PRINT ISSN : 2395-6011 ONLINE ISSN : 2395-602X

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN SCIENCE & TECHANOLOGY

VOLUME 1 ISSUE 1 MARCH-APRIL 2015



Web Site : www.ijsrst.com

Email : editor@ijsrst.com



International Journal of Scientific Research in Science and Technology

Print ISSN: 2395-6011 Online ISSN : 2395-602X

Volume 1 Issue 2 May-June 2015

International Peer Reviewed, Open Access Journal Bimonthly Publication

Published By

Technoscience Academy (The International Open Access Publisher)

Email: info@technoscienceacademy.com Website: www.technoscienceacademy.com

Advisory/Editorial Board

- Dr. Manish Shorey, Bangalore, Karnataka
- Dr. M. K. Rameshaiah, Bangalore, Karnataka
- Dr. V. S. Majumdar, Pune, Maharashtra
- Prof. Shardul Agravat, Surendranagar, Gujarat, India
- Dr. Sundeep Sinha, Delhi, Gujarat, India
- Dr. Ashish Sharma, Delhi, Gujarat, India
- Prof. Vaishali Kalaria, RKU, Rajkot, Gujarat, India
- Prof. H. B. Jethva, L. D. College of Engineering, Ahmedabad, Gujarat, India
- Prof. Bakul Panchal, L. D. College of Engineering, Ahmedabad, Gujarat, India
- Prof. Bhavesh Prajapati, Government MCA College Maninagar, Ahmedabad, Gujarat, India
- Prof. Amod Pandurang Shrotri, Shivaji University, Kolhapur, Maharashtra, India
- Prof. Sunil Kulkarni, Datta Meghe College of Engg. Airoli, Mumbai, Maharashtra, India
- Prof. Atishey Mittal, S.R.M. University, NCR Campus, Modinagar, Ghaziabad, Uttar Pradesh, India
- Dr. Syed Umar, Dept. of Computer Science and Engineering, KL University, Guntur, Andhra Pradesh, India
- Dr. S. Ahmed John, Jamal Mohamed College, Tiruchirappalli, India
- Prof. S. Jagadeesan, Nandha Engineering College Erode, Tamil Nadu, India
- Dr. Faisal Talib, IIT Roorkee(PhD), Aligarh, Uttar Pradesh, India
- Prof. Joshi Rahul Prakashchandra, Parul Institute of Engineering & Technology, Vadodara, Gujarat, India
- Dr. Aftab Alam Tyagi, Department of Mathematics, SRM University NCR Campus, Uttar Pradesh, India
- Dr. Sudhir Kumar, Department of Mathematics, S.D. (P.G.) College, Uttar Pradesh, India
- Dr. Rimple Pundir, Nagar, Uttar Pradesh, India
- Prof (Dr.) Umesh Kumar, Dept of Science & Technology, Govt. Women's Polytechnic, Ranchi, Jharkhand, India
- Abhishek Shukla, R. D. Engineering College Technical Campus, Ghaziabad, Uttar Pradesh, India
- Dr. Balram Panigrahi, Soil & Water Conservation Engineering, College of Agricultural Engg. & Techn. Orissa University Of Agriculture & Technology, Bhubanmeswar, Odisha, India

- Dr. Anant Lalchand Chaudhari, Department of Electronics, Arts, Science & Commerce College, Chopda, Jalgaon, Maharashtra India
- Dr. V. Ananthaswamy, Department of Mathematics, The Madura College (Autonomous), Madurai, Tamil Nadu, India
- Dr. Arvind Bijalwan, Indian Institute of Forest Management (IIFM) (Ministry of Environment & Forests, Govt. of India) Bhopal, Madhya Pradesh, India
- Dr. Aditya Kishore Dash, Department of Environmental Engineering, Institute of Technical Education and Research (ITER), S'O'A University, Bhubaneswar, Odisha, India
- Dr. Subha Ganguly, Department of Veterinary Microbiology Arawali Veterinary College, Bajor, Rajasthan, India

International Advisory/Editorial Board

- Prof. Sundeep Singh, Mississauga, Ontario, Canada
- Dr. Joseph Easton, Boston, USA
- Dr. M. Chithirai Pon Selvan, School of Engineering & Information Technology, Manipal University - Dubai
- Dr. Md. Abdullah Al Humayun, School of Electrical Systems Engineering, University Malaysia, Perlis, Malaysia
- Dr. V. Balaji, Bahir Dar University, Bahir Dar, Ethiopia
- Lusekelo Kibona, Department of Computer Science, Ruaha Catholic University (RUCU), Iringa, Tanzania
- Dr. Mohamed Abdel Fattah Ashabrawy, Reactors Department, Atomic Energy Authority, Egypt
- Dr. Abul Salam, UAE University, Department of Geography and Urban Planning, UAE
- Ayisi Larbi Christian, Shanghai Ocean University, Shanghai China
- Md. Amir Hossain, IBAIS University/Uttara University, Dhaka, Bangladesh
- Dr. Amer Taqa, Department of Dental Basic Science College of Dentistry, Mosul University, Iraq
- Prof. Dr. H. M. Srivastava, Department of Mathematics and Statistics, University of Victoria, Victoria, British Columbia, Canada
- AJENIKOKO Ganiyu Adedayo, Electronic and Electrical Engineering, Ladoke Akintola University of Technology, Ogbomosho, Nigeria

International Journal of Scientific Research in Science and Technology

CONTENTS

Sr. No	Article/Paper	Page No
1	Face Recognition as a Biometric Security for Secondary Password for ATM Users. A Comprehensive Review Lusekelo Kibona	1-8
2	Remote Sensing towards Water Quality Study in Malacca River. Case Study: A Review Perspective Ang Kean Hua, Faradiella Mohd Kusin	9-15
3	A Study on Customer Satisfaction: With Special Reference to Detergent Powder Alaka Samantaray	16-19
4	Bacterial Blight Resistance in Rice: A Review Mohammad Noroozi, Haj Beheshtizadeh, A-Sattari	20-23
5	Viscosity Studies of Na ² So ⁴ .10H ² O in Mixed Solvents at Different Temperatures D. Sahu, A. K. Patnaik	24-27
6	Comparision of MPC and PID Controls of Sirnak Water Supply Network System Bekir Cirak	28-36
7	Microcrystal Tests for Detection of Nicotine in Hookah Bar Samples Falguni Patel, Astha Pandey	37-41
8	Larvicidal Effect of Seeds of Myristica Fragrans (Houttuyn) on Larvae of Anopheles Gambiae Romanus Umoh, Samuel Offor, Nkechi Onyeukwu, Akwaowo Elijah, Hilary Otimanam, Timma Uwah, Clement Jackson	42-46
9	Network Reconfiguration for Loss Reduction of a Radial Distribution System Laxmi .M. Kottal, Dr. R Prakash	47-51
10	Data Swapping in Cloud Computing Sachida Nanda Barik	52-56
11	Response Surface Methodology for Optimizing the Parameters of a Roasting Machine Using Maize (Zea mays L.) Atere A. O., Olukunle O. J., Olalusi A. P.	52-61
12	Speed Control of DC Motor Using Microcontroller Katke S P, Rangdal S.M	62-67
13	Quantitative Assessment on Fitting of Gumbel and Frechet Distributions for Extreme Value Analysis of Rainfall N. Vivekanandan	68-73

