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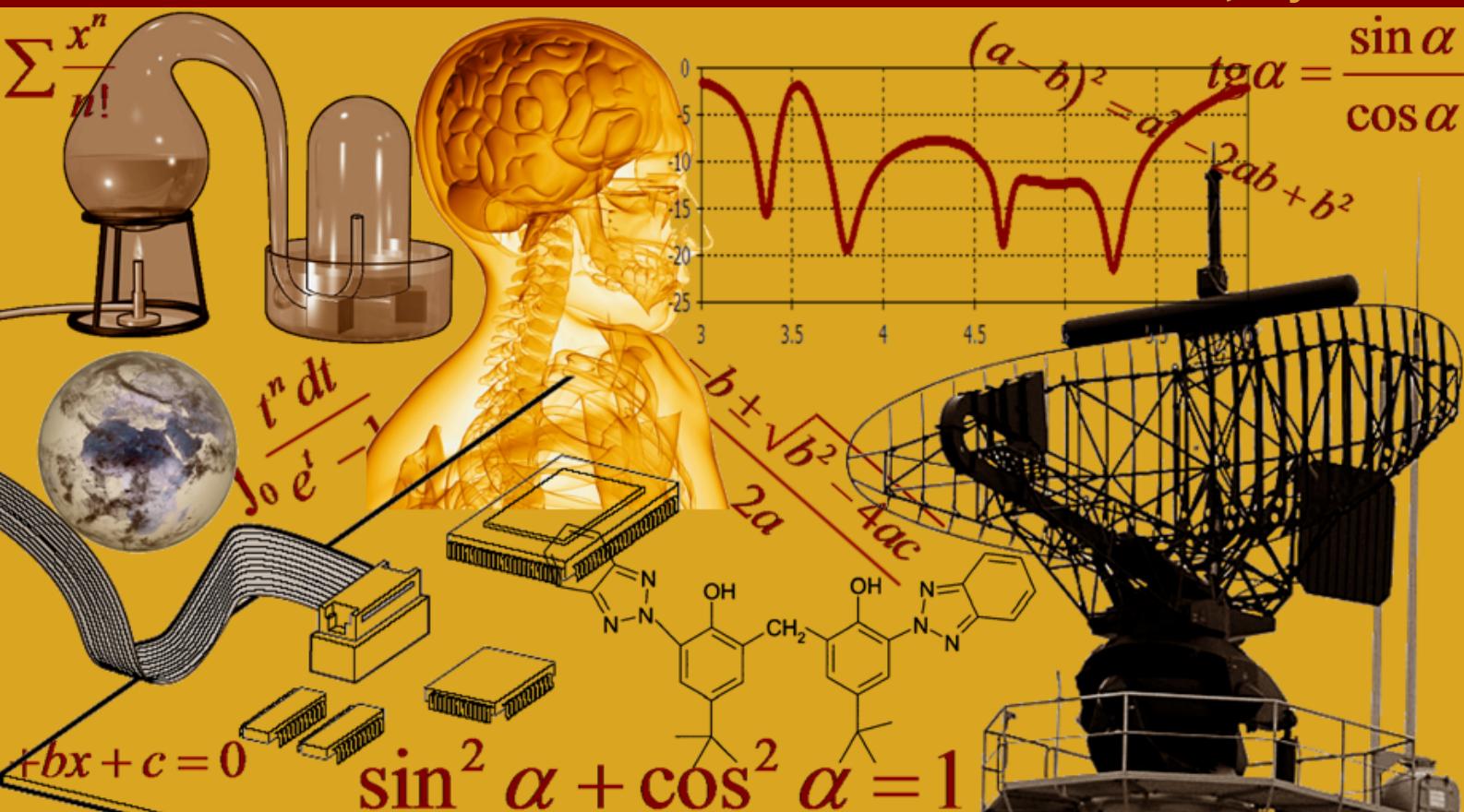
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Background Modelling and Subtraction in High Level Computer Vision Application with Security

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ABSTRACT: Intelligent video surveillance system deal's with the real-time monitoring of persistent and transient objects within a specific environment. In existing video surveillance using CCTV (close circuit television) works with binary segmentation algorithm and it had critical pre processing steps in various high level computer vision application. This can be applied not only in security systems, but also uses in environmental surveillance. The basic principle of moving object detecting is given by the Background Subtraction algorithm. Then, a self-adaptive background model that can update automatically and timely to adapt to the slow and slight changes of natural environment is detailed. When the subtraction of the current captured image and the background reaches a certain threshold, a moving object is considered to be in the current view, and the mobile phone will automatically notify the central control unit and automatic alerting system alert the authorized user through SMS and user can view the detected image by GPRS enabled mobile devices.

KEYWORDS: Background Modelling and Subtraction, GPRS, SMS, surveillance.

1 INTRODUCTION

The identification of regions of interest is typically the first step in many computer vision applications, including event detection, visual surveillance, and robotics. A general object detection algorithm may be desirable, but it is extremely difficult to properly handle unknown objects or objects with significant variations in color, shape, and texture. Therefore, many practical computer vision systems assume a fixed camera environment, which makes the object detection process much more straightforward; a background model is trained with data obtained from empty scenes and foreground regions are identified using the dissimilarity between the trained model and new observations. This procedure is called background subtraction.

Various background modelling and subtraction algorithms have been proposed [1], [2], [3], [4], [5] which are mostly focused on modelling methodologies, but potential visual features for effective modelling have received relatively little attention. The study of new features for background modelling may overcome or reduce the limitations of typically used features, and the combination of several heterogeneous features can improve performance, especially when they are complementary and uncorrelated. There have been several studies for using texture for background modelling to handle spatial variations in the scenes; they employ filter responses, whose computation is typically very costly. Instead of complex filters, we select efficient Haar-like features [6] and gradient features to alleviate potential errors in background subtraction caused by shadow, illumination changes, and spatial and structural variations.

Model-based approaches involving probability density function are common in background modelling and subtraction, and we employ Kernel Density Approximation (KDA) [3], [7], where a density function is represented with a compact weighted sum of Gaussians whose number, weights, means, and covariances are determined automatically based on mean-shift mode-finding algorithm. In our framework, each visual feature is modelled by KDA independently and every density

function is 1D. By utilizing the properties of the 1D mean-shift mode-finding procedure, the KDA can be implemented efficiently because we need to compute the convergence locations for only a small subset of data. When the background is modelled with probability density functions, the probabilities of foreground and background pixels should be discriminative, but it is not always true. Specifically, the background probabilities between features may be inconsistent due to illumination changes, shadow, and foreground objects similar in features to the background. Also, some features are highly correlated, i.e., RGB color features. So, we employ a Support Vector Machine (SVM) for nonlinear classification, which mitigates the inconsistency and the correlation problem among features. The final classification between foreground and background is based on the outputs of the SVM.

There are three important aspects of our algorithm integration of multiple features, efficient 1D density estimation by KDA, and foreground/background classification by SVM. These are coordinated tightly to improve background subtraction performance. An earlier version of this research appeared in [8]; the current paper includes more comprehensive analysis of the feature sets and additional experiments.

2   RELATED WORKS

Video surveillance takes place normally by using CCTV cameras (Closed Circuit Television) for monitoring or surveillance for intruder detection in case of emergencies in hospitals, shopping mall, banking sectors, and personal purpose automation and so on.

Later Video fusion approach also used for monitoring such systems. These systems are designed in such a way that monitoring images are stored and there is a need for human to interact for knowing about the changes in the current surveillance systems and than they will intimate to the concerned organization. Hence this is not a fast secured monitored due to the time delay taken for human interaction.

Due to time delay, we cannot get the update information for every minute or second and so it is not possible to detect the intruder in an appropriate time. This system uses the moving average algorithm to store the monitored images. Also this system lack the computation capability for surveillance meant for security

3   PROPOSED FRAMEWORK FOR BACKGROUND MODELING AND SUBTRACTION ALGORITHM

This section describes our background modelling and subtraction method based on the 1D KDA using multiple features. KDA is a flexible and compact density estimation technique, and we present a faster method to implement KDA for 1D data. For background subtraction, we employ the SVM, which takes a vector of probabilities obtained from multiple density functions as an input.
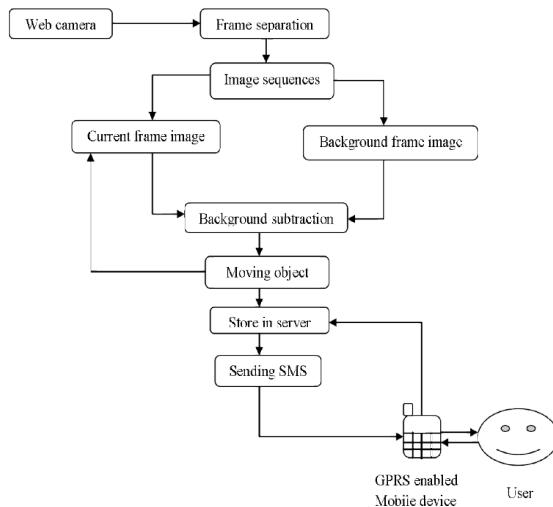

Fig. 1.Overall structure of high level computer vision application

3.1   MULTIPLE FEATURE COMBINATION

The most popular features for background modelling and subtraction are probably pixel wise color (or intensity) since they are directly available from images and reasonably discriminative. Although it is natural to monitor color variations at each pixel for background modelling, they have several significant limitations as follows:

1. They are not invariant to illumination changes and shadows.

2. Multidimensional color features are typically correlated and joint probability modelling may not be advantageous in practice.

3. They rely on local information only and cannot handle structural variations in neighbourhoods.

We integrate color, gradient, and Haar-like features together to alleviate the disadvantages of pixel wise color modelling. The gradient features are more robust to illumination variations than color or intensity features and are able to model local statistics effectively. The strength of Haar-like features lies in their simplicity and the ability to capture neighbourhood information. Each Haar-like feature is weak by itself, but the collection of weak features has significant classification power. The integration of these features is expected to improve the accuracy of background subtraction. We have 11 features altogether, RGB color, two gradient features (horizontal and vertical), and six Haar-like features. The Haar-like features are extracted from rectangular regions at each location in the image, while the gradient features are extracted with 3 _ 3 Sobel operators. The fourth and fifth Haar-like features are similar to the gradient features, but differ in filter design, especially scale.
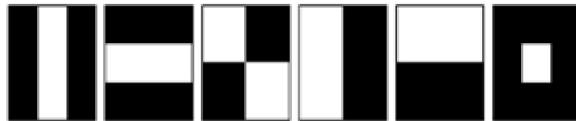

Fig. 2.Haar-like features for our background modelling

3.2   FOREGROUND AND BACKGROUND CLASSIFICATION

After background modelling, each pixel is associated with k 1D Gaussian mixtures, where k is the number of features integrated.

Background/foreground classification for a new frame is performed using these distributions. The background probability of a feature value is computed by (2), and k probability values are obtained from each pixel, which are represented by a k-dimensional vector. Such k-dimensional vectors are collected from annotated foreground and background pixels, and we denote them by y_j (j = 1, . . ., N), where N is the number of data points.

In most density-based background subtraction algorithms, the probabilities associated with each pixel are combined in a straight forward way, either by computing the average probability or by voting for the classification. However, such simple methods may not work well under many real-world situations due to feature dependency and nonlinearity. For example, pixels in shadow may have a low-background probability in color modelling unless shadows are explicitly modelled as transformations of color variables, but high-background probability in texture modelling.

Also, the foreground color of a pixel can look similar to the corresponding background model, which makes the background probability high although the texture probability is probably low. Such inconsistency among features is aggravated when many features are integrated and data are high dimensional, so we train a classifier over the background probability vectors for the feature set,$\{Y_j\}_{1:N}$.Another advantage to integrating the classifier for foreground/background segmentation is to select discriminative features and reduce the feature dependency problem; otherwise, highly correlated non discriminative features may dominate the classification process regardless of the states of other features.
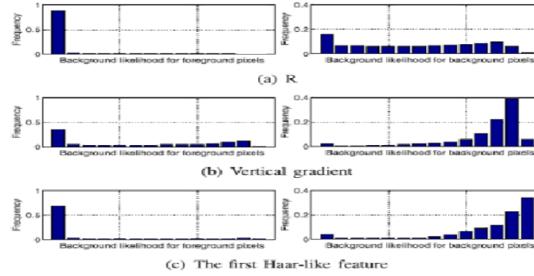
Fig. 3. *Feature performance for classification. The histograms of background probability for foreground and background pixels are presented for each feature.*
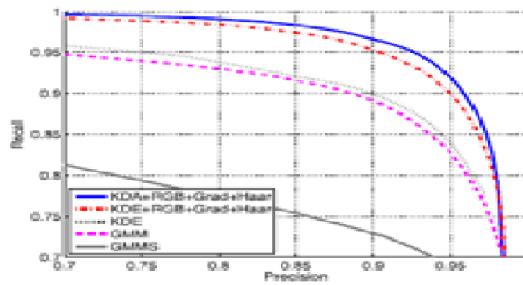

Fig. 4. *PR curves for different density estimations*

4   EXPERIMENTS

We present the performance of our background modeling and subtraction algorithm using real videos. Each sequence involves challenges such as significant pixelwise noises (subway), dynamic background of a water fountain (fountain), and reflections and shadow in wide area.

4.1   IMAGE CAPTURING USING WEBCAM

In this module we are capturing the video from webcam using Java Media Framework (JMF) API. JMF is a framework for handling streaming media in Java programs. JMF is an optional package of Java 2 standard platform. JMF provides a unified architecture and messaging protocol for managing the acquisition, processing and delivery of time-based media. JMF enables Java programs to get the video image from web camera
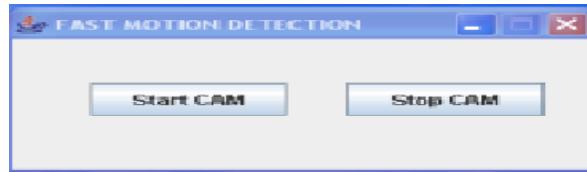
Fig 5 camera control for fast motion detection

4.2   BACKGROUND DETECTION

K-means clustering is a method of cluster analysis which aims to partition observations into k clusters in which each observation belongs to the cluster with the nearest mean. The problem is computationally difficult; however there are efficient heuristic algorithms that are commonly employed that converge fast to a local optimum. These are usually similar to the expectation-maximization algorithm for mixtures of Gaussian distributions via an iterative refinement approach employed by both algorithms. Additionally, they both use cluster centres to model the data, however k-means clustering tends to find clusters of comparable spatial extend, while the expectation-maximization mechanism allows clusters to have different shapes.

Fig 6 capturing frames for test motion detection

4.3 IMAGES STORES IN SERVER

After the background template has been constructed, the background image can be subtracted from the observed image. The result is foreground (moving objects). Actually, the background is timely updated. To classify a new pixel value with respect to its immediate neighborhood in the chosen color space, so as to avoid the effect of any outliers. This motivates us to model each background pixel with a set of samples instead of with an explicit pixel model. and so the current value of the pixel is compared to its closest samples within the collection of samples.

In case of some random disturbances, each pixel will fluctuate in a small range even there is no expected moving objects in the scene. So there must be a strategy to judge it. A threshold is defined in the system. If the difference of one pixel between real time frame and template is more than 10, then add 1 to the threshold. When differences of all pixels in the frame are all calculated, moving objects is thought to appear if the threshold is more then 3 percent of the total number of pixels in the frame.

Fig 7 motion detected images stores in server

4.4 ALERTING SYSTEM

After detecting the changes in video frames, we are alerting the central control unit or the user through SMS using the GSM Modem. A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.
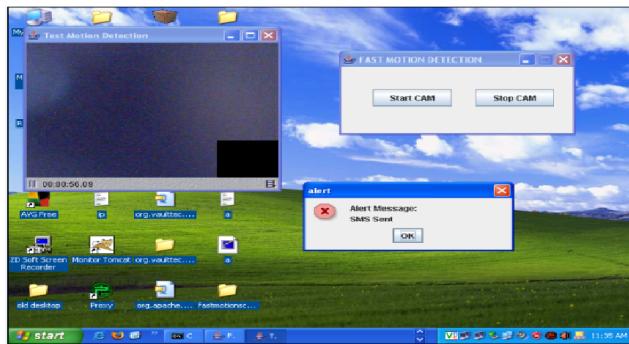
Fig 8 alerting system

After the receiving of SMS by an authorized user, they can view the detected image by GPRS enabled mobile devices.

4.5   COMPARISON BETWEEN HIGH LEVEL COMPUTER VISION APPLICATION WITH SECURITY AND CCTV VIDEO SURVEILLANCE SYSTEM

Features	CCTV Video surveillance system	Background Modelling And Subtraction In High Level Computer Vision Application With Security
Memory	Store's continuously	When object detect in current frame
Human interaction	Needed	Not needed
Alerting features	Not applicable	Applicable by sending SMS
Remote monitoring	Not applicable	Applicable by using GPRS enabled mobile devices

Fig 9 Comparison between High Level Computer Vision Application With Security and CCTV Video surveillance system
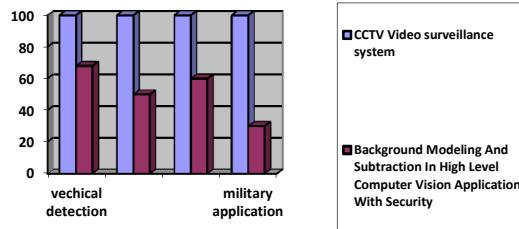
Fig 10 memory consumption between High Level Computer Vision Application With Security and CCTV Video surveillance system in many applications

5   CONCLUSION

We have introduced a multiple feature integration algorithm for background modelling and subtraction, where the background is modelled with a generative method and background and foreground are classified by a discriminative technique. Here we can use background subtraction in many high level computer vision applications, some of the security features enclosed, like SMS generation and remote monitoring using a GPRS enabled mobile phone devices. Our algorithm demonstrates better performance and less storage space than CCTV video surveillance system and the performance is tested quantitatively and qualitatively using a variety of indoor and outdoor video applications.

REFERENCES

[1] A. Elgammal, D. Harwood, and L. Davis, "Non-Parametric Model for Background Subtraction," Proc. European Conf. Computer Vision, pp. 751-767, June 2000.
[2] C. Stauffer and W.E.L. Grimson, "Learning Patterns of Activity Using Real-Time Tracking," IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 22, no. 8, pp. 747-757, Aug. 2000.

[3] B. Han, D. Comaniciu, and L. Davis, "Sequential Kernel Density Approximation through Mode Propagation: Applications to Background Modeling," Proc. Asian Conf. Computer Vision, 2004.

[4] D.S. Lee, "Effective Gaussian Mixture Learning for Video Background Subtraction," IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 27, no. 5, pp. 827-832, May 2005.

[5] Z. Zivkovic and F. van der Heijden, "Efficient Adaptive Density Estimation Per Image Pixel for Task of Background Subtraction," Pattern Recognition Letters, vol. 27, no. 7, pp. 773-780, 2006.

[6] P. Viola and M. Jones, "Rapid Object Detection Using a Boosted Cascade of Simple Features," Proc. IEEE Conf. Computer Vision and Pattern Recognition, pp. 511-518, 2001.

[7] B. Han, D. Comaniciu, Y. Zhu, and L.S. Davis, "Sequential Kernel Density Approximation and Its Application to Real-Time Visual Tracking," IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 30, no. 7, pp. 1186-1197, July 2008.

[8] B. Han and L.S. Davis, "Adaptive Background Modeling and Subtraction: A Density-Based Approach with Multiple Features" Intelligent Video Surveillance Systems and Technology, Y. Ma and G. Qian eds., ch. 4, pp. 79-103, CRC Press, 2010.

الجزائر و المنظمة العالمية للتجارة: العوائق و التحديات

[Algeria and the World Trade Organization: obstacles and challenges]

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ABSTRACT: The aim of this research paper is to provide an overview on the course of negotiations of Algeria to join the World Trade Organization, since more than a quarter century the negotiations remain moving slowly and know sometimes stopping, which made it difficult way for Algeria to join WTO, and The presence of other obstacles like: unstable business environment, and some policies that do not compatible with WTO agreements Did not give enough guarantees for the negotiation parties, and for the bilateral negotiations with the European Union and the United States it seems that will be difficult to reached.

KEYWORDS: Negotiations, Multilateral Trading System, World trade organization, Algeria.

ملخص: تهدف هذه الورقة البحثية في تقديم نظرة على مسار مفاوضات الجزائر للانضمام الى المنظمة العالمية للتجارة، فمنذ أزيد من ربع قرن بقيت المفاوضات تسير بطريقة بطيئة و تعرف في بعض الاحيان توقفات، مما صعب الطريق امام الجزائر، كما أن وجود عراقيل اخرى على غرار بيئة الاعمال الغير مستقرة و بعض السياسات التي لا تتطابق و إتفاقيات المنظمة العالمية للتجارة مثل: الدعم المحلي و رخص الاستيراد و منع استيراد بعض المنتجات لم تعطي ضمانات كافية للاطراف المفاوضة، كما ان المفاوضات الثنائية هي الاخرى خاصة مع دول الاتحاد الاوروبي و الولايات المتحدة الأمريكية ستكون صعبة.

كلمات دلالية: المفاوضات، النظام التجاري متعدد الاطراف، المنظمة العالمية للتجارة، الجزائر.

1 مقدمة

يعتبر تحرير التجارة الدولية أداة هامة لدعم معدلات النمو الاقتصادي و تقليص نسب البطالة، خفض معدلات الفقر و زيادة مساهمة الدول النامية في الاقتصاد العالمي، حيث أن إلغاء أو تقليل الحواجز الغير جمركية و التعريفات الجمركية و دعم التجارة العادلة يمكن من زيادة نفاذ السلع و الخدمات الى الاسواق بشكل غير تمييزي، و هذا ما نجده كهدف للمؤتمر الامم المتحدة للتجارة و العمل و المنبثق عنه الاتفاقية العامة للتعريفة الجمركية و التجارة سنة 1947، كما أن المعاملة الخاصة و التفضيلية التي أقرتها اتفاقيات منظمة التجارة العالمية سنة 1994 تقر بوجوب منح الدول المتقدمة لمعاملة تفضيلية لمنتجات الدول النامية بدون شرط "المعاملة بالمثل"، لهذا سارعت العديد من الدول خاصة النامية للدخول في هذا الفضاء التجاري متعدد الاطراف لرغبتها في الاستفادة من هذه المكاسب.

و كغيرها من الدول النامية سارعت الجزائر لمحاولة الالتحاق بهذا النظام التجاري من خلال الاتفاقية العامة للتعريفة الجمركية و التجارة ثم بعدها المنظمة العالمية للتجارة، خاصة بعد المشاكل الاقتصادية التي بدأت تظهر في أواخر الثمانينات نتيجة الاعتماد المفرط على المحروقات كمصدر وحيد في المبادلات التجارية و تبني الجزائر للاصلاحات الاقتصادي من خلال برامج صندوق النقد الدولي (برنامج التكيف الهيكلي و برنامج التثبيت الاقتصادي)، لكن المفاوضات مع المنظمة العالمية للتجارة عرفت العديد من النكسات خاصة و أن حجم التنازلات التي حاولت بعض الاطراف فرضها تمس العديد من القطاعات الحيوية للجزائر مثل: الطاقة و الخدمات.

و من خلال ما سبق تقديمه سنحاول الاجابة على الاشكالية التالية:

ما هي مراحل المفاوضات مع المنظمة العالمية للتجارة؟ و ما هي أسباب تعطلها؟

و للإجابة على هذا التساؤل سنقوم بالتطرق للنقاط التالية:

- نشأة المنظمة العالمية للتجارة؛
- اتفاقيات المنظمة العالمية للتجارة؛
- مبادئ المنظمة العالمية للتجارة؛
- مسار المفاوضات مع المنظمة العالمية للتجارة؛
- عقبات في طريق الانضمام.

2 نشأة المنظمة العالمية للتجارة

تعود أول محاولات تحرير التجارة العالمية الى نهاية الحرب العالمية الاولى، و بالضبط في الولايات المتحدة الامريكية حيث قدم الرئيس الامريكي مقترح عرف بـ"وثيقة ويلسون" ضمت اربع عشر نقطة، دعت إلى إلغاء الكلي لكل العوائق الاقتصادية والاجراءات التجارية الغير عادلة لكافة الدول من أجل ضمان السلم في العالم والمساهمة في الحفاظ عليه، أما عن أول محاولة لتأسيس هيئة دولية مختصة بالتجارة الدولية فتعود الى ما يعرف بمشروع " جيمس ميد". وكان ذلك في 1 أوت 1942، وقد تضمن المشروع في وثيقته 22 فقرة، حيث تعرض للمشاكل التجارية بعد الحرب العالمية الثانية، وكذا مساهمة المؤسسة الأخرى (على غرار اتحاد المقاصة الدولي) المقترحة لحل هاته المشاكل مثل: خفض القيود الجمركية ومعالجة اختلال ميزان المدفوعات، وتحفيز التوسع في الطلب العام في الأسواق العالمية، حيث يستوجب على إثرها جميع الدول المنضمة للإتحاد بتقديم كافة الترتيبات التجارية التفضلية لجميع الدول الأعضاء وأيضا تقديم ضمانات للحد من القيود التجارية، كما جاء أيضا اقتراح بإنشاء لجنة للتجارة الدولية تقوم بالتحكيم الدولي في المنازعات، ثم جاء المقترح الامريكي بإنشاء منظمة التجارة الدولية في سنة 1946 حيث تم تقديم اقتراح ميثاق لمنظمة التجارة الدولية للجنة الاقتصادية للأمم المتحدة وقد احتوى المقترح على خمس فصول ضمت 79 مادة، حيث تم التطرق للاقتراح العام بشأن المنظمة، وكذا العضوية وسياسة التجارية العامة من خلال الدولة الأولى بالرعاية، المعاملة الوطنية فيما يخص الضرائب واللوائح الداخلية والإجراءات المضادة للاغراق، التقييم الجمركي، تخفيض الرسوم، وإلغاء الاجراءات التفضلية والقيود التجارية الكمية، كما تناول الفصل الاخير مهام المنظمة وهيكلها، المؤتمرات، اللجان و الامانة العامة.

2.1 ميثاق هافانا

يعتبر ميثاق هافانا مرحلة أولية لمحاولة تنفيد الاقتراح الامريكي بإنشاء منظمة دولية للتجارة، حيث إجتمعت 56 دولة في 21 نوفمبر 1947، بعاصمة كوبا هافانا و قد ضلت أشغاله متواصلة إلى غاية 24 مارس 1948، حيث تم الخروج بالوثيقة الختامية لميثاق هافانا و فقد ضمت هذه الاخيرة 106 مادة موزعة على تسع فصول و قد حملت عنوان "ميثاق هافانا-إنشاء منظمة دولية للتجارة"، أما عن أهداف هذه الوثيقة فتتمثل في: [1]

- ضمان حجم متزايد من الدخول الحقيقية، الطلب الفعال، تطوير الانتاج، استهلاك والتبادل الدولي في السلع، والمساهمة بالتالي في تحقيق توازن وتوسع في الاقتصادي العالمي؛
- مساعدة وتحفيز التنمية الصناعية و التنمية الاقتصادية الشاملة، وخاصة فيما يتعلق بالدول التي تشهد بداية لمسيرة التنمية، تشجيع تدفق رؤوس الأموال الدولية الموجهة للاستثمارات المنتجة؛
- تسهيل وصول الدول الأعضاء بشكل متساوي للأسواق و للموارد و عناصر الانتاج التي هي ضرورية لتحقيق الإزدهار والتنمية الاقتصادية؛
- القضاء على التميز في التجارة الدولية والحد من استخدام التعريفات الجمركية وغيرها من الحواجز؛
- السماح لمختلف الدول من إمكانية زيادة تجارتها، وتنمية اقتصادها، وتجنب استخدام معايير تشوه التجارة العادلة، تقلص فرص العمل أو تؤخر التقدم الاقتصادي؛
- تطوير التفاهم المشترك، التشاور و التعاون، وحل المشاكل فيما يخص العمل، التنمية الاقتصادية، السياسة التجارية.

2.2 الاتفاقية العامة للتعريفة الجمركية و التجارة 1947

لقد كان شهر نوفمبر من عام 1946 محطة انطلاق لوضع إطار قانوني لإتفاقيات متعددة الاطراف تهدف الى تحرير التجارة و إرساء مبادئ التجارة العادلة، حيث كان الاجتماع الاول للجنة التحضيرية لمؤتمر الأمم المتحدة للتجارة و العمل بمدينة جنيف في سويسرا، حيث خلص هذا الاجتماع على تبني هدف تحقيق و المحافظة على معدلات الطلب العالمي، التوظيف، التنمية الصناعية، السياسة التجارية العامة من خلال مسألة الدعم و القيود التجارية [2]، لتتوالى بعدها اجتماعات اللجنة التحضيرية للمؤتمر الامم المتحدة للتجارة و العمل في كل من نيويورك في مارس 1947 و جنيف في 30 أوت 1947، لتنتهي بذلك صياغة الاتفاقية العامة للتعريفة الجمركية و التجارة في 4 أكتوبر 1947 بمدينة جنيف خلال الاجتماع الثاني للجنة التحضيرية لمؤتمر الامم المتحدة للتجارة و العمل، و تصدر بعدها الوثيقة الختامية للاتفاقية و برتوكول التطبيق المؤقت Protocole d'application provisoire في 30 أكتوبر 1947 و دخل حيز التنفيذ في 30 جوان 1948، و قد استمر العمل بهذا البرتوكول لأزيد من نصف قرن، أما عن المكاسب التي يمكن تحقيقها من تطبيق الاتفاقية العامة للتعريفة الجمركية و التجارة فيمكن أن نعددها في النقاط التالية:

- تحقيق الرفاهية للشعوب؛
- خفض و إلغاء الحواجز و القيود التي تشوه التجارة الدولية العادلة؛
- تشجيع النفاذ للاسواق الدولية؛
- زيادة مساهمة الدول النامية في التجارة العالمية؛
- المساهمة في تنشيط الطلب العالمي و تحقيق التوظيف الكامل؛
- و وضع ألية لحل المنازعات التجارية من خلال المفاوضات؛
- تحقيق التنمية الاقتصادية على أعلى مستوى.

عرفت الاتفاقية العامة للوثيقة الحركية والتجارة ثماني جولات وذلك منذ سنة 1947 ومؤتمر جنيف إلى غاية جولة الاوروغواي (86-94) والمنبثق عنها المنظمة العالمية للتجارة، و لم تكن الجولات الخمس الاولى بمحطات الهامة في تاريخ الاتفاقية العامة للتعريفة الجمركية و التجارة كونها لم تهدف إلا للحد من التعريفات الجمركية من جهة و عدد الأعضاء المشاركة فيها لم يكن كبير من جهة أخرى.

2.3   المنظمة العالمية للتجارة

لقد تم التوصل الى إنشاء المنظمة العالمية للتجارة عن طريق توصيات الجولة الختامية للاتفاقية العامة للتعريفة الجمركية و التجارة (جولة الاوروغواي1986- 1994) و كان في بداية الامر مقترح كندي ثم تبنته الدول الاوروبية بعد خضوعه لتعديلات، حيث لم يكن الامر سهلا خلال هذه الفترة خاصة بعد الصراع الامريكي-الاوروبي حول ملف الزراعة، حيث مرت الجولة التفاوضية بأصعب مراحلها في كل من مونتريل وكندا و بروكسل في بلجيكا، و قد تم التوصل الى الاتفاق بشأن مشروع مسودة القرار الختامي التي تم التوقيع عليها في افريل 1994 بمدينة مراكش المغربية بمشاركة 123 دولة، و القاضية بإنشاء منظمة دولية تهدف لتحرير التجارة العالمية من العوائق الجمركية، وهي منظمة التجارة العالمية و التي انشئت سنة 1995.

أما عن المهام التي انشئت من أجلها منظمة التجارة العالمية فيمكن إيجازها في اربع عناصر التالية:[3]

- المفاوضات التجارية، حيث تسعى منظمة التجارة العالمية من خلال فتح باب المفاوضات التجارية بين دول الاعضاء الى التوصل الى ارضية اتفاق بشأن العديد من المسائل على غرار التجارة في السلع، من خلال الاتفاقية العامة للتعريفة الجمركية و التجارة سنة 1994، و اتفاقية العامة حول تجارة الخدمات، وكذا اتفاقية جوانب حقوق الملكية الفكرية المتصلة بالتجارة، حيث تتم هذه المفاوضات تحت مضلة المؤتمرات الوزارية التي تجتمع في الغالب مرة كل سنتين لمناقشة المواضيع التي يتم اقتراحها من قبل الاعضاء في الفترة التحضيرية للمؤتمرات؛
- التنفيذ و المتابعة، تسمح هذه الالية بمراقبة مستوى الشفافية بالنسبة للسياسات التجارية للدول الاعضاء، من خلال التدابير و الاجراءات التي تتخذها، كما تخضع السياسات و الممارسات التجارية للدول الاعضاء للمراقبة بشكل دوري من طرف اللجان المختصة على مستوى منظمة التجارة العالمية؛
- تسوية المنازعات، يتم الفصل في المنازعات التجارية بين الاعضاء بشأن عدم الالتزام بالاتفاقات على مستوى لجان تسوية المنازعات، وتعتبر هذه الالية حجر الزاوية بالنسبة لمنظمة التجارة العالمية، لانها تسمح بتطبيق الاتفاقات المبرمة، وتضمن عدم انتهاكها؛
- تدعيم القدرات التجارية، وتشمل الدول النامية و الدول الاقل نموا حيث تتضمن احكاما خاصة تحدد الفترات الزمنية للتكيف مع هذه الاتفاقات، كما تسمح بتقديم الدعم الفني للدول النامية و الاقل نموا، خاصة فيما يتعلق بالبنية التحتية من أجل زيادة قدراتها التجارية .

و لقد شهدت منظمة التجارة العالمية منذ إنشائها سنة 1995، تسعة مؤتمرات وزارية أخرها في بالي بإندونيسيا في ديسمبر 2013 ، وتعتبر المؤتمرات الوزارية حجر الزاوية في مفاوضات الدول الأعضاء، حيث يتم عن طريقها إتخاذ القرارات المتعلقة بالاتفاقات التجارية متعددة الاطراف، حيث تتمتع المؤتمرات الوزارية بالسلطة العليا (Highest Authority)، فمنذ سنة 1996 تاريخ اول مؤتمر وزاري بسنغافورة تم التطرق الى العديد من المواضيع، سواء التقليدية أو الجديدة التي تعرف بمسائل ما بعد سنغافورة و تعتبر جولة الدوحة أو جولة الالفية كما أطلق عليها الجولة التي أسالت الكثير من الحبر، حيث جاءت مباشرة بعد فشل مؤتمر سياتل و التهميش الذي تعرضت له الدول النامية، بالاضافة الى القضايا التي ناقشتها ولعلى أهمها التجارة و التنمية المستدامة.

3   إتفاقيات المنظمة العالمية للتجارة

منذ إنشائها سنة 1994 و دخولها حيز التنفيذ في جانفي 1995، و ضعت المنظمة العالمية للتجارة جملة من الاتفاقيات متعددة الاطراف و المتصلة بالتجارة، حيث شملت العديد من الجوانب مثل: الزراعة، الخدمات و الاستثمار ، و يمكن أن نعددها في مايلي:

3.1   إتفاقية تحرير تجارة السلع

تعتبر اتفاقية تحرير التجارة في السلع من بين الاتفاقيات الاكثر شمولا، حيث عالجت اكثر من 10 مسائل تمس التجارة في السلع، ولقد كانت الزراعة من بين اهم القضايا التي مستها هذه الاتفاقية، بالاضافة الى المنسوجات و الملابس، وكذا مراجعة قواعد الاتفاقية العامة للتعريفة الجمركية و التجارة 1947، و قد شملت الاتفاقية ما يلي:

- الاتفاقية العامة للتعريفة الجمركية و التجارة 1994
- الاتفاق حول الزراعة
- الاتفاق بشأن تدابير الصحة و الصحة النباتية
- الاتفاق بشأن المنسوجات و الملابس
- العوائق الفنية أمام التجارة
- اتفاق الجوانب المتعلقة بالاستثمار و المتصلة بالتجارة
- اتفاق بشأن الدعم و الرسوم التعويضية
- اتفاق حول تراخيص الاستيراد
- اتفاق بشأن الوقاية

3.2   الاتفاقية العامة للتجارة في الخدمات

يمكن اعتبار الاتفاقية العامة للتجارة في الخدمات ثاني أكبر اتفاقية بعد الاتفاقية العامة للتعريفة الجمركية و التجارة، و ذلك لعدد المواضيع المتفق عليها على غرار الخدمات المالية، خدمات النقل الجوي و البحري، و الاتصالات، ولقد بدأت المفاوضات منذ جولة الاوروغواي حيث تعين على جميع الدول تقديم تعهدات معينة في مجال الخدمات، تلزم جميع الاعضاء بتطبيق هذه التعهدات، حيث جاءت هذه الاتفاقية في ثلاث جوانب، أما الجانب الاول فقد اشتمل على الالتزامات و المجالات العامة، كمعاملة الدولة الاكثر رعاية، الشفافية، مشاركة الدول النامية... أما الجانب الثاني فقد تعلق بالتعهدات الخاصة، وهي النفاذ الى الاسواق، المعاملة الوطنية و تعهدات إضافية، أما الجانب الاخير و هو التحرير التدريجي للتجارة في الخدمات، و تخص القيود و الشروط المتعلق بالنفاذ الى الاسواق، و كذا شروط المعاملة الوطنية، التعهدات المتصلة بالالتزامات الاضافية و تاريخ دخول الاتفاقية حيز التنفيذ و تنفيذ الالتزامات.

3.3   اتفاقية الجوانب الملكية الفكرية المتصلة بالتجارة

و قد ضمنت الاتفاقية ثمانية جوانب تخص الملكية الفكرية وهي:

- حقوق المؤلف.
- العلامات التجارية.
- المؤشرات الجغرافية.
- التصميمات و النماذج الصناعية.
- براءات الاختراع.
- الرسومات الطبوغرافية للدوائر المتكاملة.
- حماية المعلومات الغير مفصح عنها.
- مراقبة الممارسات المنافية للمنافسة في التراخيص التعاقدية.

