sum_{l=k}^{N}\binom{N}{l}P_{d,i}{}^{l}\left(1-P_{d,i}\right)^{N-l} \tag{23}$$

$$P_f=\sum_{l=k}^{N}\binom{N}{l}P_{f,i}{}^{l}\left(1-P_{f,i}\right)^{N-l} \tag{24}$$

Where $P_{d,i}$ is the probability of detection for each individual CR user as defined by (3) and (6).

AND-Rule:- In this rule, if all of the local decisions sent to the decision maker are one, the final decision made by the decision maker is one. Cooperative detection performance with this fusion rule can be evaluated by setting *k*=*N* in eq. (23).

The cooperative probability of detection using AND rule is

$$P_{d,AND}=\Pr\{Fusiondecision=1\mid H_1\}=\prod_{i=1}^{N}Pd_i \tag{25}$$

The cooperative probability of false alarm using AND rule is

$$P_{f,AND}=\Pr\{Fusiondecision=1\mid H_0\}=\prod_{i=1}^{N}Pf_i \tag{26}$$

The cooperative probability of misdetection using hard decision AND rule is

$$P_{Pm,AND}=1-\left(P_{d,AND}\right)$$

$$= 1 - \left(\prod_{i=1}^{N} Pd_i \right) \tag{27}$$

OR-Rule:- In this rule, if any one of the local decisions sent to the decision maker is a logical one, the final decision made by the decision maker is one. Cooperative detection performance with this fusion rule can be evaluated by setting *k*=1 in eq. (23).

The cooperative probability of detection using OR rule is

$$P_{d,OR} = \Pr\{Fusiondecision = 1 \mid H_1\} = 1 - \prod_{i=1}^{N} (1 - Pd_i) \tag{28}$$

The cooperative probability of false alarm using OR rule is

$$P_{f,OR} = \Pr\{Fusiondecision = 1 \mid H_0\} = 1 - \prod_{i=1}^{N} (1 - Pf_i) \tag{29}$$

The cooperative probability of misdetection using OR rule is

$$P_{Pm,OR} = 1 - (P_{d,OR}) \tag{30}$$

This can also be written as

$$P_{Pm,OR} = 1 - \left(1 - \prod_{i=1}^{N} (1 - Pd_i) \right) \tag{31}$$

$$= \prod_{i=1}^{N} (1 - Pd_i) \tag{32}$$

MAJORITY-Rule:- In this rule, if half or more of the local decisions sent to the decision maker are the final decision made by the decision maker is one. Cooperative detection performance with this fusion rule can be evaluated by setting $k = \lfloor N/2 \rfloor$ in eq. (23).

$$P_{d,MAJ} = \sum_{l=\lfloor N/2 \rfloor}^{N} \binom{N}{l} {P_{d,i}}^{l} \left(1 - P_{d,i}\right)^{N-l} \tag{33}$$

Where $\lfloor . \rfloor$ represents the floor operator.