14	Contribution to the Method of Sugar Analysis in Legume Grains for Ensiling - A Pilot Study Annette Zeyner, Annett Gefrom, Dirk Hillegeist, Manfred Sommer, Jorg M. Greef	74-80
15	Comparison of Scanning Electron Microscopic Examination of Oats, Barley and Maize Grains with the Analyzed Degree of Starch Breakdown and Glycaemic Responses in Horses Mandy Bochnia, Sabine Walther, Hans Schenkel, Kristin Romanowski, Annette Zeyner	81-84
16	Case Study on Improving Overhaul Performance of CAT 3412 Marine Engine by Six Sigma Program Chin-Chiuan Lin, Chang-Jiang Lee, Liang-Yu Chueh	85-89
17	Bio-Medical Waste Disposal- A Survey to Assess the Knowledge, Attitude and Behaviour Among Dental Personnel in Kanpur City, (U.P.), India Dr. Lakshmana Rao. Bathala, Dr.Rajashekar Sangur, Dr.Tanu Mahajan, Dr.Pawanjeet Singh Chawla, Dr.Ankit Mehrotra, Dr.Parul Singhal	90-93
18	An Experiment to Improve Classification Accuracy Using Ensemble Methods Bhavesh Patankar, Dr. Vijay Chavda, Maulik Dhandhukia	94-97
19	Optimized Architecture for Centralized MIS for Distributed Database Systems Maulik R. Dhandhukia	98-104
20	A Review of Sequential Extraction Method for Lead in Samples: A Case Study of Artisanal Mines of Sokoto Basin (Zamfara State) Y. M. Ahijjo, A.N. Baba-Kutigi, M. Momoh, A. U. Moreh	105-109
21	Scanning Electron Microscopic Examination of Different Varieties of Oat Grains in Comparison with the Analyzed Degree of Starch Breakdown and Glycaemic Responses in Horses Mandy Bochnia, Sabine Walther, Hans Schenkel, Kristin Romanowski, Annette Zeyner	110-113

Face Recognition as a Biometric Security for Secondary Password for ATM Users. A Comprehensive Review

Lusekelo Kibona Department of Computer Science Ruaha Catholic University (RUCU) Iringa, Tanzania

ABSTRACT

Authentication is an important aspect in system control in computer based communication. Automatic Teller Machines (ATMs) are widely used in our daily lives due to their convenience, wide-spread availability and time-independent operation. In this paper, the author tried to review some mechanisms used in dealing with security threat posed to ATM users and found that there are potential threats associated with using card based security system so there is a need to add up another secondary security after the primary stage has been passed and that secondary stage is facial recognition security system as explained in an algorithm developed in this paper. The recommendations for future biometric system has been suggested like smell from mouth breathing be considered as the future secondary security system even though it has got its challenges.

Keywords: ATM, ATM cards, Face recognition, Biometric security, banking systems.

I. INTRODUCTION

Biometrics refers to automatic identification of a person based on his or her physiological or behavioral characteristics. It provides a better solution for the increased security requirements of our information society than traditional identification methods such as passwords and PINs [1].

ATM as a cash dispenser which is designed to enable customers enjoy banking service without coming into contact with Bank Tellers (Cashiers). The ATM, therefore, performs the traditional functions of bank cashiers and other counter staff. It is electronically operated and as such response to a request by a customer is done instantly [2]. On most modern ATMs, the customer is identified by inserting a plastic ATM card with a magnetic stripe or a plastic smartcard with a chip that contains a unique card number and some security information, such as an expiration date. Security is provided by the customer entering a personal identification number (PIN) [3].

Due to limitation on banking hours, it is therefore difficult for people to get access to their money when needed. ATM, represents customers' satisfaction and cost savings device. Customers become their own teller when they use ATM.

Automatic Teller Machines (ATMs) are widely used in our daily lives due to their convenience, wide-spread availability and time-independent operation. Automatic retraction of forgotten card or cash by ATMs is a problem with serious consequences (lost time and money), typically caused by user inattention/negligence [4].

Authentication is an important aspect in system control in computer based communication. Human face recognition is an important biometric verification and has widely used in many applications such as video monitoring system, human computer interaction, door control system and network security.

1

Face recognition technology is gradually evolving to universal Biometric solutions, since it requires virtually zero efforts from the user end while compared with other biometric options [5].

Using credit or debit cards to withdraw cash from an ATM may become a thing of the past with the introduction of facial recognition technology. The ATM comes with a camera that sends details of a customer's facial dimensions to a database for verification. Once the image is verified, the customer either enters a PIN or answers a personal security question. A thief could not use a photograph to trick the machine because the machine uses length, width and depth to recognize the image [6].

To use an ATM with facial recognition system, all you need is walk to the atm. its digital camera is on 24hours a day, and its computer will automatically initiate a face recognition procedure, whenever the computer detects a human face in camera obtains a picture of your face, the computer compares the image of your face to the images of registered customers in its database .If your face (as seen by the ATMs camera) matches the picture of the in the data base you are automatically recognized by the machine [7].



Figure 1: Images showing the ATM with embedded camera and customers doing transactions[8].

The smart ATM removes the need to carry cards every time one wishes to access the bank account. The idea behind the machine's development is to make banking friendly. Its use could also reduce the now common incidents where carjackers force their victims to empty their accounts at gunpoint, often taking the card and the personal identification number (PIN). The camera uses the system of biometrics to recognize the account holder — those used in computer science are the distance between the eyes and the proportion of the nose to the mouth and the location of the cheekbones. Once the image is found to be authentic, the customer is then prompted to enter their PIN or asked a personal question such as "What's your pet's name?" The correct PIN or answer would then allow the person to use the ATM in the normal way. Your twin brother or sister would pass the face test but fail at the PIN or question stage. It also impossible to use a life-size photograph of the account holder as the machine uses three dimensions, length, width and depth, to recognize the image [9].

Background and Literature Survey

Biometric recognition systems should provide a reliable personal recognition schemes to either confirm or determine the identity of an individual. Applications of such a system include computer systems security, secure electronic banking, mobile phones, credit cards, secure access to buildings, health and social services. By using biometrics a person could be identified based on "who she/he is" rather than "what she/he has" (card, token, key) or "what she/he knows" (password, PIN) [10].