3.4   تسوية المنازعات

وردت هذه الاتفاقية في الملحق رقم 2 من الاتفاقيات التجارية متعددة الاطراف، و ضمن 27 مادة، حيث تم بموجب هذه المذكرة تأسيس هيئة تسوية المنازعات على مستوى المنظمة تؤكل لها مهام إنشاء اللجان و كذا اعتماد تقارير الفرق و هيئات الاستئناف، بالاضافة الى تنفيذ القرارات و التوصيات.
أما عن اجندة سير عملية التسوية فهي تمتد على عدة مراحل: [4]

- استلام أولى المذكرات المكتوبة: الطرف الشاكي من 3 الى 6 اسابيع
  الطرف المشتكي من 2 الى 3 اسابيع
- تاريخ و مكان اول اجتماع مع الاطراف: من أسبوع الى أسبوعين.
- تسلم الردود المكتوبة من الاطراف: من اسبوعين الى 3 اسابيع.
- تاريخ و مكان ثاني اجتماع: من اسبوع الى اسبوعين
- صدور الجزء الوصفي من التقرير: من اسبوعين الى 4 اسابيع.
- استقبال الملاحظات على الجزء الوصفي من التقرير : اسبوعين.
- صدور التقرير المؤقت: من اسبوعين الى 4 اسابيع.
- طلب المراجعة: اسبوع واحد.
- فترة المراجعة: اسبوعين.
- التقرير النهائي: اسبوعين.
- توزيع التقرير على الاعضاء: 3 اسابيع.

3.5   مراجعة السياسات التجارية

الهدف من آلية مراجعة السياسة التجارية هي المساهمة في تنفيذ جميع التزامات الدول الاعضاء بالقواعد المنصوص عليها في الاتفاقيات التجارية متعددة الاطراف، و بالتالي تسهيل عملها و فهم افضل لسياسات و الممارسات التجارية للدول الاعضاء بفضل الشفافية و الحوكمة، فآلية مراجعة السياسة التجارية "تسمح بالتقدير و التقييم الجماعي و على أساس منتظم لمختلف السياسات و الممارسات التجارية للدول الاعضاء و تأثير ذلك على النظام التجاري متعدد الاطراف" [5].

3.6   الاتفاقيات التجارية الجماعية

تعتبر الاتفاقيات التجارية الجماعية إمتداد لاتفاقيات جولة طوكيو و قد شملت الاتفاقيات اربع محاور، و تتميز بأنها ليست ملزمة للأطراف الغير مصادق عليها، و هي:

- اتفاق بشأن تجارة الطائرات المدنية؛
- اتفاق بشأن المشتريات الحكومية؛
- الاتفاق الدولي في قطاع الالبان؛
- الاتفاق الدولي للحوم الابقار.

4   مبادئ المنظمة العالمية للتجارة

ان هدف الاتفاقية العامة للتعريفة الجمركية و التجارة هو تحرير التجارة العالمية في مجال السلع و الخدمات و ذلك بتخفيض الرسوم الجمركية و إلغاء القيود الكمية من اجل تشجيع التبادلات التجارية و بالتالي تحقيق التنمية الاقتصادية، و من اجل تحقيق هذا الهدف تم وضع مبادئ عامة لهاته الاتفاقية و هو ما تضمنته الوثيقة النهائية للاتفاقية العامة للتعريفة الجمركية الجزئية سنة 1947 و اهم هذه المبادئ هي:

- **المعاملة العامة للدولة الاولى بالرعاية**
  و هو المبدأ الاول الذي نصت عليه المادة الاولى في الجزء الاول من الوثيقة النهائية من الاتفاقية العامة للتعريفة الجمركية و التجارة [6]، حيث لا يحق لأي طرف من الاعضاء المتعاقدة منح تفضيلات لدولة على حساب دولة اخرى، بحيث ان اي مزايا، تفضيلات و امتيازات يمنحها طرف متعاقد لمنتج ذو منشأ محلي لدولة اخرى، يجب ان يمنح لكل منتج مشابه لكافة الدول الاعضاء دون قيد او شرط، و على العموم هذه التفضيلات تشمل الرسوم الجمركية، و مهما كانت طبيعتها على

الاستيراد و التصدير، التحويلات الدولية لرؤوس الاموال، و كذا جميع المسائل التي وردت في المادة الثالثة، فيما استثنت الاتفاقيات التفضيلية التي وردت في الملاحق (أ-ب-ج-د-ه-و) و ذلك لبعض المنتجات فقط.

- **المعاملة الوطنية**

و جاء هذا المبدأ في الجزء الثاني من وثيقة الاتفاقية العامة للتعريفة الجمركية، و ذلك في المادة الثالثة، تحت بند المعاملة الوطنية فيما يخص الضرائب و اللوائح الداخلية، حيث لا يجب على اي دولة متعاقدة فرض ضرائب او رسوم داخلية، قوانين تخص البيع، الشراء، النقل و التوزيع او استعمال المنتج في الاسواق الداخلية او نسب معينة لبعض المنتجات المستورد بهدف حماية الانتاج الوطني، كما ان منتجات الدول الاعضاء المستوردة من دول اخرى عضو لا يمكن ان تفرض عليها رسوم او ضرائب سواء بشكل مباشر او غير مباشر، مهما كانت طبيعة الرسوم بشكل اعلى من تلك التي تفرض على المنتجات الوطنية المشابهة، كما لا يمكن ان تمنح لها معاملة اقل تفضيلية من تلك التي تمنح لمنتج محلي.

- **تحرير التجارة و دعم التجارة العادلة**

لقد جاءت العديد من الدراسات السابقة لتبين دور الاتفاقية العامة للتعريفة الجمركية و التجارة في تحرير التجارة الدولية، ورغم ان هذه الدراسات لم تشر الى تحرير التجارة كمبدأ من مبادئ الاتفاقية العامة للتعريفة الجمركية، لكنها اشارت الى العديد من المبادئ التي ترتبط ضمنيا بتحرير التجارة مثل "مبدأ استخدام الرسوم الجمركية كوسيلة وحيدة للحماية، حظر الاجراءات التقييدية الكمية، محاربة سياسة الاغراق"، و لابد الاشارة هنا الى ما ورد الجزء الثاني من الاتفاقية العامة للتعريفة الجمركية في موادها الخامسة، السادسة، الحادية عشر، السادسة عشر، ففي المادة الخامسة التي تضمنت حرية النقل العبور " freedom of transit "

و التزمت الدول المتعاقدة على ضمان حرية العبور للسلع التي تجتاز الحدود الدولية سواء حدثت مع او بدون تخزين للسلعة و اعادة شحنها، و لا يجوز التمييز فيما بينها بناءا على مكان المنشأ، الوجهة، او ملكية وسيلة النقل، و يجب ان تكون الرسوم او اللوائح التنظيمية المفروضة على حركة العبور معقولة [7] .

كما التزمت المادة السادسة المتعلقة بمكافحة الاغراق و الرسوم التعويضية في الاتفاقية العامة للتعريفة الجمركية و التجارة سنة 1947 على وجوب الاطراف المتعاقدة عدم ممارسة سياسة اغراق تسبب او تهدد بإلحاق ضرر مادي للصناعة المحلية او تعيق بطريقة مباشرة في انشاء فرع للصناعة المحلية، و يتحقق الاغراق كما سبق و ان تعرضنا اليه، إذا كان سعر هذا المنتج اقل من السعر المماثل المطبق في المعاملات التجارية الدولية لمنتج مشابه موجه للاستهلاك في البلد المصدر، او في حالة كان اقل من تكاليف الانتاج للمنتج في البلد المنشأ، و يحق للدول الاعضاء حسب نفس المادة فرض ضريبة على المنتجات الموجهة للإغراق و ذلك بهدف تعويض و منع الاغراق بشريطة ان لا تتجوز هذه الضريبة هامش الاغراق، و في حالة وجود دعم لمنتج معين يمكن فرض رسوم على هذا المنتج و تسمى هذه الرسوم ب "الرسوم التعويضية" Contervailing Duties (CVDs)

أما فيما يخص إلغاء القيود الكمية فقد نصت المادة الحادية عشر من الاتفاقية على فرض إلغاء الحظر أو القيود على استيراد اي منتج لدول الاعضاء، مثل تراخيص الاستيراد أو التصدير، أو نظام الحصص، رغم وجود بعض الاستثناءات و التي حملتها المادة الثانية عشر و الخاصة بالقيود الموجهة لحماية الميزان التجاري و أيضا المعاملة الممنوحة للدول النامية و المنصوص عليها في المادة الثامنة عشر و ذلك لدعم جهود التنمية الاقتصادية في تلك الدول.

- **الشفافية**

و نعني بالشفافية إلتزام الدول الاعضاء نشر و تطبيق اللوائح المتعلقة بالتجارة و ذلك وفقا للمادة العاشرة، هذه الاخيرة نصت على أن القوانين و الانظمة و الاحكام التشريعية، القرارات الادارية السارية المفعول و التي قد تؤثر على حركة و اتجاه التجارة مثل التقييم الجمركي، معدل الرسوم و كذا القيود المتعلقة بالاستيراد و التصدير يجب ان تكون محل نشر على وجه السرعة و على نطاق واسع لتمكين الاطراف التجارية من الاطلاع عليها، كما يجب على الدول المتعاقدة نشر التدابير و الاجراءات المتصلة بالتجارة قبل دخولها حيز النفاذ.

- **التنمية الاقتصادية**

و يعتبر تحقيق التنمية الاقتصادية في الدول النامية خاصة أحد أهم مبادئ الاتفاقية العامة للتعريفة الجمركية و التجارة، حيث جاء في الجزء الرابع من الاتفاقية تحت عنوان "التجارة و التنمية"، مبادئ و أهداف و كذا تعهدات الاطراف المتعاقدة، و قبلها في المادة الثامنة عشر الدعم التي تقدمه الدولة لصالح التنمية الاقتصادية، كما أشارت المادة السادسة و الثلاثون الى أن الاهداف الانمائية لهذا الاتفاق تتمثل في رفع مستويات المعيشة وتطوير اقتصاديات الدول الاعضاء، كما أن عائدات التصدير للاطراف المتعاقدة خاصة الدول النامية و الاقل نموا يمكن أن تلعب دورا هاما في التنمية الاقتصادية، و تعتبر التجارة الدولية أداة تقدم اقتصادي و اجتماعي مثلما أشارت لذلك الفقرة (ه) من نفس المادة.

5 مسار المفاوضات مع المنظمة العالمية للتجارة

تعتبر الجزائر من الدول القليلة التي شهدت أطول مراحل مفاوضات مع المنظمة العالمية للتجارة، فكرونولوجيا المفاوضات تعود الى تاريخ 3 جوان 1987 تاريخ تقديم أول طلب للانضمام الى الاتفاقية العامة للتعريفة الجمركية و التجارة، و بعدها تشكيل مجموعة العمل المكلفة بدراسات طلب الانضمام في 17 جوان 1987، لكن و مع إنشاء المنظمة العالمية للتجارة و دخولها حيز التنفيذ في جانفي 1995، تم تحويل الملف الى المنظمة العالمية للتجارة، و لقد قدمت الجزائر أول مذكرة للسياسة التجارية في 11 جويلية 1996، و قد ضمت ستة محاور أساسية:[8]

- **الاقتصاد، السياسة الاقتصادية و التجارة الخارجية**: و قد ضمت عرض تفصيلي للوضعية الاقتصادية، السياسة الاقتصادية و أهدافها، السياسة النقدية و سعر الصرف، سياسة ترقية الاستثمار، مستوى الاسعار و المنافسة...
- **إطار لوضع و تنفيذ السياسات المؤثرة على التجارة الخارجية**: و شملت صلاحيات السلطات التنفيذية، التشريعية و القضائية، الهيئات الحكومية المسؤولة على إعداد و تنفيذ السياسات التجارية، التشريعات و القوانين...
- **السياسة المؤثرة على التجارة في السلع**: لوائح الاستيراد، التصدير، السياسات المحلية بشأن تجارة السلع و الزراعة، ....
- **السياسة التجارية للملكية الفكرية**: و تمس تطبيق معاملة الدولة الاكثر رعاية، التدابير فيما يخص منع إساءة استخدام حقوق الملكية الفكرية، قائمة للوائح و التشريعات التي تتناول الملكية الفكرية...
- **السياسة التجارية للخدمات**: و تشمل القواعد العامة للتجارة في الخدمات بالاضافة الى القوانين و التشريعات المتعلقة بها...

- **القواعد المؤسساتية للعلاقات الاقتصادية و التجارية مع الدول الاخرى**: و تشمل الاتفاقيات الثنائية و الجماعية المتعلقة بالتجارة الخارجية للسلع و الخدمات، اتفاقيات الاندماج الاقتصادي، الاتحاد الجمركي...

بعد ذلك قامت الجزائر بالإجابة على أكثر من 500 سؤال و تقديم توضيحات لفريق العمل و كان ذلك في 14 جويلية 1997، لتجتمع بعد ذلك مع فريق العمل في أول جولة في 22 و 23 افريل 1998، و ذلك بعد الاجابة على الاسئلة الاضافية في 22 جانفي 1998، و لم تحمل الجولة الاولى أي تقدم بل كانت مجرد جولة لجس النبض، خاصة و أن الجزائر مازالت في مرحلة تجسيد الاصلاحات الاقتصادية.

و بعد اربع سنوات إجتمع فريق العمل في جولته الثانية لتتبعه جولتان في نفس السنة، لكنها لم تأتي بالجديد، و قد قدمت الجزائر في أكتوبر من نفس السنة مذكرة ثانية لسياسة التجارية و إجابات عن تساؤلات إضافية بالاضافة الى معلومات حول القطاع الزراعي، الخدمات، العوائق الفنية أمام التجارة، معايير الصحة و الصحة النباتية، حقوق الملكية الفكرية، و قد شهدت المفاوضات نوع من التقدم الى غاية سنة 2008، حيث شهد مسار المفاوضات الجولة العاشرة و بالضبط في 17 جانفي 2008، قبل أن تتوقف المفاوضات الى غاية السنة الفارطة، حيث إجتمع فريق العمل في جولته الحادية عشر في 5 أفريل 2013 بعد تقديم الجزائر توضيحات إضافية و كذا خطة العمل التشريعية في جانفي 2013، و قد شهدت هذه الجولة تقدم ملحوظ في العديد من المجالات فيما بقيت محاور أخرى لم يتم التوصل الى اتفاق مثل: الخدمات، الملكية الفكرية، سياسات الدعم، الاستثمار، أما فيما يخص المفاوضات الثنائية فقد انهت الجزائر المفاوضات مع كل من كوبا، فنزويلا، البرازيل و الاورغواي، سويسرا و الارجنتين فيما تبقى المفاوضات مستمرة مع 13 بلد أخر.

و من المنتظر أن تعقد الجولة الثانية عشر مع نهاية شهر مارس من هذه السنة، حيث تم تقديم توضيحات جديدة بالاضافة الى مخطط الاصلاحات التشريعية، هذه الجولة ستكون متبوعة بسلسلة من الاجتماعات الثنائية مع كل من كندا، أندونيسيا، ماليزيا، نيوزيلندا، تركيا و كوريا الجنوبية [9].

تواجه الجزائر العديد من التحديات تعرقل سعيها للانضمام الى المنظمة العالمية للتجارة، سواء من حيث تقديم ضمانات كافية للدول الشريكة في المفاوضات الثنائية أو الدول المشكلة لمجموعة العمل، ففي ما يخص المفاوضات الثنائية تم الاتفاق بعض الاطراف و في مجملها دول امريكا الجنوبية و من المنتظر بدأ المفاوضات مع بعض دول قارة أسيا في انتظار الدول العربية و الاتحاد الاوروبي و امريكا، و تبقى الامور معقدة بعض الشيء فيما يخص التعريفات الجمركية المطبقة، حيث أن متوسط التعريفات الجمركية المطبقة على واردات الاتحاد الاوروبي هو 12 بالمائة في حين متوسط التعريفة الجمركية المطبقة على الدول العربية هي 20 بالمائة و باقي الدول هي 16 بالمائة، و هو ما يتناقض مع أحد مبادئ المنظمة العالمية للتجارة هو مبدأ معاملة الدولة الاكثر رعاية.

كما تواجه الجزائر بعض الاشكالات في العديد من القضايا مثل: الاستثمار، الدعم و حقوق الملكية الفكرية.

بالنسبة لقضايا المتعلقة بالاستثمار و المتصلة بالتجارة، فقد قدمت الجزائر توضيح بشان حقوق الملكية الفكرية في 22 أفريل 2002، حيث شمل 121 بند و تبقى بعض الاشكاليات قائمة مثل: فعالية التشريعات في حفظ الملكية الفكرية، كما يبقى القطاع الزراعي يطرح إشكال أمام المفاوضات، حيث و منذ سنة 1998 قدمت الجزائر عشر مقترحات و توضيحات كان أخرها في 14 جوان 2013، حيث تم تقديم توضيحات بشأن الدعم المحلي و دعم الصادرات للقطاع الزراعي.

الجدول 1: العروض و المراجعات في قطاع الزراعة

العروض و المراجعة	التاريخ
العرض الاول	30 جانفي 1998
العرض الثاني	8 افريل 2002
مراجعة	19 افريل 2004
مراجعة	18 ماي 2004
مراجعة	28 جانفي 2005
مراجعة	14 فيفري 2013
مراجعة	05 جوان 2013

و بالنسبة للجانب التشريعي المرتبط بالتجارة الخارجية فيبقى يشكل عقبة في طريق الانضمام بسبب عدم وضوح التشريعات و تناقضها في بعض الاحيان مع بعض بنود اتفاقيات منظمة التجارة العالمية، حيث تم مراجعة التشريعات التي تمس التجارة الخارجية في 26 فيفري 2014.

و بخصوص مسألة النفاذ الى الاسواق، ففي الجانب المتعلق بالتجارة في السلع، قدمت الجزائر العرض الاولي في 8 فيفري 2002، لتتبعه عرض إضافي في 18 نوفمبر 2013، حيث تبقى بعض النقاط عالقة مثل: العوائق الفنية امام التجارة، معايير الصحة و الصحة النباتية بالاضافة الى تراخيص الاستيراد و التقييم الجمركي،

الجدول 2: العروض و المراجعات في مجال تجارة السلع

العروض و المراجعات	التاريخ
العرض الاولي	8 مارس 2002
مراجعة	18 سبتمبر 2003
مراجعة	05 نوفمبر 2007
مراجعة	17 ديسمبر 2012
مراجعة	01 فيفري 2013
مراجعة	18 نوفمبر 2013

أما فيما يخص التجارة في الخدمات فهي الاخرى تشكل تحدي أمام الانضمام الى المنظمة حيث قدمت الجزائر في أكتوبر الماضي مراجعة حول التجارة في الخدمات، فمنذ تحويل ملف الجزائر الى فريق العمل على مستوى المنظمة العالمية للتجارة و على مدار 19 سنة قدمت الجزائر 222 منها 31 وثيقة خاصة بالأجوبة و التوضيحات.

الجدول 3: العروض و المراجعات في تجارة الخدمات

التاريخ	العروض و المراجعات
8 مارس 2002	العرض الاولي
22 مارس 2002	مراجعة
22 افريل 2002	معلومات حول السياسات المؤثرة على التجارة في الخدمات
11 نوفمبر 2002	مراجعة
17 سبتمبر 2003	مراجعة
15 جوان 2004	مراجعة
18 جانفي 2005	مراجعة
06 نوفمبر 2007	مراجعة
25 اكتوبر 2013	مراجعة

6 خاتمة

إن طريق الانضمام الى المنظمة العالمية للتجارة يبقى على الارجح طويلا و شاقا خاصة في الوقت الحالي و الذي يشهد فيه العالم بطئ في معدلات النمو و صراع على الاسواق الخارجية خاصة بين الولايات المتحدة الامريكية و الاتحاد الاوروبي، و تعتبر الجزائر الدولة الوحيدة تقريبا التي استمر مسار مفاوضاتها أكثر من ربع قرن، و يعتبر كل من الجانب التشريعي للتجارة الخارجية بالاضافة الى التجارة في الخدمات و التجارة في السلع و الدعم المحلي و دعم الصادرات للمنتجات الزراعية و الاستثمار من القضايا التي تعترض طريق الجزائر للانضمام الى المنظمة العالمية للتجارة، خاصة و أنها مازلت على طاولة المفاوضات ليومنا هذا.

ففي مجال التجارة في الخدمات تشكل الخدمات البنكية و الفندقية و خدمات الاتصال و السمعي البصري العائق الاكبر أمام التوصل الى إتفاق، أما في مجال التجارة في السلع فبعض القضايا مثل الرسوم الجمركية و التقييم الجمركي، القيود الكمية أمام الصادرات و الواردات، الوقاية مازالت تثير حفيظة أعضاء فريق العمل، أما في ما يخص الجوانب التجارية المتعلقة بحقوق الملكية الفكرية، فالتصاميم الهندسية و الحقوق المجاورة مازال ينتابها بعض الغموض، كما أن الجوانب المتعلقة بالاستثمار و المتصلة بالتجارة فهي الاخرى تلعب دور أساسي يحول دون إنضمام الجزائر الى المنظمة العالمية للتجارة و ذلك بسبب بعض القوانين المقيدة لحرية الاستثمار مثل: قاعدى51/49 و كذا شرط المكون المحلي أو حدود التصدير،كما أن بعض مبادئ المنظمة مازالت غامضة في التشريع الجزائري مثل: الشفافية و معاملة الدولة الاكثر رعاية.

لكن يجب أن لا نوهم أنفسنا بأن الانضمام الى المنظمة العالمية للتجارة سوف يحل المشاكل الاقتصادية التي تعاني منها الجزائر، بل قد تكون نتائجه وخيمة على بعض القطاعات مثل: الزراعة و الخدمات، فالامثلة كبيرة اليوم لدول تعتمد على صادراتها النفطية بشكل كبير و رغم دخولها في هذا الاطار المتعدد الاطراف إلا أنها مازالت نعاني من مشاكل كبيرة في إقتصادياتها.

REFERENCES

[1]   Commission Intérimaire de l'organisation international du commerce, Acte final et documentes connexes, Conférence des nation unies sur le commerce et l'emploi (la havane, cuba, du 21 novembre 1974 au 24 mars 1948), E/conf.2/78, New York, USA, avril 1948, p12.

[2]   United Nations, United Nations Economic and Social Council, Report of The First Session of the Preparatory Committee Of UN Conference on Trade and Employment, UN Secretariat, E/PC/T/33, New York, USA, November 1946.

[3]   OMC, comprendre l'OMC, Ce que nous faisons, site de l'OMC, site de l'OMC :

[4]   http://www.wto.org/french/thewto_f/whatis_f/what_we_do_f.htm (31:03:2013, 03:28 GMT).

[5]   OMC, Accords général sur les tarifs douaniers et le commerce 1994, Annexe 2, Mémorandum D'accord sur les règles et procédures régissant le règlement des différends, secrétariat du l'OMC, Genève, 1994, p 420.

[6]   OMC, Accords générales sur les tarifs douaniers et le commerce 1994 , Annexe2, Mécanisme d'examen des politiques commerciales, secrétariat du l'OMC, Genève, 1994, sans pages.

[7]   United Nations, General Agreement On Tariffs And Trade, United Nation Secretary, UN Treaty Series, NY, USA, 1950, p 196.

[8]   GATT, Acte Finale De l'Accord Général Sur Les Tarif Douaniers Et Le Commerce, Secrétariat De GATT, Genève, 1947, p-p : 9-10.

[9]   OMC, ACCESSION DE L'ALGERIE, Aide-mémoire sur le régime de commerce extérieur, WT/ACC/DZA/1, 11 juillet 1996.

[10] APS, Accession de l'Algérie à l'OMC: le 12e round des négociations fin mars à Genève, Economie, Mercredi, 12 Mars 2014 13:04.

[11] http://www.aps.dz/fr/economie/2807-accession-de-l-alg%C3%A9rie-%C3%A0-l-omc-le-12e-round-des-n%C3%A9gociations-fin-mars-%C3%A0-gen%C3%A8ve

COMPUTATIONAL SYNTHETIC PEPTIDE VACCINE DESIGNING AGAINST GASTROENTERITIS DISEASE THROUGH REVERSE VACCINOLOGY APPROACH

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ABSTRACT: Aeromonas hydrophila subsp. Dhakensis a causative agent of gastroenteritis disease present in Diarrheal faeces. Computational research for peptide vaccine against aeromonal protein has been Published. In this study, the complete genome sequence of a virulent Aeromonas hydrophila strain was retrieved from genomic database. We screened the genome and identify the protein which was least similar to the human. Antigen determinant peptide was predicted with different databases and ASA calculation. Identified antigen was designed 3D model and simulation was performed in discovery studio from the docking study. We identify LATL determinant were the best peptide having CDocker energy 76.1367Kcal/mol. As this peptide was transmembrane protein it can be best potential vaccine.

KEYWORDS: Peptide vaccine, Epitope design, Gastroenteritis, Docking, minimization and Reverse vaccinology.

INTRODUCTION

Gastroenteritis is a diarrheal disease that occurs from bacteria as well as viruses. Bacteria like Aeromonas hydrophila subsp. Dhakensis infection Resulting in some combination of diarrhea, vomiting and abdominal pain and cramping. It is estimated that three to five billion cases of gastroenteritis occur globally on an annual basis, primarily affecting children and those in the developing world. It resulted in about 1.3 million deaths in children less than five as of 2008, with most of these occurring in the world's poorest nations.

Gastroenteritis has many causes, Viruses and bacteria are the most common. The infectious agents can come from outside your body or internally from some abnormal condition. For example, both normal and disease-causing intestinal bacteria may grow when antacids or other medication alter the stomach acidity. Viruses and bacteria are very contagious and can spread through contaminated food or water. In up to 50% of diarrheal outbreaks, no specific agent is found. Improper hand washing following a bowel movement or handling a diaper can spread the disease from person to person. Gastroenteritis caused by viruses may last 1-2 days. On the other hand, bacterial cases can last a week or more.

Reverse Vaccinology:

The process of vaccine discovery starts in Insilco using the genetic information rather than the pathogen itself, this novel process can be named as reverse vaccinology. The reverse approach to vaccine development takes advantage of the genome sequence of the pathogen. The genome sequence provides at once a catalog of virtually all protein antigens that the pathogen can express at any time. As this approach starts from the genomic sequence, by computer analysis, predicts those antigens that are most likely to be vaccine candidates.

MATERIALS AND METHOD

To identify the Aeromonas pathogenic protein sequence for their antigenic properties the bioinformatics tools are used. The complete protein sequence of Aeromonas hydrophila subsp. Dhakensis was extracted from JCVI CMR (TIGRhttp://www.tigr.org) in the FASTA format. SDSC biological workbench is used for the purpose of screening the complete protein sequence. The least identity of the protein sequence was found by screening the protein sequence. The protein sequence which having least identity is used to find the epitope. The antigenic determinants (epitope) are found out by using EMBOSS antigenic. MAPPP (MHC-I Antigenic Peptide Processing Prediction) is used for binding prediction and proteasome cleavage prediction. This help to predict possible antigenic peptides to be processed and finally presented on the cell surfaces. The antigenic determinant having greater ASA (Accessible surface area) value is chosen to design a molecule by using discovery studio 2.5.

RESULT AND DISCUSSION

Screening:- The screening of protein sequence of Aeromonas hydrophila subsp. Dhakensis is done and the sequence having accession number AFH09486**.1** had least identity 25.484% is found. The sequence having least identity is chosen and used for finding antigenic determinants using Emboss Antigenic.

Identification of Epitope: The ASA values of the antigenic determinants were calculated. The antigenic determinant having greater ASA value is selected (Table 1). The result is compared with the MAPPP results for the binding of MHC 1 molecule (Table.3 & 4). The selected antigenic determinant is used to design the structure of epitope.

Minimization: The designing and minimization of MHC molecule is done by using Discovery studio 2.5. The epitope LATLKADVQLGVD is designed. The minimization energy of MHC molecule is found to be -28014.32249

Docking:- Docking is a method which predicts the preferred orientation of one molecule to a second when bound to each other to form a stable complex. Knowledge of the preferred orientation in turn may be used to predict the strength of association or binding affinity between two molecules. The epitope molecule is docked with MHC I molecule successfully is shown in the figure given below. The epitope molecule docked with MHC-I molecule successfully this shows that MHC I molecule represent the epitope to B cells. Cdocker energy of the interaction was found to be 76.1367Kcal/mol.

Emboss Result(Table .1)

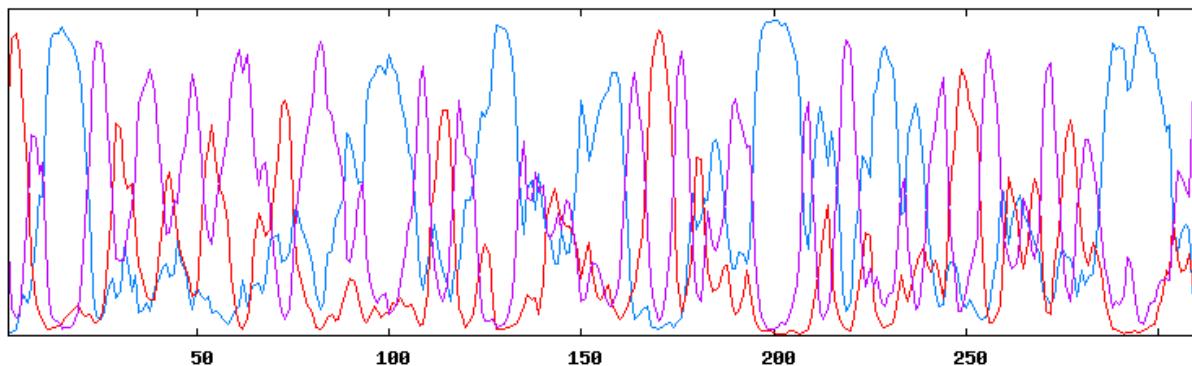**#Sequence : AFH09486.1**

Score 1.123 length 13 at residues 296->308

```
                *
Sequence: LATLKADVQLGVD
          |        |
        296      308
Max_score_pos: 307
ASA:30.76
```

Antigenic plot for sequence

**(Table.2) There are 13 antigenic determinants in your sequence:**

N	Start Position	Sequence	End Position
1	12	IGQALALLLKN	22
2	26	AGSELSLYDIAPVTPGVAVDLSHIPTDVKVKG	57
3	63	PSPALVGADVVLISAGVAR	81
4	97	IVKNLVEKCAASCPKALIGIIT	118
5	121	VNTTVAIAAEVLKKAGV	137
6	142	RLFGVTTLDVIRAETFVAE	160
7	162	KGLNVDKVRVNVIGGHSGVTILPLLSQ	188
8	210	GTEVVEA	216
9	227	MGQAACRFGLSLIK	240
10	247	NVIECAYV	254
11	260	HATFFAQPILLG	271
12	274	GVETVLDYGKLSA	286
13	295	M**LATL**KADVQLGV	307

MAPPP

Query parameters	
Start with	Protein cleavage
Cleavage algorithm	FRAGPREDICT
Min. residue cleavage prob.	0.6
Min. fragment cleavage prob.	0.6
MHC binding matrices	SYFPEITHI
MHC type(s)	ALL
Min. binding score	0.6
Weight (cleavage:binding)	5:5

Query results							
Protein position	**Length**	**Sequence**					
Epitope	**Position**	**MHC type**	**n-mer**	**Overall score**	**Cleavage Probability**	**MHC binding score**	**Group**
0..310	311	MKVAVLGAAGGIGQALALLL..MDGMLATLKADIQLGVDFVK					
NRLPAGSEL	21	HLA_B_2705	9	0.8347	0.9937	0.6757	n-term. trimmed
NRLPAGSEL	21	HLA_B_2705	9	0.8378	1.0000	0.6757	n-term. trimmed
LPAGSELSL	23	HLA_B_0702	9	0.8571	1.0000	0.7143	same length
LPAGSELSL	23	H2_Ld	9	0.8871	1.0000	0.7742	same length
LPAGSELSL	23	HLA_B_0702	9	0.8388	0.9634	0.7143	c-term. trimmed
LPAGSELSL	23	H2_Ld	9	0.8688	0.9634	0.7742	c-term. trimmed
LPAGSELSL	23	HLA_B_0702	9	0.8571	1.0000	0.7143	c-term. trimmed

LPAGSELSL	23	HLA_B_0702	9	0.8571	1.0000	0.7143	c-term. trimmed
LPAGSELSL	23	H2_Ld	9	0.8871	1.0000	0.7742	c-term. trimmed
SELSLYDI	27	H2_Kk	8	0.8833	1.0000	0.7667	trimmed twice
APVTPGVAV	35	HLA_B_0702	9	0.8566	0.9988	0.7143	n-term. trimmed
NINAGIVKNL	91	HLA_A_0201	10	0.8234	0.9997	0.6471	n-term. trimmed
GIITNPVNTT	114	HLA_A_0201	10	0.8235	1.0000	0.6471	n-term. trimmed
EVLKKAGVY	129	HLA_A3	9	0.8256	1.0000	0.6512	trimmed twice
EVLKKAGVY	129	HLA_A3	9	0.8256	1.0000	0.6512	c-term. trimmed
RRLFGVTTL	140	HLA_B_2705	9	0.9324	1.0000	0.8649	n-term. trimmed
RRLFGVTTL	140	HLA_B_2705	9	0.9324	1.0000	0.8649	trimmed twice
AEAKGLNV	158	H2_Kk	8	0.8667	1.0000	0.7333	n-term. trimmed
TILPLLSQI	180	HLA_A_0201	9	0.8470	0.9995	0.6944	c-term. trimmed
TVLDYGKL	276	H2_Kb	8	0.8534	0.9971	0.7097	c-term. trimmed
AMDGM**LATL**	290	HLA_A_0201	9	0.9167	1.0000	0.8333	n-term. trimmed
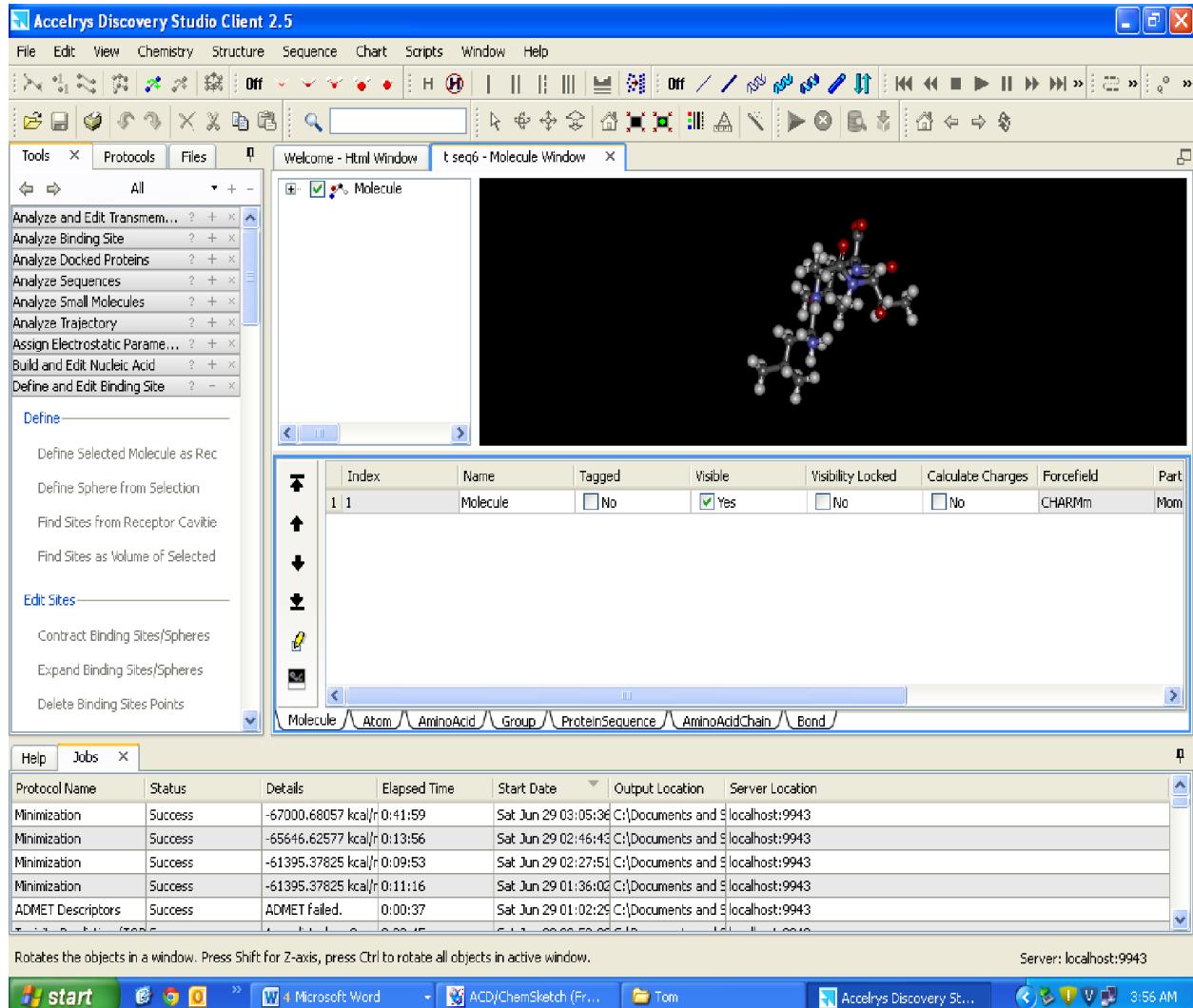
(Fig.1)Minimization of Antigenic Epitope
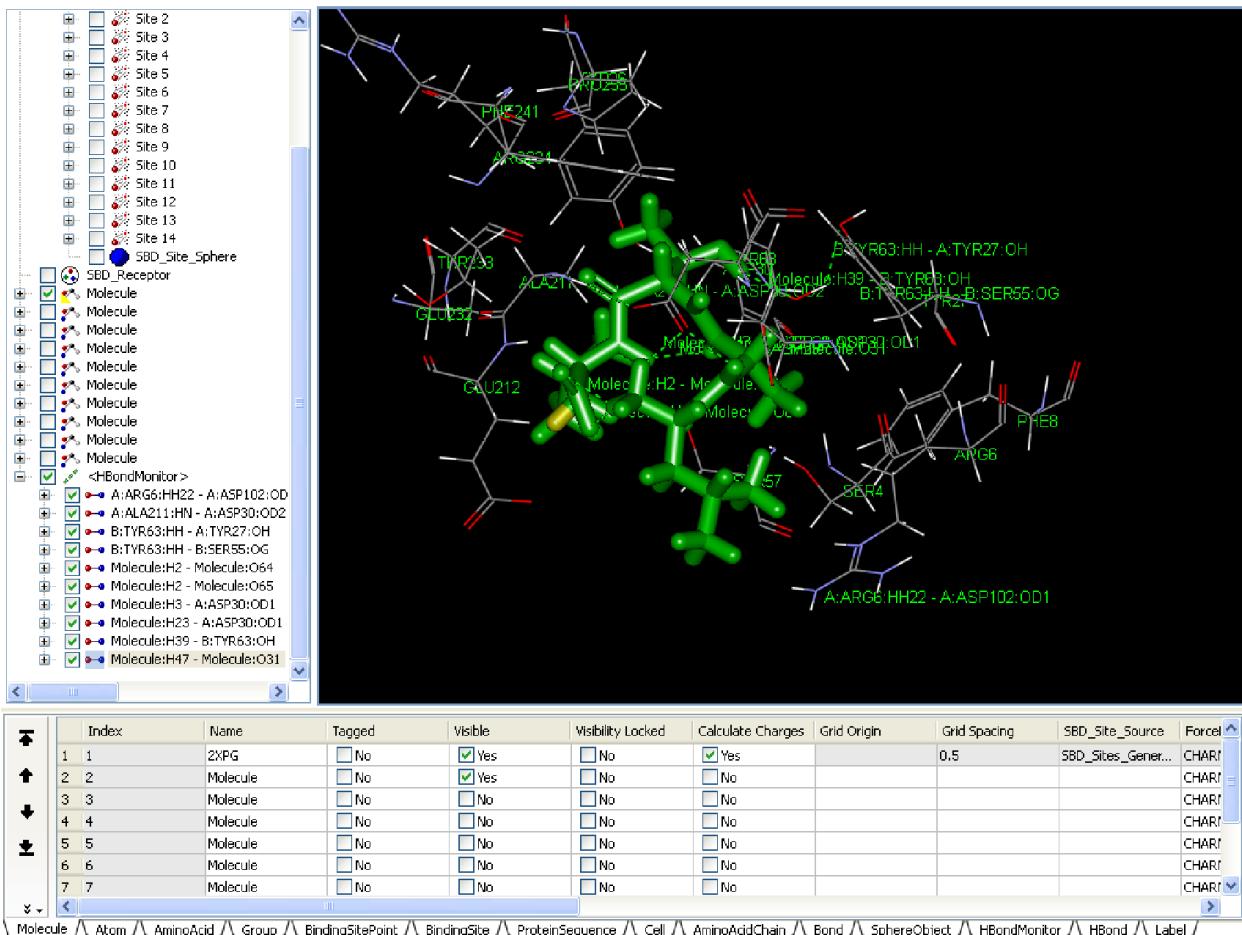
(Fig.2)Docking result

CONCLUSION

Gastroenteritis is a diarrheal disease that occurs from Aeromonas hydrophila subsp.Dhakensis infection Resulting in some combination of diarrhea, vomiting and abdominal pain and cramping. It is estimated that three to five billion cases of gastroenteritis occur globally on an annual basis, primarily affecting children and those in the developing world. It resulted in about 1.3 million deaths in children less than five as of 2008, with most of these occurring in the world's poorest nations.