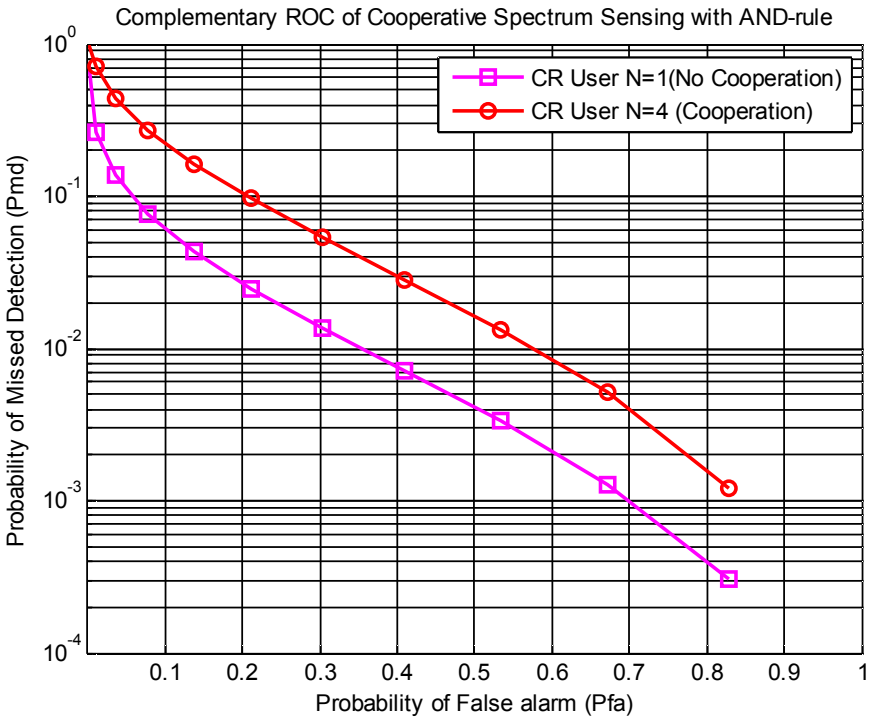

Fig.2 Complementary ROC of AND fusion rule over Rayleigh fading channel ($\bar{\gamma}$=10dB, u=5)

5 SIMULATION RESULT AND DISCUSSION

All simulation was done on MATLAB version R2011a over Rayleigh fading channel and a non-fading AWGN channel.

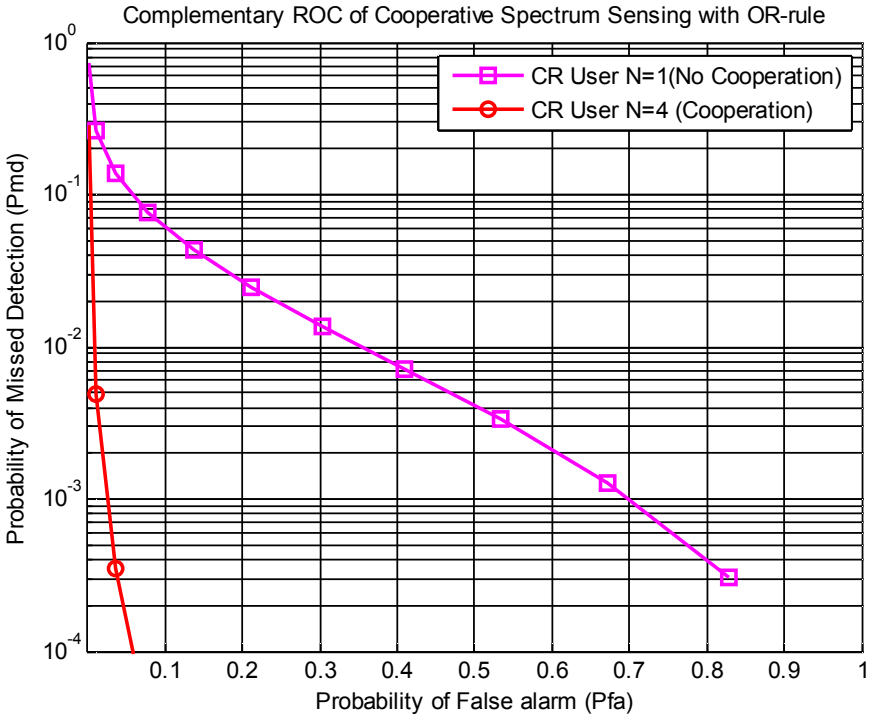

Fig.3 Complementary ROC of OR fusion rule over Rayleigh fading channel ($\bar{\gamma}$=10dB, u=5)