The existing ATM model uses a card and a PIN which gives rise to increase in attacks in the form of stolen cards, or due to statically assigned PINs, duplicity of cards and various other threats [11].

As per [11], The face recognition feature inhibits access of account through stolen or fake cards. The card itself is not enough to access account as it requires the person as well for the transaction to proceed. Eigen face based method is used for the face recognition. However, the drawback of using Eigen face based method is that it can sometimes be spoofed by the means of fake masks or photos of an account holder.

[12], pointed out that the lack of cooperation among banks in the fight to stem the incidence of ATM related frauds now plaguing the industry. He expressed that the silence among banks on ATM frauds makes it difficult for banks to share vital information that will help curb the menace.

According to [13], the current upsurge and nefarious activities of Automated Teller Machine (ATM) fraudster is threatening electronic payment system in the nation's banking sector with uses threatening massive dumping of the cards if the unwholesome act is not checked.

As per [14] the ATM services are highly profitable for banks, and banks aggressively market the use of ATM cards. ATMs that are off bank premises are usually more profitable for banks because they attract a higher volume of non-bank customers, who must pay service fees. Unfortunately, customers using off premise ATMs are more vulnerable to robbery. ATM robberies estimates are derived from periodic surveys of banks conducted by banking associations. According to those surveys, there was an estimated one ATM crime (including robbery) per 3.5 million transactions.

In his white paper [15], pointed that, there are different techniques of ATM frauds, which are:

Card Theft: In an effort to obtain actual cards, criminals have used a variety of card trapping devices comprised of slim mechanical devices, often encased in a plastic transparent film, inserted into the card reader throat. Hooks are attached to the probes preventing the card from being returned to the consumer at the end of the transaction. When the ATM terminal user shows concern due to the captured card, the criminal, usually in close proximity of the ATM, will offer support, suggesting the user enter the PIN again, so that he or she is able to view the entry and remember the PIN. After the consumer leaves the area, believing their card to have been captured by the ATM, the criminal will then use a probe (fishing device) to extract the card. Having viewed the customers PIN and now having the card in hand, the criminal can easily withdraw money from the unsuspecting user's account.

Skimming Devices: Another method of accessing a consumer's account information is to skim the information off of the card. Skimming is the most frequently used method of illegally obtaining card track data. "Skimmers" are devices used by criminals to capture the data stored in the magnetic strip of the card. Reading and deciphering the information on the magnetic stripes of the card can be accomplished

through the application of small card readers in close proximity to, or on top of, the actual card reader input slot, so it is able to read and record the information stored on the magnetic track of the card. The device is then removed, allowing the downloading of the recorded data.

PIN Fraud: This can take the following forms:

Shoulder Surfing: Shoulder Surfing is the act of direct observation, watching what number that person taps onto the keypad. The criminal usually positions himself in close but not direct proximity to the ATM to covertly watch as the ATM user enters their PIN. Sometimes miniature video cameras that are easily obtained might be installed discretely on the fascia or somewhere close to the PIN Pad, to record the PIN entry information.

Utilizing a Fake PIN Pad Overlay: A fake PIN pad is placed over the original keypad. This overlay captures the PIN data and stores the information into its memory. The fake PIN pad is then removed, and recorded PINs are downloaded. Fake PIN pads can be almost identical in appearance and size as the original. An additional type of overlay that is more difficult to detect is a 'thin' overlay that is transparent to the consumer. This method used in conjunction with card data theft provides the criminal with the information needed to access an unsuspecting consumer's account. PIN Interception: After the PIN is entered, the information is captured in electronic format through an electronic data recorder. Capturing the PIN can be done either inside the terminal, or as the PIN is transmitted to the host computer for the online PIN check. In order to capture the PIN internally, the criminal would require access to the communication cable of the PIN pad inside the terminal, which can more easily be done, at off-premise locations.

The moment the card is accessible, PIN is guessed or obtained through other means such as social engineering, shoulder surfing or outright collection under duress. Recently, Biometric ATMs are introduced to be used along with card. This will definitely impact on the amount frauds if fully implemented. Further development has produced biometric authentication in Japan where customers face is used as a means of authentication [16, 17].

According to [7], biometrics as means of identifying and authenticating account owners at the Automated Teller

Machines gives the needed and much anticipated solution to the problem of illegal transactions.

In his research titled "A Third Generation Automated Teller Machine Using Universal Subscriber Module with Iris Recognition" [18], pointed out that in real time ATM cards are being used as a form of identification and authentication. But there is a highest possibility for the ATM cards to be theft or lost and even if the card is bent or heated, it becomes useless to access the ATM machine. With the increase of automated teller machine (ATM) frauds, new authentication mechanisms are developed to overcome security problems. One inherent problem with ATM cards is the possibility of loss or theft and it should be carried for each and every transaction, which we forget to do in many cases.

According to [19], for face recognition, there are two types of comparisons. The first is verification, this is where the system compares the given individual with who that individual says they are and gives a yes or no decision. The next one is identification this is where the system compares the given individual to all the other individuals in the database and gives a ranked list of matches. Face recognition technology analyzes the unique shape, pattern and positioning of the facial features. Face recognition is very complex technology and is largely software based.

Eum et al [20] in their research, viewed that biometrics has been extensively utilized to lessen the ATM-related crimes. One of the most widely used methods is to capture the facial images of the users for follow-up criminal investigations. However, this method is vulnerable to attacks made by the criminals with heavy facial occlusions. In today's scenario of banking operations, user identity protection, password protection is no longer safe to guard your personal information, in his paper [21], they tried to explain different types of vulnerabilities and loose points which are attempted at the time of financial operations and generates fraud transactions due to fake entries and fake cards which makes the ATM vulnerable.

According to [22], the use of ATM has newline grown rapidly in popularity because of its low banks transactions costs and customers newline convenience which has made it a basic element of today s financial service offering. However, newline the ATM which is meant to serve the customers better is now becoming a frightening for some newline customers because of fraud perpetuated in their accounts through ATM withdrawals. This newline unpleasant experience by customers is one of the challenges of the ATM through all over the newline world. As the ATM works without any human teller interactions It is designed with so many newline security features so that a costumer can perform banking financial transactions without any newline problem with secure transactions but remain there are some vulnerabilities are there which newline make the transaction unsuccessful and unauthorized transactions can be made using ATM .

Furthermore, [23] discussed that, attacks on Automated Teller Machines (ATMs) have become a major problem for ATM-vendors and banks. The most widely used attack method is the so-called skimming. During some of these skimming attacks fake keypad overlays are placed on top of the original ATM keypad. In their paper they proposed a method for the detection of fake keypads. To use the fake card, criminals also need the correct personal identification number (PIN). Until today, there are two methods in use to acquire the PIN: One uses a small camera to capture the keystrokes of a customer. The other one is based on a fake keypad (overlay), that passes the keystrokes on to the real keypad, while capturing and storing the pressed keys.