We have found the complete proteome sequence of the pathogen using TIGR and screening was carried out by SDSC Biology Workbench. We got 25.484% Identity. Antigenic Determinant was predicted, from which we have designed the epitope which binds to the MHC 1 molecule and selected the docked sequence using Discovery studio.

Therefore, from the whole analysis concluded that this vaccine is the potent and also good for the further clinical studies.

ACKNOWLEDGEMENT

REFERENCES

[1] Schiller LR, Sellin JH. Diarrhea. In: Feldman M, Friedman LS, Brandt LJ, eds. *Sleisenger & Fordtran's Gastrointestinal and Liver Disease.* 9th ed. Philadelphia, Pa: Saunders Elsevier; 2010:chap 15.

[2] Sodha SV, Griffin PM, Hughes JM. Foodborne Diseases. In: Mandell GL, Bennett JE, Dolin R, eds. *Principles and Practice of Infectious Diseases*. 7th ed. Philadelphia, Pa: Elsevier Churchill Livingstone; 2009:chap 99.

[3] Craig SA, Zich DK. Gastroenteritis. In: Marx JA, ed. *Rosen's Emergency Medicine: Concepts and Clinical Practice*. 7th ed. Philadelphia, Pa: Mosby Elsevier; 2009:chap 92.

[4] www.webmed.com

[5] www.nlm.nih.gov

[6] Adachi JA, Backer HD, DuPont HL. Infectious diarrhea from wilderness and foreign travel. In: Auerbach PS, ed.*Wilderness Medicine*. 6th ed. Philadelphia, Pa: Mosby Elsevier; 2011:chap 68. US Food and Drug Administration. Food safety at home. Accessed 1/11/12.

[7] Semrad CE. Approach to the patient with diarrhea and malabsorption. In: Goldman L, Ausiello D, eds. *Cecil Medicine*. 24th ed. Philadelphia, Pa: Saunders Elsevier; 2011:chap 142.

[8] Esteve c, Alcaide E, B, Blasco MD department de microbiologia Y Ecologia, Universitat de Valencia, 2012, 27(4), vol 367-73.

[9] www.ncbi.nlm.nih.gov

[10] www.sciencedirect.com

[11] Dr. Ralph A. Tripp 28th annual report page no. 7, the veterinary medical experiment Station, The university of Georgia 2004.

[12] www.niad.niaid.nih.gov, www.neurobox.org&en.wikipedia.org

[13] bioinfo.ym.edu.tw

[14] Dorothia Sesardic, Department of bacteriology, National institute for biological stands & Controls, J. med. Microbio-vol/39(1993), 241-242.

[15] Peterson, J.D, Umayam, L.A. Dickinson, T. Hickey, E.K., White o. The comprehensive microbial resource nucleic acids Res. 2001, jan 01; 29(1),123-5.

[16] Pallavi Kashikar, Chandan Dipke, Journal of Advanced Bioinformatics Applications and   Research ISSN 0976-2604Vol 3, Issue 1, 2012, pp 262-266.

[17] Amol M Kanampalliwar*, Rajkumar Soni, Amandeep Girdhar and Archana Tiwari Kanampalliwar et al., J Vaccines Vaccin 2013, 4:6
http://dx.doi.org/10.4172/2157-7560.1000194

[18] Sedláček I, Krejčí E, Andělová A, Sedláčková M, Porazilová I, Holochová P. Aeromonas   hydrophilasubsp. dhakensis– a causative agent of gastroenteritis imported into the Czech Republic. Ann Agric Environ Med. 2012; 19 (3): 409-413

Effect of Drying Temperature on Some Quality Attributes of Mango Slices

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ABSTRACT: The objective of this study was to investigate the effect of three drying temperatures (60, 70 and 80°C) on quality attributes of mango slices. The investigated quality attributes were: color change and rehydration ratio of dried mango slices. Result showed that drying temperatures had great effect on the quality attributes of mango slices. The color was measured from the surface and expressed in the Hunter L*a*b* system. Moreover, the total color change (ΔE), chroma (color saturation), hue angle and browning index (BI) were determined. L* and b* parameters were found to decrease as affected by drying temperature and drying time, whereas a* parameter increases. Results also indicated that drying time has significant effect on color change and rehydration ratio. The lowest total color change and highest rehydration ratio were obtained at drying air temperature of 80°C then 70°C and finally 60°C with drying time of 3,5 and 7 hours, respectively. In contrast to common practice, drying at elevated air temperature (80°C), instead of 60°C for a longer time, was optimal, since significant color changes of mango slices were not observed. Moreover, at increased temperature, drying time was considerably shortened from about 7 h to 3h, resulting in significant extension of drying capacity.

KEYWORDS: Drying temperature; Mango; Quality; Color change; Rehydration ratio.

1 INTRODUCTION

Mango (*Mangifera indica* L.) is one of the tropical and subtropical fruit of great importance for both economical and nutritional point of view. It is considered to be a good source of carbohydrates; vitamin C and very rich source of pro-vitamin A. Since industrial capacities for the processing of highly perishable mangoes into storable products are limited due to seasonal over production of the fruits, drying of excess and partly defected mangoes is a promising preservation technique, meeting the processing requirements of small and medium-size producer [1]. Beside traditional sun drying by direct solar radiation, solar dryers and conventional overflow dryers are presently used by small-scale enterprises to reduce the water activity. According to common practice for preservative-free as well as sulphited mangoes, drying air temperature ranges between 50 and 60 ºC. During sun and solar drying, even lower maximum temperatures are reached. Consequently, drying usually needs at least 20 h, resulting in low drying capacities or high investments, respectively. Observed quality deficiencies of the dried fruits caused by these long–term processes were mainly discoloration, such as browning or bleaching, and cracked or scorched products, while insufficient drying limits the shelf life of the product due to microbial spoilage. Drying air temperature and drying time were shown to be the primary factors influencing product color and water activity [1]. Currently hot air drying is the most widely used method in post-harvest technology of agricultural products. Using this method, a more uniform, hygienic and attractively colored dried product can be produced rapidly [2].

The rehydration capacity and color characteristics are considered as the most important quality parameters for the dehydrated products. The rehydration capacity is used to express ability of the dried material to absorb water. The largest part of the dehydrated products must be rehydrated during their final use. Rehydration is a process performed in order to obtain an adequate restitution of raw material properties when dried material is in contact with water [3]. In some foods, as dry fruits for breakfast, the rehydration velocity is very important in the judgment of its quality [4].

The first quality judgment made by a consumer on a food at the point of sale is its visual appearance. Appearance analyses of foods are used in maintenance of food quality throughout and at the end of processing. Color is one of the most important appearance attribute of food materials, since it influences consumer acceptability. Abnormal colors, especially those associated with deterioration in eating quality or with spoilage, cause the product to be rejected by the consumer [5]. The deterioration of the color attributes with drying conditions has been widely studied in a large number of fruits, mainly in apple [6], kiwifruit [7], cherries [8] and pineapple [4].

The color measurements can be used in an indirect way to estimate color change of foods, since it is simpler and faster than chemical analysis [7]. Hunter color parameters (L,a,b) have previously proved valuable in describing visual color deterioration and providing useful information for quality control in fruits and fruit products such as sultana grapes[9], concentrated fruit pulp[10], diced apple [11], pear puree [12] and banana [13].There are other parameters derived from Hunter L*,a*,b* scale: the total color difference (ΔE), the saturation index or chroma that indicates color saturation and is proportional to its intensity. The Hue angle is another parameter frequently used to characterize color in food products.

Therefore, the objectives of this study were :(1) to investigate the effect of drying temperatures on color and rehydration ratio of mango slices and (2) to determine the optimum drying temperature for mango slices.

2 MATERIALS AND METHODS

2.1 RAW MATERIAL

Fresh mangoes, var. *Kent*, from Mali, were purchased at the wholesale market in Goettingen, Germany. The mangoes were left for 5days for post-harvest ripening at 25±2ºC and 50% relative humidity [1]. The fruits were then washed, manually peeled using a stainless steel knife, and sliced using an electric food-slicer (Krups variotronic, Germany) to a thickness of 3 mm.

2.2 DRYING EXPERIMENTS

Drying experiments were performed using a convective cross flow cabinet dryer (Heraeus, UT6120, Germany) at temperature of 60, 70 and 80°C. The dryer is consisted of heating unit, temperature control unit, drying chamber and centrifugal fan that has a fixed air velocity of 0.5 m/s. The average initial moisture content of the mango fruit was 82.5±0.4 %(w.b.), as determined using a precision air-oven method, at a temperature of 135°C for 2 hours until constant weight was reached, according to the standard method of AOAC [14] and moisture content on wet basis (w.b.) was calculated by the following equation:

$$MC_{wb} = \frac{W_w}{(W_w + W_d)} \times 100\% \qquad (1)$$

Where:

MC_{wb} = moisture content, percent, wet basis

W_w = weight of water, g

W_d = weight of dry matter, g

Prior to starting the experiments, the dryer was adjusted to the selected temperature for about half an hour to reach thermal stabilization. Then the samples were uniformly spread in a single layer of 3mm thick on a tray. A representative sample of sliced mango for moisture loss assessment was placed in a circular wire mesh of 10cm diameter and placed onto the center of the tray. For the determination of the drying curve and estimation of total drying time, the sample on the circular wire mesh was taken out of the drying chamber and weighed on a digital balance and placed back into the drying chamber every 30 min during the drying process. The digital top pan balance (Sartorius, Goettingen, Germany) of ±0.01g accuracy, was kept near to the drying unit and weight measurement process took less than 10 seconds time. The drying process was stopped when the moisture content decreased to about 9.5±0.2 % (w.b). At the end of the drying process, some of the dried samples were taken for color measurement and the rest were placed in plastic bags and wrapped by aluminum foil and stored at -18C for subsequent quality parameter measurements (rehydration ratio). All the experiments were replicated two times at each air temperature and the average values were used.

2.3   COLOR MEASUREMENT

Color parameters were measured using a Minolta CR-310 Chroma-meter (Minolta, Japan). The chroma meter consisted of a respective measuring head and the data processor. The measuring head of the chroma meter CR-310 uses wide-area illumination and a 0° viewing angle and has 50mm-diameter measuring area to average the reading. Hunter scale (L*, a*, b*) system was used. The instrument was calibrated with a standard white plate at D_{65} illumination before taking measurements (Y=94.3, x= 0.3156 and y= 0.3324) equivalent to HL system: HL = 97.10, a = -0.17 and b= 1.80. Calibration was made at each experiment. The parameter L* represents the brightness of the color, a* the hue range of the colors red (+) and green (-) and b*hue range of colors yellow (+) and blue (-). Three measurements were made on the surface of sliced mango fresh and after drying and average values were made for calculation and each experiment was duplicated. From the color values, total color change (ΔE), chroma (C), hue angle (h) and browning index (BI) were calculated using equations described by Maskan [7] as follows:

$$\Delta E = \sqrt{(L_0 - L)^2 + (a_0 - a)^2 + (b_0 - b)^2} \qquad (2)$$

$$Chroma = \sqrt{a^2 + b^2} \qquad (3)$$

$$\text{Hue angle} = \tan^{-1}(\frac{b}{a}) \qquad (4)$$

Where; subscript "0" refers to the color reading of fresh mango slices. Fresh mango was used as a reference and a larger ΔE denotes greater color change from the reference material [7].

$$BI = \frac{[100(x - 0.31)]}{0.17} \qquad (5)$$

Where:

$$x = \frac{(a + 1.75L)}{(5.645L + a - 3.01b)}$$

2.4   REHYDRATION RATIO

Rehydration characteristics of the dried products were used as a quality index and they indicated the physical and chemical changes that occurred during the drying and were influenced by processing conditions, sample compositions, sample preparation and extent of structural and chemical disruptions induced by drying [15].

Rehydration ratio was determined according to the official method of AOAC[16],   5g of dried sample was soaked for 60 min in 50 ml distilled water, filtered through filter paper and then the filtrates were weighed (two measurements for each sample). The rehydration ratio (R/R) was used to express ability of the dried material to absorb water. It was determined by the following equation:

$$\text{Rehydration ratio (R/R)} = \frac{W_2}{W_1} \qquad (6)$$

Where: W_2 = weight of drained material, g

W_1 = weight of dried material, g

2.5   STSTISTICAL ANALYSIS

Statistical analysis was conducted using Minitab version 16. Significant differences (p<0.05) between means were evaluated by one-way ANOVA and Tukey's test. Results were presented as mean± standard deviation (SD).

3   RESULTS AND DISCUSSION

3.1   EFFECT OF DRYING TEMPERATURE ON DRYING TIME AND MOISTURE CONTENT

The effect of drying temperature on the time required to reach the final moisture content of 9.5±0.2 (w.b.) is shown in Fig. 1. As expected, the moisture content decreased considerably with increasing drying temperature. The time required to reduce the moisture content to any given level was dependent on the drying temperature, being highest at 60°C and lowest at 80°C. The time required to reduce the moisture content of mango slices from 82.5±0.4 % (w.b.) to the final 9.5±0.2 % (w.b.) was 3, 5 and 7 h at 80°C,70°C and 60°C, respectively. It was observed that the main factor influencing drying time was the drying air temperature, as noted in other studies [17],[18]. Thus, a higher drying air temperature produced a higher drying rate and consequently the moisture content decreased faster. This is due to increase of air heat supply rate to the product and the acceleration of water migration inside the mango slices.

3.2   EFFECT OF DRYING TEMPERATURE ON COLOR PARAMETERS

3.2.1 COLOR PARAMETERS L*, a*, b* AND TOTAL COLOR CHANGE (ΔE)

The results of color measurements on fresh and dried mango slices at different drying temperatures are shown in Table 1 and Fig.2. The lightness (L*) and yellowness/ blueness (b*) values of all of the samples decreased from 70.39 to 65.16 and 36.49 to 34.41, respectively. However, the redness/ greenness (a*) value increased from -3.44 to -0.25. All of the color values of fresh mango did not differ significantly from the values of the dried mango slices (p<0.05). Among all of the drying temperatures used for mango slices, the closets value to the color of fresh mango slices was obtained at 80°C. While the raw material was characterized by an average greenish shade of the yellow slice surface as represented by a chromaticity coordinate of a*=-3.44±0.14, this values was increased towards positive direction regardless of drying temperature indicating that the sample color shifting to redness. However, all applied air temperatures did not cause browning (a*<1.0). These results are in agreement with findings of Pott et al.[1] (2005). On the other hand, it was observed that the lightness, L*, for mango slices decreased with drying temperature and drying time. Since it is a measure of the color in the light-dark axis, this falling value indicates that the samples were turning darker. It has been stated that the variation in the brightness of dried samples can be taken as a measurement of browning [5], [12]. These findings indicated that the lightness (L*) was inversely correlated with the drying time and drying temperature. These results are in well agreement with those reported by Arsland and Özcan [19] for oven drying of pepper slices, Karabulut et al. [20] for apricot drying and Maskan [7] for kiwifruit drying. The decrease in the L* value can be attributed to the formation of brown pigment during drying [19]. It is clear that browning increases with an increase in drying temperature and time [21], [22]. Avila and Silva [5] examined the color degradation of peach puree as affected by heat treatment. Peach puree became darker, corresponding to a decrease in L* value and an increase in a* value, with increasing temperature. Moreover, the loss of yellowness was also expressed by a decrease in the b* value. They concluded that the major causes of color change were due to carotenoid degradation and non-enzymatic browning (Maillard).

The total color change (ΔE), which is a combination of parameters L*, a* and b* values, is a colorimetric parameter extensively used to characterize the variation of colors in foods during processing. It was calculated from Eq. (2). The color change parameter had lowest value of 7.24 at 80°C (3 h) and highest value of 26.39 at 60°C (7h). Thus, drying temperature and drying time had a great effect on total color change of dried mango slices. An increase in ΔE was observed with drying time and drying temperature (Table 1.). The lowest total color change (Δ E) was recorded at 80°C as shown in Fig. 3. From this result it could be concluded that 80ºC is the optimum drying temperature for mango slices.

3.2.2. CHROMA, HUE ANGLE AND BROWNING INDEX (BI)

The values of the chroma, the hue angle and the browning index were calculated using Eqs. (3) - (5) and are shown in Table.2. The chroma values decreased during drying process and closely followed the b* values (Fig. 3.), and were found to be 36.65, 34.41, 34.49 and 35.44 for fresh, 60°C, 70°C and 80°C, respectively. The chroma value indicates the degree of saturation of color and is proportional to strength of the color. Little change in values of chroma was found between fresh and dried fruit and they were not significant (P<0.05) among the drying temperatures considered in this study. This indicates stability of yellow color in mango fruit. On the other hand, the hue angle values were also decreased from about 95.39 to 90.41 during drying process. It suggested reduction from a more green (when Hue>90°) to an orange-red (when Hue <90º) color of dried mango slices. Similar findings were reported by Maskan [7] for color change of kiwifruits, Ramallo and Mascheroni [4]for color change of pineapple and Izli and Isik [23]for dent corn drying. The changes in hue angle values were not significant (P<0.05) compared to drying temperatures. Another color parameter is the browning index (BI) which

represents the purity of brown color and is reported as important parameters in processes where enzymatic and non-enzymatic browning taking place [24]. In this study, the browning index (BI) values were found to be 65.66, 71.24, 68.52and 67.37 for fresh, 60°C, 70°C, 80°C, respectively. Statistically, the change among the three temperatures, was not significant (P<0.05). However, these results suggested that drying time strongly affected the color quality of mango fruit.

3.3   REHYDRATION RATIO OF DRIED MANGO SLICES

The capability for fast and complete rehydration is considered to be one of the most important characteristics of dried mango slices. The rehydration ratio of mango was measured at ambient temperature of 20°C. Fig.4. shows rehydration ratio versus drying temperature. It is clear that drying temperature 80°C scored the highest rehydration ratio, then 70°C and finally 60°C. There is decreasing rehydration ratio with increasing drying time. This may be due to changes in the structure/ texture of the samples during long time drying. From these results it could be concluded that 80°C is the optimum drying temperature for mango slices.

4   CONCLUSIONS

The results revealed that drying temperature had great effect on color change of mango slices. Increasing the temperature caused a significant decrease in the drying time. Statistical analysis of data revealed no significant difference (P>0.05) among color at the different drying temperatures. However, these results suggested that drying time strongly affected the color quality of mango fruit. Mango slices dried at 80°C had better rehydration ability and less color change than those obtained by 60°C and 70C. Hence, 80°C drying temperature was the best condition for mango quality preservation.
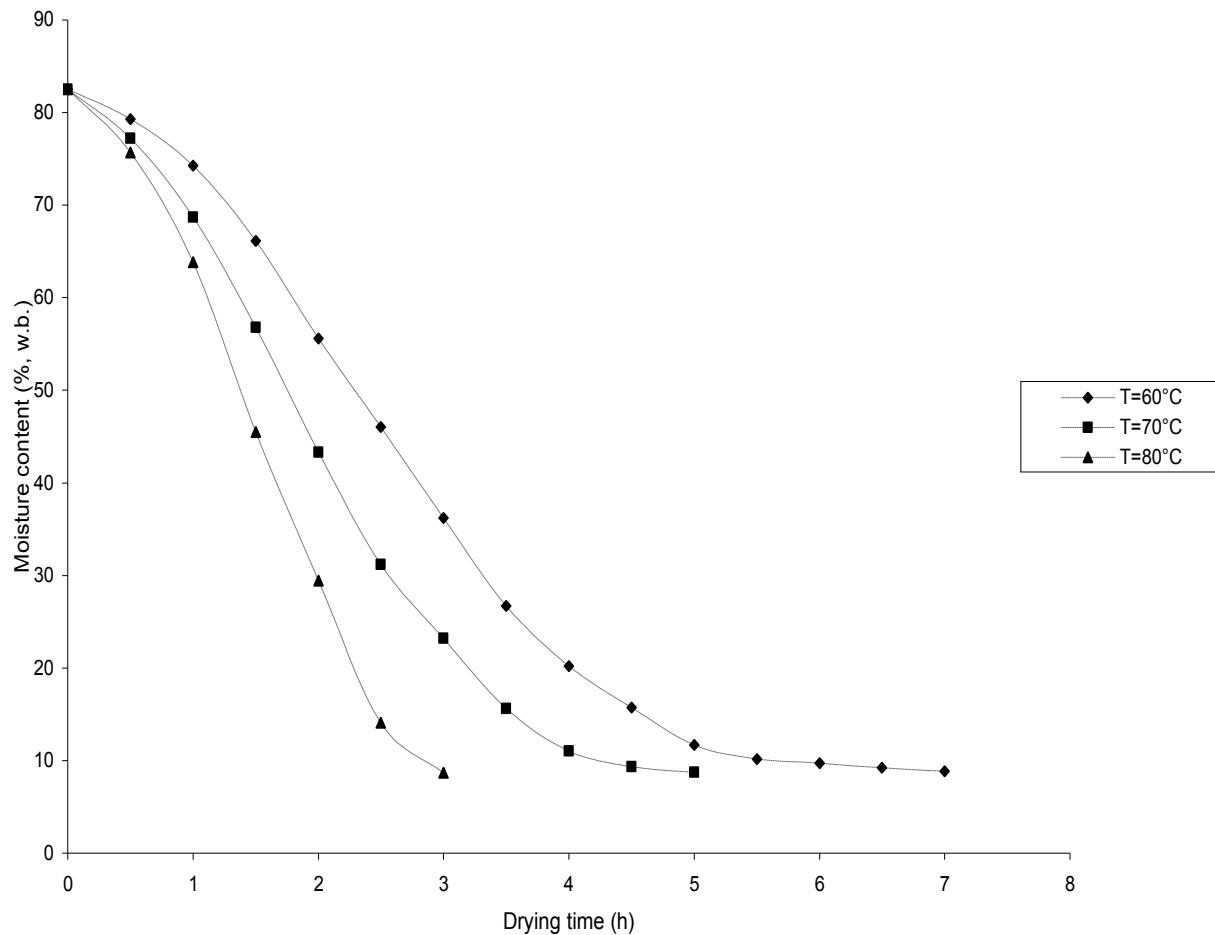
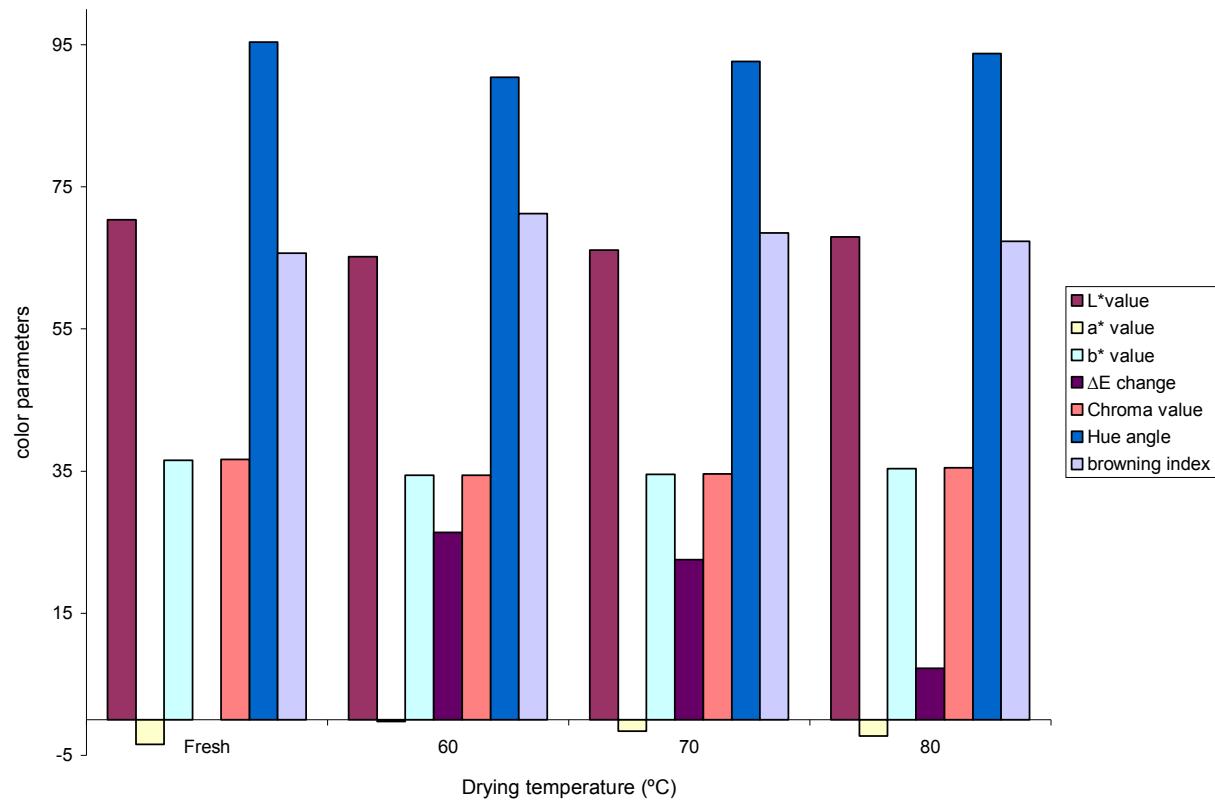*Table 1. Effect of drying temperature on color parameters of mango slices*

Treatment	L*	a*	b*	Total color change (ΔE)	Drying time (h)
Fresh	70.39±1.12	-3.44±0.18	36.49±0.5	-	-
60ºC	65.16±1.3	-0.21±0.9	34.41±0.3	26.39±0.77	7
70°C	66.11±1.24	-1.59±0.25	34.55±0.4	22.54±0.14	5
80°C	67.92±1.1	-2.31±0.31	35.36±0.5	7.24±0.13	3

Values are: means ± standard deviation (SD).

Table 2. Effect of drying temperature on Chroma, Hue angle and Browning index of mango slices

Treatment	Chroma	Hue angle (degree)	Browning index (BI)
Fresh	36.65±0.53	95.39	65.66
60°C	34.41±0.95	90.41	71.24
70°C	34.59±0.47	92.64	68.52
80°C	35.44±0.59	93.73	67.32

Fig. 1.   Effect of drying temperature on the drying time and moisture content of mango slices.

Fig. 2.   Effect of drying temperature on color parameters
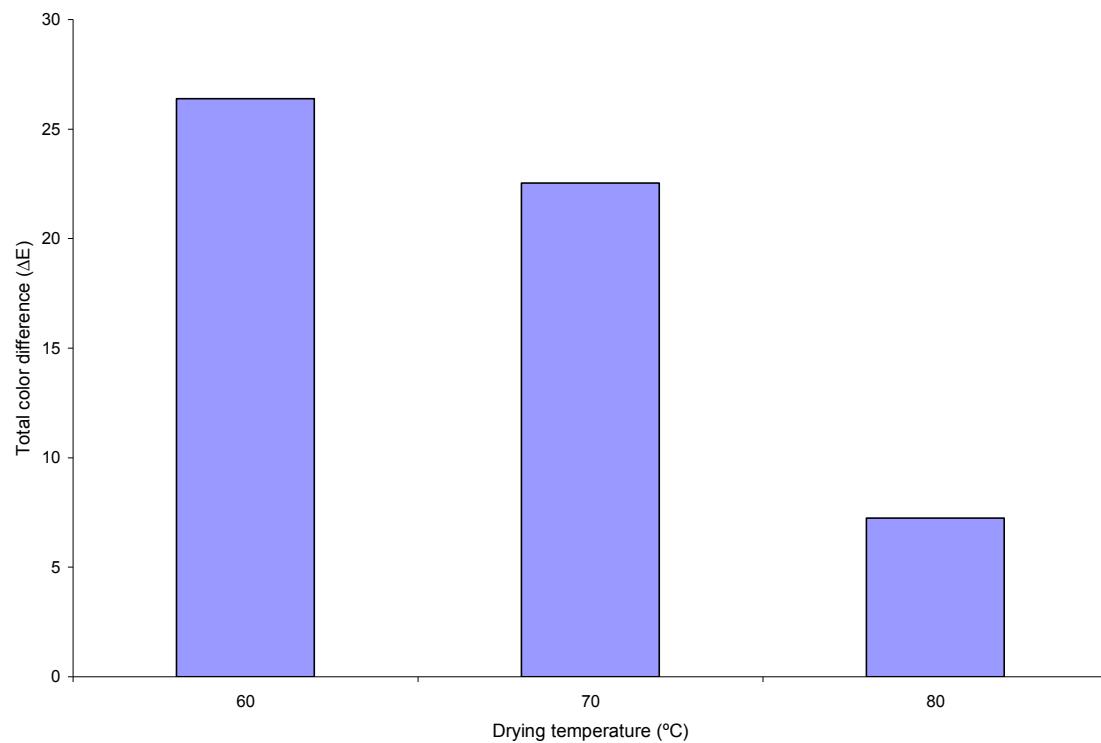
Fig. 3.   Effect of drying temperature on total color change (ΔE)
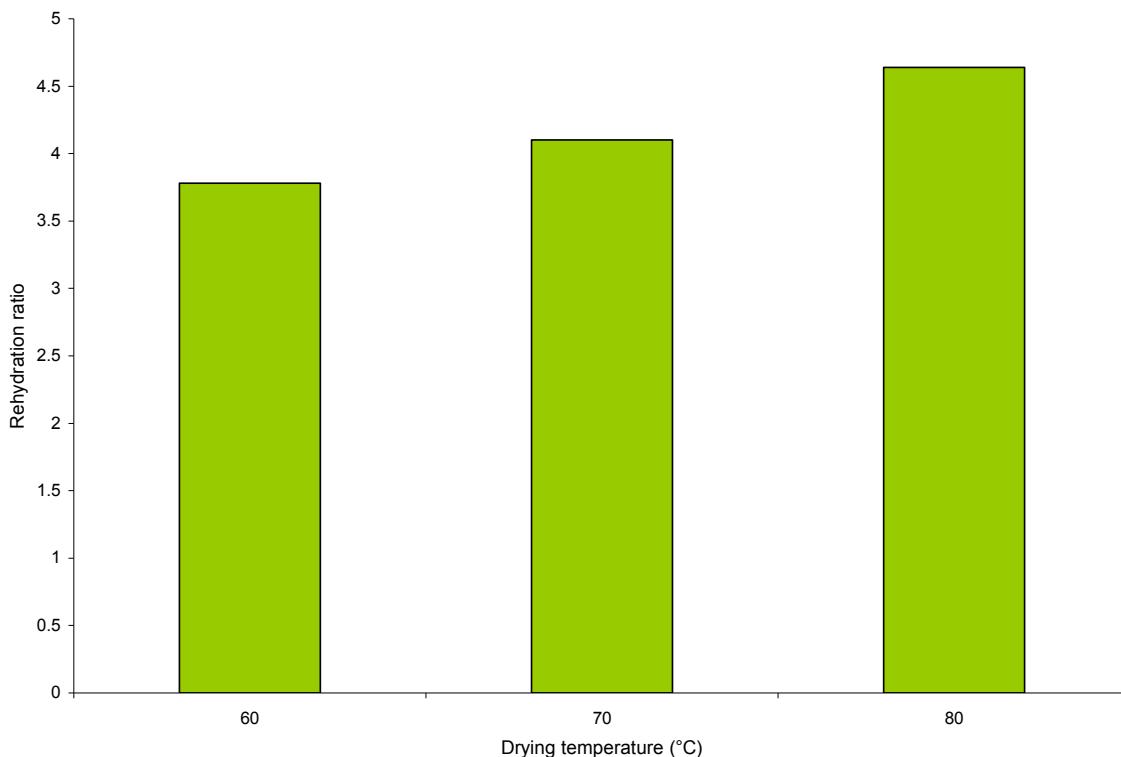
Fig. 4. *Effect of drying temperature on rehydration ratio of the dried mango slices.*

REFERENCES

[1] I. Pott, S. Neidhart; W. Muhlbauer and R.Carle, "Quality improvement of non-sulphited mango slices by drying at high temperatures", Innovative Food Science and Emerging Technologies, vol. 6, pp. 412-419, 2005.

[2] P.K.Wankhade, R.S. Sapkal and V.S.Sapkal, "Drying characteristics of okra slices on drying in hot air dryer", Procedia Engineering, vol. 51, pp. 371-374, 2013.

[3] K.A.Taiwo, A. Angersbach and D.Knorr, "Rehydration studies on pretreated and osmotically dehydrated apple slices", Journal of Food Science, vol. 67, pp. 842-847, 2002.

[4] L.A.Ramallo and R.H.Mascheroni, "Quality evaluation of pineapple fruit during drying process", Foods and Bioproducts Processing, vol. 90, pp.275-283, 2012.

[5] I.M.L.B. Avila and C.L.M. Silva, "Modeling kinetics of thermal degradation of color in peach puree", Journal of Food Engineering, vol. 39, no. 2, pp.161-166, 1999.

[6] I.G.Mandala, E.F. Anagnostaras and C.K. Oikonomou, "Influence of osmotic dehydration conditions on apple air-drying kinetics and their quality characteristics", Journal of Food Engineering, vol. 69, pp. 307-316, 2005.

[7] M.Maskan, "Kinetics of color change of kiwifruits during hot air and microwave drying", Journal of Food Engineering, vol. 48, pp. 169-175, 2001.

[8] E.Ohaco, B. Pirone, M. Ochoa, A. Kesseler and A.De Michelis, "Pigments evolution during air dehydration of sweet cherries", In: Proceedings of EMPROMER, vol. (Ш), pp. 1435-1440, 2001.

[9] J. M.Aguilera, K. Oppermann, and F. Sanchez, "Kinetics of browning of sultana grapes", Journal of Food Science, vol. 52, pp. 990-993, 1987.

[10] J. E. Lozano and A. Ibarz, "Color changes in concentrated fruit pulp during heating at high temperatures", Journal of Food Engineering, vol. 31, pp. 365-373, 1997.

[11] H.Feng and J. Tang, "Microwave finish drying of diced apples in a spouted bed", Journal of Food Science, vol. 63, pp. 679-683, 1998.

[12] A. Ibarz, J. Pagan and S. Garza, "Kinetics models for color changes in pear puree during heating at relatively high temperatures", Journal of Food Engineering, vol. 39, pp. 415-422, 1999.

[13] M. Maskan, "Microwave/air and microwave finish drying of banana", Journal of Food Engineering, vol. 44, pp. 71-78, 2000.

[14] AOAC, Official methods of analysis of AOAC international, 17th Ed. Association of the Official Analytical Chemists (AOAC) International, Horwitz, USA, 2000.

[15] M.K.Krokida, E.Tsami and Z.B. Maroulis, "Kinetics on color changes during drying of some fruits and vegetables", Drying Technology, vol. 16, pp. 667-685, 1998.

[16] AOAC, Official methods of analysis of AOAC international, 14th Ed. Association of the Official Analytical Chemists (AOAC) International, Washington, DC, USA, 1984.

[17] A. Belghit, M. Kouhila and B.C. Boutaleb, "Experimental study of drying kinetics by forced convection of aromatic plants", Energy Conservation and Management, vol. 44, no. 12, pp. 1303-1321, 2000.

[18] M.Kouhila , N. Kechaou, M. Otmani, M. Fliyou and S. Lahsasni, "Experimental study of sorption isotherms and drying kinetics of Moroccan *Eucalyptus Globulus"*, Drying Technology, vol. 20, no. 10, pp. 2027-2039, 2002.