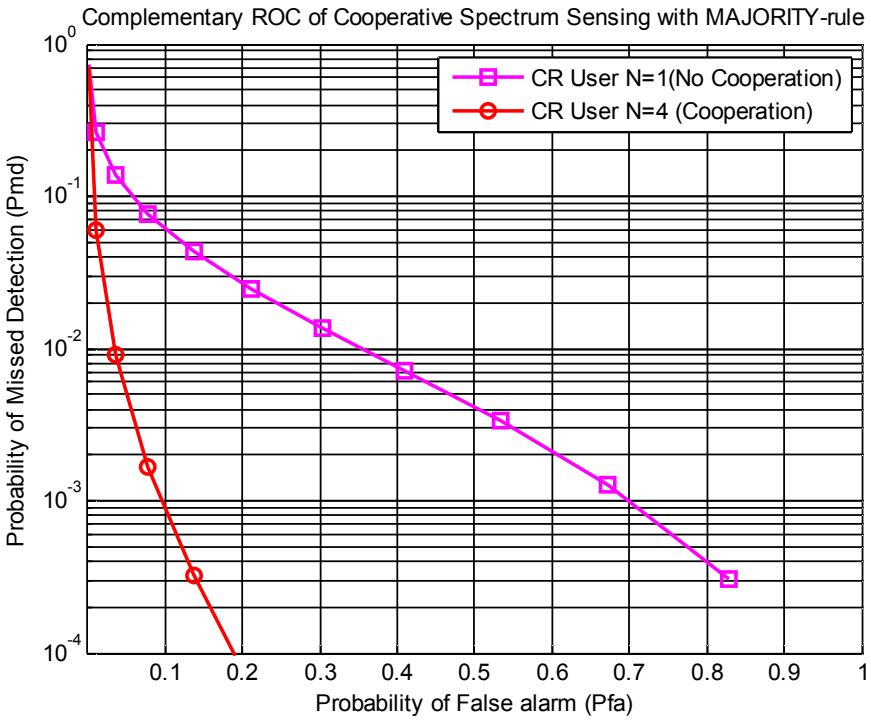

Fig.4 Complementary ROC of MAJORITY fusion rule over Rayleigh fading channel ($\bar{\gamma}$=10dB, u=5)

Fig 2, 3 and 4 show complementary ROC curves of cooperative spectrum sensing in Rayleigh fading following AND rule, OR rule and MAJORITY rule respectively. Average SNR and *u* are assumed to be 10 dB and 5 respectively. A plot for non-cooperative spectrum sensing case is also provided for comparison. Fig. 2 shows, probability of missed detection is decreasing according to the increasing probability of false alarm. Fig. 3 shows, probability of missed detection is decreasing more than fig.2 according to the increasing probability of false alarm. And fig. 4 shows, probability of missed detection is decreasing more than fig.2 and less than fig.3 according to the increasing probability of false alarm. In fig 2, 3 and 4 also shows that spectrum sensing is better in presence of cooperative than non-cooperation over Rayleigh fading channel.

6 CONCLUSION

We have discussed cooperative spectrum sensing based on energy detection in CR networks. Cooperative spectrum sensing improves the detection performance. We also have studied cooperative spectrum sensing over Rayleigh fading channel. The performance of ED-CSS also has been investigated via probability of missed detection versus different probability of false alarm values in Rayleigh fading channel. Performance of cooperative spectrum sensing over Rayleigh fading is presented and compared with the non-cooperative spectrum sensing. In this paper, the sensing of primary user in a cooperative spectrum sensing model under Rayleigh fading was investigated by implementing the local spectrum sensing with the energy detection technique. We observe that the OR rule has the better performance than AND and MAJORITY rule. We also observe that spectrum sensing is better in presence of cooperation.

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AUTHORS' PROFILES

Mohammad Alamgir Hossain received his B.SC degree with honors in Computer Science and Engineering (CSE) from Islamic University (IU), Kushtia-7003, Bangladesh, in 2010 and his M.SC degree in same department, in 2012. His current research interest is in the area of OFDM, Wireless Communication and Cognitive Radio.

Md. Shamim Hossain has been received Bachelor's and Master's degree in CSE from Islamic University, Kushtia. Courrently he is a Lecturer of the Department of Computer Science and Engineering (CSE), Islamic University (IU) His areas of interest include mobile communication & Cognitive Radio.

Md. Ibrahim Abdullah has been received the Bachelor's, Master's and M.Phil degree in Applied Physics & Electronics from Rajshahi University, Rajshahi. Courrently he is an Associate Professor of the department of CSE, Islamic University, Kushtia-7003, Bangladesh. His areas of interest include Network security, Wireless Sensor Network, mobile communication & Cognitive Radio.