According to [24], crimes related to automated teller machines (ATMs) have increased as a result of the recent popularity in the devices. One of the most practical approaches for preventing such crimes is the installation of cameras in ATMs to capture the facial images of users for follow-up criminal investigations. However, this approach is vulnerable in cases where a criminal's face is occluded. Therefore, this paper proposes a system which assesses the recognizability of facial images of ATM users to determine whether their faces are severely occluded.

As per [25], the most significant impact of ATM technology is the customer's ability to withdraw money outside banking hours. But this feat achieved by ATM technology is not without challenges. ATM technology is prone to fraud, and this has made many people shun its use. As suggested by [26], biometric authentication has a great potential to improve the security, reduce cost, and enhance the customer convenience of payment systems. Despite these benefits, biometric authentication

has not yet been adopted by large-scale point-of-sale and automated teller machine systems. [27] discussed that newly-emerging trend in facial recognition software uses a 3D model, which claims to provide more accuracy. Capturing a real-time 3-D image of a person's facial surface, 3D facial recognition uses distinctive features of the face -- where rigid tissue and bone is most apparent, such as the curves of the eye socket, nose and chin -- to identify the subject. These areas are all unique and don't change over time.

[28], defined the face that can identify is normal face. It is necessary for the person who wears these obstacles to prevent the use of ATM. As control the access of ATM, we can reduce the crime and increase the detection ratio of the normal face. According to [29], a Biometric Identification system is one in which the user's "body "becomes the password/PIN. Biometric characteristics of an individual are unique and therefore can be used to authenticate a user's access to ATM centers.

As per [30], the use of Biometric ATM's based on iris recognition technology has gone a long way in improving customer service by providing a safe and paperless banking environment. A biometric system provides automatic recognition of an individual based on some sort of unique feature or characteristic possessed by the individual. Biometrics gained lot of attention over recent years as a way to identify individuals. According to [31], in recent years the algorithm that the fingerprint recognition continuously updated has offered new verification means for us, the original password authentication method combined with the bio-metric identification technology verify the clients identity better and achieve the purpose that use of ATM machine improve the safety effectively.

It is very important that the face is at proper distance from camera or system, at proper angle and lighting is appropriate, otherwise distance from camera will reduce facial size and thus resolution of image. Facial-scan technology has unique advantage, over all other biometrics in the area of surveilling large groups and the ability to use pre-existing static image [32].

II. METHODS AND MATERIAL

The methodology adopted by this study was 'Internet Search'. The study consulted different sources on the

Internet to establish evidence and facts about the claimed issues. Where possible the websites of the specific resource were visited, for example website of some journals which only put materials in html format rather than pdf or documents. The reviewed literatures are mostly available on the Internet. Another means employed is observations and where possible in some areas algorithm were developed to facilitate the discussion. So generally secondary source of data were mainly used in a large part to come up to conclusion.

III. RESULTS AND DISCUSSION

In the case of Tanzania especially Iringa Municipal, the facial recognition systems as an added security towards securing the transactions done at ATM will be difficult task for most of the users as it will prompt banks to every time recapture the images of the users due to either face fractures due to accidents or human violence which is now taking place in large part of the municipal and that leaves either part to be injured and then makes facial recognition system a difficult task.

The ATM system consists of camera embedded in machine that will recognize the face standing about 0.5m in front of system and perform matches against the facial database. The user usually starts with the ATM card as usual but must also have the PIN correctly remembered for pre verification before the facial scanning starts. The following is an algorithm to be used.

- 1. Starts
- 2. The user inserts an ATM card into the ATM slot
- 3. The user is asked for first time to enter the correct password/PIN for the inserted card
- 4. The machine verifies if the inserted PIN matches with the stored one in the database and if the inserted PIN is incorrect then the machine will prompt the user to reenter the correct PIN again and if again the entered PIN is incorrect then the machine will withhold the card and report to the bank officer before even going to the next step for facial recognition.
- 5. If the entered PIN in step 4 above is correct then the machine will prompt the ATM user to face the ATM embedded camera for capturing the image.
- 6. The machine then compares the captured image at ATM place and the one stored in the database if there is a match between the two, if there is no

match between the two images then the card will be withheld by the ATM and the report will be sent to the bank officer for further action.

- 7. If there is a match between the two images that is the one captured at ATM and the one stored in the database, then the user will be allowed to carry out the transaction he want to perform.
- 8. End.

The above algorithm shows that there is double authentication for the user before he/she is allowed to carry out any transactions, the first one is the normal one which we usually use for the carded ATMs but the second one is the tight biometric security system in which the user himself will be identified based on the information stored in the database, if there is a match for both of the security credentials supplied by the customer then the transactions will be freely opened.

In the decision box for matching the face by comparing the captured image and the stored one in the database, the following is done:



Figure 2: Face detection and verification flow diagram



Figure 3: System flow diagram for the transactions made in ATM by the user after authentication.

Advantages of using Double Authentication

There will be great advantage to use double authentication for security purpose as one will be required to have both ATM PIN and his/her facial representations in order to have access to the transaction. This will dramatically reduce some card theft incidences as one may have the password/PIN of the card but will again be required to have facial match with the card owner. And in case there are two identical twins who are closely related to each other still the PIN will decide who us the real owner of the ATM card.

Disadvantages

In case the card owner gets accident or get injured in the face, then he will be prompted to go to the bank where his account details are stored in the database in order to change the image stored to match the current image.

In case customer have forgotten his password for the ATM card, then there will be no option rather than going to the respective bank where he firstly opened his account so as to have PIN reset.

IV. CONCLUSION

According to visited literature review which brings about the secondary data sources and some few primary data sources, it seems that there are potential threat posed to the ATM users either in robbery or in lost cards. The purpose of this study was to visit the literature in ATM security system and to propose one which will be more secure compared to the existing system. It was found that most of the visited literatures suggests that the use of ATM cards be suspended or totally discouraged while imposing new security system which will be more advanced compared to PIN based cards and the suggested system to be imposed is biometric security system either in finger print or facial recognition even though there are some challenges concerning facial recognition as a biometric security because of injuries which can occur to customer himself/herself.

A part from biometric security systems involving only facial, eye, iris and fingerprint, new biometric security can be used which is smell sensing from the mouth as everyone has natural smell from the mouth it will be easier to have unique identification except when one is drunk.

From above explanation, the author thinks that having both ways of logging in, in the ATM will be more safe than having only one way of accessing transactions, that is to say having PIN accesses and facial recognition login credentials creates more security as one have to pass both security barriers before having access to the transactions.

V. FUTURE WORK

In the future research must be conducted on the use of smell from mouth breathing as the second security for one to have access to transactions after passing the first security barrier that is PIN. And more often restrictions must be made on the users as warning before using ATM you are required to have your original smell because at the moment of taking or capturing your biometric information you were not drunk then the same must be applied to the ATM usage but if your information were taken while you were drunk then the same trend must continue when you need to access the ATM, it is a bit challenge.