[19] D. Arslan and M.M.Özcan, "Dehydration of red bell-pepper (Capsicum annuum L.): Change in drying behavior, color and antioxidant content", Food Bioproducts Processing, vol. 89, pp. 504-513, 2011.

[20] I. Karabulut, A.Topcu , A.Duran, S. Turan and B.Ozturk, "Effect of hot air drying and sun drying on color and β-carotene content of apricot (Prunus armeniaca L.)", LWT-Food Sciences and Technology, vol. 40, pp. 753-758, 2007.

[21] K. Sacilik and A.K. Elicin, "The thin layer drying characteristics of organic apple slices", Journal of Food Engineering, vol. 73, pp. 281-289, 2006.

[22] J. Wang and Y.Chao, "Drying characteristics of irradiated apple slices", Journal of Food Engineering, vol. 52, pp. 83-88, 2002.

[23] N. Izli and E. Isik, "Batch drying characteristics of dent corn (Zea mays var. indentata Sturt.)", Journal of Food, Agriculture &Environment, vol. 11, no. 1, pp. 259-263, 2013.

[24] E. Palou, A. Lopez-Malo, G.V. Barbosa-Canovas, J. Welti-Chanes and B.G. Swanson, "Polyphenoloxidase activity and color change of blanched and high hydrostatic pressure treated banana puree", Journal of Food Science, vol. 64, pp. 42-45, 1999.

THE CAUSAL RELATIONSHIP BETWEEN LIFE INSURANCE BUSINESS AND ECONOMIC GROWTH IN NIGERIA

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ABSTRACT: This study investigated the causality of the relationship between life insurance business and economic growth of Nigeria for the period 2000-2011. Pearson's Product Movement Correlation Coefficient was used to test the hypothesis to determine the extent of the causality of the relationship between life insurance business and economic growth. The researcher graphically measured the ratio of life insurance premium to Gross Domestic Product (GDP). The study revealed that there was significant causal relationship between life insurance business and economic growth of Nigeria. It was also discovered that despite the high degree of the causality of the relationship between life insurance premium and GDP, that life insurance premium has not been able to make a meaningful contribution to economic growth of the country. The study concluded that life insurance business has not effectively contributed to the growth of Nigeria economy due to low consumption, and that individual and corporate organizations have failed to embrace life insurance policies in Nigeria. The researcher therefore, recommended that National insurance commission (NAICOM) should enforce the compulsory group life insurance policy, and ensure that there is high level of transparency initiative and efficiency in Nigeria insurance industry. This would go a long way in mitigating the factors that hinder individuals and organizations in embracing life insurance policies in Nigeria.

KEYWORDS: Life Insurance, Premium, Economic Growth.

1 INTRODUCTION

Life insurance is a social security scheme that provides benefits when certain events occur, or certain conditions exist, that may adversely affect the welfare of the households concerned. It is a scheme that retards the adverse effect of economic insecurity, which arises as a result of the disability or death of a breadwinner in a household. Modern life insurance policies were established in the early 18th century. The first company to offer life insurance was the Amicable Society for a Perpetual Assurance Office, founded in London in 1706 by William Talbot and Sir Thomas Allen (Oviatt, 1905). Life insurance is a contract between an insured (insurance policy holder) and an insurer, where the insurer promises to pay a designated beneficiary a sum of money (the "benefits") in exchange for a premium, upon the death of the insured person. Depending on the contract, other events such as terminal illness or critical illness may also trigger payment. The policy holder typically pays a premium, either regularly or as a lump sum. Other expenses (such as funeral expenses) are also sometimes included in the benefits. Life insurance companies are financial intermediaries that bring together the surplus spending unit and the deficit spending unit for the purpose of the insurer protecting the financial interest of the beneficiary in the event of the demise of the insured (Catalan, Impavido and Musalem, 2000; Impavido and Musalem, 2000).

Life insurance companies play an increasingly important role within the financial sector. While during the period 1980-85 total assets of life insurance companies constituted only 11% of GDP for a sample of 13 countries, for which data were available, they constituted 28% for the period 1995-97 in the same countries. This increased importance was also reflected in the business volume of life insurers. Whereas life insurance penetration – the ratio of premium volume to GDP – was at 1.2% during the period 1961-65, it reached 4.2% in the period 1996-2000 for a sample of 19 countries, for which data were available (Beck and Webb, 2002). While this increased importance of life insurance both as provider of financial services and of investment funds on the capital markets is especially pronounced for developed countries, many developing countries still experience very low levels of life insurance consumption, which affects the contribution of life insurance business to economic growth. Beck and Webb (2002) however, stated that even within the group of developing countries, there are striking differences. While South Africa's penetration ratio was 12.7% over the period 1996-2000, Syria's was less than 0.01%. Given the large variation in the use of life insurance across countries, the question of the causes of this variation and therefore the effect of life assurance business on economic growth arises.

Life Insurance is one of the cornerstones of modern-day financial services sector. In addition to its traditional role of managing risk, life insurance market activity, both as intermediary and as provider of benefit to the insured or its beneficiary in the case of death, may promote growth by allowing different life insurance risks to be managed more efficiently, promoting long term savings and encouraging the accumulation of capital, serving as a conduit pipe to channel funds from policy holders to investment opportunities, thereby mobilizing domestic savings into productive investment (Skipper, 2001 and Arena, 2008). Life insurance companies act as a vehicle for the mobilization of savings for long term investment purpose, leading to economic growth and development. Through financial intermediation, life insurance product has become a key source of long term finance, encouraging the development of capital markets (Catalan, Impavido and Musalem, 2000; Impavido and Musalem, 2000). A thriving life and non-life insurance business is not only evidence of an efficient financial service sector, but it is also a key barometer for measuring a healthy economy (Omoke, 2012).

Indeed several studies have found evidence that the development of the life and non life insurance sector is related to economic growth and key elements in the economic development of a country (Arena, 2008; Webb, Grace and Skipper, 2002; Ward and Zurbruegg 2000; Webb, 2000 and Soo, 1996). Kumar and Prakash (2012) states that some research suggests that the positive contribution of life insurance to growth is primarily through the channel of financial intermediation and long term investments. It is thus expedient for a country like Nigeria that has witnessed a prolonged period of recession and macro-economic instability to initiate a strong financial market via life insurance companies for economic recovery.

Life insurance business starts thousands of years back, but it seems as if it is at the preliminary stage as compared to banking industry. It appears that organizations and individuals failed to patronize life assurance product and see it as a product that is futile. Some of the organization and individuals in Nigeria are still ignorant and unaware of the existence and roles of the different types of life assurance policies made available to enhance economic security. Olagbegi (2008), states that the level of insurance awareness in Nigeria, a factor that influences the degree of patronage, remains one of the lowest in the world. Buttressing his point with records sourced from the industry, he showed that Nigeria, with a population of over 140 million people has an insurance density of about 5-10%, as against 40-50% in some developing countries, and 90-98% in most developed countries. Many Nigerians seem not to have proper understanding of the immense benefits that life insurance offers, and some refused to patronize life insurance business due to non claims payment by insurance companies and ignorance (Agabi, 2010). However, this research work will examine the level significance relationship between life insurance business and economic growth.

2 LITERATURE REVIEW

2.1 THEORETICAL FRAMEWORK

The theories adopted in this research is the Modern Theory of Financial Intermediation and Growth theory

Modern Theory of Financial Intermediation

Merton and Bodie (1995) developed a theory called modern theory of financial intermediation which comprises traditional theory and the changes in financial environment. The modern theory of financial intermediation emphasizes six core functions of insurance to include: provision of means for clearing and settling payments to facilitate exchange of goods and services; provision of mechanism for pooling resources; resources allocation; risk management; provision of price information to help in coordinating decentralized decision making in various sectors of the economy and provision of means to tackle the problem of moral hazard, physical hazard and information asymmetry. For the purpose of this study, the enumerated functions by Merton and Bodie (1995) could be expressed as resources accumulation, resource allocation,

managing various risks and facilitation of exchange. It is by realizing these functions that the life and non life insurance companies contributes to economic growth. Skipper (1997) show that insurance market activity, both as a provider of risk transfer and indemnification and as an institutional investor, may contribute to economic growth in the following ways: (a) mobilizing domestic savings; (b) allowing different risks to be managed more efficiently, thereby encouraging the accumulation of new capital; (c) boosting financial stability; (d) facilitating trade and commerce (the most ancient insurance activity); (e) supporting to reduce or mitigate losses; and (f) fostering a more efficient allocation of domestic capital.

Beck and Webb (2003) assert that life insurance provides individuals and the economy as a whole with some financial services. First, life insurance takes increasing magnitude as a way for individuals and families to manage income risk. Next, life insurance products expedite long-run savings and the re-investment of substantial sums in private and public sector projects. Life insurance products offer a means for disciplined contractual saving and have become effective as instruments for boosting substantial amounts of savings. Third, life insurance mobilizes funds through attractive medium and long-term savings products that enhance economic growth. Long-term finance provided by life insurers may have an especially decisive role in economics, which needs such financing for infrastructure development. Haiss and Sümegi (2008) analyze the manifold channels of influence on the insurance sector and economic growth: risk transfer, substitute savings, investment, institutional extents of influence, and possible sources of contagion and repercussions to the economy. Moreover, Sümegi and Haiss (2008) present that overlooking the insurance sector may be among the causes why the finance-growth nexus seems to have become less robust.

The Growth Theory

The theory of economic growth developed in the 1950's by R. Harrod (Great Britain) and E. Domar (USA) was based on Keynesian premises. In the Keynesian approach to the analysis of economic growth, demand does not automatically equal supply, nor do savings automatically equal investments; demand especially the demand for capital investment plays a key role in economic growth; and the basic technological coefficients (for example, the relationship of capital to product, and of labor to capital) remain unchanged because of the rigidity of prices and are determined by the neutral quality of technological progress that is, by such technological progress as does not influence the effectiveness of production factors. The growth theory states that well developed financial intermediation can promote economic growth through marginal productivity of capital, efficiency of channeling savings to investment, savings rate and technological innovations (Eze and Okoye, 2013). The channels to growth model tries to link the financial intermediation function of insurance companies to economic growth. Webb, Grace and Skipper (2002) stated that life insurance reserves can be used as approximation of the investment function, they used technical reserves of both life and non-life insurance companies as a proxy for their investment function (IF), and the expected effect on economic growth is positive. Life and non life insurance as a financial intermediation contribute to economic growth through accumulation of productive capital within an economy and the Improvement of the efficiency of investments (Conyon and Leech, 1994; Skipper and Kwon, 2007; Dorfman, 2008).

2.2   EMPIRICAL REVIEW

Catalan, Impavido and Musalem (2000) analysed Granger Causality of insurance asset for 14 OECD and 5 developing countries over the period 1975 to 1997 vis-à-vis GDP growth (among others). According to their analyses, contractual savings seems to have some connection to Market Capitalization (MC) and Value Trade (TC) in the majority countries. The correlation between MC and pension funds is the same as with MC and contractual savings, but the nexus of pension funds-VT is mixed. The Catalan et al (2000) analyses, 9 OECD countries support the life insurance- MC link, the result for the developing countries are mixed. Evidence for the connection of life insurance to VT is not so strong in OECD countries, whereas, the majority of non OECD countries show this linkage. The impact of non-life business is almost equal to the impact of the life business for MC and less for VT. The linkage proposed by the author between contractual savings and MC or VT seem to hold for OECD countries, especially for countries in small and tight market but enabling regulatory environment. The second proposition- to favour contractual saving over institutional investors (e.g. non-life insurance) – is also supported by the result and induces the authors to recommend an appropriate sequencing of financial institutions' development.

Arena (2008) used dynamic models of panel data for 55 countries and for the 1976-2004 periods. His study was on the causal relationship between insurance market activity and economic growth. He uses data for non-life and life insurance premiums in order to assess potentially different effects on economic growth, measured by growth in real GDP per capita. As additional explanatory variables he useds private credit, stock market turnover, initial GDP per capita, openness, government consumption, inflation, human capital, and terms of trade changes data. He found support for causal effect of insurance to economic growth. However, the research results evidence different impact of life and non-life insurance on economic growth. While life insurance premiums positive effect on economic growth is driven by high-income countries only, non-life

insurance premiums effect on economic growth is driven by all countries, although a larger effect is found in high-income countries.

Webb, Grace and Skipper (2002) examine whether banks, life and nonlife insurers individually and collectively contribute to economic growth by facilitating the efficient allocation of capital using revised Solow-Swan model of economic growth. They use cross-country data for 55 developed and developing countries, excluding ex-communist European economies, for the period 1980-1996. In addition to average penetration of life and non-life insurance, as explanatory variables for GDP per capita growth, they use average growth rate of capital stock per capita, average penetration of banking activity, average level of exports as a share of GDP, average government expenditure share of GDP, natural log of initial real GDP per capita and data on proportion of the population over 25 who have completed primary school. They found that the exogenous components of banking and life insurance penetration are robustly predictive of increased productivity. Synergy between banks and insurers exists, which indicates that banks and insurers collectively provide greater benefits than it would be by summing their individual contributions. Additionally, they found that there is no link between economic growth and non-life insurance. Economic growth affects life insurance penetration while it does not predict banking development.

Kugler and Ofoghi (2005) use the components of net written insurance premium to evaluate a long run relationship between development in insurance market size and economic growth by using Johansen's λTrace and λmax co integration tests. In addition, they use Granger causality tests with disaggregated measures of specific classes of long-term and general business insurance for the United Kingdom. Disaggregated data for long-term insurance includes yearly and single premium (including life insurance, annuities, individual pensions and other pensions) for the period 1966-2003 and for general business insurance, includes motor, accident and health, liability, property, pecuniary loss, reinsurance and MAT (Marine, Aviation and Transport) for the period 1971-2003. For most of variables and for at least at 5% level of significance, co integration tests confirmed long run relationship between development in insurance market size and economic growth. Causality tests' results show for eight out of nine markets (the exception is pecuniary loss insurance) that the long run relationship between insurance market size development and economic growth is present rather than there is cyclical effect. In the short run, growth in life (both yearly and single premium), liability and pecuniary loss insurance causes economic growth. Additionally, they found that causality from GDP growth to insurance market size development is more powerful than the causality from the other side.

Oke (2012) used fixed effect model and co-integration analysis to determine the short-run and long-run relationship between economic growth and insurance sector growth and development in Nigeria. The study spanned from the period of 1986 to 2009. The result reveals that insurance sector growth and development positively and significantly affects economic growth. The result of the granger causality test indicates that the extent of influence the insurance sector growth had on economic growth was limited and not direct because of some cultural, attitudinal traits and values in the economy.

Shittu (2012) carried out a study on financial intermediation and economic growth in Nigeria for the period of 1970 to 2010 using unit root test, cointegration test, Error Correction Model (ECM) and Engle-Granger causality test. The result observed that the financial intermediaries have significant impact on the growth of Nigerian economy.

Odhiambo (2011) in a study "dynamic causal relationship between financial development, economic growth and poverty reduction in South Africa for the period of 1960 to 2006" using a trivariate causality model and error correction model (ECM) in data analysis. The study reveals that the hypothesis of finance-led growth do not hold in South Africa. The result shows that finance has nothing to do with the growth of South African economy. That whether finance or not, the economy continue to grow.

Mojekwu, Agwuegbo and Olowokwdejo (2011) used a dynamic factor model to estimate the impact of insurance contributions on the growth of Nigerian economy within the period of 1981 to 2008. The result indicates that the functional relationship between the volume of insurance contribution and economic growth in Nigeria is a first order autoregressive model. This model observed that economic growth is positively correlated with insurance contributions. This implies that if insurance contribution increases, economic growth will as well increase.

Anthony and Luke (2011) in their study on "the effect of insurance business on economic development in Nigeria" using descriptive survey and random sampling techniques. The findings revealed that insurance companies provide financial services to some substantial number of people in the economy and that insurance helps in capital accumulation than payment of reparation of loses.

Peter and Kjell (2006) worked on the relationship of insurance and economic growth, a theoretical and empirical analysis. They applied a cross country panel data analysis using annual insurance premium data from 29 European countries over the 1992 to 2004 period. They observed a weak evidence for a growth-supporting role of life insurance and explain this with similarities to recent bank and stock sector findings.

Haiss and Sümegi (2008) applied a cross country panel data analysis from 29 European countries in the period from 1992 to 2005 to study the relationship between insurance companies and economic growth in Europe. Ordinary least squares (OLS) estimate and time-fixed effects were used in data analysis. They observed that there is a positive impact of life insurance on GDP growth in the 15 European countries; while non life insurance has a larger impact in Central and Eastern Europe.

Wadlamannati (2008) examined the effects of insurance growth and reforms along with other relevant control variables on economic development in India in the period from 1980 to 2006. Growth of insurance was penetration (life, non-life and total insurance). Using Ordinary Least Square (OLS), co-integration analysis and error correction models (ECM), the study finds that reforms in insurance sector do not affect economic activities; but their growth has positive impact oneconomic growth.

Marijuana, Sandra and Lime (2009) empirically examined the relationship between insurance sector development and economic growth in 10 transition European Union member countries in the period from 1992 to 2007. Their findings show that, insurance sector development positively and significantly affects economic growth. The results are confirmed in terms of life and non-life insurance, as well as total insurance.

Eze and Okoye (2013), employed unit root tests, Johansen co-integration test and error correction model with data spanning from 1980-2011. The aim of their study is to estimates and analyses the impact of insurance practice on the growth of Nigerian economy, and to determine the short and long run effect of the model. The study observed that the insurance premium capital has significantly impacted on economic growth in Nigeria; that the level of total insurance investment has significantly effected on economic growth in Nigeria; and that there is causal relationship between insurance sector development and economic growth in Nigeria.

Verma and Bala (2013) employed Ordinary Least Square regression model to examines the relationship between the life insurance and economic growth in India. The total life insurance premium (TLIP), and total life insurance investment (TLII), are used as proxy for life insurance and Gross Domestic Product (GDP) is used for the economic growth. The data has been compiled from the Handbook on Indian Insurance Statistics, IRDA annual reports and economic survey for the time period 1990-91 to 2010-11. The Ordinary Least Square regression model is used for data analysis. The Breusch-Godfrey Serial Correlation LM, Heteroskedasticity: Breusch-Pagan-Godfey, Jarque- Bera, Collinearity Diagnoses tests were applied to check robustness of the OLS regression model. The results provide empirical evidence that life insurance has both positive as well as significant influence on the economic growth in India.

Akinlo (2013), in his work on causal relationship between insurance and economic growth in Nigeria over the period 1986-2010. Employed The Vector Error Correction model (VECM). The cointegration test shows that GDP, premium, inflation and interest rate are cointegrated when GDP is the edogeneous variable. The granger causality test reveals that there is no causality between economic growth and premium in short run while premum, inflation and interest rate Granger cause GDP in the long run which means there is unidirectional causality running from premium, inflation and interest rate to GDP. This means insurance contributes to economic growth in Nigeria as they provide the necessary long-term fund for investment and absolving risks.

Hussels, Ward and Zurbruegg (2000) examined short and long dynamic relationships between economic growth, measured by annual real GDP, and insurance industry, measured by total real premiums, for nine OECD countries for the period 1961-1996. As additional explanatory variables they used changes in private saving rates, the general government budget surplus, population size, the general government level of current expenditure and youth plus old age dependency ratios, measured as the proportion of the total population under 16 and over 65 years of age. Based on bivariate VAR methodology to test for Granger causality4 authors found that the causal relationship between economic growth and insurance market development vary across countries. They did not determined the exact causes although they express their suspicions that possible causes are country-specific nature of cultural, regulatory and legal environment, the improvement in financial intermediation and the moral hazard effect of insurance.

Adams, Andersson, Andersson and Lindmark (2009) analyze long-run historical relation between banking, insurance and economic growth in Sweden using time-series data from 1830 - 1998. They use econometric tests for co integration and Granger causality to identify conjoint effects of banking and insurance and economic growth. In addition to the whole period, they use Granger causality tests for three sub-periods (1830-1888, 1889-1948 and 1949-1998). They use log of annual per capita growth in the rate of real GDP to measure national economic growth, data for the total (central, commercial and savings) annualized amount of real bank lending to the non-bank public on a per capita basis to represent bank credit variable and real annualized value of total premiums (life and non-life) per capita to represent insurance penetration variable. They found that the development of bank lending activity preceded economic growth in Sweden during the

nineteenth century and increased the demand for insurance, while Granger causality was reversed in the twentieth century. Additionally, they found that in later sub-periods insurance development fosters demand for banking services but only in times of economic prosperity. Their results for the entire period indicate that banking has the predominant influence on both economic growth and the demand for insurance while insurance market appears to be driven more by the pace of economic growth rather than leading economic development.

The above empirical review of related research work proved that insurance industry business activities contributes to economic growth, that there is a significant and causal relationship between insurance business and economic growth. It was also seen from the empirical reviews that life insurance business has significant effect on economic growth only in develop countries, while it's significant effect is not found in developing countries.

3   RESEARCH AND METHODOLOGY

3.1   INTRODUCTION

The study examined the significance of the causality relationship between life insurance business and economic growth in Nigeria. In this section, the researcher presented the research design, source of data collection, method of data analysis, testing of hypotheses, and discussion of results.

3.2   RESEARCH DESIGN:

In this research work, the researcher will employ ex-post facto analytical research design. It is an Ex-post facto research because the researcher makes use of existing data rather than new data gathered specifically for the study.

3.3   SOURCE OF DATA COLLECTION

The researcher used only secondary method of data collection in obtaining data for the work. The data were sourced from Nigeria Insurance Digest and IMF world economic data.

3.4   MODEL SPECIFICATION

The Pearson's Product Movement Correlation Coefficient is used in this study. The correlation matrix was run using SPSS 19.0.

3.5   TESTING OF HYPOTHESES

In this section the researcher analyzed the significant causal relationship between life assurance business and economic growth of Nigeria from 2000-2011.

HYPOTHESIS I

There is no significant causal relationship between life assurance business and economic growth of Nigeria.

Table 1.   Structure showing life insurance premium and GDP (in Billion)

Year	Life Insurance Premium (b)	GDP(b)
2000	5.1	4717.33
2001	6.4	4909.53
2002	8.3	7128.20
2003	10.2	8742.65
2004	12.2	11673.60
2005	12.9	14735.32
2006	12.7	18709.79
2007	15.8	20874.17
2008	29.3	24552.78
2009	34.3	25102.78
2010	39.8	29584.84
2011	54.3	36552.84

Source: Nigeria Insurers Digest and CBN Statistical Bulletin

Table 2.   causal relationship between life assurance business and economic growth of Nigeria (in Billion)

		GDP	Life Insurance Premium
GDP	Pearson Correlation	1	.945[**]
	Sig. (1-tailed)		.000
	N	12	12
Life Insurance Premium	Pearson Correlation	.945[**]	1
	Sig. (1-tailed)	.000	
	N	12	12

SPSS 19.0. Correlation is significant at the 0.01 level (1-tailed).

4   DISCUSSION OF THE RESULTS

Life insurance premium has a positive relationship and a significant relationship with GDP in Nigeria. The strength of the relationship of .945 indicates a very high degree of positive relationship between life insurance premium and GDP. The significance value .000 indicates that the relationship is not only positive but highly significant. The null hypothesis is rejected. It is therefore, observed that there is significant causal relationship between life insurance premium and economic growth (GDP) in Nigeria.

Table 3.   life insurance percentage to GDP

Year	Life Insurance Premium (b)	GDP(b)	Percent of life insurance to GDP
2000	5.1	4717.33	0.108
2001	6.4	4909.53	0.130
2002	8.3	7128.20	0.117
2003	10.2	8742.65	0.117
2004	12.2	11673.60	0.105
2005	12.9	14735.32	0.088
2006	12.7	18709.79	0.069
2007	15.8	20874.17	0.076
2008	29.3	24552.78	0.119
2009	34.3	25102.78	0.137
2010	39.8	29584.84	0.135
2011	54.3	36552.84	0.149

Source: Filed Survey 2014.

Table 3 indicates that N5.1 billion representing 0.108% of the Nigeria GDP of N4717.3billion was generated as Life Insurance Premium in the year 2000, N6.4billion representing 0.130% of the Nigeria GDP of N4909.53billion was generated as Life Insurance Premium in the year 2001, N8.3billion representing 0.117% of the Nigeria GDP of N7128.20billion was generated as Life Insurance Premium in the year 2002, N10.2billion representing 0.117% of the Nigeria GDP of N8742.65billion was generated as Life Insurance Premium in the year 2003, N12.2billion representing 0.105% of the Nigeria GDP of 11673.60billion was generated as Life Insurance Premium in the year 2004, N12.9billion representing 0.088% of the Nigeria GDP of N14735.32billion was generated as Life Insurance Premium in the year 2005, N12.7billion representing 0.069% of the Nigeria GDP of N18709.79billion was generated as Life Insurance Premium in the year 2006, N18.8billion representing 0.076% of the Nigeria GDP of N20874.17billion was generated as Life Insurance Premium in the year 2007, N29.3billion representing 0.119% of the Nigeria GDP of N24552.78billion was generated as Life Insurance Premium in the year 2008, N34.3billion representing 0.137% of the Nigeria GDP of N25102.78billion was generated as Life Insurance Premium in the year 2009, N39.8billion representing 0.135% of the Nigeria GDP of N29584.84billion was generated as Life Insurance Premium in the year 2010, N54.3billion representing 0.149% of the Nigeria GDP of N36552.84billion was generated as Life Insurance Premium in the year 2011,

Graphical representation of the penetration rate of life insurance premium to GDP
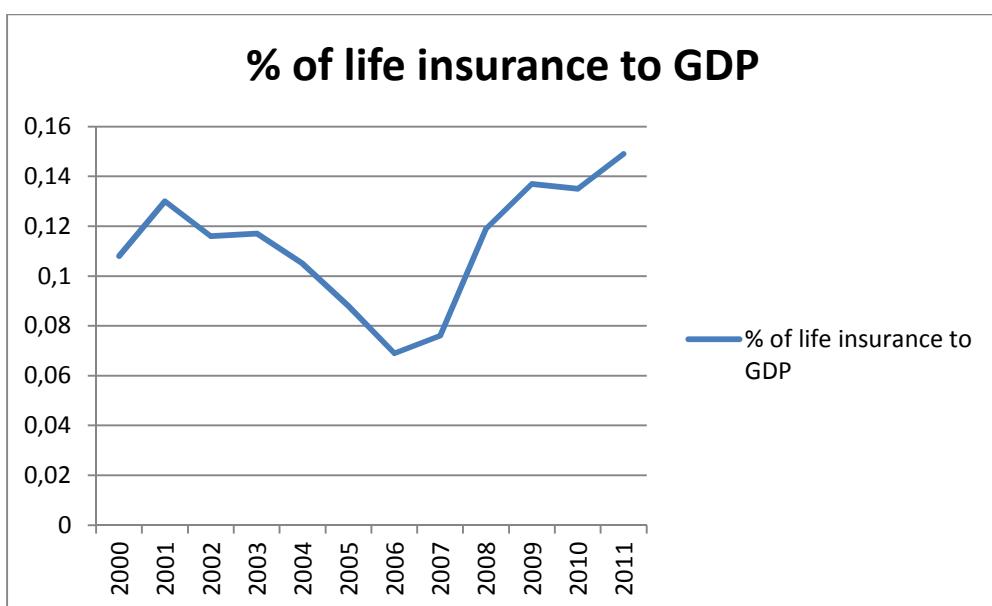
The graph represents the penetration rate of life insurance premium to GDP; it shows the level of development of life insurance sector in Nigeria. It measured the ratio of life insurance premium underwritten in a particular year to the GDP, and it can be proved that life insurance premium has not been able to make meaningful contribution to the nation's Gross Domestic Product (GDP).

This result of the poor penetration rate of life insurance premium to GDP could be attributed to the poor enforcement of the compulsory group life insurance policy, and first major recapitalization process, which was introduced by the insurance Act 2003. Section 9 of the Act raised the minimum capital requirement by as much as 650%. This recapitalization exercise, which made the number of insurance to reduce, might be the contributory cause of poor penetration rate of life insurance premium to GDP from 2003 to 2006. The new consolidation exercise conducted in September 2005, which was to be complied with by the end of February 2007 aid the life insurance business to perform well from 2007. The graph also proved the findings of Beck and Webb (2002); Arena (2008); Peter and Kjell (2006); Haiss and Sumeji (2008); Ward and Zurbruegg (2000); Catalan, Impavido and Musaleth (2000), that the life insurance market development vary across countries and that life insurance business contribute to economic growth in the developed countries, but many developing countries still experience very low level of life insurance consumption, which affected economic growth.

5   CONCLUSION AND RECOMMENDATIONS

Life is business that provides a measure of financial security, enhance savings, accumulate capital and enhance economic performance of a country. This research work has proved, irrespective of the role of life insurance companies that the life

insurance business has not effectively contributed to economic growth of Nigeria economy. It is evidence from the result of the study that life insurance consumption is low in Nigeria that individual and corporate organizations have failed to embrace the important life insurance policies.

The study recommended that the National insurance commission (NAICOM) should ensure that organizations embrace the compulsory group life insurance policy, and sanction those that failed to comply with the stipulations of Insurance Act 2003.

National insurance commission (NAICOM) should ensure that there is a high level of transparency initiative and efficiency in Nigeria insurance industry. This will go a long way in mitigating the factor that affects individuals and organizations in embracing life insurance policies in Nigeria.

There should also be adequate and effective sensitization, workshop, seminar etc. on the benefits of life insurance policies, the role it play, how it works and its impact on economic growth and development.

REFERENCE

[1] Adams, M., Andersson, J., Andersson L-F. and Lindmark, M. (2009), "Commercial banking, insurance and economic growth in Sweden between 1830 and 1998", *Accounting, Business & Financial History*, Vol. 19, No. 1, pp. 21-38.

[2] Agabi, C. (2010). *Why Nigerians don't take life insurance.* http://sundaytrust.com.ng/index.php/business/539-why-nigerians-dont-take-life-insurance. Accessed on 23 January, 2013.

[3] Akinlo, T. (2013). The Causal Relationship between Insurance and Economic Growth in Nigeria (1986-2010). *Australian Journal of Business and Management Research* Vol.2 No.12 [49-57]

[4] Arena, M. (2008), "Does Insurance Market Activity Promote Economic Growth? A Cross-Country Study for Industrialized and Developing Countries". *Journal of Risk and Insurance*, Vol. 75, No. 4, pp. 921-946.

[5] Beck T. & Webb I., (2003). "Economic, Demographic, and Institutional Determinants of Life Insurance Consumption across Countries". *World Bank Economic Review, World Bank Group*, vol. 17(1), pages 51-88, June.

[6] Beenstock, M, Dickinson, G, and Khajuria, S. (1986), The Determination of Life Premiums: An International Cross Section analysis 1970-1981. *Insurance, Mathematics and Economics*, Vol. 5, No. 4, pp. 261270,

[7] Catalan, M., Impavido, G. and Musalem, A. (2000). *C*ontractual Savings or Stock Market Development Which Leads? *Policy research Paper* Nr.2421, World Bank, Washington.

[8] Eze, O. R. and Okoye, V. (2013), Analysis of insurance practices and economic growth in Nigeria: using co-integration test and error correction model. *Global Advanced Research Journal of Management and Business Studies* (ISSN: 2315-5086) Vol. 2(1) pp. 063-070, January, 2013

[9] Haise P, Sümeg K (2008). *"*The relationship between Insurance and Economic Growth in Europe. A Theoretical and empirical analysis". *Empirical Journal*, 35(4): 405-431.

[10] Hussels, S, Ward, D. and Zurbruegg, R. (2000*)* Stimulating the Demand for Insurance*. Risk Management and Insurance Review,* Vol. 8, No. 2, pp. 257278.

[11] Impavido, Gregorio and Alberto Musalem. (2000). Contractual Savings, Stock and Asset Markets*. World Bank Policy Research Working Paper 2490. Washington, D.C.* ISSN No. 2231-248X (Online), 2319-2194 (Print) © VSRD International Journals: www.vsrdjournals.com

[12] Kugler, M. and Ofoghi, R. (2005), *"Does Insurance Promote Economic Growth? Evidence from the UK".* Money Macro and Finance Research Group / Money Macro and Finance (MMF) Research Group Conference 2005, 1-3 September, University of Crete, Rethymno, Greece. Available from: http://repec.org/mmfc05/paper8.pdf (referred on 29/12/2013)

[13] Kumar v. and Prakash, v. (2012), Indian Insurance and Economic Development. *VSRD International Journal of Business and Management Research*, Vol. 2 No. 11 November 2012

[14] Marijuana C, Sandra L, Lime P (2009). "Insurance Sector development and Economic growth in Transition countries". *International Resources Journal of Finance and Economics*, issue 34.

[15] Merton RC, Bodie Z (1995). *"A conceptual framework for analyzing the financial environment".* Eds. Crane et al DB the global financial system, a Functional perspective, Harvard Business School press.

[16] Odhiambo N (2011). Financial intermediaries versus financial markets: A South African Experience*. International Business and Economic Research Journal*. 10(2): 77-84.

[17] Oke, M. O. (2012). Insurance Sector Development and Economic Growth in Nigeria. *African J. Business Management*. 6(23): 7016-7023.

[18] Olagbegi, L (2008), *Repositioning the Insurance Industry for a Prosperous Future Insurance*. Future Summit 2008, Transcorp Hilton Hotel Abuja.

[19] Omoke, P. H. (2012). Insurance Market Activity and Economic Growth: Evidence from Nigeria. *Acta Universitatis Danubius* Vol 8, no. 2.

[20] Oviatt, F. C. (1905). *"Economic place of insurance and its relation to society" in American Academy of Political and Social Science*. Annals of the American Academy of Political and Social Science XXVI. Published by A.L. Hummel for the American Academy of Political and Social Science. Retrieved 25 December, 2013.

[21] Peter RH, Kjell S (2006). "*The relationship of insurance and economic growth, A theoretical and Empirical analysis*". A paper presented at the 2006 EcoMod Conference, Hongkong. June 28-30.

[22] Popoola, N. (2010), *Challenges and Prospects of Life Insurance Business*. http://www.thenigerianvoice.com/nvnews/23292/1/challenges-and-prospects-of-life-insurance-busines.html. Accessed on 23 January, 2013.

[23] Shittu A. I. (2012). Financial International and Economic Growth in Nigeria. *British J. Arts and Social Sciences*. 4(2): 104-179.

[24] Skipper, H. D. (2001). *Insurance in the general agreement on trade in services.* America Enterprise Institute.

[25] Skipper, H. D., (1997), *Foreign Insurers in Emerging Markets: Issues and Concerns*, Occasional Paper 97-2, Center for Risk Management and Insurance.

[26] Soo, H. H. (1996). "*Life Insurance and Economic Growth: Theoretical and Empirical Investigation*." Dissertation. University of Nebraska.

[27] Verma, A. and Bala, R. (2013), The Relationship between Life Insurance and Economic Growth: Evidence from India. *Global Journal of Management and Business Studies*. ISSN 2248-9878 Volume 3, Number 4 (2013), pp. 413-422

[28] Wadlamannati KC (2008). "Do Insurance Sector Growth and Reforms affect Economic Development? Empirical evidence from India". *Journal of Applied Economic Resources*. 2(1): 43-86.

[29] Ward, D. and Zurbruegg, R. (2000), "Does Insurance Promote Economic Growth? Evidence from OECD Countries". *Journal of Risk and Insurance*, Vol. 67, No. 4, pp. 489-506.

[30] Webb, I. (2000). "*The Effect of Banking and Insurance on the Growth of Capital.*" Dissertation. Georgia State University.

[31] Webb, I., Grace, M. F. and Skipper, H. D. (2002), "*The Effect of Banking and Insurance on the Growth of Capital and Output*," Center for Risk Management and Insurance, Working Paper 02-1

THE EMPIRICAL EVIDENCE OF NIGERIA INSURANCE BUSINESS, CAPITAL MARKET AND ECONOMIC GROWTH

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ABSTRACT: This study examined the significance relationship that exists between insurance investment and the Nigeria capital market, and the significance relationship that exists between total insurance business and economic growth of Nigeria for the period 2000-2011. The Pearson's Product Movement Correlation Coefficient was used to test the hypotheses to determine the extent of correlation, while the t-test was used to find out the significance of the relationship that exists between the variables. The study discovered that there was a significant relationship between Nigeria Insurance market investment and capital market, and there was also a significant relationship between Insurance business and economic growth. The study concluded that Insurance business is a business that have allowed different risk to be managed more efficiently, boosting financial stability, mobilization of domestic saving and accumulation of new capital that enhance the performance of the Nigeria Capital market and Economic Growth. The researchers therefore recommended that National insurance commission (NAICOM) should make policy that will enhance effective growth and development of insurance business in Nigeria and ensures that cooperate organizations and individual embraces the compulsory insurance business in Nigeria.

KEYWORDS: Capital Market, Insurance, Investment, Economic Growth.

1   INTRODUCTION

1.1   BACKGROUND OF THE STUDY

Insurance is a form of risk management in which the insured transfers the cost of potential loss to another entity in exchange for monetary compensation known as the premium. Insurance In economic terms is refers to the pooling mechanism for reducing the down-side of risk through resource reallocation from good to stormy states of the world (Masci, Tejerina and Webb, 2007). Insurance facilitates financial protection against by reimbursing losses during crisis. It is designed to protect the financial well-being of an individual, company or other entity in the case of unexpected loss. This protection is accomplished through a pooling mechanism whereby many individuals who are vulnerable to the particular risk are joined together into a risk pool. Each person pays a small amount of money, known as a premium, into the pool, which is then used to compensate the unfortunate individuals who do actually suffer a loss. (Churchill, Craig, Liber, McCord, and Roth, 2003).

Typically, risk coverage is provided through a policy from an insurance company. The extent to which the insurer successfully facilitates coverage (and is able to spread its risk assumptions) is the extent to which the insured can take greater chances and better manage risk exposure. As such, insurance markets are crucial for economic growth and a complementary stimulus to capital market development (Masci, Tejerina and Webb, 2007).

The insurance market has been identified as an institution that contributes to the growth of the capital market. This is made possible through some of the vital roles played such as channeling resources, promoting reforms to modernize the financial sectors, and a veritable tool in the mobilization and allocation of savings among competitive uses which are critical to the growth and efficiency of the capital market. In developed economies, huge amounts of stable, long-term funds were channeled into capital markets by pension funds and the insurance sector and these funds facilitated the emergence of very liquid stock markets in those economies (Economic Survey of Indian Finance Ministry, 2012). Insurance market channels long-term resources that enhance the performance of the capital market, increase productivity, and thus enhancing economic expansion and growth (Alile 1997). The insurance market does not only serve as a source of capital for the capital market and industries, but provide a wide range of security and also enhance socio-economic benefits to any country. Ekundayo (2002) argues that a nation requires a lot of local and foreign investments to attain sustainable economic growth and development. The insurance industry invests in the capital market, hence providing the means of enhancing sustainable economic growth and development. However, the paucity of long-term capital has posed the greatest predicament to economic development in most African countries including Nigeria (Donwa and Odia, 2010).

The Nigeria Insurance Industry is one of the key sectors of the Nigerian economy and plays a very vital role in the nation as a whole (Agbamuche, 2012). The industry mobilizes funds that are channeled into productive investments and also acts as a catalyst of economic growth, helping to accelerate the process of qualitative structural transformation. It basically provides services in the form of security against general uncertainties which are likely to occur in everyday life, thereby resulting in liabilities which translate to a financial loss. These services are usually provided by the insurer to the insured in return for a given small consideration known as a premium which basically serves as the main source of insurance funds and also used in the settlement of claims (Agbamuche, 2012). The accumulated insurance premium and source of insurance fund are not kept dormant rather they are invested in capital market and other investment outlet as specified in Insurance Act of 2003.

The capital market is a network of specialized financial institutions, series of mechanisms, processes and infrastructure that, in various ways, facilitate the bringing together of suppliers and users of medium to long term capital for investment in socio-economic developmental projects (Al-Faki, 2006). The Capital Market is where individuals and institutions trade financial securities. As a whole organisations/institutions in the public and private sectors often sell securities on the capital markets to raise funds. In other words it is the mobilisation of funds from the savings (surplus) sector of the economy to the savings deficit sector. It is a market for the generalization and utilisation of long term funds for development purposes and deals with various securities such as bonds, debentures and equities. The Nigerian insurance industry like most other insurance companies around the world, channels a substantial part of its surplus funds to the capital market.

Olagbegi (2008) complained that while insurance companies are known to play dominant roles in developed economies, the sector in Nigeria is the exact opposite – the insurance industry in Nigeria contributes less than One percent to the nation's GDP. He says that the level of insurance awareness in Nigeria, which is a factor that influences the degree of patronage, remains one of the lowest in the world. Buttressing his point with records sourced from the industry, he showed that Nigeria, with a population of over 140 million people has an insurance density of about 5-10%, as against 40-50% in some developing countries, and 90-98% in most developed countries. This led to ask whether the level of insurance awareness and patronage aid the Nigeria insurance industry to contribute more effectively to economic growth and development. Therefore this journal paper assessed the level of significant relationship between the insurance market and capital market, and the level of the significant relationship between insurance business and economic growth.

2   LITERATURE REVIEW

2.1   THEORETICAL FRAMEWORK

The theory that guides this study is the theory of Financial Liberalization Theory. Financial liberalization theory has its origins in the work of McKinnon [1973] and Shaw [1973]. It was Patrick [1966], however, who published the seminal work on the relationship between financial development and economic growth. He hypothesized two possible relationships, a "demand-following" approach, in which financial development arises as the economy develops, and a "supply-leading" phenomenon, in which the widespread expansion of financial institutions leads to economic growth (Arestis, Nissanke and Stein, 2005). Led by seminal papers of McKinnon [1973] and Shaw [1973], a significant number of studies have pointed out that financial liberalization can exert a positive effect on growth rate as interest rate levels rise towards their competitive market equilibrium, while resources are efficiently allocated. Arestis (2005) states that the relationship between financial development and economic growth has received a great deal of attention throughout the modern history of economics.

2.2 EMPIRICAL REVIEW

Demiurgic-Kunt and Levine (1996) using data from 44 countries for the period 1986 to 1993 found that different measures of stock exchange size are strongly correlated to other indicators of activity levels of financial, banking, non-banking institutions as well as to insurance companies and pension funds. They concluded that countries with well-developed stock markets tend to also have well-developed financial intermediaries.

Agbamuche (2012) employed Chi-square model in his study on Investment of insurance funds in the Nigerian Capital market, and find out that; (i) the insurance industry invest substantial parts of its funds in the capital market. This implies that the surplus funds of the insurance companies after claims to policyholders have been paid out is then invested in the capital market in the form of government securities, corporate funds, real estate, mortgages etc. (ii) that the investments of insurance funds contributes to the socio economic growth of the country. This implies that as insurance contributions increase, economic growth would also increase hand in hand, (iii) that the insurance industry contributes positively to the growth of the capital market. This implies that the insurance industry is also a centre of capital formation, mobilization and allocation of resources within the economy because it deals with long term securities and it enables the funding of other deficit sectors of the economy. This finding shows that the major source of funds available to the insurance industry is through premium incomes; however other incomes come in the form of issuance of shares and other investment returns, (iv) that the insurance industry is a relevant sector of the economy. This would suggest that a direct or positive relationship exists between the insurance industry, insurance contribution and economic growth in the country. Ultimately a relevant and formidable insurance sector would help greatly in boosting overall economic growth in Nigeria.

Boon (2005) also observed in his study that total insurance funds affect both capital formation and gross domestic product growth in the short and long term. The importance of Boon's finding have to do with the fact that insurance and its core activities has a lot to do with investment, which in turn has a direct correlation with increased economic growth and productivity.

Mojekwu, Agwuegbu and Olowokudjo (2011) established and found that total insurance funds affect both capital formation and GDP growth in the short and long term. Their study employed dynamic factor model in their study and find out that there is a functional positive relationship between insurance contributions and economic growth in Nigeria.

Ngong (1997) developed an aggregate index of capital market development and use it to determine its relationship with long run economic growth in Nigeria. The study employed a time series data from 1970 to 1994. For measures of capital market development the ratio of market capitalization to GDP (in percentage), the ratio of total value of transactions on the main stock exchange to GDP (in percentage), and the value of equities transaction relative to GDP and listings used. The four measures were combined into one overall composite index of capital market using principal component analysis. A measure of financial market depth (which is the ratio of broad money to stock of money to GDP) was also included as control. The result of the study was that capital market development is negatively and significantly correlated with long run growth in Nigeria. The result also showed that there exists bi-directional causality between capital market and economic growth.

Ewan, Esang and Bassey (2009) appraise the impact of the capital market efficiency on the economic growth of Nigeria using time series data from 1961 to 2004.They found that the capital market in Nigeria has the potential of growth inducing but it has not contributed meaningfully to the economic growth of Nigeria because of low market capitalization, low absorptive capitalization, illiquidity, misappropriation of funds among others.

Haiss and Sümegi (2008) applied a cross country panel data analysis from 29 European countries in the period from 1992 to 2005. The insurance variable is measured by premium income and total net investment of insurance companies. Premium income is split into life and non-life premium income. As estimation method, the authors use ordinary least squares (OLS) or unbalanced panel with country and time-fixed effects. According to the findings, there is a positive impact of life insurance on GDP growth in the EU-15 countries; Switzerland, Norway and Iceland, while non-life insurance has a larger impact in Central and Eastern Europe.

Wadlamannati (2008) examined the effects of insurance growth and reforms along with other relevant control variables on economic development in India in the period from 1980 to 2006. Growth of insurance penetration (life, non-life and total) is used as proxies of insurance sector growth. The author applied ordinary least square (OLS), co-integration analysis and error correction models (ECM). The study confirms positive contribution on insurance sector to economic development and a long-run equilibrium relationship between the variables. While the reforms in the insurance sector do not affect economic activity, their growth has positive impact on economic development.

Marijuana, Sandra and lime (2009) empirically examined the relationship between insurance sector development and economic growth in 10 transition European Union member countries in the period from 1992 to 2007. Three different

insurance variables were used; life, non-life and total insurance and other control variables like education, openness, inflation, investment, bank credit, stock capitalization. According to their findings, insurance sector development positively and significantly affects economic growth.

Eze and Okoye (2013) examined the impact of insurance practice on the growth of Nigerian economy. Insurance premium income, total insurance investment and income of insurance development was used as determinants of insurance practice. They employed unit root tests, Johansen co-integration test and error correction model in data analysis to determine the short and long run effect of the model. The study observed that the insurance premium capital has significantly impacted on economic growth in Nigeria; that the level of total insurance investment has significantly effected on economic growth in Nigeria; and that there is causal relationship between insurance sector development and economic growth in Nigeria. Their findings implied that insurance industry would contribute meaningful to the growth of Nigeria economy in the long run. The study concluded that there is a significant positive effect of insurance practice on the growth of Nigerian economy. They recommended that, having seen that there is long-run relationship between insurance industry practice and economic growth in Nigeria. They further advised that more efforts should be made to increase transparency and efficiency in insurance industry through adequate legislation and policy formulation targeted at providing institutional improvement, especially in risk management and product innovations in Nigeria insurance industry.

2.3   THE CONCEPT OF INSURANCE AND CAPITAL MARKET

Insurance is a safeguard against risk. It is a device aimed at reducing the chance of a risk occurring or when it happen reduces the extent of its damage and providing the affected person with compensation is a form of insurance (Ogwo, Eche, Ibeabuchi, Nwite and Enwereuzor: 2000). Irukwu (1989) further defined insurance as a device for the transfer of some risks of economic loss from the insured who otherwise would have borne the risks to an insurer in return for a premium.

Irukwu (1989) defined insurance as a social device whereby the participants provide financial compensation to those among them who encounter the many misfortunes or contingencies that could happen in a world full of assorted risks and hazards. Lijadu (1999) describes insurance as the principle of charity put into an official form for business purposes in other to meet financial requirements. It is the conversion of unknown risks into fixed costs by way of consolidation of an economic device where by various the risks associated with living or other economic enterprises are transferred from an individual to a group.

Insurance is a social device that provides financial compensation for the effect of misfortune; the payment is being made from the accumulated contribution of all parties participating in the scheme. Insurance as a modern principle of solving risk-related problem depends on the law of co-operation of large number of people for its success. Its operation involves payment of assessed contribution, known as premium, by the person wishing to insure known as the insured or the policyholder. The payment is made to an organization legally constituted and registered in accordance with the law to function as an insurance company or insurer (Ogwo et al: 2000). The role insurance play encompass: Promotion of industrial safety and general loss prevention measure (Nwite, 2004), encouraging savings (Ogwo et al: 2000), promoting the growth of capital market and foreign direct business, promoting growth and development of the economy (Nwite, 2004), protection against economic insecurity, reduction of the level of unemployment in the country etc.

Capital market is one of the significant aspects of every financial market. It is a market for financial assets that have a long or indefinite maturity. Rose (2009) accord with the above definition by saying that capital market is a market that is designed to finance long term investment.

Capital market is seen as a "market for the mobilization of funds from the savings surplus sector of the economy to the savings deficit sector. According to Al-Faki (2006), the capital market is a "network of specialized financial institutions, series of mechanism, processes and infrastructure that, in various ways, facilitate the binging together of suppliers and users of medium to long term capital for investments in socio economic developmental projects". Adewole (2010) further described the capital market as covering all services rendered institutions and facilities which exist for mobilizing long term funds and for channeling such funds to ultimate users. He divided the market into two segments namely the long term securities market and market for negotiated long term finance, otherwise called the primary and secondary market.

-**Long term securities market**: This constitutes the centre point of the capital market and is involved in productive assets. It includes the new issues market and the stock exchange which exist for the resale of existing securities.

-**Market for negotiated long term finance**: These are dealings in long term funds not covered by negotiable instruments dealings but involve direct negotiation between suppliers and users of long term funds.

The role of the capital market include; Mobilization of Savings, Capital Formation, Provision of Investment Avenue, Speed up Economic Growth and Development and Continuous Availability of Funds Kalyan City Life (2010).

3   RESEARCH METHODOLOGY

3.1   RESEARCH DESIGN

The type of study was a correlation study (ex-post-facto research). The work employed analytical research design. Being an empirical research work, the data used were secondary data, and were collected from CBN statistical bulletin and Nigeria Insurers Digest.

In line with previous similar studies on the insurance, capital market and economic growth, Pearson's Product Movement Correlation Coefficient and the student t-test were used to test the hypothesis of the study.

3.2   NATURE AND SOURCE OF DATA

This work employed secondary data. Such data were extracted from Central Bank of Nigeria statistical bulletin and Nigeria Insurance Digest. All data span a period from 2000 to 2011.

3.3   METHOD OF DATA ANALYSIS

The researchers employed Pearson's Product Movement Correlation Coefficient and the student t-test to test the formulated hypotheses. The Pearson's Product Movement Correlation Coefficient in testing the hypotheses is to determine the extent of correlation between the coefficient of correlation, while the t-test is used to ascertain the level of significance that exists between the variables.

3.4   MODEL SPECIFICATION

The Product Movement Correlation Coefficient is used in this study. The formula is thus illustrated:

$$R = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2] \times [n\sum y^2 - (\sum y)^2]}}$$

Where: R= the correlation coefficient

   X= independent variable (life insurance)

   Y=dependent variable (GDP)

   N=number of years

   ∑= summation sign

Decision Rule:

Accept the Null hypothesis (Ho) if the tabulated value of the T-Test is greater than the calculated value of T-test and vice-versa.

3.5   TESTING OF HYPOTHESES

Hypothesis I:

Ho: there is no significant relationship that exists between the Nigeria insurance market investment and capital market.

Table 1.   Structure Showing Total Insurance Business Investment and Market Capitalization in trillion.

Year	Insurance Business Investment (t)	Market Capitalization (t)
2000	0.025	0.472
2001	0.032	0.663
2002	0.037	0.765
2003	0.055	1.352
2004	0.075	2.115
2005	0.122	2.900
2006	0.216	5.121
2007	0.329	13.182
2008	0.336	9.563
2009	0.343	7.031
2010	0.351	9.918
2011	0.359	9.671

Source: CBN Statistical Bulletin

Table 2.   Structure of Contingent Table

Year	Insurance Investment (x)	Market Capitalization (y)	x^2	y^2	xy
2000	0.025	0.47	0.00063	0.22	0.012
2001	0.032	0.66	0.00102	0.44	0.021
2002	0.037	0.77	0.00137	0.59	0.028
2003	0.055	1.77	0.00303	3.14	0.097
2004	0.075	2.11	0.00563	4.46	0.158
2005	0.122	2.90	0.0149	8.41	0.354
2006	0.216	5.12	0.0467	26.22	1.106
2007	0.392	13.18	0.1082	173.77	4.337
2008	0.336	9.56	0.0467	91.45	3.213
2009	0.343	7.03	0.1082	49.43	2.412
2010	0.351	9.92	0.1232	98.37	3.481
2011	0.359	9.67	0.1289	93.53	3.472
Total	∑x=2.28	∑y=63.16	$\sum x^2$=0.6641	$\sum y^2$=550.03	∑xy=16.691

Source: field survey (2014)

Applying Pearson's Product Correlation Coefficient Formular;

$$R = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2] \times [n\sum y^2 - (\sum y)^2]}}$$

$$R = \frac{12(16.691) - (2.28)(63.16)}{\sqrt{[12(0.6641) - (2.28)^2] \times [12(550.03) - (63.2)^2]}}$$

$$R = \frac{200.292 - 144.005}{\sqrt{(7.79 - 5.1984)(6600.36 - 3989.19)}}$$

$$R = \frac{56.287}{\sqrt{(2.7716)(2611.17)}}$$

$$R = \frac{56.287}{\sqrt{7237.12}}$$

$$R = \frac{56.287}{85.071} = 0.66$$

r= 0.66

It is shown that there is a positive correlation between Total Insurance business investment and market capitalization. Therefore to test the level of its significant of the positive correlation coefficient, the researcher applied t-test formular and converted the value of "r" to "t" score.

The formula is thus illustrated;

$$T = r \frac{n-2}{1-r^2}$$

Where t = the significant correlation

N= sample population

n-2= Degree of freedom

r^2= The coefficient determination

$$T = 0.66 \frac{\sqrt{12 - 2}}{1-(0.66)}$$

$$T = 0.66 \frac{\sqrt{10}}{1-0.4356}$$

$$T = 0.66 \frac{\sqrt{10}}{1-0.5644}$$

$$T = 0.66 \times \sqrt{17.71}$$

T=0.66 x 4.21

T=2.79

At 5% level of significant error the tabulated value of t- test is1.812 at 10 degree of freedom.

Hypotheses 2

Ho: there is no level of significant relationship between insurance business and economic growth.

Table 3. Structure showing total insurance business and GDP

Year	Total Insurance Business(t)	GDP(t)
2000	0.11	4.72
2001	0.14	4.91
2002	0.17	7.13
2003	0.23	8.74
2004	0.29	11.67
2005	0.40	14.74
2006	0.61	18.71
2007	0.86	20.87
2008	1.06	24.55
2009	1.11	25.10
2010	1.12	29.59
2011	1.22	36.55

Source: CBN Statistical Bulletin and Nigeria Insurance Digest.

Table 4. Contingency Table

Year	Total Insurance Business (t) (x)	GDP (t) (y)	x^2	y^2	xy
2000	0.11	4.72	0.012	22.28	0.52
2001	0.14	4.91	0.020	24.11	0.69
2002	0.17	7.13	0.029	50.84	1.21
2003	0.23	8.74	0.053	76.39	2.01
2004	0.29	11.67	0.084	136.18	3.38
2005	0.40	14.74	0.16	217.27	5.90
2006	0.61	18.71	0.372	350.06	11.41
2007	0.86	20.87	0.740	435.56	17.95
2008	1.06	24.55	1.124	602.70	26.02
2009	1.11	25.10	1.232	630.01	27.86
2010	1.12	29.59	1.254	875.57	33.14
2011	1.22	36.55	1.488	1335.57	44.59
Total	∑x=7.32	∑y=207.28	$\sum x^2 = 6.57$	$\sum y^2$=4756.87	∑xy=174.68

Source: field survey (2014)

Applying pension's product correlation coefficient formular:

$$R = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2] \times [n\sum y^2 - (\sum y)^2]}}$$

$$R = \frac{(174.68) - (7.32)(207.28)}{\sqrt{[12(6.57) - (7.32)^2] \times [12(4756.87) - (207.28)^2]}}$$

$$R = \frac{2096.16 - 1517.29}{\sqrt{[78.84 - 53.58] \times [57082.44 - 42965.00]}}$$

$$R = \frac{578.87}{\sqrt{25.26 \times 14117.44}}$$

$$R = \frac{578.87}{\sqrt{356606.53}}$$

$$R = \frac{575.87}{597.17}$$

It is shown that there is a high positive relationship between Total Insurance business in Nigeria and Gross domestic product (GDP). However, to test the level of significant positive correlation coefficient researcher applied t –test formular and corrected the value of "r" to "t" score. The formular is

$$T = r\sqrt{\frac{n-2}{1-r^2}}$$

$$T = 0.97\sqrt{\frac{12-2}{1-(0.97)^2}}$$

$$T = 0.97\sqrt{\frac{10}{1-0.92}}$$

$$T = 0.97\sqrt{\frac{10}{0.078}}$$

$$T = 0.97\sqrt{128.205}$$

$$T = 0.97 \times 11.32$$

$$T = 10.98$$

At 5% level of significant error the tabulated value of t- test is1.812 at 10 degree of freedom.

4 EMPIRICAL RESULT

We investigated the hypothesis by using Pension's Product Movement Correlation Coefficient. The result of the hypothesis one revealed that there is a significant relationship between Nigeria Insurance market investment and capital market. This means that Nigeria insurance contribute to the growth and development of Nigeria capital market.

In the hypothesis two tested, the researcher find out that there is a significant relationship between Insurance business and economic growth, and it means that the Nigeria insurance market contributes to economic growth and development of Nigeria.

5   CONCLUSIONS

Insurance business is a business that have allow different risk to be managed more efficiently, boosting financial stability, mobilization of domestic saving, accumulation of new capital etc. hence contributes to the growth of the Nigeria capital market and economic growth of Nigeria. The research work has shown insurance performance in Nigeria.

The importance of the insurance sector within total financial intermediation has risen overtime and the magnitude and relationship between insurance sector and capital market has also risen, thus the contributions insurance sector enhances economic growth and development of the Nigeria.

6   RECOMMENDATION

The insurance market activities and its contribution to economic growth are still at minimal to compare with that of developed countries. Therefore, the researcher recommends to that National Insurance Commission should make policy that will enhance effective growth and development of insurance business in Nigeria and ensures that both cooperate organizations and individual embraces the compulsory insurance business in Nigeria.

The Nigeria government should also provide enabling environment that will facilitate the growth of insurance business.

The Nigeria insurance industry should also ensure prompt settlement of genuine claims.

REFERENCES

[1]   Adewole, A,. (2010). *Predicting insurance investment: A factor analytic approach*. J math science publication. 6 (3) 321-324.
[2]   Agbamuche U., (2012). *Investment of insurance funds in the Nigerian Capital market*. www.dare.uva.nl/document/358477. Accessed on 3rd January 2014.
[3]   Al-Faki, M. (2006). *The Nigerian Capital Market and socio economic development.* Faculty of social sciences public lecture, University of Benin. 9-16.
[4]   Alile, H. (1997). "Government Must Divest" *The Business Concord of Nigeria.* 2nd December, page 8.
[5]   Arestis, P. (2005), *"Financial Liberalisation and the Relationship between Finance and Growth",* Working Papers Series No.05/05, Department of Land Economy, University of Cambridge, UK.
[6]   Arestis, P., Machiko, N. and Howard S. (2005), "*Finance and Development: Institutional and Policy Alternatives to Financial Liberalization Theory".* college.holycross.edu/eej/Volume31/V31N2P245_263.pdf   accessed on 9th August, 2013.
[7]   Boon, K., (2005). *An analysis of Singapore economy*, working paper of the School of Humanities and social studies, Nanyang Technological University.
[8]   Churchill, C., Liber D., McCord M., and Roth J.(2003). *Making Insurance Work for Microfinance Institutions*: A Technical Guide to Developing and Delivering Microinsurance. Geneva: International Labour Organization.
[9]   Demirgüç-Kunt, A., and Ross L. (1996). Stock Markets, Corporate Finance, and Economic Growth: An Overview. *World Bank Economic Review 10 (2): 223–39.*
[10] Donwa P. and Odia J., (2010). *An Empirical Analysis of the Impact of the Nigerian Capital Market on Her Socio-economic Development*. www. Krepubplishers.com/02-journals. Accessed on 3rd January 2014.
[11] Economic Survey of Indian Finance Ministry,(2012). Insurance Sector Investment for Capital Market Development. Economic *Survey of Indian Finance Ministry; March. Vol 3. No 1*.
[12] Ekundayo IK (2002). Creating a conducive Environment for Investment in the Nigerian Capital Market. *Paper Presented at Public Enlightenment on Opportunities in the Capital Market for industrial Development of Kogi stat '* Lokoja 29th March to1st April, 2002.
[13] Eze, O. R. and Okoye, V. (2013), Anaysis of insurance practices and economic growth in Nigeria: using co-integration test and error correction model, *Global Advanced Research Journal of Management and Business Studies Vol. 2(1) pp. 063-070.*
[14] Falegan, J., (2000). Insurance and Capital Market. *CBN bulletin publication Vol 8,(2) 43 -47.*
[15] Haise P, Sümeg K (2008). *"*The relationship between Insurance and Economic Growth in Europe. A Theoretical and empirical analysis". *Empirical Journal*, 35(4): 405-431.
[16] Irukwu, J.O. (1981) *Insurance management in Africa*. Lagos, Published by Caxton Press (W.A) Nigeria Ltd.
[17] Kalyan City Life (2010), *What is Capital Market ? Meaning, Functions and Role.* http://kalyan-city.blogspot.com/2010/09/what-is-capital-market-meaning.html. Accessed 12th January, 2014.

[18] Lijadu. Y., (1999). Insurance industry and capital development. *CBN publication*, Vol 8.1, 22.

[19] Marijuana C, Sandra L and lime P (2009). "Insurance Sector development and Economic growth in Transition countries". *Int. Res. J. Financ. Econom., issue 34.*

[20] Masci, P., Tejerina, L. and Webb, I. (2007). *Insurance Market Development in Latin America and the Caribbean.* Inter-American Development Bank 1300 New York Avenue, N.W. Washington, D.C. 20577.

[21] McKinnon, R.I. (1973), *Money and Capital in Economic Development*, Washington, DC: Brookings Institution.

[22] Mojekwu, J.N, Agwuegbo, S. and Olowokudejo F. F., (2011). The Impact of Insurance Contribution on Economic Growth in Nigeria. *Journal of economics and international finance.* Vol. 3 (7), 444-451, July.

[23] Nwite, S. C. (2004): *Element of Insurance.* Enugu, Nigeria; Immaculate Publication, Ltd.

[24] Nyong M. O. (1997). Capital Market Development and Long run Economic Growth: Theory, Evidence and Analysis, *First Bank Review,* December pp. 13-38.

[25] Ogwo, Eche, Ibeabuchi, Nwite Enwereuzo (2000), *Introduction to Insurance.* Enugu, Nigeria. Immaculate Publication Ltd.

[26] Olagbegi, L (2008), *Repositioning the Insurance Industry for a Prosperous Future Insurance,* Future Summit 2008, Transcorp Hilton Hotel Abuja.

[27] Patrick, H. (1966), "*Financial Development and Economic Growth in Underdeveloped Countries*" New Haven, Ct.: Yale University, Economic Growth Center.

[28] Rose, P., (2009). Money and capital market. Rexas business. *Journal of the CIIN*, Vol 4, 5, 20.

[29] Shaw, E.S. (1973), *Financial Deepening in Economic Development*, New York: Oxford University Press.

[30] Wadlamannati K. C. (2008). "Do Insurance Sector Growth and Reforms affect Economic Development? Empirical evidence from India". *J. Appl. Econom. Res., 2(1): 43-86.*

New Artificial Intelligent Approach for Bubble Point Pressure

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ABSTRACT: Bubble point pressure is the most crucial Pressure-Volume-Temperature property of reservoir fluid, which plays a critical role in almost all tasks related to reservoir and production engineering. There are numerous approaches for predicting various Bubble point pressure properties, namely, empirical correlations and few computational intelligence schemes. The achievements of Neural Networks (NN), Fuzzy Logic (FL) Genetic Algorithm (GA), and Expert System (ES) alone open the door to the Hybrid Systems; a genetically optimized neural network (GA-ANN) and Neuro-Fuzzy (NF) modeling techniques to play a major role in petroleum industry.

In this paper, a novel comprehensive approach to the prediction of the bubble point pressure (Pb) using two hybrid systems (GA-ANN and NF) and Expert System is introduced. A total of about 160 data points from Middle East oil samples were used. Twenty three correlations of Pb are integrated to develop Expert System. The performance of the proposed techniques is compared against performance of the most accurate general correlations for Pb calculation. Statistical error analysis was also used to check the validation of the proposed techniques. From the results of this study, it can be pointed out that these methods are more accurate and reliable.

KEYWORDS: Neural Network, fuzzy logic, Neuro-Fuzzy, Expert Systems.

1 INTRODUCTION

Bubble point pressure is one of the most critical quantities for characterizing an oil reservoir. So, accurate determination of this property has been the main challenge in reservoir development and management.

1.1 EMPIRICAL CORRELATIONS

Since the 1940s engineers have realized the importance of developing empirical correlation for bubble point pressure. Studies carried out in this field resulted in the development of new correlations. **Table1** shows the most published correlations for estimation the bubble point pressure from 1947 till now.

Table 1. Bubble Point Pressure Correlations, Moradi [1] and Al-Shammasi [2].

Authors	Samples Origin	No. of Data Points	No. of Reservoir	Authors	Samples Origin	No. of Data Points	No. of Reservoir
Standing (1947)	California	105	22	Farshad, Leblance, Garber & Osorio [Single Stage] (1996)	Colombia	98	-
Lasater (1958)	Canada	158	137	Almehaideb (1997)	UAE	62	15
Vazquez &Beggs (1980)	World Wide	5008	600	Hanafy, Macary, ElNadi, Baiomi& El Batanony (February 1997)	Egypt	324	123
Glaso (1980)	North Sea	41	45	Hanafy, Macary, ElNadi, Baiomi& El Batanony (1997)	Egypt	324	123
Al-Marhoun (1988)	Middle East	160	69	Khairy and El-Tayeb (1998)	Egypt	43	-
McCain (1991)	World Wide	100	-	Boukadi, Al-Alawi, Al-Bemani& Al-Bemani (1999)	Oman	45	-
Kartoatmodjo and Schmidt (1991)	World Wide	5392	740	Velarde, Blasingame& McCain (1999)	World Wide	2097	world
Dokla& Osman (1992)	U.A.E	51	-	Al-Shammasi (1999)	World Wide	1709	world
Macary and El-Batanoney (1992)	Gulf of Suez	90	30	Dindoruk&Christman (2001)	Gulf of Mexico	99	100
Petrosky&Farshad (1993)	Gulf of Mexico Texas	81	-	Bolondarzadeh, Hashemi&Soltani (2006)	Iran	166	-
Omar &Todd (1993)	Malaysia	93	38	Mehran, Movagharnejad and Didanloo (2006)	Iran	387	-
-	-	-	-	Hemmati&Kharrat (2007)	Iran	287	30

1.2 HYBRID ARTIFICIAL INTELLIGENT

The achievements of Neural Networks, Fuzzy Logic and Genetic Algorithm alone open the door to the Hybrid modeling techniques to play a major role in the oil and gas industry. Unfortunately, the used NN, GA, and FL modeling schemes alone have many drawbacks and limitations (**Table 2**).

Table 2. Advantages and disadvantages of the NNs, FL and GAs.

Technology	Advantage	Disadvantage
NN	Adaptation, learning, approximation	Slow convergence speed, 'black box' data processing structure
FL	Approximate reasoning	Difficult to tune, lacks effective learning capability
GA	Systematic random search, derivative-free optimization	Difficult to tune, no convergence criterion

1.2.1 ANN Optimization by GA

The non-linearity and non-continuity of oil field optimization problem makes GA a more preferable option over traditional method of back propagation (BP). A hybrid genetic algorithm–neural network strategy (GA-ANN) were used by (Rumelhart et al. [3]; Miller et al. [4]; Marshall and Harrison [5]; Bornholdt and Graudenz [6]; Huanga et al. [7]; Chena and Lina [8]; Saemi et al. [9]; Rasoul and Reza [10]; and Hossein K. et al. [11] for permeability prediction modeling.

In additional, several hybrids of genetic algorithm with ANNs were proposed by Balan et al. [12] for hydraulic fracture treatment design and optimization. Mohsen et al. [13] proposed a new method for the auto-design of ANN based on Genetic

Algorithm. In Oloso et al. [14] a differential evolutionary artificial neural network was introduced for predicting viscosity and gas/oil ratio curves.

1.2.2 Neuro-Fuzzy

Adaptive neuro-fuzzy inference systems have been proposed as a new intelligence frame work for both prediction and classification based on fuzzy clustering optimization criterion and ranking (Jang et al. [15]). In 2000, Ouenes [16] used fuzzy neural networks to fractured reservoir characterization. In 2012, Khoukhi [17] also used GA to optimize ANN model to estimate the two PVT properties of crude oil systems; namely bubblepoint and oil formation volume factor (Bob). Fatai A. et al [18] used different versions of Adaptive Neuro-Fuzzy Inference Systems (ANFIS) to predict the porosity and permeability. Abbas M. Al-Khudafi and et al. [19] used ANFIS for estimating K-values for heptanes plus fractions.

1.2.3 Expert System (ES)

Expert system technology has recently gained an increasing importance in the petroleum industry. Application areas include diagnosis, planning, design, prediction, interpretation, monitoring, debugging, repair, and control of different processes in oil and gas engineering.

An expert system developer can choose three different approaches in developing an ES, which are: using programming language (example Matlab); using an Expert System shell; and using the tools in an artificial environment. Sayyouh, M.H et al [20]; Khaled A. Fattah et al. [21]; and Elradi and Cheng [22] applied of an Artificial Intelligence (AI) technique to assist in the selection of an Enhanced Oil Recovery method (EOR). Ahmed Al-Zahaby et al. [23] developed an expert system that checks the input parameters (e.g. reservoir parameters) against the valid ranges of input data for different correlations, and then recommends which correlations to use for specific input parameters. Senan A. Ghallab and et al. [24] designed an expert system to predict temperature, pressure, crude oil density, gravity and gas density factors.

2   DATA ACQUISITION AND PROCESSING

A total of about 160 data points were available from Middle East oil samples. The overall range of experimental data points used for this study was summarized in Table 3. Data is normalized between (0 1), in order to data rate reduction, noise suppression and avoiding ill conditioning.

$$Vnorm = (V-Xmin) / (Xmax-Xmin) \dots\dots\dots\dots\dots\dots\dots (1)$$

Where: V is a current value of the variable X, Xmin, is the minimum value for this variable, and Xmax, is the maximum value for that variable X in the data set. Then data renormalized between (0.2-0.8) to alleviate saturation problem by an equation such as:

$$Y = Vnorm \times (0.8-0.2) + 0.2 \dots\dots\dots\dots\dots\dots (2)$$

Table 3.   Range of data used in this study.

Parameter	Maximum	Minimum
P_b	3573	130
Gas Oil Ratio (R_S)	1602	26
Gas Specific Gravity (γ_g)	1.367	0.752
API	44.6	19.4
Temperature (T ^{o}F)	240	74
Formation Volume Factor (FVF)	1.997	1.032

3   BUILDING THE MODELS

3.1   DESIGN OF THE HYBRID GA-ANN MODEL

In this work we investigate how the reliability and predictability of artificial neural network (ANN) are improved when it genetically optimized by genetic algorithm (GA).

The ANN learning process consists of two stages: Firstly GA is employed to search for optimal or approximate optimal connection weights and thresholds for the network, then the back-propagation learning rule and training algorithm is used to adjust the final weights (Figure1).
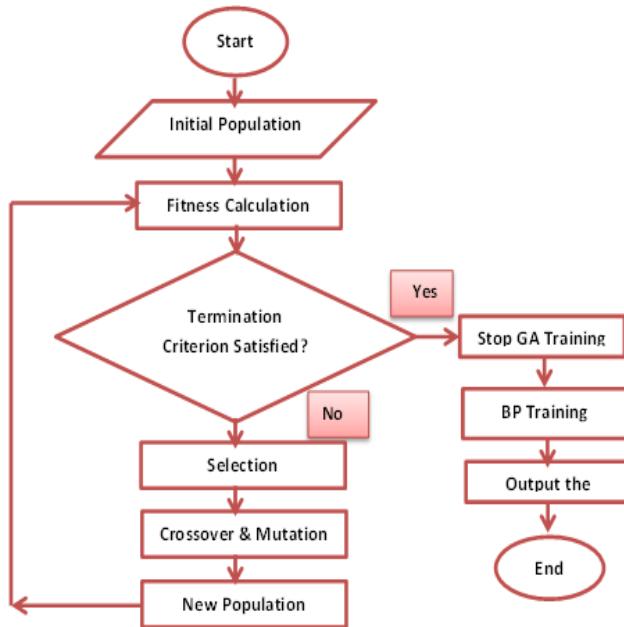

Fig. 1.   Genetic Algorithm-Backpropagation Flow Chart.

The operations are as follows: The ANN weights and thresholds are initialized as genes of chromosomes, and then the global optimum is searched through selection, crossover and mutation operators of genetic algorithm. This procedure is completed by applying a BP algorithm on the GA established initial connection weights and thresholds. Therefore in this study, hybrid genetic algorithm-back propagation neural network would be applied to estimate Bubble Point Pressure.

3.2   DESIGN OF THE NEURO-FUZZY MODELING

The fuzzy logic Pb modeling system used in this study is a multi-input single output (MISO) Takagi-Sugeno system. Neuro-fuzzy inference systems are hybrid forecasting frameworks, which learn the rules and membership functions from data. It is a network of nodes and directional links. Associated with the network is a learning rule, for instance, back-propagation. These networks are learned a relationship between inputs and outputs. This type of network covers a number of different approaches, namely Mamdani type and Takagi–Sugeno–Kang (TSK) type (see Jang et al. [25]) for more detail. The TSK fuzzy objective modeling method is a framework for generating fuzzy if-then rules from input/output numerical data. A way to construct a TSK fuzzy model from numerical data proceeds in three steps: fuzzy clustering, setting of the membership functions, and parameter estimation (Jang and Gulley [26]). Figure2 shows an ANFIS System with a two-inputs two-rules one-output arrangement.
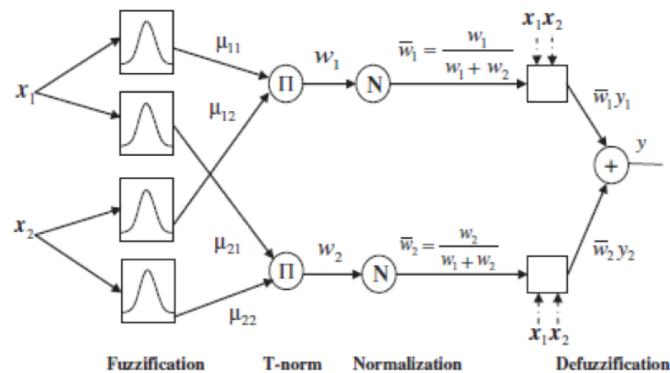
Fig. 2.   ANFIS system with two inputs two-rule one-output, [15].

The implemented ANFIS in the study at hand is made up of six layers. The first layer is the input layer, characterizing the crisp inputs. The second layer performs the fuzzification of the crisp inputs into linguistic variables, through transfer functions. The thirds rule layer, which applies the product T-norm to produce the firing strengths of each rule. This is followed by a normalization layer, at which each node calculates the ratio of a rule's firing strength to the sum of the firing strengths of all rules. The fifth layer performs the defuzzification. The last layer conducts the aggregation, where an output is obtained as the summation of all incoming signals. The training rule option used is the Levenberg-Marquard version of the gradient back-propagation algorithm.

3.3 DESIGN OF THE EXPERT SYSTEM

As it shown from Table1,some bubble point pressure correlations was developed using data from particular region with different reservoir conditions whereas the others can be developed using data from different region and reservoir conditions. The most correlation can be predicted either by recalculating the coefficients of pervious correlation or by evaluating the exist correlations without respect of region and reservoir types. Thus, the problem will arise in which correlation is better to use. Therefore, the Expert System was developed to solve this problem by getting the nearest value of Pb that agrees with region and reservoir conditions. The Expert System integrated all correlations with respect to their limitations.