VI. ACKNOWLEDGMENT

I would like to extend our appreciations to Dr. Silvano Kitinya and Carl Mmuni from Ruaha Catholic University (RUCU) for their support during the preparation of this paper and Ruaha Catholic University management and staff for encouragement they gave me during data collection, analysis and interpretation. Also I would like to thanks our childrens Neema and Nelson Lusekelo Kibona for being there all the time when I needed them

VII. REFERENCES

- A. Jain, L. Hong, and S. Pankanti, "Biometric identification," Communications of the ACM, vol. 43, pp. 90-98, 2000.
- [2] A. Ogunsemor, "Banking services: The emergence and impact of electronic banking," The Nigerian Banker, pp. 2006-1781, 1992.
- [3] A. S. Adepoju and M. E. Alhassan, "Challenges of Automated Teller Machine (ATM) Usage and Fraud Occurrences in Nigeria–A Case Study of Selected Banks in Minna Metropolis," Journal of Internet Banking and Commerce, vol. 15, pp. 1-10, 2010.
- [4] E. Derman, Y. K. Gecici, and A. A. Salah, "Short term face recognition for Automatic Teller Machine (ATM) users," in Electronics, Computer and Computation (ICECCO), 2013 International Conference on, 2013, pp. 111-114.
- [5] S. M. Satone and G. Kharate, "Face detection and recognition in color images," IJCSI, p. 467, 2011.
- [6] http://www.atmmarketplace.com/news/facial-recognitioncoming-to-atms/.
- [7] O. E. Aru and I. Gozie, "Facial Verification Technology for Use In Atm Transactions," American Journal of Engineering Research (AJER) e-ISSN, pp. 2320-0847.
- [8] https://www.google.co.tz/search?q=face+recognition+systems+f or+atm+images.
- [9] http://www.nation.co.ke/News/Your%20face%20is%20all%20y ou%20will%20need%20at%20an%20ATM%20/-/1056/911432/-/3f6h2w/-/.
- [10] K. Delac and M. Grgic, "A survey of biometric recognition methods," in Electronics in Marine, 2004. Proceedings Elmar 2004. 46th International Symposium, 2004, pp. 184-193.
- [11] M. Karovaliya, S. Karedia, S. Oza, and D. Kalbande, "Enhanced Security for ATM Machine with OTP and Facial Recognition Features," Procedia Computer Science, vol. 45, pp. 390-396, 2015.

7

- [12] R. Ihejiahi, "How to fight ATM fraud online," Nigeria Daily News, p. 18, 2009.
- [13] O. Odidison, "ATM fraud rises: Nigerians groan in Nigeria," Daily News, pp. 8-10, 2009.
- [14] C. E. Anguelov, M. A. Hilgert, and J. M. Hogarth, "US consumers and electronic banking, 1995-2003," Fed. Res. Bull., vol. 90, p. 1, 2004.
- [15] I. Diebold, "ATM fraud and security: White Paper," New York, 2002.
- [16] S. Das and J. Debbarma, "Designing a Biometric Strategy (Fingerprint) Measure for Enhancing ATM Security in Indian ebanking System," International Journal of Information and Communication, 2011.
- [17] J. O. Adeoti, "Automated Teller Machine (ATM) Frauds in Nigeria: The Way Out," Journal of Social Sciences, vol. 27, pp. 53-58, 2011.
- [18] B. S. Raj, "A Third Generation Automated Teller Machine Using Universal Subscriber Module with Iris Recognition," image, vol. 1, 2013.
- [19] K. J. Peter, G. Nagarajan, G. G. S. Glory, V. V. S. Devi, S. Arguman, and K. S. Kannan, "Improving ATM security via face recognition," in Electronics Computer Technology (ICECT), 2011 3rd International Conference on, 2011, pp. 373-376.
- [20] S. Eum, J. K. Suhr, and J. Kim, "Face recognizability evaluation for atm applications with exceptional occlusion handling," in Computer Vision and Pattern Recognition Workshops (CVPRW), 2011 IEEE Computer Society Conference on, 2011, pp. 82-89.
- [21] N. Sharma, "Analysis of different vulnerabilities in auto teller machine transactions," Journal of Global Research in Computer Science, vol. 3, pp. 38-40, 2012.
- [22] N. Sharma, "Analysis of vulnerability and security issues over auto teller machine transactions and design of a general security model," 2014.
- [23] J.-F. Ehlenbröker, U. Mönks, and V. Lohweg, "Surface Fingerprint Detection."
- [24] J. K. Suhr, S. Eum, H. G. Jung, G. Li, G. Kim, and J. Kim, "Recognizability assessment of facial images for automated teller machine applications," Pattern Recognition, vol. 45, pp. 1899-1914, 2012.
- [25] G. N. Odachi, "ATM Technology and Banking System in West African Sub-Region: Prospects and Challenges," African Research Review, vol. 5, 2011.
- [26] J. Breebaart, I. Buhan, K. de Groot, and E. Kelkboom, "Evaluation of a template protection approach to integrate fingerprint biometrics in a PIN-based payment infrastructure," Electronic Commerce Research and Applications, vol. 10, pp. 605-614, 2011.\
- [27] S. Thorat, S. Nayak, and J. P. Dandale, "Facial recognition technology: An analysis with scope in India," arXiv preprint arXiv:1005.4263, 2010.
- [28] S. M. Yoon and S.-C. Kee, "Detection of Partially Occluded Face Using Support Vector Machines," in MVA, 2002, pp. 546-549.
- [29] S. Pravinthraja and K. Umamaheswari, "Multimodal Biometrics for Improving Automatic Teller Machine Security," Bonfring International Journal of Advances in Image Processing, vol. 1, pp. 19-25, 2011.
- [30] K. L. N. Rao, V. Kulkarni, and C. K. Reddy, "Recognition Technique for ATM based on IRIS Technology."

- [31] R. Rasu, P. K. Kumar, and M. Chandraman, "Security for ATM Terminal Using Various Recognition Systems," International Journal of Engineering and Innovative Technology (IJEIT), vol. 2, 2012.
- [32] E. Spinella, "Biometric Scanning Technologies: Finger, Facial and Retinal Scanning," SANS Institute, San Francisco, CA, vol. 28, 2003.