The development of the Expert System of PVT properties involves the following three phases Knowledge Acquisition, System Formulation, and System Verification and validation.

3.3.1 Knowledge Acquisition

Understanding the main input parameters and the range of each published correlations (limitations) are the first step as well as the identification of the expert systems. The developed Expert System for the bubble point pressure correlations considers the Table5 as a knowledge data base.

3.3.2 System Formulation

The system formulation formulates the acquired knowledge from the first phase through rules. The rules are conditional statements in the form of IF-THEN statements. The system was developed by using Matlab Program that flexible to allow the system to perform its task easily. Figure3 shows bubble point pressure Expert System utilization.

3.3.3 Expert System Utilization and Validation

The developed Expert System could be utilized to determine bubble point pressure by integrated 23 correlations. The developed Expert System can check the different input reservoir parameters and run each correlation regarding into their limitation. Each correlation can utilize in some input data and exclude in others which don't achieve the criteria of the limitation of the input parameters.

The reservoir parameters are processed through developed software to determine the most accurate bubble point pressure regarding to the minimum absolute error.
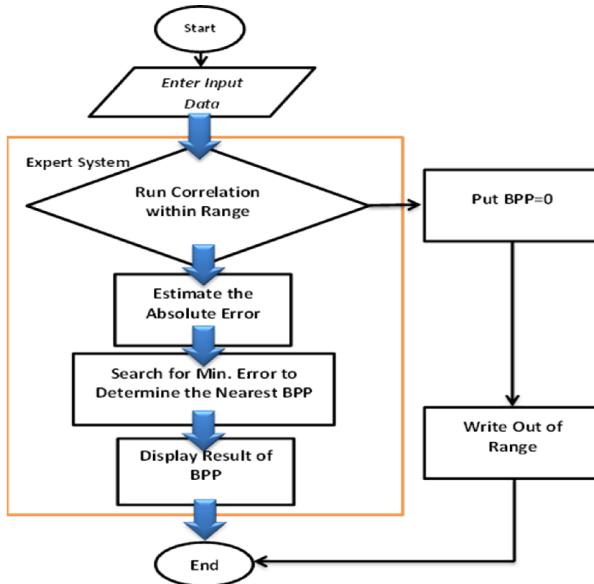
Fig. 3.   Bubble Point Pressure Expert System Utilization.

4   RESULTS AND DISCUSSION

4.1   THE HYBRID GA-ANN MODEL

The total number of chromosomes was (300chromosomes×50 generation×2 layers), although there was no difference between chromosomes in one generation with one in another generation of each case. BP network has two layers including input layer, one hidden layer, and output layer. There have 5 input neurons in the code and the output layer neuron is 1.

In our model we set the hidden layer number is 14 deliver neuron functions is tansig in the hidden layer, and the output layer's deliver neuron function is purelin. The simulation performance of the GA-ANN model (Figure4) was evaluated on the basis of mean square error (MSE= 9.96*10-4) and correlation coefficient (R2 = 0.99988).
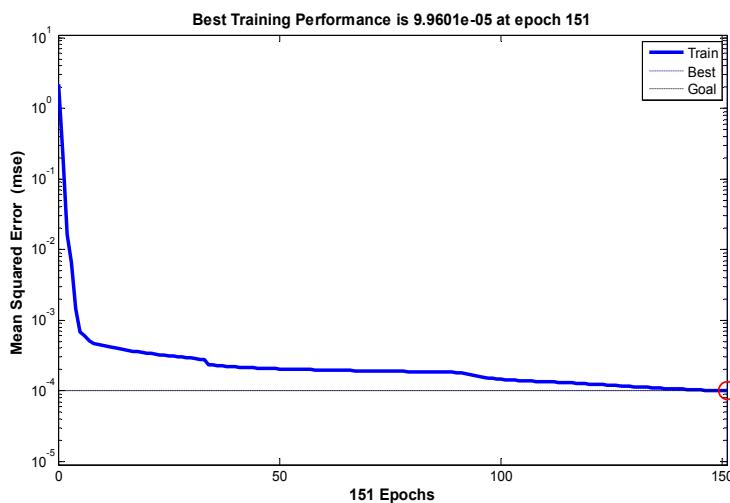
Fig. 4.   RMSE training performance by GA-ANN optimization.

4.2   THE NEURO-FUZZY MODELLING

In this stage of study, an adaptive neuro-fuzzy inference system (ANFIS) was used to optimize the fuzzy model. The schematic structure of ANFIS model, formulating PVT data to bubble point pressure, is illustrated inFigure5.

Two versions based on the training algorithm, of the ANFIS hybrid model were used in this study: Grid Partitioning, and Subtractive Clustering. The ANFIS with Grid Partitioning (ANFIS-GP) was used to generate a single-output Sugeno-type fuzzy inference system (FIS) using a grid partition on the data. The Neuro-Fuzzy model always needs to select the suitable input-output data. All options of this model were applied and the optimal option was chosen.

The ANFIS with Subtractive Clustering (ANFIS-SC) was also used to generate a FIS by first applying subtractive clustering on the data. This is accomplished by extracting a set of rules that models the data behavior by first using the genfis2 function to determine the number of rules and antecedent membership functions and then using linear least squares estimation to determine each rule's consequent equations.

In order to find the optimum radii, firstly different radii were proposed to estimate the bubble point pressure. The RMSE and the correlation coefficients (R^2) were calculated. From Figures 6&7, the optimal clustering radius was specified (0.42) whereas the optimal output function with RMSE equal to 35 and 90.4 and R^2 equal to 0.9994 and 0.996 for training and testing data respectively.
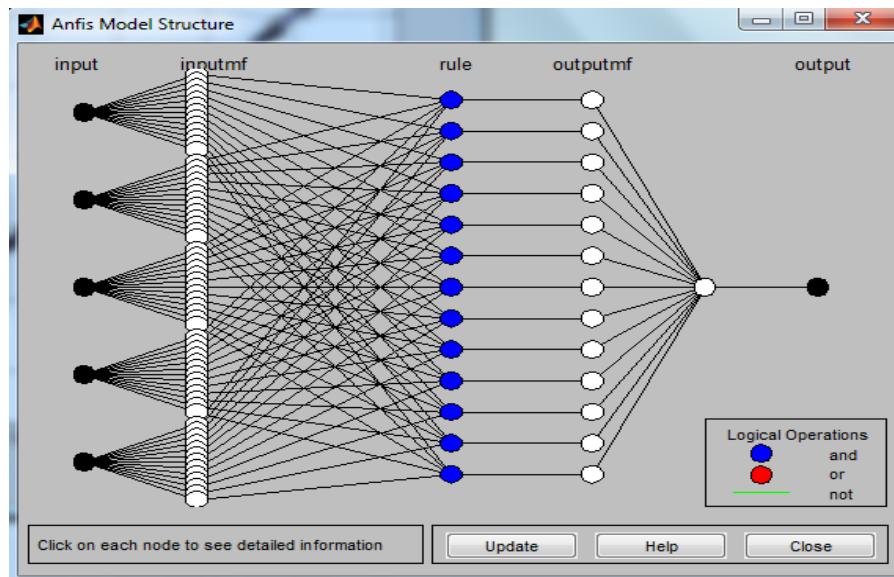
Fig. 5. ANFIS model structure of Pb prediction.
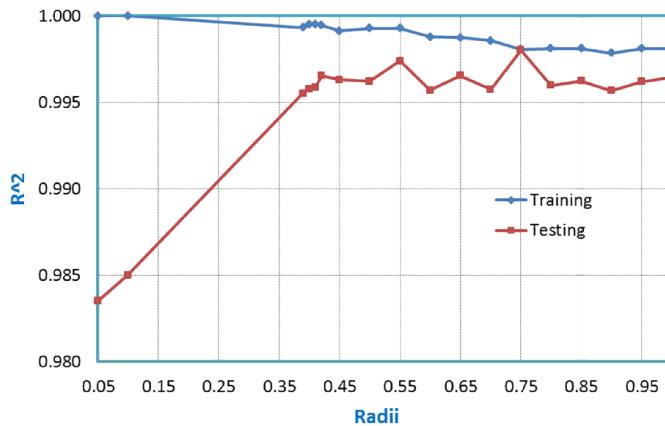
Fig. 6. Optimal Radii for ANFIS-SC with Dataset.

Fig. 7. *Optimal Radii for ANFIS-SC with Dataset.*

A hybrid optimization method which combines least squares estimations with back-propagation was used to adjust the membership functions' (MFs) parameters. Several input MFs types with different number function (2, 3) were tried with linear and constant output MFs. The grid partition method first uses the genfis1 function to determine the optimal number and type of membership functions from input-output bubble point pressure datasets. This is summarized and shown in Figures8 & 9. However, Gaussian MFs with linear output MF were found to be highly competitive in performance. A further comparative investigation showed that the Gaussian MF is optimal for this problem. This agrees with literature of Quintana [26] who presents the Gaussian MF as the best for most applications.

$$\mu_{Ai}(x) = exp\left(\frac{-(x-c)^2}{2\sigma^2}\right) \dots \dots \dots \dots \dots \dots \dots (3)$$

Where C and σ^2 are the centre and width of the fuzzy set Ai respectively.

Two Gaussian MFs were found as the optimal input function whereas the linear function as the optimal output function with RMSE equal to 13.8 and 10.7 and R2 equal to 0.99992 and 0.999952 for training and testing data respectively.
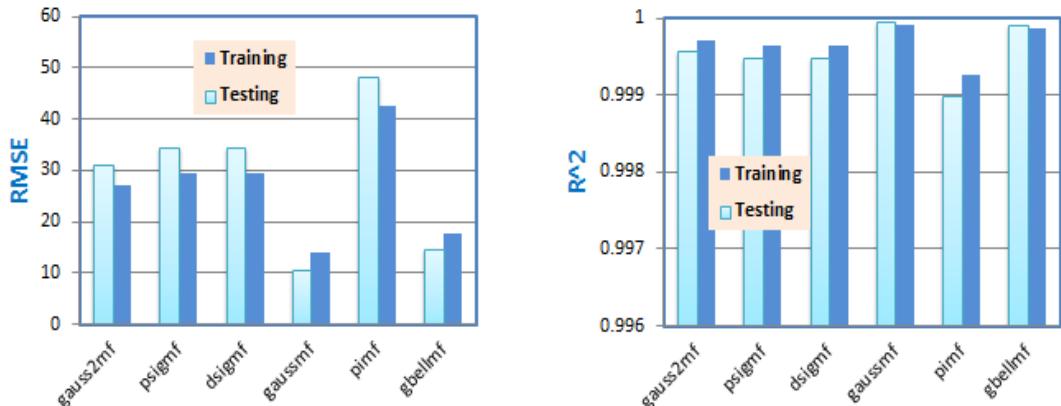
Fig. 8. *Performance of Three Input MFs for Linear Output MF.*
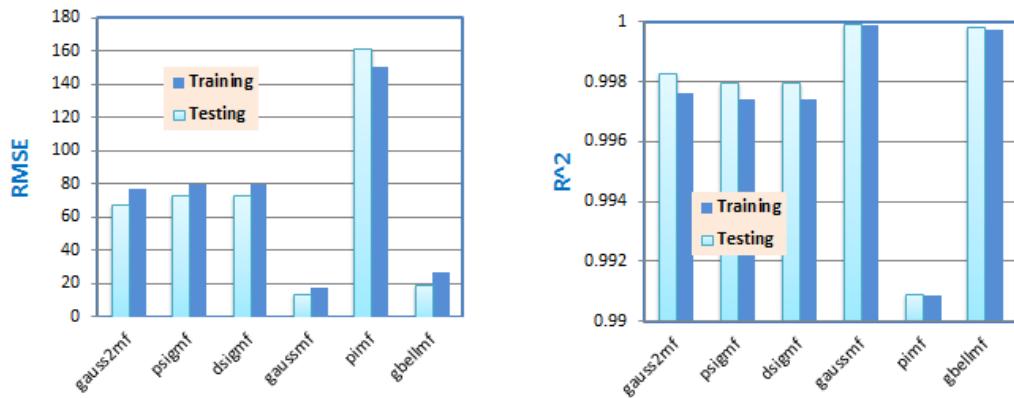
Fig. 9.   Performance of Three Input MFs for Constant Output MF.

4.3   THE EXPERT SYSTEM MODELLING

Figure11 illustrates the AAPRE and RMS of twenty three correlations with expert system. The results show the improvement in Pb accuracy by using ES with AAPRE equal to 1.94 and RMS=36.7 (red column).Figure 10 Shows the participation rate of each correlation in Expert System correlation.

Expert system is able to determine the best empirical correlations. To check the validation of ES program, the different data from different region was chosen. The results (Figure12) show that the ES correlation gives better accuracy in estimating bubble point pressure of Malaysian crudes (93 data points) than other known correlations available in the literature. The ES correlations give low values of AAPRE=2.16 and RMS=78 with correlation coefficient values close to an ideal value of 1.0.Table 4 shows a wide range of parameters that can be used in this Expert System.Figure 11&12 illustrates the user-friendly interface and result of Expert System.

Table 4.   The limitations of developed Expert System.

Parameter	Maximum	Minimum
P_b	12230	15
R_S	4569	0
γ_g	1.872	0.335
API	124	6
T ^{o}F	327	59
FVF	4.35	1.007
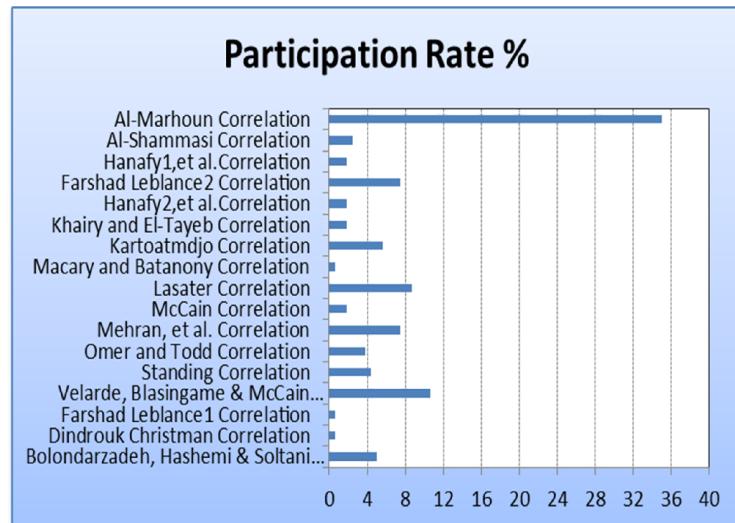
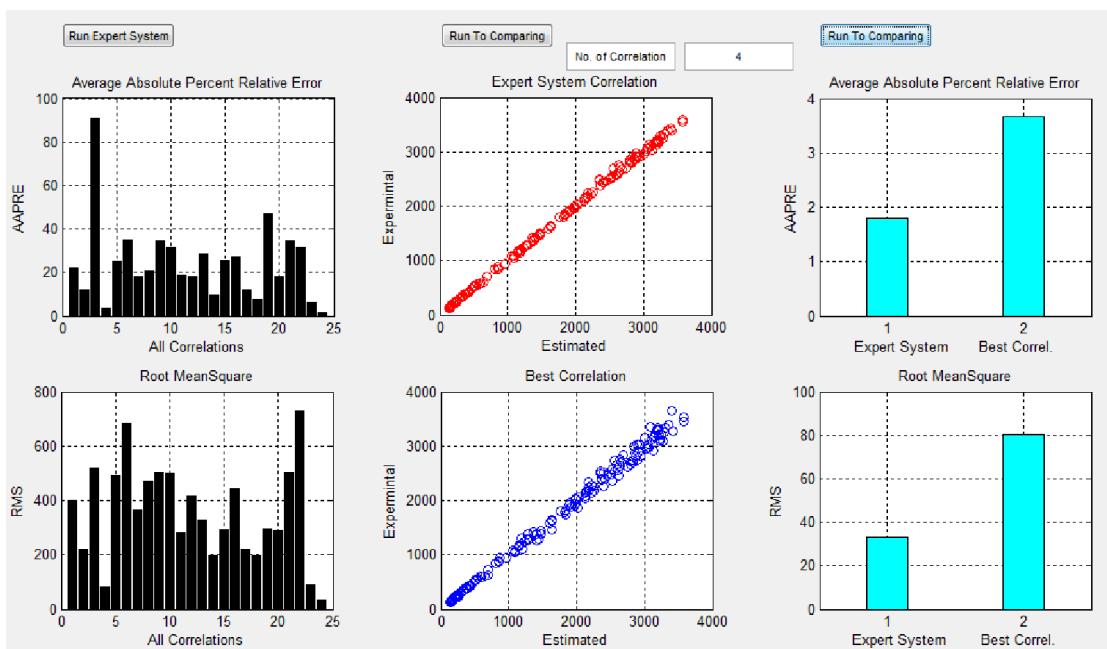*Fig. 10.   Participation Rate of Correlations.*

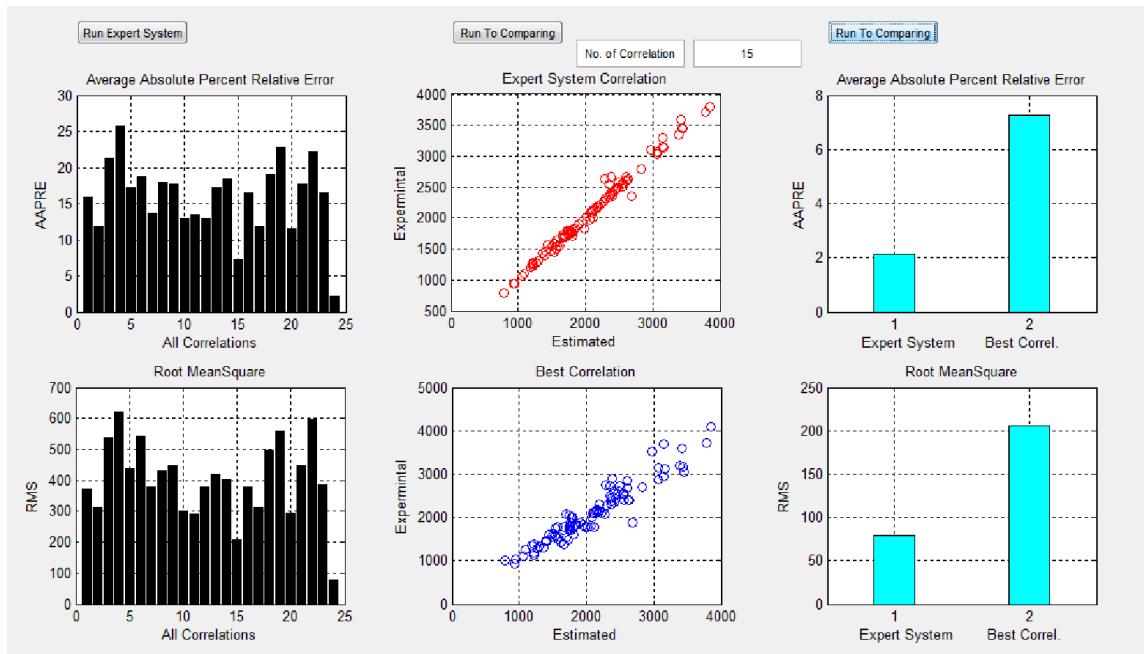*Fig. 11.   AAPRE and RMS for 23 Correlations with ES result from Middle East Data.*

Fig. 12. *AAPRE and RMS for 23 Correlations with ES form Malaysian Crudes.*

4.4 COMPARISON

The comparison was done between Artificial Intelligent methods and the most accurate empirical correlations (Al-Marhoun, Fig.11). The results show that the performance of Artificial Intelligent models is more accurate than the empirical correlation. The results also showed that, in terms of R2 and RMS, the GA-ANN hybrid model outperformed all the other hybrid models with the highest accuracy as shown in (Figs. 13-16). Expert System and ANFIS models might perform equally well as GA-ANN models (Figs.14-16). Based on the result of this study, Al-Marhoun did not perform well as Artificial Intelligent.

5 CONCLUSIONS

The following conclusions have been drawn from this study:

- A novel methodology for predicting bubble point pressure was introduced.
- Intelligent techniques are powerful tools which overcome incompleteness, imprecise and uncertainty existent in reservoir parameters.
- The hybrid models showed superior performance with the highest correlation coefficients, and lowest root mean square errors.
- Hybrid optimization method is faster and more accurate than any artificial intelligent algorithm alone.
- A detailed comparative study of 23 Bubble Point Pressure correlations, GA-ANN, Expert System, and 2 versions of Adaptive Neuro-Fuzzy Inference System are presented in this paper.
- The two versions of ANFIS used in this study are equally good and demonstrate competitive capabilities due to the excellent performance of the grid partitioning (ANFIS-GP), and subtractive clustering (ANFIS-SC) algorithms.
- A comparison was based on the prediction of bubble point pressure of oil reservoirs obtained from diverse fields with different lithological and geological formations.
- Neuro-fuzzy systems are data driven fundamentally. Thus, more data for training the system, better performance and more generalization will be achieved.
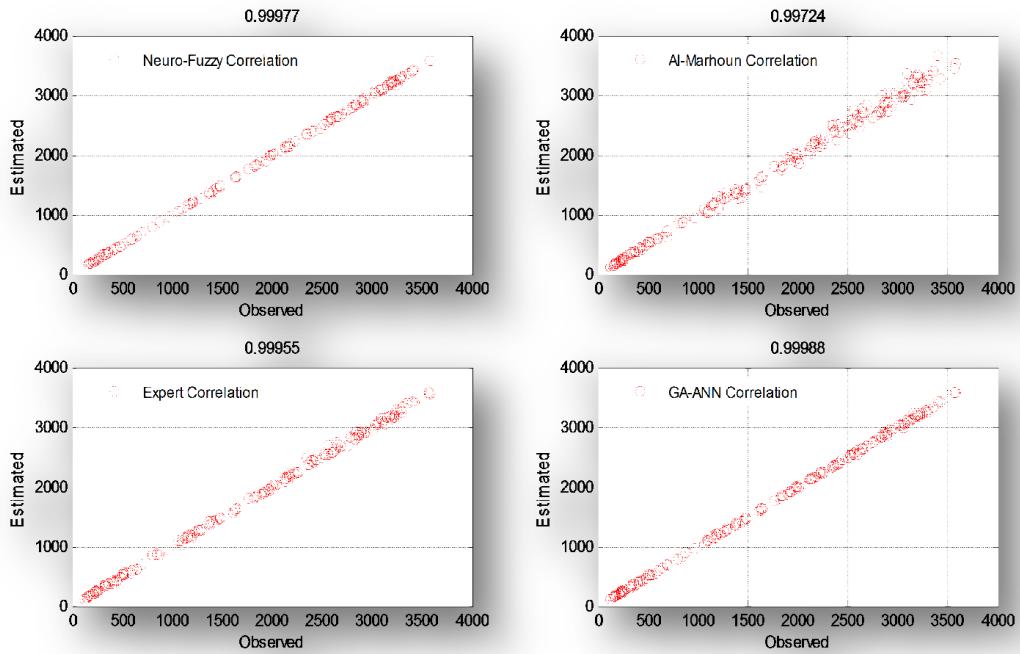
Fig. 13. *Cross Plot of Neuro-Fuzzy, Al-Marhoun, Expert System, and GA-ANN Correlations.*
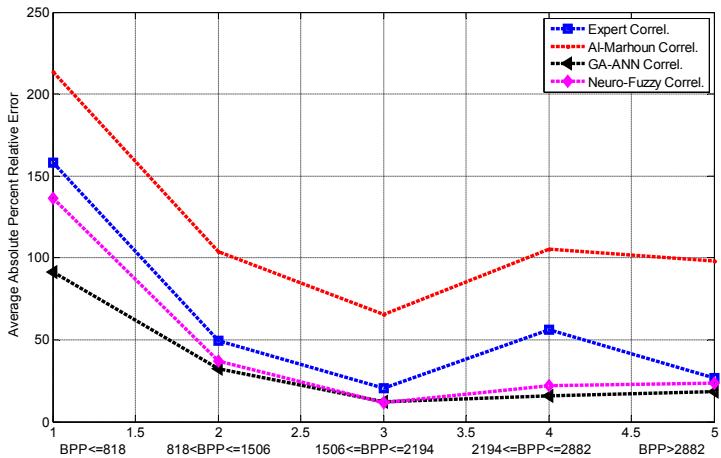

Fig. 14. *Statistical accuracy of total grouped of Pb.*
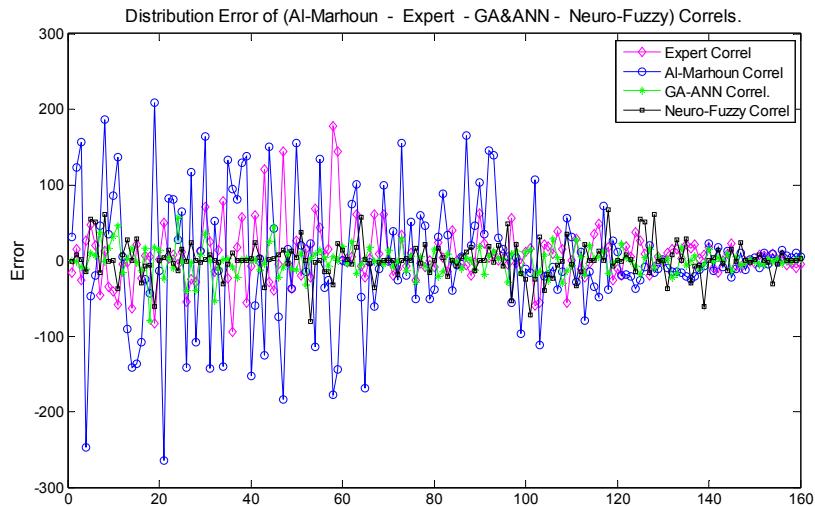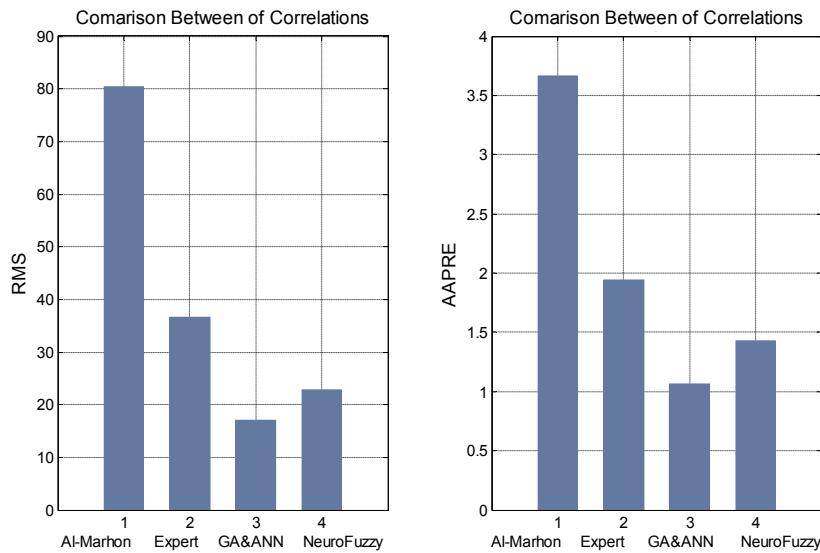
Fig. 15.   Error distribution of the Four Models.

Fig. 16.   Comparison of R2 and AAPRE for different Pb models.

Table 5. Input Parameters Ranges for Bubble Point Pressure Correlation

Authors	Pb	API	γ_g	T	GOR	FVF
Standing (1947)	7000-130	63.8 -16.5	0.95-0.59	258-100	1425-20	2.15-1.024
Lasater (1958)	5780-48	51.1-17.9	1.2-0.57	272-82	2905-3	
Vazquez &Beggs	6055-15	59.3-15.3	1.35-0.51	294-75	2199-0	2.226-1.028
Glaso (1980)	7142-165	48.1-22.3	1.276-0.65	280-80	2637-90	2.588-1.032
Al-Marhoun (1988)	3573-130	44.6-19.4	1.367-0.752	240-74	1602-26	1.997-1.032
Kartoatmodjo and Schmidt	6055-15	58.9-14.4	1.71-0.38	320-75	2890-0	2.747-1.007
Dokla& Osman (1992	4640-590	40.3-28.2	1.29-0.80	275-190	2266-181	2.493-1.216
Macary and El-Batanoney (1992)	4600-1200	40-25	1.0-0.7	290-130	1200-200	2-1.2
Petrosky&Farshad (1993)	6523-1574	45-16.3	0.8519-0.5781	288-114	1406-217	1.623-1.118
Omar &Todd (1993)	3851-790	53.2-26.6	1.32-0.612	280-125	1440-142	1.954-1.085
Farshad, Leblance, Garber & Osorio [Single Stage] (1996)	4138-32	44.9-18	1.73-0.66	260-95	1645-6	2.747-1.007
Farshad, Leblance, Garber & Osorio [Single Stage] (1996)	4138-32	44.9-18	1.73-0.66	260-95	1645-6	2.747-1.007
Almehaideb (1997)	4822-501	48.6-30.9	1.12-0.75	306-190	3871-128	3.562-1.142
Hanafy, Macary, ElNadi, Baiomi& El Batanony (February 1997)	5003-36	48.8-17.8	1.627-0.623	327-107	4272-7	4.35-1.032
Hanafy, Macary, ElNadi, Baiomi& El Batanony (March 1997)	5003-36	48.8-17.8	1.627-0.623	327-107	4272-7	4.35-1.032
Khairy and El-Tayeb (1998)	4930-236	54.3-30.7	1.417-0.675	282-120	4569-15.8	-
Khamechi, Rashidi, RasouliEbrahimian 2009	-	124-33.4	0.858-0.554	306-100	1708-83	-
Velarde, Blasingame& McCain (1999)	6700-70	55-12	1.367-0.556	327-74	1870-10	-
Al-Shammasi (1999)	7127-31.7	63.7-6	3.44-0.51	341.6-74	3298.6-6	2.916-1.02
Dindoruk&Christman (2001)	12230-926	40-14.7	1.027-0.6017	276-117	3050-133	2.8984-1.0844
Bolondarzadeh, Hashemi&Soltani (2006)	5300-100	-	-	-	1527-334	1.8492-1.1851
Mehran, Movagharnejad and Didanloo (2006)	4930-236	-	1.872-0.335	306-77.5	3539-83	3.23-1.09

REFERENCES

[1] Moradi B., Malekzadeh E., Amani M., Boukadi F.H., Kharrat R., Bubble Point Pressure Empirical Correlation.Presented at the Trinidad and Tobago Energy Resources Conference held in Port of Spain, Trinidad, 2010.

[2] Al-Shammasi, A. A., A Review of Bubblepoint Pressure and Oil Formation VolumeFactor Correlations. SPE53185 first presented at the 1999 SPE Middle East Oil Show, Bahrain, 2001.

[3] Rumelhart, D.E., Hinton, G.E., Williams, R.J., Learning internal representations by error propagation. Parallel Data Processing, 1. The M.I.T. Press, Cambridge, MA, pp. 318–362, 1986.

[4] Miller, G., Todd, P., Hedge, S., Designing neural networks using genetic algorithms. Proceeding of the Third International Joint Conference on Genetic Algorithms, pp. 379–384, 1989.

[5] Marshall, S.J., Harrison, R.F., Optimization and training of feed-forward neural networks by gas. Proceeding of IEE Second International Conference on Artificial Neural Networks, pp. 39–43, 1991.

[6] Bornholdt, S., Graudenz, D., General asymmetric neural networks and structure designby genetic algorithms. Neural Netw. 5, 327–334, 1992.

[7] Huanga, Y., Gedeonb, T., Wongc, P., An integrated neural–fuzzy genetic algorithm using hyper-surface membership functions to predict permeability in petroleum reservoirs. J. Pet. Sci. Eng. 14, 15–21, 2001.

[8] Chena, C., Lina, L., A committee machine with empirical formulas for permeability prediction. Comput.Geosci. 32, 485–496, 2006.

[9] Saemi, M., Ahmadi, M., Yazdian, V.A., Design of neural networks using genetic algorithm for the permeability estimation of the reservoir. J. Pet. Sci. Eng. 0920-4105, 2007.

[10] Rasoul I. and Reza N., Evolving neural network using real coded genetic algorithm for permeability estimation of the reservoir. Expert Systems with Applications 38, 9862–9866, 2011.

[11] Hossein Kaydani, Ali Mohebbi, Ali Baghaie, Permeability prediction based on reservoir zonation by a hybrid neural genetic algorithm in one of the Iranian heterogeneous oil reservoirs. Journal of Petroleum Science and Engineering 78 (2011) 497–504, 2011.

[12] Balan, B., Ameri, S., Mohaghegh, S., A hybrid neuro-genetic approach to hydraulic fracture treatment design and optimization. SPE 36602, 1996.

[13] Mohsen S., Morteza A., Ali Y.V., Design of Neural Networks using Genetic Algorithm for the Permeability Estimation of the Reservoir. Journal of Petroleum Science and Engineering, 59, pp. 97–105, 2007.

[14] Oloso, M., Khoukhi, A., Abdulraheem, A., El-Shafei, M., A genetic-optimized artificial neural networks for predicting viscosity and gas/oil ratio curves.SPE/ EAGE Reservoir Characterization and Simulation Conference & Exhibition, Abu-Dhabi, UAE, 2009.

[15] Jang, S.R., Sun, C.T., Mizutani, E., Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence. Prentice-Hall, 1996.

[16] Ouenes, A., Practical application of fuzzy logic and neural networks to fractured reservoir characterization. Computers & Geosciences 26 (8), 953–962, 2000.

[17] Khoukhi, A., Hybrid soft computing systems for reservoir PVT properties prediction. Computers & Geosciences 44, 109–119, 2012.

[18] Fatai A. Anifowose, Jane Labadin and Abdulazeez Abdulraheem, Prediction of Petroleum Reservoir Properties using Different Versions of Adaptive Neuro-Fuzzy Inference System Hybrid Models, 2013.

[19] Abbas M. Al-Khudafi et al. Neuro-fuzzy Inference System for Modeling Equilibrium Ratio for Heptanes-plus Fraction. International Journal of Innovation and Applied Studies ISSN 2028-9324 Vol. 4 No. pp. 334-342, 2013.

[20] Sayyouh, M.H.; Shindy, A.M.; Darwich, T.D.; and Osman, A., Development of an expert system for EOR method selection. Society of Petroleum Engineer, Paper SPE 37708-MS, 291-298, 1997.

[21] Khaled A. Fattah et al., Selection and Evaluation EOR Method Using Artificial Intelligence. Annual International Conference and Exhibition, 5-7 August 2002, Abuja, Nigeria, SPE79163, 2005.

[22] Elradi and Cheng, Artificial Intelligence Selection with Capability Of Editing A New Parameter For EOR Screening Criteria.Journal of Engineering Science and Technology Vol. 6, No. 5, 628 – 638, 2011.

[23] Ahmed Al-Zahaby et al. Guidelines for Selecting Appropriate PVT Correlations forBlack Oils.North Africa Technical Conference and Exhibition, 20-22 February 2012, Cairo, Egypt, SPE 150650, 2012.

[24] Senan A.Ghallab and et al., A Fuzzy Expert System for Petroleum Prediction. Recent Advances in Computer Science and Applications, ISBN: 978-960-474-317-9, 2013.

[25] Jang J.-S. R., Gulley N., Fuzzy Logic Toolbox. Reference Manual, the Mathworks Inc., Natick, MA, 1996.

[26] Quintana C., Kreinovich V., Leon Reznik., Gaussian Membership Functions are Most Adequate in Representing Uncertainty in Measurements. In Proceedings North American Fuzzy Information Processing Society (NAFIPS'92) Conference, 2, pp 618-624, 1992.

Potential of *Eucalyptus* in the Remediation of Environmental Problems: A review

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ABSTRACT: Water logging, heavy metals contamination, energy crisis and pest control are some serious environmental problem that affects valuable agriculture lands, production and affect other organisms directly and indirectly. Many convention techniques are used to remediate pests, water logging and heavy metals pollution. However these techniques require extensive operation and management practices. Biotechnology and bioremediation provide some of the most economically and environmentally sound techniques for the environmental pollution. This review paper discusses the potential of *Eucalyptus* in the remediation of environmental problems.

KEYWORDS: Bio-drainage; *Eucalyptus*; water logging; water table; heavy metals.

1   INTRODUCTION

Eucalyptus has over 700 species distributed throughout the world [1]. *Eucalyptus* plants vary in size from small shrubs to giant trees. The growth of *Eucalyptus* species are quick and produce large quantities of wood when grown within or outside their natural range. Mostly *Eucalyptus* species are introduced to provide various products such as fuel wood, pulp and paper, sawn timber, essential oils e.g. for medicine and perfumes, and services including reclamation of degraded lands, saline areas and drainage of water-logged areas [2]. The aim of this review paper is to investigate the potential of *Eucalyptus* for environmental remediation.

1.1   ROOT SYSTEM OF *EUCALYPTUS*

Eucalyptus has a special rooting system. This rooting system consists of a shallow rooting system just beneath the soil surface, and deep tap roots that penetrate deep into the soil reaching the water table. The shallow roots extend horizontally to more than three to five meters, these roots are used to absorb surface soil moisture but they are not very dense. The tap roots can grow up to 9 meters into deeper soil layers. They are used to take up groundwater from aquifers that are more permanently available than surface soil moisture. In dry times *Eucalyptus* shift their water uptake to the deep roots. This roots system makes them able to survive and even grow during dry periods [3]. In an impressive review of measurements from a wide range of sites with stands at different stages of development, Knight [4] showed that roots of *Eucalyptus* trees are consistently dimorphic, comprising a widely spreading lateral system just below the soil surface and a deep tap root system in young trees that develops deep sinker roots as trees mature. Dawson and Pate [5] present an elegant demonstration of the adaptation of deep-rooted trees to access different sources of water from within the soil profile in relation to seasonal water availability. They used measurements of the natural abundance of hydrogen stable isotopes to detect seasonal changes in the sources of water for plantation stands of *E. globulus* and *E. camaldulensis* at Mount Barker, Western Australia. Both species accessed ground water using sinker roots in the summer, but the proportion of ground water in stems in the more opportunistic *E. camaldulensis* (26–47%) was much higher than that for *E. globulus* (9–15%).