Remote Sensing towards Water Quality Study in Malacca River Case Study : A Review Perspective

Ang Kean Hua, Faradiella Mohd Kusin Faculty of Environmental Studies, Universiti Putra Malaysia, UPM Serdang, Selangor Darul Ehsan

ABSTRACT

Water is among the natural resources that needed by living organisms such as human. Rapid development through human activities leading to the water pollution existed in river, for example Malacca River. Therefore, a literature review has been conducted to identify the effectiveness of using remote sensing towards water quality in Malacca River. Various research studies conducted by scientists and researchers stated that data from the satellite like Landsat, IKONOS, SPOT, IRS, CZCS, and SeaWiFS may be applied in assessing water quality parameters including suspended matter, turbidity, phytoplankton, and dissolved organic matter. The measurement for water quality parameters can be carried out through in-situ measurement, as experimental examination may be done through on-site studies and inside laboratories. Water quality assessment is extremely needed to strengthen the result produced through analysis of remote sensing data to determine the impacts and factors that contributed to the river pollution. As a result, remote sensing data from Landsat, IKONOS, Quickbird and SPOT may be applied to determine water quality parameters such as suspended matter, phytoplankton, turbidity, dissolved organic matter, and other parameters in the Malacca River. As conclusion, remote sensing has become a tool in monitoring and solving water quality issues, serving as a basis for management activities and planning activities in terms of river water quality.

Keywords: Rapid development, effectiveness, assessment, monitoring, management, planning

I. INTRODUCTION

Natural water resources are God's creation, and are an indispensable element to most of creatures. For example, the importance of water to human beings is to regulate body temperature, helps to carry nutrients and oxygen to cells, moisten oxygen for breathing, help to convert food to energy, protect and act as cushions towards vital organs, remove waste, act as cushion for the joints between bones, and help the body to absorb nutrients. Therefore, water resources have the ability to maintain the quality of human life through the balance of metabolism in the body for growth from the childhood to adulthood and until the old ages. However, intake of water resources depends on the quality of water supplied. Water should be totally clean, clear, and free from any harmful bacteria threat. According to the percentage of world fresh water statistics, only 2.5 percent of

freshwater (where 1.2 percent can be found through the water surface and remaining percentage can be obtained through groundwater or in the form of ice) may be supplied directly to living beings [27]. In other words, the supply of freshwater resources remains minimal in terms of helping living beings to continue to survive on the earth's surface.

The earth has been developed quickly in terms of human pursuit of development and modernization without any limitation and barriers, helping in reducing any difficulties and providing a variety of facilities to humans. This includes the development of the airplane, which has improved the accessibility from destination to destination and shortened travel time. This also includes the existence of smartphones helping to strengthen the relationship between peoples separated by the vast expanse of the Pacific Ocean. On the other hand,



modernization not only brings benefits but also contributes a number of detriments to society. These issues exist due to the greedy attitude and selfishness of human that forget their responsibility towards the natural environment which cause pollution to occur, such as river water pollution. Referring to the Environmental National Geographic, developing countries have contributed about 70 percent of water pollution by industrial waste into the water of rivers, causing the percentage of water supply to decline. In other words, the 99 million pounds of fertilizer and chemicals used every year produce a very high percentage of water pollution, and this situation is harmful to living beings on the earth [8]. A research study that carried out by Cornell University (2007) has stated that about 40 percent of deaths in worldwide are caused by water, air, and soil pollution, as these problems can happen due to environmental degradation, increasing world population, and rapid development in urban areas [4]. Therefore, determination towards water quality in the river and determine the factor that contribute to river pollution is requires categorization in order to reduce the percentage of pollution from continuously increasing.

In Malaysia, there are several issues and problems that need to be noted especially development in river basins, such as environmental impacts (high siltation in river and lakes, point and non-point source pollution, and so on) and social impacts (industrialization increase, population growth increase, improper land use increase, and so on). These activities allow soil erosion to the water, increase matter mixture, turbidity, organic matter and river sedimentation problem. As general, the water characteristics can be categorized into physical, chemical, and biological factors. However, there are specific parameters used to determine the water quality studies, namely Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammoniac Nitrogen (NH3-N), Suspended Solid (SS), and pH. The six parameters are formulated as a general measurement and are often used in assessing water quality, also known as the Water Quality Index (WQI). According to data from the Department of Environment Malaysia (2012), out of 473 rivers monitored, 278 (59%) were found to be clean, 161 (34%) were slightly polluted, and 34 (7%) were polluted [6]. Stations located upstream are generally slightly polluted due to physical parameters, while downstream were slightly polluted or polluted due to chemical and

biological parameters. The polluted rivers are mostly located in development and industrial areas such as Sungai Pinang, Sungai Juru, Sungai Merlimau, Sungai Danga, Sungai Segget, Kawasan Pasir Gudang, and Sungai Tebrau [7]. Therefore, technology such as remote sensing is a very powerful and useful tool in assessing and monitoring water quality.

II. METHODS AND MATERIAL

Malacca, also known as the historical city, received recognition from UNESCO on 07 July 2008 [24] [2] as a world heritage site, which has become the starting point of the tourism industry based on the historical city (e.g. Fort A Famosa, St. John's Fort, Christ Church, etc.) and social-cultural heritage (e.g. Baba and Nyonya cultural features, Portuguese cultural, Malacca Sultanate Palace Museum, etc.) [25] [15]. According to the geographical coordinates of Malacca state, it is located at latitude of 2°11'39.53"N and longitude of 102°14'56.58"E [17], which covers an area of 1658 that divided into three districts, namely Melaka Tengah, Alor Gajah, and Jasin [17]. Melaka Tengah has become the main city and capital of Malacca State. There are several transport facilities accessible to Malacca State by road, rail, and airplanes [16]. On the other hand, the statistics for the number of population in the state of Malacca was 830 900. Most of the local residents are Malay with total of 523 800, followed by Chinese with 210 100, Indian with 49 400, and others with 48 500 [17]. Therefore, this situation shows that rapid development has taken place in the state of Malacca, which has not only attracted the attention of all levels of society in providing jobs, but also provided an opportunity to engage in business in the tourism industry in Malacca State.

The rapid development in the state of Malacca has contributed various advantages and disadvantages towards the local citizens. For examples, the advantages that can be seen are through providing job opportunities, business opportunities, investment opportunities, and so on. However, the development could also bring disadvantages to Malacca State, where it will cause river water pollution to occur [18], as this situation will lead to the spreading of infectious diseases, killing aquatic animals, damage the landscape and produce bad odor sensed, and disrupt the relationship between human with the environment such as through recreational activities. Until now, the river pollution is still currently occurring and this situation does not show any change to positive impacts [12]. This may be proven through the research studies conducted by Hua (2014), as the majority of respondents agreed that the pollution in the Malacca River still occurs due to the construction of industries, the construction of buildings, the settlements and so on, as carried out adjacent to the Malacca River [11]. Hence, this literature review study has been conducted to determine the effectiveness of remote sensing as a modern technology tool that can help in planning water resources in Malacca River.

A. Sampling Area

The sampling area that chosen for this study is Malacca State (figure 3), where a small scope is concentrate along the river in Malacca (figure 4). The vastness for Malacca State is 1650 km2, where it can be divided into three districts, namely Alor Gajah (660 km2), Jasin (676.07 km2), and Melaka Tengah (313.93 km2) (Melaka State Government Official Portal). Referring to the total population by districts, Melaka Tengah has the highest population with the value of 510 257 peoples, followed by Alor Gajah district with a value of 189 796 peoples, and the last district is Jasin with the value of 142 447 peoples [16]. Meanwhile, the position of Malacca River shows the flow of water is flowing from upstream (part of Alor Gajah) to downstream (part of Melaka Tengah) before the water is discharged into the Straits of Malacca. There are various tributaries that flow from various directions before entering the main river. The existence of these tributaries will result in a river basin and watershed, which is important to act as a supply of clean water to the human and ecosystem. The existence of Malacca River is due to the water that flows from small streams into the main river, which has a length of 42 km2 [21]. Hence, the Malacca River is relevant and appropriate to serve as a sample area in this literature study.



Figure 3. Malacca State according to the districts Source: Malacca Town and Country Planning Department, 2012



Figure 4. Malacca River across the districts. Source: Malacca Town and Country Planning Department, 2012.

B. Remote Sensing

Remote sensing is a tool that has the ability to observe information about the earth's surface and water surfaces by using satellite technology and interpreting them into images using electromagnetic spectrum through electromagnetic radiation (figure 5). In Malaysia, the satellite technology is controlled by the government department known as Malaysian Remote Sensing Agency (MRSA), which controls several satellites such as Landsat-1 MSS, Landsat-5 TM, Ikonos-2, GeoEye-1, and SPOT-1 to SPOT-6. Each satellite has a specific function, where Landsat obtaining information on agricultural and forestry resources, geology and mineral resources, hydrology and water resources, geography, cartography, environmental pollution, oceanography and marine resources, and meteorological phenomena. SPOT satellites are designed to improve the knowledge and management of the Earth by exploring Earth's resources, detecting and forecasting phenomena involving climatology and oceanography, and monitoring human

activities and natural phenomena. Ikonos satellites have the ability to extract vector features and geographic features in 3D such as buildings, roads, manmade structures and other terrain feature, and also include mapping for oil and gas exploration, mining, engineering and construction, environmental, urban planning, agriculture, and forestry. GeoEye helps the user in mapping, change detection and image analysis [22]. Therefore, remote sensing technology is believed to be able to solve the problems mainly involved with environmental monitoring such as river water pollution and determine the development in urban planning in Malacca State.



Figure 5. The absorption process by remote sensing. Source:http://margaux.ipt.univparis8.fr/vgodard/enseigne/tele d2/memotele/imemtele/tfm12fi1.gif

III. RESULT AND DISCUSSION

A. Application of Remote Sensing towards Water Quality Study

Water can be determined in two methods, namely internal characteristics and external characteristics. Internal characteristics refer to water quality involving chemical, physical, and biological characteristics. Meanwhile, external characteristics can be defined as the water surface that interacts with the outer elements to result in any changes in water quality. The chemical, physical, and biological characteristics of water bodies are important in a water quality study because it can help in determine and identifying the source of any possible pollution or contamination which might cause degradation of water quality. The water quality indicators can be divided into four main types, per Usali and Ismail (2010) [26]:

e	(1) Biological	: bacteria (total coliform, E
2		coli, fecal coliform) and
9		algae
9	(2) Physical	: temperature, turbidity &
,		clarity, color, salinity,
1		suspended solid,
9		dissolved solids.
5	(3) Chemical	: pH, dissolved oxygen,
1		biological oxygen demand,
1		chemical oxygen
1		demand, nutrient (nitrogen
1		and phosphorus), organic
		and inorganic compounds.
	(4) Aesthetic	: odors, taints, color, and
		floating matter.

Hence, a water quality study can be determined through the Water Quality Index (WQI), where this experimental are need to carry out through in-situ measurement (experimental can be done on-site studies and inside laboratory). This has become an important method for monitoring water quality parameter with the purposes to improve the river water quality in becoming a clean condition like reducing the higher percentage to lower percentage of pollution class; and help to restore, conserve, maintain and sustain water quality in a clean status. However, external characteristics also need to play a role together with internal characteristics so that the objective can be achieved, for example remote sensing. Remote sensing has become a usefulness tool in monitoring water quality [19] [23] [5]. Research done by Ritchie et al. (1976) stated that remote sensing has the ability to monitor water quality study [20]. They developed a general formulation equation towards suspended sediment as follows:

$$Y = A + BX \text{ or } Y = AB^X$$

Where:

Y is remote sensing measurement (radiance, reflectance, energy);

X is water quality parameter (suspended sediment, turbidity);

A and B determine the spectral reflectance value and between in situ water quality parameters.

The spectral reflectance will provide information about band or wavelengths for water quality parameter. Since

12

that, the formula starts to be applied by researcher to estimate the water quality, and the equation is being used until today.

B. Water Quality Parameter versus Remote Sensing

Remote sensing can used to determine water quality parameter through suspended matter, phytoplankton, turbidity, and dissolved organic matter. Suspended matter consists of organic and inorganic matter, which involve with heavy metal and micro-pollutants. Both pollutants are affecting the surface water. When examined through remote sensing, the suspended pollutants will result the radiance in visible and near infrared ranged of electromagnetic spectrum [19]. So, when carrying out a laboratory experiment, the results show that the water is affected by sediments type, texture, color, sensor view and sun angles, as well as water depth [19]. Among of remote sensing data that suitable to be applied is Landsat, SPOT, Indian Remote Sensing (IRS), Coastal Zone Color Scanner (CZCS) and Sea-viewing Wide Field of View Sensor (SeaWiFS) [26]. Continued by the phytoplankton, this may be defined as the concentration of chlorophyll contain in algal plankton cell that exist in the water. According to Schalles et al. (1998), since chlorophyll is a photosynthetic agent that can contribute to the change of water color, so remote sensing can be used for mapping the chlorophyll A, which becomes a key for assessing the water quality [23]. Conducting a research study especially at the lakes, rivers or reservoirs will have a higher percentage of chlorophyll A; however, the presence of pollutants will impact the color and affect the routine extraction of chlorophyll A from the original which can be detected in remote sensing. Hence, only certain data like Landsat, SPOT, SeaWiFS and CZCS may be used to map the chlorophyll of oceans, estuaries, and freshwater [26].