1.2 *EUCALYPTUS* AND WATER

Eucalyptus species use more water than native species of trees [6]. Soil moisture depletion rates were higher under *Eucalyptus* trees in dry season and were lower under the teak and jackfruit. The roots of *Eucalyptus camaldulensis* penetrate in the soil at 2.5 meters per year and absorb water from ground reservoir. *Eucalyptus* utilizes ground water as well as water from upper vadose zone [7]. When roots of *E. camaldulensis* and *E. platypus* grow through layers of soil with different water contents, they are able to redistribute water between the layers by transferring significant quantities along gradients of water potential [8]. The direction of the movement of water, termed 'hydraulic lift' may be upwards or downwards depending on the timing of rainfall and availability of water stored in different layers. Soares and Almeida [9] used a hydrological model to estimate water movement in five layers in the soil profile for *E. grandis* plantation in Brazil. Water was supplied from the root zone for transpiration during the wet period. In the dry period, rates of transpiration fell but water was supplied from soil below the root zone. At the end of the dry season this upward movement of water amounted to 1 mm per day and was sufficient to balance transpiration rate and maintain water potential in the trees above the critical limit for stomata closure. The trees growth causes an increase in the depth of the water table. The rate of fall of the water table doubled with the development of the trees [10]. Ahmad et al., [11] studied the *Eucalyptus* plantation for intercepting canal seepage and controlling water table. White et al., [12] showed that transpiration and evaporation for four species of *Eucalyptus* planted in contour belts were effective at reducing groundwater recharge with minimal competition with adjacent crops for water.

The high growth rate of *Eucalyptus* by utilizing more water makes it a water pumper in marshy lands. *Eucalyptus* has an inbuilt mechanism to utilize water luxuriously in marshy areas [13]. Among the different *Eucalyptus* introduced, *Eucalyptus camaldulensis* and *Eucalyptus tereticornis* are found to be grown extensively [14]. Depending upon the genetic makeup, *Eucalyptus* are showing good tolerance to salinity, water logging etc. Utilizing these variations, benefit capturing through selection of tolerant genotypes to abiotic stresses must be exploited in *Eucalyptus* [15].

2 WATER LOGGING

Water logging is the condition of the soil in which excess water limits gas diffusion [16]. Presently about one third of the world's irrigated area faces the threat of water logging and 60 Mha is already waterlogged and 20 Mha salt affected [17]. A soil is said to be water logged when the ground water table gets linked to soil water in the crop root zone and remains like this for the remaining period in a year [18]. In other words water logging is the condition when the soil becomes 100% saturated with water and becomes unfit for the growth of plants. In such soils, the space between the soil particles is occupied by water instead of air. Water logging occurs whenever water enters the soil at a faster rate than it can drain away. The duration and severity of the water logging event is influenced by the amount of water entering the system, the topography of the site, soil structure and the water absorbing capacity of the soil. The soil is made up of different sized soil particles with different sized spaces or pores. The smaller pores (less than 0.5 mm wide) are usually filled with water while the larger pores are usually filled with air. Good horticultural soils normally have between 10 to 30% of their volume composed of larger pores that are filled with air and 10% is considered the minimum air content for healthy root growth depending on plant species [19]. Rise in groundwater level followed by water logging and secondary Stalinization has become a serious problem in canal irrigated areas located in arid and semi-arid regions of the world [20].

The causes of water logging can be natural and anthropogenic. Main causes are heavy rainfall, poor water management system, high water table, floods, over irrigation, seepage from the canals, dams, and other construction activities like railways and roads. Water logging and salinity has adverse impact on crop productivity [21], [22], [23]. The principal cause of damage to plants grown in waterlogged soil is inadequate supply of oxygen to the submerged tissues as a result of slow diffusion of gases in water and rapid consumption of O_2 by soil microorganisms. Oxygen deficiency in waterlogged soil occurs within a few hours under some conditions. In addition to the O_2 deficiency, production of toxic substances such as Fe^{2+}, Mn^{2+}, and H_2S by reduction of redox potential causes severe damage to plants under waterlogged conditions [24].

Suitable water management strategies such as conjunctive use of groundwater and canal water and changes in crop patterns by reducing rice crop areas against of other low-water crops such as sorghum are suggested to bring the groundwater table down to a safe limit and prevent further rise of the groundwater table [25].

2.1 CONVENTIONAL DRAINAGE TECHNIQUES

The conventional techniques for recovery of waterlogged areas are the engineering based sub-surface horizontal drainage and sub-surface vertical drainage. These techniques are quite effective provided these are properly designed, installed, maintained and operated [17].

2.1.1 SURFACE DRAINAGE

According to American Society of Agricultural Engineers surface drainage is the removal of excess water from the soil surface in time to prevent damage to crops and to keep water from ponding on the surface. The term surface drainage applies to situations where overland flow is the major component of the excess water movement to major drains or natural streams. The technique normally involves the excavation of open trenches/drains. It could also include the construction of broad-based ridges or beds, as grassed waterways, with the water being discharged through the depressions between ridges. Surface drainage is most commonly applied on heavier soils where infiltration is slow and excess rainfall cannot percolate freely through the soil profile to the water table [17].

2.1.2 HORIZONTAL SUBSURFACE DRAINAGE

Horizontal subsurface drainage involves the removal of water from below the surface. The field drains can either be open ditches, or more commonly a network of pipes installed horizontally below the ground surface. These pipes used to be manufactured of clay tiles, with the water entering the pipes through the leaky joints [17].

Horizontal subsurface drainage has been found to be an effective technique. It controls the rise of groundwater tables and enables productive agriculture. However it is relatively expensive to install, operate and maintain. Also the disposal of drainage water that can contain high concentrations of pollutants (nutrients and/or toxic elements such as boron) can create problems [17].

2.1.3 VERTICAL SUBSURFACE DRAINAGE

Vertical subsurface drainage involves the removal of groundwater through pumped boreholes or tube wells, either in single or multiple well configurations. The common problem with this technique is that deeper, often more saline water can be mobilized which can cause disposal problems. Also, as the water is commonly used for irrigation rather than disposal, salt is recycled through the soil profile and inevitably groundwater salinities will increase over time.

Conventional physical drainage works require expensive capital investment, operation and maintenance. Physical drainage measures also generate drainage effluent. Bio-drainage is the use of vegetation to manage water fluxes in the landscape, is one such technique that has recently attracted interest in drainage and environmental management circles [17].

2.2 BIO-DRAINAGE

Bio-drainage is the pumping of excess soil water by deep rooted plants using their bio-energy [26]. Bio-drainage is the use of vegetation to manage water fluxes through evapotranspiration [27]. The Bio-drainage system consists of fast growing tree species, which absorb water from the capillary fringe located above the ground water table. It is an alternative technique that has recently attracted interest in drainage and environmental management. The absorbed water is transported to different parts of plants and finally more than 98% of the absorbed water is transpired into the atmosphere by stomata. This combined process of absorption, translocation and transpiration of excess ground water into the atmosphere by the deep rooted vegetation conceptualizes Bio-drainage.

Fast growing *Eucalyptus* species are known for luxurious water consumption under excess soil moisture conditions is suitable for Bio-drainage. These species can be planted in blocks in the form of farm forestry or along the field boundary in the form of agroforestry [28]. Bio-drainage can be a feasible option for controlling water logging and salinity in irrigated lands [29]. So far *Eucalyptus* species has a higher Bio-drainage potential as compared to relatively slow bio-drainers like *T. aphylla* and *P. pinnata* [30]. The growth behavior, biomass accumulation by the plants and physiological parameters suggests that *Eucalyptus* has high potential to be used as an efficient Bio-drainage species [31]. *Eucalyptus tereticornis* and *Eucalyptus* hybrid are fast bio-drainers primarily due to their ability to display large leaf area [32]. Cloned *Eucalyptus tereticornis* (Mysure gum) is fast growing, goes straight and thus has low shading effect and has luxurious water consumption where excess soil moisture conditions exist. It grows well under a wide range of climatic conditions. In waterlogged areas, it can be successfully

grown by ridge planting. The world's *Eucalyptus* plantation area has increased to 19 Mha because of its fast growth rate, good wood properties, carbon sequestration, and thus seems to be a good option for Bio-drainage [33]. In a study conducted by Ram et al., [34] the annual rate of transpiration by *Eucalyptus* plantations was 268 mm against the mean annual rainfall of 212 mm. These plantations generated 46.6 tons ha^{-1} fresh biomass with benefit cost ratio of 3:5 and also sequestered 15.5 tons carbon ha^{-1}. Lowering of water table and associated soil improvement by *Eucalyptus* plantations increased the wheat grain yield by 3.4 times and resulted in reclamation of waterlogged areas.

3   HEAVY METALS

The problem of heavy metals getting worse in the environment from year to year [35]. Therefore heavy metal problem must be handled to ensure maintenance of environmental and ecological restoration. Conventional methods are generally considered as destructive, expensive, labor intensive and causing secondary problems [36]. Phytoremediation is a new, economical, efficient, environmentally friendly remediation strategy with social acceptance [37], [38], [39].

3.1   HEAVY METALS REMEDIATION BY EUCALYPTUS

Woody vegetations are advantageous for phytoremediation as they produce large amounts of biomass, which can be used an energy source [40]. *Eucalyptus* has a huge shoot system which should be able to bioaccumulate large concentrations of heavy metals from the soil [41]. *Eucalyptus* species are effective accumulators of both organic and inorganic compounds, which may be due to the leaf geometry and to the possession of epidermal features that include the excretion of sticky secondary compounds, thus promoting the adsorption of particulates [42]. Although *Eucalyptus* accumulates lower levels of heavy metals compared to hyper accumulating but using *Eucalyptus* as bioaccumulator for heavy metals is the low risk of entering the food chain because this plant is not consumed by humans and hardly ever used by mammals [43]. For the phytostabilisation of arsenic (As) contaminated land and mine tailings E. cladocalyx is an effective species [43]. *Eucalyptus* species are effective in the bioaccumulation of Pb, Zn and Cr in its tissues. However the bioaccumulation can be improved by the addition of biodegradable chelating agents such as methylglycine diacetate (MGDA), ethylene succinic acid (EDTS), L-glutamic acid diacetate (GLDA), L-aspartic acid diacetate (ASDA) [44]. The efficiency of phytoremediation can also be enhanced by rhizospheric bacteria [45] and saprophytic fungi [46]. Arriagada et al., [47] reported that *Glomus deserticola* enhances the amount of Pb absorbed by *Eucalyptus* plants.

3.2   SORPTION OF HEAVY METALS BY EUCALYPTUS BARK

On the other hand *Eucalyptus* bark has the ability to remove Hg [48], Cu and Pb [49] and Cr [50] from contaminated water. *Eucalyptus* bark is an economic sorbent for removal of cadmium ions from aqueous solution [51]. The bark of *Eucalyptus tereticornis* can remove about 96% of Fe, 75% of Zn, 92% of Cu and 41% of sulphate from the acid mine water [52]. Kongsuwan et al., [53] demonstrated the use of *Eucalyptus* bark in the binary component sorption for Cu and Pb. The maximum sorption capacities for Cu and Pb were 0.45 and 0.53 mmol/g.

4   *EUCALYPTUS* OIL

Apart from the direct services provided by *Eucalyptus* specie like biomass production and sink for atmospheric carbon dioxide [54], it also has indirect services through their essential oil used as insect/pest repellent and as a pesticidal agent [55]. Widespread oil yielding *Eucalyptus* species are *E. citriodora, E. globulus, E. polybractea, E.* camaldulensis and *E. grandis, E. citriodora. Eucalyptus* species are among the world's top traded oils and oil extracted from *E. citriodora* is one of the world's major oil in terms of trade volume [56]. Under Food and Drug Authority of USA *Eucalyptus* oil is GRAS (Generally Regarded as Safe) category by and classified as non-toxic [57]. Council of Europe has also approved the use of *Eucalyptus* oil as a flavoring agent in foods (≤5 mg/kg) and candies and confectionery items (≤15 mg/kg) [58]. *Eucalyptus* essential oils and their major constituents possess toxicity against a wide range of microbes including bacteria and fungi, both soil borne and post harvest pathogens.

Table 1. Eucalyptus oil used as pesticide

Eucalyptus Species	Extracted constituent	Reference
E. citriodora	Citronellal	Ramezani et al., [65]
E. globules	1,8-Cineole	Yang et al., [61]
E. urophylla *E. camaldulensis, E. grandis*	γ-Terpinene, 1,8-Cineole	Su et al., [62]
E. grandis	α-Pinene, 1,8-cineole	Lucia et al.,[66]
E. grandis, E. urophylla	Alloocimene, α-pinene	Liu et al., [67]
Eucalyptus oleosa	1,8-cineole	Naceur et al., [68]
Eucalyptus camaldulensis, Eucalyptus astringens, Eucalyptus leucoxylon, Eucalyptus lehmannii and Eucalyptus rudis	1,8-cineole, α-pinene, and α-terpineol	Mediouni et al., [69]
Eucalyptus camaldulensis	1,8-Cineole	Cruz-galvez et al., [70]

They have been found to reduce mycelial growth and inhibit spore production and germination [59], [60]. *E. globules* and its major monoterpene 1,8-cineole showed toxicity against human head lice, *Pediculus humanus capitis* [61]. The essential oil from E. Citriodora could be an excellent choice as a wood preservative and preservation of leather goods and wood artifacts [62]. *Eucalyptus* oil is toxic for weeds and has a great potential for weed management [63], [64].

Table 2. Eucalyptus oil used as insecticide

Eucalyptus Species	Used for	Reference
Eucalyptus camaldulensis	*Tribolium confusum* and *Ephestia kuehniella*	Tunc et al., [71]
Eucalyptus spp.	*Sitophilus oryzae*	Lee et al., [72]
Eucalyptus spp.	*Thaumetopoea pityocampa*	Kanat and Alma [73]
E. globules	*Pediculus humanus capitis*	Yang et al., [61]
E. globules	*Musca domestica*	Abdel Halim and Morsy [74]
Eucalyptus spp.	*Lycoriella mali*	Choi et al., [75]
E. tereticornis	*Anopheles stephensi*	Nathan, [76]
Eucalyptus spp.	*Tribolium castaneum, Rhyzopertha dominica, Sitophilus oryzae* and *Sitophilus zeamais, Corcyra cephalonica* and *Sitotroga cerealella*	Rajendran and Sriranjini [77]
Eucalyptus leucoxylon	*C. maculates, S. oryzae* and *T. castaneum.*	Kambouzia et al.,[78]
Eucalyptus globulus	*Trogoderma granarium*	Tayoub et al., [79]
E. camaldulensis	*Ectomyelois ceratoniae*	Mediouni et al., [69]

5   BIO-ENERGY FROM *EUCALYPTUS*

Eucalyptus is among the fastest growing hardwood plantation genus in the world. In addition, *Eucalyptus* has been used for bio-energy production in many countries. *Eucalyptus* species have potential for high biomass production and they tolerate a wide range of soils and climatic conditions. High productivity can provide substantial yields of biomass reduce greenhouse gas emissions from fossil fuel consumption and can also reduce operational fossil fuel use by replacement of more energy intensive forms of land use [80]. Annual stem growth rate vary with soil, climate, biotic influences and genetic factors. *Eucalyptus* yields $18m^3ha^{-1}$ $year^{-1}$ over a 12 year rotation with single species clones [81] and up to $35m^3$ ha^{-1} $year^{-1}$

with hybrid clones [82]. Cold tolerant species like *E. gunnii* have yielded annual stem growth rate of 25m^3 ha^{-1} year^{-1} at 11 years old [83]. Faster growing species such as *E. nitens* may yield mean annual increments of over 25m^{3}ha^{-1} year^{-1} [84].

6   CONCLUSION

This was concluded that *Eucalyptus* species are effective in combating water logging, heavy metals remediation and as natural pest control. *Eucalyptus* can provide substantial yields of biomass can reduce greenhouse gas emissions from fossil fuel consumption. *Eucalyptus* in remediated water logging, pest control and heavy metal pollution is economically feasible, socially acceptable and ecologically viable as compared to conventional techniques. Bio-drainage is a viable alternative of conventional engineering-based techniques could be bio-drainage by high water uptake trees like *Eucalyptus* species. Bio-drainage is economical because it requires only initial investment for planting the vegetation, and when established, the system provides economic returns by means of fodder, wood or fiber harvested and additionally sequesters carbon in the timber. However the salts extraction ability of *Eucalyptus* needs to be improved to make these species more effective for water logging.

REFERENCES

[1]   M.I.H. Brooker, and D.A. Kleinig, Field Guide to *Eucalyptus*. vol. 1. South-eastern Australia, Third edition. Bloomings, Melbourne.

[2]   Munishi PKT. The *Eucalyptus* Controversy in Tanzania. Department of Forest Biology, Sokoine University of Agriculture; Morogoro, Tanzania, 2006.

[3]   F. Fritzsche, A. Abate, M. Fetene, E. Beck, S. Weise, and G. Guggenberger, "Soil-plant hydrology of indigenous and exotic trees in an Ethiopian montane forest." Tree Physiology 26(8): pp. 1043-1054, 2006.

[4]   J.H. Knight, Root distributions and water uptake patterns in *Eucalyptus* and other species. In: Landsberg, J.J. (Ed.), The Ways Trees use Water. Water and Salinity Issues in Agroforestry No. 5. Rural Industries Research and Development Corporation Publication Number 99/37, Barton, ACT, pp. 55– 85, 1999.

[5]   T.E. Dawson, J.S. Pate, Seasonal water uptake and movement in root systems of Australian phraeatophytic plants of dimorphic root morphology: a stable isotope investigation. Oecologia 107:pp. 13–20, 1996.

[6]   D. M. Zahid, F. R. Shah, and A. Majeed, Planting *Eucalyptus* camaldulensis in arid environment is it useful species under water deficit system. J. Bot., 42(3): pp. 1733-1744, 2010.

[7]   Calder, Ian. R., Paul, T.W., Roiser, Prasanna, K.T and Parameswarappa, *Eucalyptus* water use greater than rainfall input, Hydrology and earth system sciences, 1(2), pp. 249-256, 1997.

[8]   S.S.O. Burgess, Adams, M.A., Turner, N.C., White, D.A., and C.K., Ong, Tree roots: conduits for deep recharge of soil water. Oecologia 126: pp. 158–165, 2001.

[9]   J. V Soares, and A.C. Almeida, Modeling the water balance and soil water uses in a fast growing *Eucalyptus* plantation in Brazil. , 253, pp.130–147, 2001.

[10]   Rodríguez-suárez, J.A. Influence of *Eucalyptus* globulus plantation growth on water table levels and low flows in a small catchment. , 396, pp.321–326, 2011.

[11]   S. Ahmad, Mohyuddin. J, Siddiqui. S.M. and Bhutta. M. N, Tree Plantation for Intercepting Canal Seepage and Controlling Watertable, Pakistan Journal of Water Resources, Vol.11(2) July-December 2007 / 35.

[12]   D.A. White, Water use by contour-planted belts of trees comprised of four *Eucalyptus* species. , 53, pp.133–152, 2002.

[13]   Tushar, *Eucalyptus* – falsely cursed. Farmers Eorums, 2(3): 17, 2002.

[14]   Mohan Varghese., A. Nicodemus, B. Nagarajan, N. Ravi and R. Hedge, A breeding Programmed for improving productivity of *Eucalyptus* camaldulensis and *Eucalyptus* tereticornis in India. Recent *Eucalyptus* research in India (eds) Bagshi, S.K., M.Varghese and Siddappa. pp.19-28, 2002.

[15]   K.V. D. Chaitanya, Sunfar, M.V., and Ramachandra R.A, Variation in photosynthesis and drought tolerance among eight open pollinated families of *Eucalyptus* camaldulensis and E. tereticornis. In: Recent Eucalypt research in India (Eds. S.K.Bagchi., M. Varghese and Siddappa). pp. 83-93, 2002.

[16]   Setter TL, Waters I, Sharma SK, Singh KN, Kulshreshtha N, Yaduvanshi NPS, Ram PC, Singh BN, Rane J, McDonald G, Khabaz-Saveri H, Biddulph TB, Wilson R, Barclay I, McLean R, White, D.A., Dunin, F.X., Turner, N.C., Ward, B.H., Galbraith, J.H, Water use by contour-planted belts of trees comprised of four *Eucalyptus* species. Agric. Water Manage. 53: 133–152, 2002.

[17]   A. F. Heuperman, and Kapoor, A. S., Bio- drainage: Principal Experiences and Applications, IPTRID, FAO, Rome, pp. 1–79, 2002.

[18]   A.M. Michael, and Ojha, T.P., Principles of agricultural engineering. vol. II, 5th ed., pp. 391-457, M/S Jain Brothers, New Delhi, India, 2006.

[19]   Hardy, Sandra, Pat Barkley, and Andrew Creek. "Impacts and management of flooding and waterlogging in citrus orchards." Published by the Department of Primary Industries, a part of the Department of Trade and Investment,

Regional Infrastructure and Services, ISSN 1832-6668, 2012.

[20] A. Singh, Groundwater modelling for the assessment of water management alternatives. Journal of Hydrology, 481: pp.220–229, 2013.

[21] A.A.M. Mohamedin, M.S. Awaad and Azza R. Ahmed, Research Journal of Agriculture and Biological Sciences, 6(4): pp.378-385, 2010.

[22] C. Zheng, Jiang, D., Dai, T., Jing, Q., Cao, W., Liu, F., plant Science 176: pp.575 – 582, 2009.

[23] Zhen Luo, Hezhong Dong, Weijiang Li, Zhao Ming, Yuqing Zhu, Crop Protection 27: pp.1485–1490, 2008.

[24] T.L. Setter, Review of wheat improvement for waterlogging tolerance in Australia and India : the importance of anaerobiosis and element toxicities associated with different soils. , pp.221–235, 2009.

[25] Singh, Ajay, Sudhindra Nath Panda, Wolfgang-albert Flugel, and Peter Krause,"Waterlogging And Farmland Salinisation: Causes And Remedial Measures In An Irrigated Semi-Arid Region Of India, Irrigation And Drainage Irrig. and Drain. (2012) Published online in Wiley Online Library (wileyonlinelibrary.com) DOI: 10.1002/ird.651, 2012

[26] J. Ram, Dagar, J.C, Singh, G, Lal, K, Tanwar, V.S, Shoeran, S.S, Kaledhonkar, M.J, Dar, S.R and Kumar, M, Bio-drainage: Eco-friendly technique for combating waterlogging and salinity. Technical Bulletin: pp.24, 2008.

[27] S. Akram, Abkavosh, S., Liaghat, H., and Abureyhan, World Congress of the International Commission of Agricultural and Biosystems Engineering (CIGR). 1–9, 2010.

[28] J. C. Dagar, G. Singh, and J. Ram, "Bio-drainage: an eco-friendly technique for combating water logging and salinity." (December):6–11. 60th 5 th International Executive Council Meeting & Asian Regional Conference, 6-11 December 2009, New Delhi, India, 2009.

[29] A.S. Kapoor, Bio-drainage: A Biological Option for Controlling Water Logging and Salinity (Tata McGraw Hill, New Delhi) 2002, 1-332,2002.

[30] O.P. Toky, R Angrish, K S Datta, V Arora, C Rani, P Vasudevan, and P J C Harris, "Bio-drainage for preventing water logging and concomitant wood yields in arid agro-ecosystems in North-Western India." 70(August): 639–644, 2011.

[31] N.G. Bala, N.K. Singh, Bohra, and N.K. Limba, "Increasing Productivity of Waterlogged Zone Of Canal Command Area In Indian Desert." (December):6–11. 60th 5 th International Executive Council Meeting & Asian Regional Conference, 6-11 December 2009, New Delhi, India, 2009.

[32] R. K. S. Angrish, Datta, C., V.S. Rani, and S.M. Chawla, 'Comparative Bio-drainage Potential Of Some Tree Species',, 6–11, 5 Asian Regional Conference, 6-11 December 2009, New Delhi, India, 2009.

[33] T. G. Iglesias, and Wilstermann, D., *Eucalyptus* universalis. Global cultivated eucalypt forests map, In GIT forestry consulting's eucalyptologics: information resources on *Eucalyptus* cultivation worldwide. Retrieved from http://www.git-forestry. com/; 19 January 2009.

[34] J. Ram, Dagar, Khajanchi Lal, G Singh, O P Toky, V S Tanwar, S R Dar, and M K Chauhan, "Bio-drainage to combat waterlogging , increase farm productivity and sequester carbon in canal command areas of northwest India." Pp. 1673–1680, 2011.

[35] C. Govindasamy, M. Arulpriya , P. Ruban, L.J.Francisca, and A. Ilayaraja, "Concentration of heavy metals in sea grasses tissue of the Palk Strait, Bay of Bengal", International Journal of Environmental Sciences, 2 (1):pp.145-153, 2011.

[36] G. Wu, H. Kang, Zhang, X., Shao, H., Chu, L., and Ruan, C., "A critical review on the bio-removal of hazardous heavy metals from contaminated soils: Issues, progress, eco-environmental concerns and opportunities", Journal of Hazardous Materials, 174:pp. 1-8, 2010.

[37] Singh, A., Eapen, S., and Fulekar M.H., (2009) "Potential of Medicago sativa for uptake of cadmium from contaminated environment", Romanian Biotechnology Letters, 14: 4164-4169.

[38] Saier, J.M.H., and Trevors, J.T. (2010) "Phytoremediation", Water, Air and Soil Pollution, 205 (Suppl 1), pp S61-S63.

[39] Revathi, K., Harbabu, T.E., and Sudha, P.N. (2011) "Phytoremediation of chromium contaminated soil using sorghum plant", International Journal of Environmental Sciences, 2 (2):417-428.

[40] French CJ, Dickinson NM, Putwain PD. Woody biomass phytoremediation of contaminated brownfield land. Environ Pollut 2006;141: 387–95.

[41] T. Martha, Flowers in Isreal. http//isreal1234wordpress.com *Eucalyptus* camaldulensis,2006.

[42] Q.D. Goodger, Cao, B., Jayali, I., Williams, S.J., & Woodraw, I.E., Non-volatile components of the essential oil secretory cavities of *Eucalyptus* leaves: discovery of two glucose monoterpene esters, cuniloside B and froggattiside A. Phytochemistry 70: pp.1187-1194,2009.

[43] D. J. King, Doronila, A. I., Feenstra, C., Baker, A. J. M., & Woodrow, I. E., Phytostabilisation of arsenical gold mine tailings using four *Eucalyptus* species: Growth , arsenic uptake and availability after five years, science of the total environment, 40: pp.35 – 42, 2008.

[44] V. Nenman, N.D. Nimyel, I. Ezekiel, Journal, I., Nenman, V., Nimyel, N. D., and I. Ezekiel, The Potentials of *Eucalyptus* camaldulensis for the Phytoextraction of Six Heavy Metals in Tin – mined Soils of Barkin Ladi L . G . A . of Plateau State , Nigeria, 2(2): pp.346–349, 2012.

[45] X. Zhuang, J. Chen, H. Shim, Z. Bai, New advances in plant growth-promoting rhizobacteria for bioremediation. Environ. Int. 33: pp.406–413,2007.

[46] C. Arriagada, Restauraci ogico, pesados: Uso de hongos saprobios y micorricicos como herramienta de mejora medioambiental. PhD thesis, Universidad de on forestal de suelos contaminados por metales ordoba, Espana, 2001.

[47] C. A. Arriagada, M. A. Herrera, and J. A. Ocampo, Beneficial effect of saprobe and arbuscular mycorrhizal fungi on growth of *Eucalyptus* globulus co-cultured with Glycine max in soil contaminated with heavy metals, 84, pp.93–99,2007.

[48] I. Ghodbane, and O. Hamdaoui, Removal of mercury (II) from aqueous media using *Eucalyptus* bark : Kinetic and equilibrium studies, 160: pp.301–309, 2008.

[49] P. Patnukao, A. Kongsuwan, and P. Pavasant, Batch studies of adsorption of copper and lead on activated carbon from *Eucalyptus* camaldulensis Dehn . bark, 20: pp.1028–1034, 2008.

[50] V. Sarin, and K.K. Pant, Removal of chromium from industrial waste by using *Eucalyptus* bark, 97: pp.15–20, 2006.

[51] I. Ghodbane, L. Nouri, O. Hamdaoui, and M. Chiha, Kinetic and equilibrium study for the sorption of cadmium (II) ions from aqueous phase by *Eucalyptus* bark, 152: pp.148–158,2008.

[52] E. Chockalingam, and S. Subramanian, Bioresource Technology Utility of *Eucalyptus* tereticornis (Smith) bark and Desulfotomaculum nigrificans for the remediation of acid mine drainage. Bioresource Technology, 100(2): pp.615–621, 2009.

[53] A. Kongsuwan, P. Patnukao, P. Pavasant, Binary component sorption of Cu(II) and Pb(II) with activated carbon from *Eucalyptus* camaldulensis Dehn bark. J. Ind. Eng. Chem. 15: pp.465-470, 2009.

[54] B. Martin, *Eucalyptus*: A strategic forest tree. In: Wei, R.-P., Xu, D. (Eds.), *Eucalyptus* Plantations: Research, Management and Development. Proceedings of the International Symposium, Guangzhou, China, 1–6 September 2002. World Scientific Publishing Co. Pte. Ltd., Singapore, pp. 3–18, 2002.

[55] A.F.M. Barton, The oil mallee project, a multifaceted industrial ecology case study. J. Ind. Ecol. 3: 161–176, 2000.

[56] C. Green, Export Development of Essential Oils and Spices by Cambodia. C.L. Green Consultancy Services, Kent, UK, 2002.

[57] USEPA (United States Environment Protection Agency), 1993. R.E.D. FACTS. Flower and Vegetable Oils. Available online at http://www.epa.gov/oppsrrd1/REDs/ factsheets/4097fact.pdf (accessed on February 02, 2013).

[58] Council of Europe, Flavouring substances and natural sources of flavourings. Volume I, 4th Edition: Chemically-Defined Flavouring Substances, 1992.

[59] A.C.G. Fiori, Schwan-Estrada, K.R.F., Stangarlin, J.R., Vida, J.B., Scapim, C.A., Cruz, M.E.S., S.F. Pascholati, , Antifungal activity of leaf extracts and essential oils of some medicinal plants against Didymella bryoniae. J. Phytopathol. 148: pp. 483–487, 2002.

[60] H.O.A. Oluma, I.U. Garba, Screening of *Eucalyptus* globulus and Ocimum gratissimum against Pythium aphanidermatum. Nigerian J. Plant Prot. 21: 109–114, 2004.

[61] Y.C. Yang, H.C. Choi, W.S. Choi, J.M. Clark, and Y.J. Ahn, Ovicidal and adulti- cidal activity of *Eucalyptus* globulus leaf oil terpenoids against Pediculus humanus capitis (Anoplura: Pediculidae). J. Agric. Food Chem. 52: pp. 2507–2511, 2004.

[62] Y.C. Su, C.L. Ho, I.C. Wang, S.T. Chang, Antifungal activities and chemical compositions of essential oils from leaves of four *Eucalyptus*. Taiwan J. For. Sci. 21: 49–61, 2006.

[63] R.D. Batish, H.P. Singh, N. Setia, R.K. Kohli, S. Kaur, S.S. Yadav, Alternative control of littleseed canary grass using eucalypt oil. Agron. Sust. Dev. 27: 171– 177, 2007.

[64] N. Setia, D.R. Batish, H.P. Singh, R.K. Kohli, Phytotoxicity of volatile oil from *Eucalyptus* citriodora against some weedy species. J. Environ. Biol. 28: pp.63–66, 2007.

[65] H. Ramezani, H.P. Singh, D.R. Batish, and R.K. Kohli, Antifungal activity of the volatile oil of *Eucalyptus* citriodora. Fitoterapia 73: pp.261–262, 2002a.

[66] A. Lucia, P.G. Audino, E. Seccacini, S. Licastro, E. Zerba, and H. Masuh, Larvicidal effect of *Eucalyptus* grandis essential oil and turpentine and their major components on Aedes aegypti larvae.J.Am. Mosq.Control Assoc. 23: pp.299–303, 2007.

[67] X. Liu, Q. Chen, Z. Wang, L. Xie, Z. Xu, Allelopathic effects of essential oil from *Eucalyptus* grandis X E. urophylla on pathogenic fungi and pest insects. Frontiers of Forestry in China 3: pp.232-236, 2008.

[68] H. Naceur, B. Marzoug, M. Romdhane, A. Lebrihi, F. Mathieu, F. Couderc, and M. Abderraba, *Eucalyptus* oleosa Essential Oils: Chemical Composition and Antimicrobial and Antioxidant Activities of the Oils from Different Plant Parts (Stems, Leaves, Flowers and Fruits), pp.1695–1709, 2011.

[69] J.B.J. ediouni, H. Soumaya, B. Mohamed, and L. Mohamed, Seasonal variations in chemical composition and fumigant activity of five *Eucalyptus* essential oils against three moth pests of stored dates in Tunisia. J. Stored Products Research., 48: pp.61–67, 2012.

[70] A.M. Cruz-galvez, C.A. Gómez-aldapa, J.R. Villagómez-ibarra, N. Chavarría-hernández,J. Rodríguez-baños, Rangel-vargas, and J. Castro-rosas, Antibacterial effect against foodborne bacteria of plants used in traditional medicine in central Mexico: Studies in vitro and in raw beef. Food Control, 32(1) pp. 289-295, 2013.

[71] I. Tunc, B.M. Berger, F. Erler, and F. Dag, Ovicidal activity of essential oils from five plants against two stored-product insects. J. Stored Prod. Res. 36, pp.161– 168, 2000.

[72] S.E. Lee, B.H. Lee, W.S. Choi, B.S. Park, J.G. Kim, and B.C. Campbell, Fumigant toxicity of volatile natural products from Korean spices and medicinal plants towards the rice weevil, Sitophilus oryzae (L). Pest Manag. Sci. 57: pp.548–553, 2001.

[73] M. Kanat, and M.H. Alma, Insecticidal effects of essential oils from various plants against larvae of pine processionary moth (Thaumetopoea pityocampa Schiff) (Lepidoptera: Thaumetopoeidae). Pest Manage. Sci. 60:pp.173–177, 2003.

[74] A.S. Abdel Halim, and T.A. Morsy, The insecticidal activity of *Eucalyptus* globulus oil on the development of Musca domestica third stage larvae. J. Egypt. Soc. Parasitol. 35 (2), pp.631–636, 2005.

[75] W.S. Choi, B.S. Park, Y.H. Lee, D.Y. Jang, H.Y. Yoon, S.E. and Lee, Fumigant toxicities of essential oils and monoterpenes against Lycoriella mali adults. Crop Prot. 25, pp.398–401, 2006.

[76] S.S. Nathan, The use of *Eucalyptus* tereticornis Sm. (Myrtaceae) oil (leaf extract) as a natural larvicidal agent against the malaria vector Anopheles stephensi Liston (Diptera: Culicidae). Biores. Tech. 98: pp.1856–1860, 2007.

[77] S. Rajendran, and V. Sriranjini, Plant products as fumigants for stored-product insect control. J. Stored Prod. Res. 44:pp. 126–135, 2008.

[78] J. Kambouzia, M. Negahban, and S. Moharramipour, Fumigant Toxicity of *Eucalyptus* Leucoxylon Against Stored Product Insects. American-Eurasian Journal of Sustainable Agriculture, 3(2): pp.229-233, 2009.

[79] G. Tayoub, A.A. Alnaser, and I. Ghanem, Toxicity of two essential oils from *Eucalyptus* globulus Labail and Origanum syriacum L . on Larvae of Khapra beetle, 2(2):pp. 240–245, 2012.

[80] A.D. Leslie, M. Mencuccini, and M. Perks, The potential for *Eucalyptus* as a wood fuel in the UK. Applied Energy, 89(1), pp. 176–182, 2012.

[81] AFOCEL. Itineraire technique et production. Lettre d'information semestrielle *Eucalyptus*. Numero 2 Avril 2003, AFOCEL, France; Pp.4, 2003.

[82] AFOCEL. Fiches clonales *Eucalyptus*, *Eucalyptus* gundal AFOCEL, France; Pp. 4, 2006.

[83] J.G. Purse, and K.E. Richardson, Short rotation single stem tree crops for energy in the UK – an examination with *Eucalyptus*. Aspects of applied biology, No. 65, Biomass and nergy Crops II; pp. 1–8, 2001.

[84] J. Neilan, and D. Thompson, *Eucalyptus* as a potential biomass species for Ireland. COFORD connects, reproductive material no. 15. COFORD, Ireland; pp. 8, 2008.

Measurement of void fraction in magnetic two-phase fluids using Microwave technique

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ABSTRACT: The ferrofluid Fe_3O_4/water had been prepared by chemical precipitation method and stabilized by the addition of long chain of polybutadien polymer. A Microwave technique (transmitter- receiver) has been used to measure the void fraction in two-phase ferrofluid flow. The system of the Microwave technique consists of transmitter of microwave generated by Gunns diode. New theoretical equations were derived. In this radio-absorption technique, because the relative difference of absorption of microwave energies between air and ferrofluid the idea is valid in somehow.

KEYWORDS: Magnetic two-phase fluid; Void fraction; Bubbly flow; Bubble column.

1   INTRODUCTION

The magnetic fluid is a suspension of fine solid magnetic particles like Fe_3O_4 in a host liquid such as water. The suspension behaves as a fluid with magnetization effects in a magnetic field. Some of the applications of magnetic fluids are the following: production of zero-leakage rotary shaft steels for use in computer disk drives, vacuum feed through for semiconductor manufacturing, pressure seals for compressors, magnetic fluid dampers and actuators, etc. An energy conversion system using magnetic fluids was proposed by Resler and Rosenwieg [1]. It was based on the principle that the magnetization of magnetic fluids changes with temperature. However, no significant results were obtained due to the difficulty of the preparation of temperature-sensitive magnetic fluids. In order to overcome this limitation, Kamiyama et al. [2] contrived a new energy conversion system using magnetic two-phase flow then a larger driving force than in conventional system can be expected to induce the magnetic fluid flow because the properties of magnetization changed not only by temperature but also by gas inclusion (that is, void fraction). Void fraction in magnetic two-phase flow is defined as the ratio of the volume of gas to the total volume of gas-magnetic fluid mixture in a finite length of the pipeline. This ratio is useful for the determination of the average density, pressure drop, flow pattern, changes of magnetic susceptibility, etc. Kamiyama et al. [2] stressed the need for the development of a measuring technique for void fraction in two-phase magnetic fluid flow. The aim of the present work is to satisfy this need.

2   THEORY

The measurement of void fraction in the colloidal magnetic fluid (ferrofluid) is based upon the fact that the radio absorption of the magnetic liquid is different from that of the gases. So the use of surface density of power P_d is useful and represented by [3]:

$$P_d = \frac{P}{4\pi R^2} \qquad\qquad (1)$$

where R represents thew distance between transmitter and receiver, P is the power emitted from the transmitter and if the surface area of the receiver is A_R then the power intered the receiver is:

$$P_R = P_d A_R = \frac{PA_R}{4\pi R^2} \tag{2}$$

In this case any change in the surface area in front of the receiver will change the received power of the receiver and then the current recorded.

The ferrofluid is an excellent absorber of microwave energy so it might be considered as a shield despite its thickness in front of the receiver. Any change in the height of the ferrofluid in the bubble column as a result of gas inclusion means changing in the shielding surface area and finally in the power and current recorded as illustrated in figure (1). So equation (2) will be rewritten in the form of:

$$P_R = P_d A_R = \frac{Pl_r f_r}{4\pi R^2} \tag{3}$$

$where$ l_r represents the width of the surface of the receiver and f_r represents the height of the face of the receiver and it will be changed under the action of gas inclusion where the rise of ferrofluid in the bubble column as a result of gas inclusion means decreasing of A_R and then in power received where the received power as a function of Δh (rise of ferrofluid).

The power received as a function of height of ferrofluid in the bubble column is given by:

$$P_R(\alpha) = P_d A_R = \frac{Pl_r(f_r - \Delta h)}{4\pi R^2} \tag{4}$$

An empirical relation has been used to express the effect of void fraction to the current registered in the receiver technique

$$P_R = KI_{max} \tag{5}$$

And

$$P_R(\alpha) = KI_\alpha \tag{6}$$

Dividing eq (4) by (3) and eq (6) by (5) leads to:

$$\frac{P_R(\alpha)}{P_R} = \frac{\frac{Pl_r(f_r - \Delta h)}{4\pi R^2}}{\frac{Pl_r f_r}{4\pi R^2}} = \frac{KI_\alpha}{KI_{max}} \tag{7}$$

and

$$\frac{I_\alpha}{I_{max}} = \frac{(f_r - \Delta h)}{f_r} = 1 - \frac{\Delta h}{f_r} = 1 - \alpha \tag{8}$$

3   MATERIALS, APPARATUS AND EXPERIMENTAL PROCEDURE.

The colloidal magnetic fluids (ferrofuid) were prepared by the chemical precipitation method [4] in the laboratory. X-ray line broadening indicates that the mixture contains fine particles of magnetite with an average particle size of d =120.5 A°. This was obtained by using Scherer's equation [5] as follows:

$$d = \frac{K\lambda}{\beta \, Cos \, \theta} \tag{4}$$

where λ is the X-ray wavelength (1.5406 A°), K is the shape factor (0.89) for magnetic particles [5]. β is the line broadening measured at the half-height of the peak and expressed in units of 2θ (β= 0.800°), θ is the Bragg angle in degree (θ=35.395). β must be expressed in units of radians in Scherer's equation. Particles diameter measurements were done by (Philips Analytical-PC 286 DIFFRACTOMETER of Germany). Magnetite particles were stabilized by the addition of the Polymer (Polybutadiene) to the mixture. This polymer normally forms a thin layer around the particles. This polymer was chosen in the laboratory on the basis that it has long molecular chains and adsorbs easily in water solutions around the magnetite particles. Fig. 1 shows the experimental apparatus of the microwave technique for void fraction measurements. This apparatus consists of a transmitter and receiver for microwave pulses generated by gunn s diode penetrating the rectangular column of thin walled glass container filled partially with ferrofluid in a shape describing a fluid height changed according to its value of gas included in any mechanism feasible and easy to measure so any change in height reflects a change in volume

of the mixture of gas and ferrofluid so the perpendicular face area in front of the transmitter and receiver will be changed and as a result the received energy of microwave pulses.

4   RESULTS AND DISCUSSION

The results of X-ray analysis were shown in Fig. 2 reflect that the results of chemical precipitation method was successes in making magnetite particles with particle size d≤120 A° which are suitable to maintain the suspension and the particles remain buoyant in the host of water but this results are no longer enough to make the suspension remain stable and does not segregate under the influence of magnetic field, so the addition of polybutadien polymer as a surfactant agent is feasible to enhance the mechanical stabilities of magnetic liquid. The associated component in magnetic fluid as a results of chemical method is the salt which is harmful and must be removed from the liquid. After a multy stage of washing of ferrofluid the agglomeration of ferrofluid particles is decreased as illustrated in Figs. 4 and 5 before and after washing respectively. This figures are of the laser particle size analyzer and the values of particle size is in the range of micrometer which give us a proof that the particles are coated with the molecules of polybutadien polymer and reflect the laser beam. Results about void fraction are clear and reliable as illustrated in Fig. 2 and the relation as expected from equation (8) is linear and the registered dimensionless current is decreased with the increased of void fraction.

5   CONCLUSIONS

1. The microwave was a new method suggested to measure the void fraction in colloidal two-phase magnetic fluid.
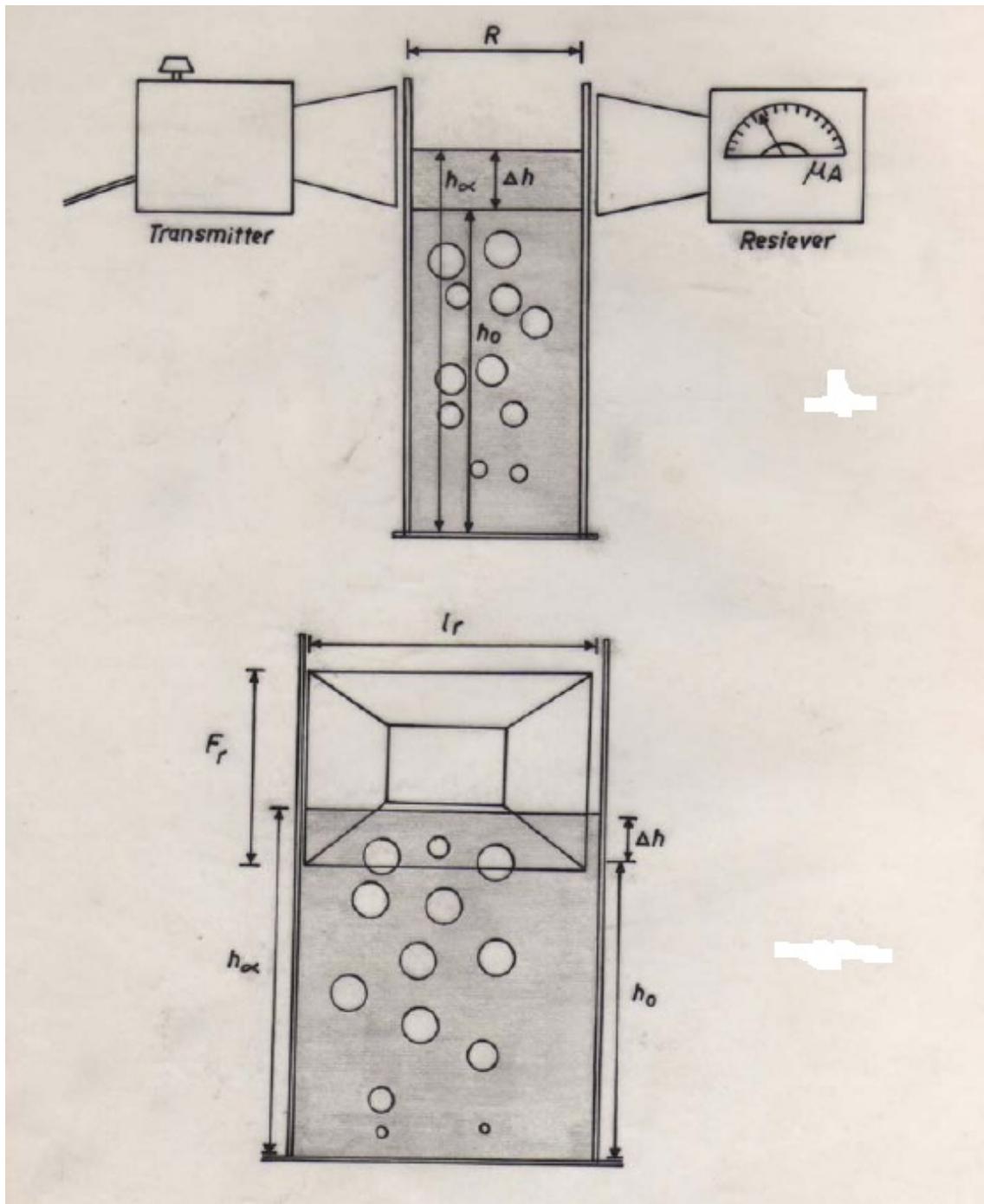
Fig. 1.   Bubble column filled with ferrofluid and a fraction of gas in bubble phase.

2. The ferrofluid is opaque medium; therefore optical methods could not be used for the measurement of void fraction.
3. Steel walled test section cannot be used in this technique, because all the microwave flux lines will concentrate in the steal wall.
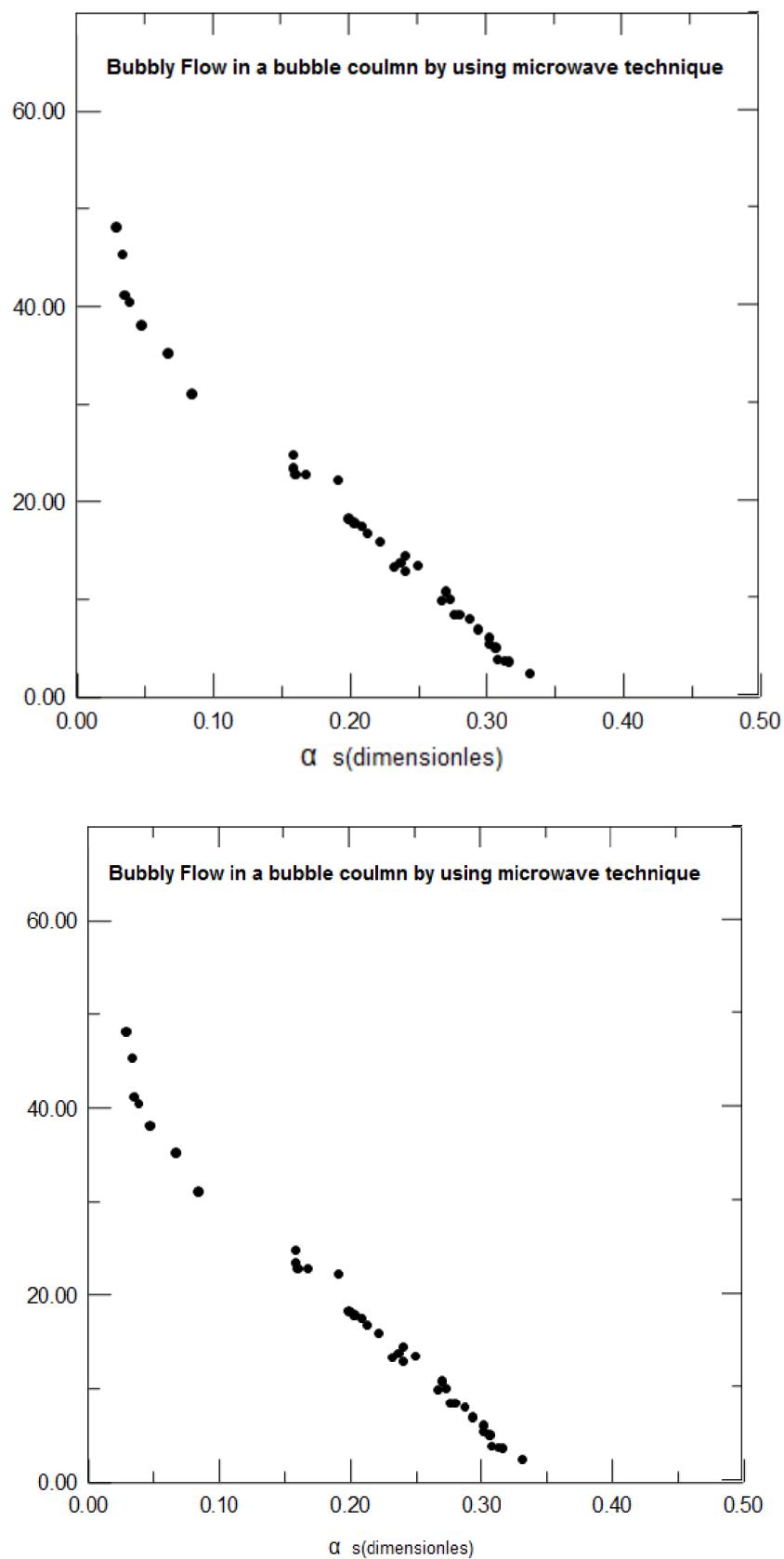
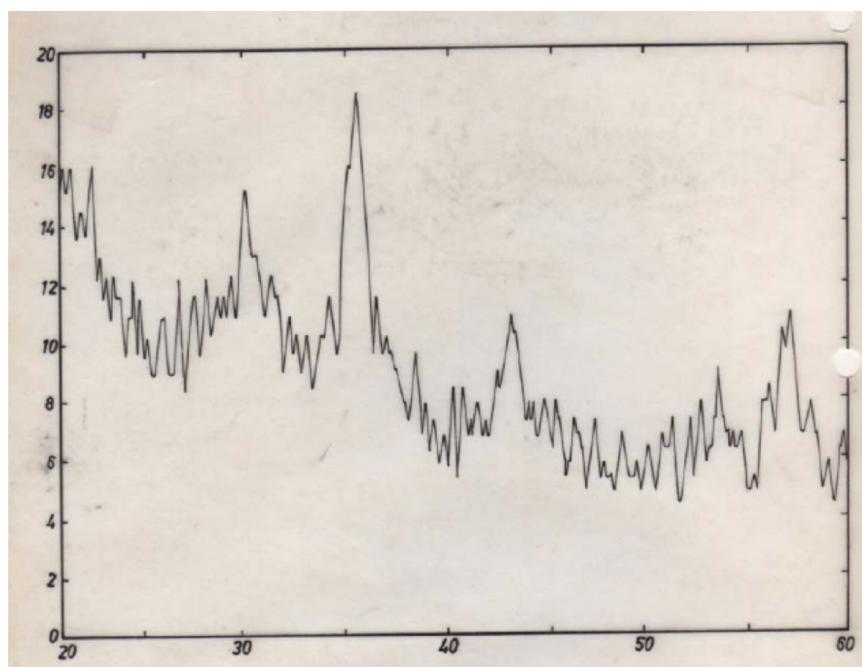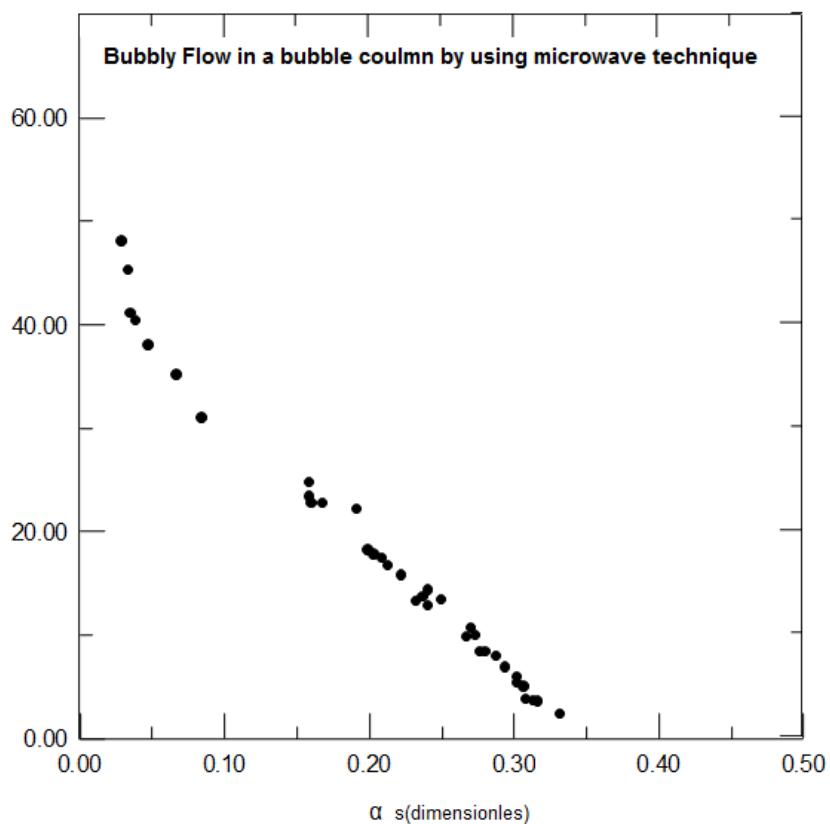*Fig. 2: Relative dimensionless current registered vs void fraction*
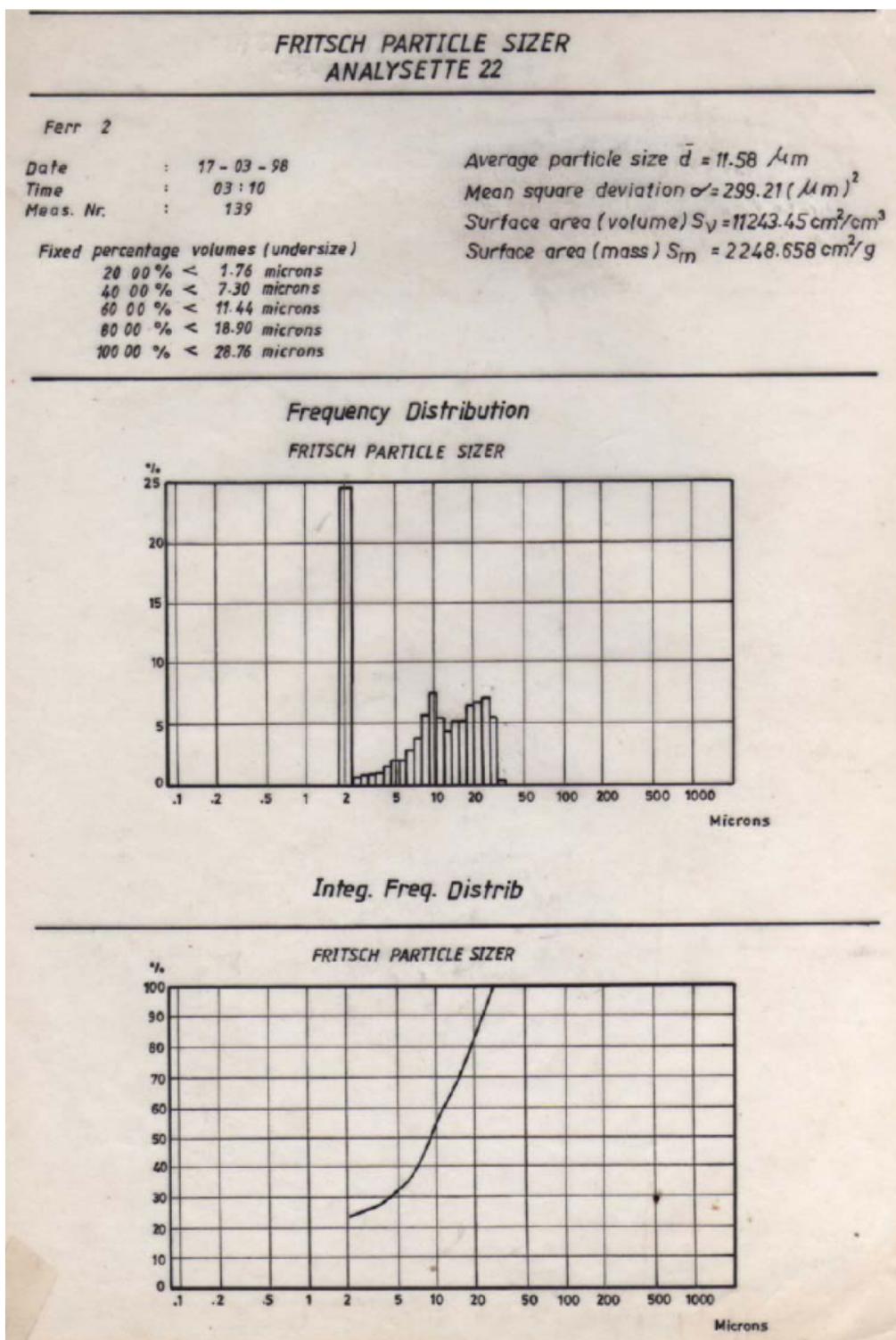
Fig. (3) X- ray analysis for ferrofluid dry sample

Fig. 4: LASER particle size analyser for ferrofluid wet sample before washing and removing salt.

FRITSCH PARTICLE SIZER
ANALYSETTE 22

Ferr 3

Date   :   23 - 03 - 98
Time   :   04 : 53
Meas. Nr.   :   140

Average particle size $\bar{d} = 3.63\,\mu m$
Mean square deviation $\sigma' = 22.96\,(\mu m)^2$
Surface area (volume) $S_V = 20961.25\,cm^2/cm^3$
Surface area (mass) $S_m = 4192.25\,cm^2/g$

Fixed percentage volumes (undersize)
  20.00 %   <   0.76   microns
  40.00 %   <   1.52   microns
  60.00 %   <   2.49   microns
  80.00 %   <   4.90   microns
 100.00 %   <   12.6   microns

Frequency Distribution

FRITSCH PARTICLE SIZER

Integ. Freq. Distrib.

FRITSCH PARTICLE SIZER.

Fig. 5: LASER particle size analyzer for ferrofluid wet sample after washing and removing salt

Design and Development of Fluidized Bed Dryer for Domestic Purposes

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ABSTRACT: Efficient drying of cereals, pulses and pellets in rural India has always been hindered in rainy seasons and during cloudy days. This can lead to wastage of agricultural products during storage in both farms and individual homes. We present the method of designing a Fluidized Bed Dryer for drying purposes. This simple and efficient system based on the fluidization process has been designed in SolidWorks software. The design has been thermally analyzed using Ansys. Stress analysis and flow simulation has also been carried out using Ansys. Our studies showed that the design can withstand the working conditions and hence a compact working model of the design was fabricated. Further tests and experiments can be conducted on the fabricated model for other uses including polishing and smoothening of rough particles for industry. We conclude that the design can effectively be used in for drying purpose both at domestic and industrial scale.

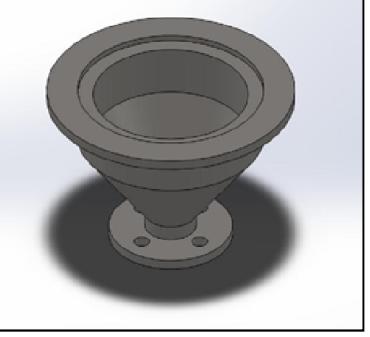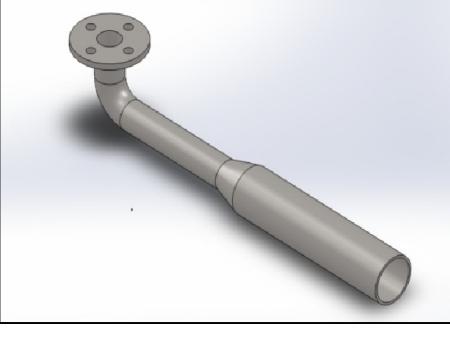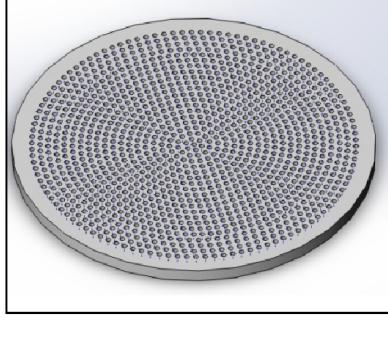**KEYWORDS:** Fluidization, Ansys, SolidWorks, Drying, Fabrication

1   INTRODUCTION

Fluidized bed technology has been used in industrial dryers for the drying of wet solid particles [1]. Industrial drying operations require a high rate of heat and mass transfer and a high rate of solid transport to or from the dryer. The main advantages of fluidized bed technology in drying application are large contact surface area between solids and gas, high thermal inertia of solids, good degree of solids mixing, and rapid transfer of heat and moisture between solids and gas that shortens drying time considerably without damaging heat sensitive materials. In addition, fluidized solid particles can be easily transported into and out of the dryer by gravity (much like a liquid) and transported elsewhere by pneumatic conveying with less mechanical equipment. Fluidized-bed drying has found many applications in chemical, metallurgical and pharmaceutical industries [1, 2].

In a country like India where grains like cereals are harvested seasonally and consumed continuously; need to be stored properly from insects, pests, mold, and fungus formation [3]. The situation can worsen during rainy seasons and high humid conditions. Cooling the grain by ambient air aeration (even in tropical climates) solar cooling' or refrigerated aeration offers many benefits including slowing insect population growth rates, reducing pesticide usage and preserving grain quality. Drying grams, such as paddy rice, to a moisture content of 14% is essential to prevent destructive mold growth and to maintain germination and milling qualities [4-9]

Heating grains to 55°C for 15 min is lethal to all stages of insect, fungus development; while at 65°C death is almost instantaneous [10]. Adequate management of insects and molds that attack and destroy harvested grain has always received less attention [11]. We present a model (design) for domestic heating of grains, cereals to prevent the mold and fungus formation in humid and wet conditions. Fluidized Bed technology has been used to achieve the same.

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2   DESIGN OF FLUIDIZED BED DRYER [FBD]

The design has been made keeping in mind various parameters including mobility, compactness, efficiency of heat transfer and volume. The model was made in SolidWorks 2012 software and has been analyzed in Ansys 14. The whole structure is supported by tripod stand. It consists of the following parts as shown in the figures,
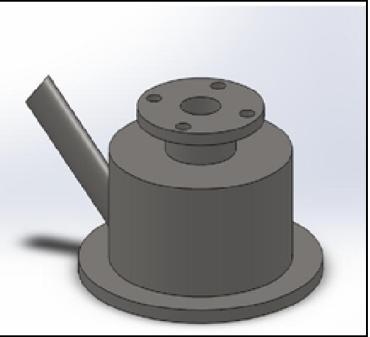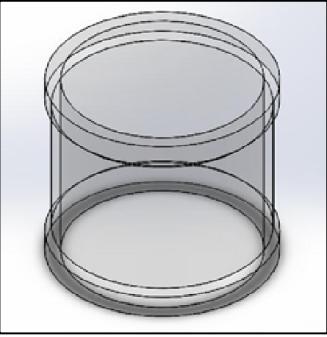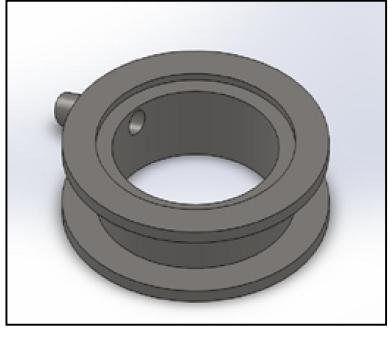
Fig. 1. Upper chamber (Pellet Inlet)	*Fig. 2. Borosilicate Glass chamber*	*Fig. 3. Middle Chamber*
Fig. 4. Lower Plenum	*Fig. 5. Air inlet tube with flange*	*Fig. 6. Teflon Distributer Plate*

Other necessary parts include the Tubular Heater (Heat source), Asbestos and Rubber gaskets (to prevent the outflow of hot air to the atmosphere), Dimmer stat (to vary the current to the tubular heater), stainless steel mesh (to hold the sand pellet mixture), Valves (for inlet and outlet) and Air Blower (provide the inlet air).
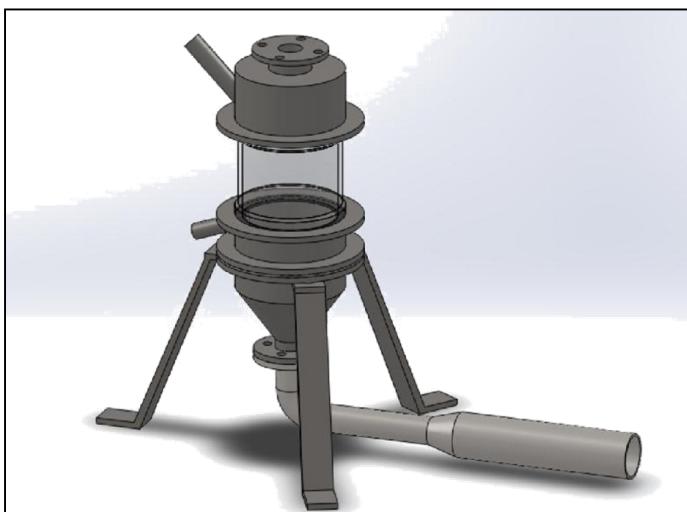
Fig. 7.   Final model assembly.

3   OPERATION/WORKING

Cleansed and clear fine sand (0.05 mm to 1 mm) is used to produce the effect of fluidization. The pellets (like cereals, grains) are mixed along with the sand and are poured into the chamber through the pellet inlet. Tubular heater fixed inside the air inlet tube provides the required amount of heating (by varying the current) and the hot air is made to flow into the chamber with the help of an air blower. Hot air is then distributed evenly before entering the chamber by Teflon distributor plate. This evenly distributed hot air mixes with the mixture of sand and pellet to cause the fluidization. A suspended state of solid fluid mixture is formed and effectively dries the pellets. Sand has a high heat retaining capacity which augments the process of drying effectively. The pellet sand mixture is then removed from the outlet and can be separated out using a simple sieve.

4   ANALYSIS IN ANSYS

A temperature close to 383K (above boiling point of water) has to be reached to remove the moisture content and effectively aid the drying process. Temperature analysis with different flow velocity was done to find out the optimal flow velocity to reach close to 373K in the chamber.
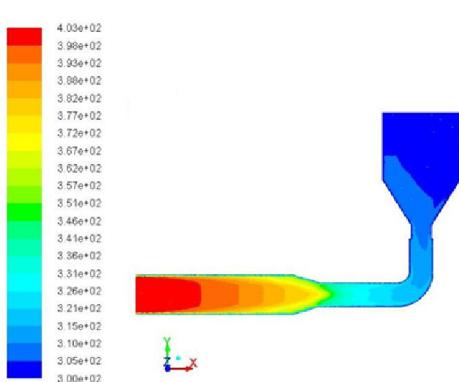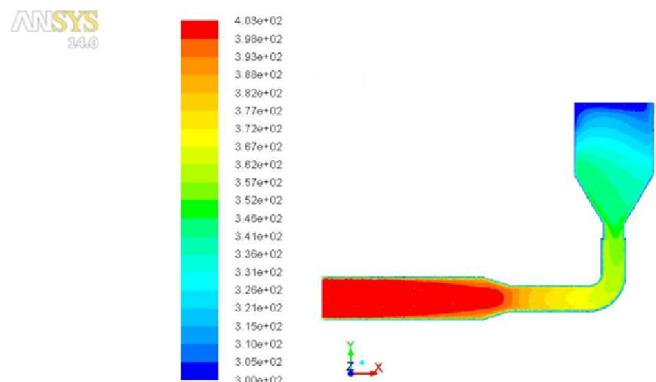

Figure 8: Temperature variation at velocity = 2 m/sec   *Figure 9: Temperature variation at velocity = 8 m/sec*
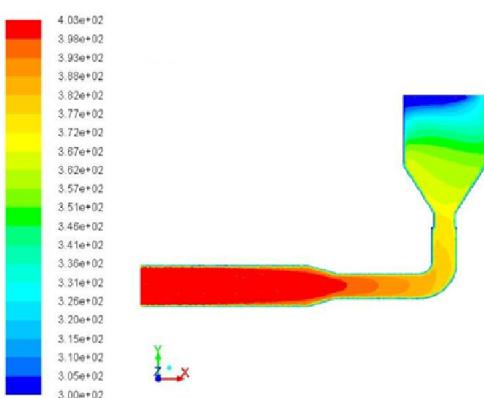

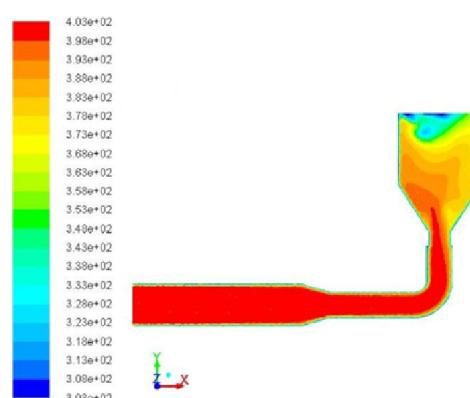*Figure 10: Temperature variation at velocity = 15 m/sec*   *Figure 11: Temperature variation at velocity = 20 m/sec*

We can see from Figure 8 that the heat is not effectively transferred from the inlet to the chamber region. Temperature of only 305K is reached as against 383K which is the target temperature. Keeping the current constant, the flow velocity is slowly increased to 8 m/sec, 15 m/sec, 20 m/sec and it can be observed that the target temperature of 388K. It can be

concluded from the temperature analysis that a flow velocity of 20 m/sec is required to attain the target temperature of 388K for effective drying of pellets and remove the moisture content completely.
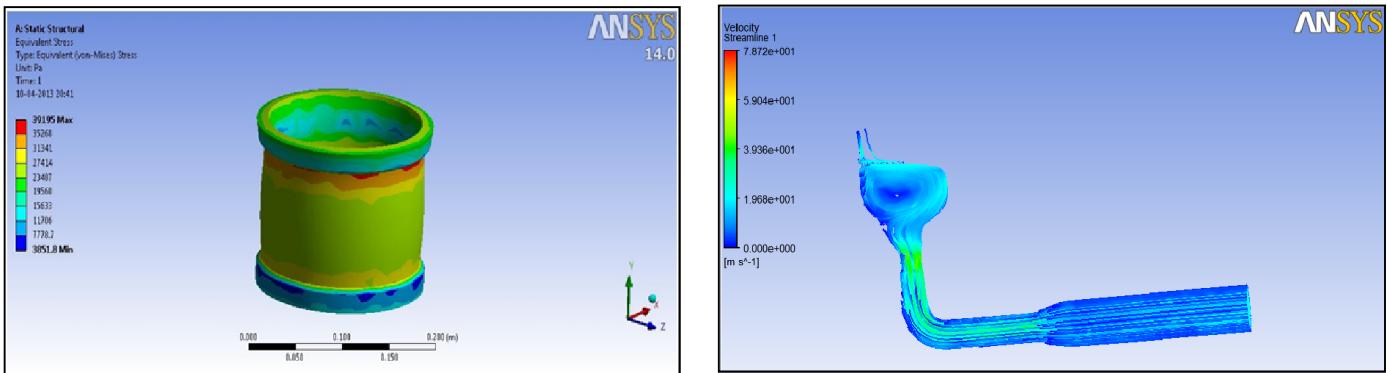

Figure 12: stresses induced in the glass structure

Figure 13: Flow happening in the Fluidised Bed Dryer

Force of 101.27N due to weight of the upper chamber acts on the glass structure and the stresses induced in it are shown in Figure 12. The maximum stress induced is 39 KPa on the borosilicate glass structure which is in the accepted limits and safe design criteria. It can be clearly seen from Figure 13 that flow is streamlined till the start of plenum from the air inlet and then it turns turbulent as the flow whirls in the plenum section due to mesh plate (acts as obstruction) to the flow with holes of diameter 2.5mm which allows only the air to pass through the mesh plate.

5 REMARKS AND CONCLUSION

The design satisfied the purpose of drying pellets effectively and an optimum temperature of 388K was reached at a flow velocity of 20 m/sec. The flow can be provided by either by an air blower or air compressor. The hardware model of the fluidised bed dryer was made for testing and analysing the effectiveness of drying and was found successful meeting the needs.

Figure 14: Hardware Model

The hardware model (Figure 14) is now been tested for its other uses including polishing and smoothening of particles for small scale industry usage. Further development to the design includes the attachment of sensors and control systems for exact measurement of various parameters of temperature, pressure and velocity which will help in conducting more tests and experiments.

REFERENCES

[1]   Fluidized Bed Dryers — Recent Advances, Wan Ramli Wan Daud; Department of Chemical and Process Engineering, Faculty of Engineering, University Kebangsaan Malaysia, 43600 UKM Bangi, Malaysia.

[2]   Heat and mass transfer during drying of a bed of shrinking particles – Simulation for carrot cubes dried in a spout-fluidized-bed drier; Ireneusz Bialobrzewski , Magdalena Zielinska, Arun S. Mujumdar; Department of Agri-Food Process Engineering, University of Warmia and Mazury, Heweliusza 14, 10-718 Olsztyn, Poland, Department of Mechanical Engineering and Engineering Science Program, National University of Singapore, Singapore.

[3]   The Thermodynamic Performance of a Continuous-flow Fluidized Bed Grain Disinfestor and Drier;G. R. THORPE.

[4]   Nour/Jantan, D. G. M.; Chek, T. I.; Rukunudin, I. H.; Ahdulla, R.; Sahim, S. Aerated bulk storage of padi in vertical concrete silos. Regional grains post-harvest workshop, Jakarta, 3-6 May 1983

[5]   Thorpe, G. R. The aeration of wheat in the climate of North India. Bulletin of Grain Technology 1980. 18(l): 3-9

[6]   Thorpe, G. R. A solar cooling system for bulk stored food grains. Agricultural Engineering Australia 1981, 10(l): 14-19

[7]   Elder, W. B.; Ghaly, T. F.; Thorpe, G. R. Grain refrigeration trials in Australia. International Symposium on Practical Aspects of Controlled Atmosphere in Fumigation in Grain Storages. Perth, 1 l-15 April 1983

[8]   Thorpe, G. R.; Elder, W. B. The use of mechanical refrigeration to improve the storage of pesticide treated grain. International Journal of Refrigeration 1980, 3: 99-106

[9]   Ghaly, T. F. Refrigerated aeration trials of stored wheat: insect control and quality changes. Proceedings 26th Annual Conference, The Royal Australian Chemical Institute Cereal Chemistry Division, Broadbeach, Queensland, 1976.

[10] Stored Grain Losses Due to Insects and Molds and the Importance of Proper Grain Management; Phillip Harein, University of Minnesota, Richard Meronuck, University of Minnesota.