Thirdly, turbidity can be expressed as the cloudiness or haziness of fluid due to the individual particles that invisible to naked eye, which caused light to be scattered and absorbed rather than transmitted in straight lines in remotely sensed data. In other words, turbidity can be considered as against the clarity. Turbidity mainly caused by the present of suspended matter, which is used to calculate fluvial suspended sediment concentration [28]. The Lathrop and Lillesand (1986) research study states that normally turbidity pollution will result in red reflectance [13]. This condition is more precisely in using data from the IKONOS which have high resolution for mapping the turbidity [9] or using Landsat 7 ETM+ Band 3 (red portion of electromagnetic spectrum) and Band 4 (near-infrared portion of electromagnetic spectrum) data to predict turbidity concentration [14]. Lastly, this may be related to dissolved organic matter, which is normally affecting the water color by soluble organic substances (that can pass 0.45µm filter) which are also referred to as Colored Dissolved Organic Matter (CDOM). In other words, CDOM is the fraction of dissolved organic substances and it is exist in water-soluble, biogenic, heterogeneous organic substances that are yellow to brown in color [1]. Basically, dissolved organic matter affects the volume of reflectance and volume spectrum, especially at the shorter wavelengths [3], and CDOM absorbs light in both ultraviolet and visible range (below 500µm) [26]. A research study done by Strombeck (2001) stated that the quantity of red light can be absorbed by CDOM at higher concentration [29]. At the same time, CDOM have an ability to absorb the UV spectrum portion which become a protection to the phytoplankton from the destruction of UVB radiation [10]. However, this will result in affecting the amount and quality of photosynthesis to phytoplankton, due to the excessive absorption of UVB by CDOM at higher level.

C. An Overview of Remote sensing towards Water Quality Study in Malacca River

As a general view, the majority of local residents are settled down nearer to the Malacca River. This situation shows that the land use by local residents can be divided into three main parts, namely upstream, middle stream, and downstream. Basically, the land use for upstream area is involved with farming activities, livestock activities, and settlements activities. The middle stream area is involved with industrial activities, manufacturing activities, and settlement activities. Lastly, the downstream area is comprised of commercial activities, domestic activities, and settlement activities. These activities can be generally observed through the map in figure 6.



Figure 6. Human activities along the Malacca River. Source: Malacca Town and Country Planning Department (2012) and Google Earth.

Since there are various activities carried out in Malacca State, the remote sensing data that can be apply are Landsat, IKONOS, Quickbird, and SPOT, which depend on the data that can be supplied by the Malaysian Remote Sensing Agency (MRSA). So, this data from different satellites can be used to determine water quality parameters such as suspended matter, phytoplankton, turbidity, dissolved organic matter, and other parameters. These factors depend on the ability and suitability between remote sensing data and water quality parameter.

IV. CONCLUSION

Water is a vital natural resource to carry out various activities such as agricultural and livestock activities, industrial and manufacturing activities, and commercial and domestic activities. However, rapid development has led to increasingly severe use, causing the quality of water to decrease and increasing percentage of river pollution. Hence, a monitoring program is indispensable to reduce river pollution before conduct any management and planning activities for the future. Therefore, the monitoring program will require remote sensing as a tool of modern technology that has ability to assess the impact and factors which contributed to the river pollution. Remote sensing data results will be more precise when carrying out a water quality assessment in the laboratory. So, remote sensing and water quality studies depend on each other in solving the problem of river pollution. Previous studies using remote sensing techniques towards water quality parameter are more helpful for to scientists, researchers, academicians, lecturers, and students, especially in mapping or modeling using data from satellite such as Landsat, IKONOS, SPOT, CZCS, and etc. Last but not least, remote sensing will become a tool in solving the water quality issues for the past, present, and future.

V.REFERENCES

- Aiken, G.R., McKnight, D.M.R., Werchaw, L. and MacArthy. (1985). Humic substances in soil, sediment and water: Geochemistry, isolation and characterization. J. Wiley and Sons, New York.
- [2] Bernama Official Portal (November 22, 2008). Pengiktirafan Tapak Warisan Dunia UNESCO Mampu Lonjak Ekonomi Negara. Retrieved from http://www.bernama.com/bernama /v3/bm/news_lite.php?id=373739
- [3] Bukata, R.P., Jerome, J.H., Kondratyev, K.Y. and Pozdnyakov, D.V. (1995). Optical properties and remote sensing of inland and coastal waters. CRC Press, Boca Raton, Florida, 362p.
- [4] Cornell University (August 14, 2007). Pollution Causes 40 Percent of Deaths Worldwide, Study Finds. Science Daily Online. Retrieved from http://www.sciencedaily.com /releases/2007/08/070813162438.htm
- [5] Dekker, A.G., Vos, R.J., and Peters, S.W.M. (2002). Analytical algorithms for lake water TSM estimation for retrospective analyses of TM and SPOT sensor data. Int. J. of Remote Sensing. 23, 15-35.
- [6] D.O.E. (2012). Malaysia Environmental Quality Report 2012. Department of Environment Ministry of Natural Resources and Environment Malaysia. 110pp. Retrieved from https://enviro.doe.gov.my/view.php?id=558
- [7] D.O.E (2007). Malaysia Environmental Report Quality 2007. Department of Environment Ministry of Natural Resources and Environment Malaysia. Petaling Jaya, Malaysia. 84pp.
- [8] [8] Environment National Geographic (n.d). Water Pollution. Retrieved from http://environment.nationalgeographic.com /environment/freshwater/pollution/
- [9] Ferdi, L., Miller, W.O. and Kehinde, S. (2007). Mapping turbidity in Charles River, Boston using a high resolution satellite. Environmental Monitoring and Assessment. 132 (1-3), 311-320.
- [10] Green, S. and Blough, N. (1995). Optical absorption and fluorescence properties of chomophoric dissolved organic matter in natural waters. Limnology and Oceanography. 39(8), 1903-1916.
- [11] Hua, A.K. (2014). Potensi instrument moral dalam melestarikan sumber air di Malaysia-Kajian kes Sungai Melaka. Geografia-Malaysian Journal of Society and Space. 10(5), 44-55.
- [12] Hua, A.K. and Marsuki, M.Z. (2014). Public perception towards environmental awareness. Case study: Malacca River. International Journal of Academic Research in Environmental and Geography. 1(2), 53-61.
- [13] Lathrop, R.G.Jr and Lillesand, T.M. (1986). Use of thematic mapper data to assess water quality in Green Bay and Central

14

Michigan. Photogrammetric Engineering and Remote Sensing. 52(5), 671-680.

- [14] Liza, K.L. (2007). Turbidity mapping and prediction in ice marginal lakes at the Bering glacier system, Alaska. M.Sc Thesis, University of Michigan. 50p.
- [15] Malacca City Council Official Portal (n.d). Melaka Harta Warisan Dunia. Retrieved from http://www.mbmb.gov.my/warisan-5
- [16] Melaka State Government Official Portal (n.d). Melaka Map. Retrieved from http://www.melaka.gov.my/en/tentangkami/peta-melaka
- [17] Melaka State Government Official Portal (n.d). Fact and Number. Retrieved from http://www.melaka.gov.my/en/tentangkami/fakta-nombor
- [18] Nasbah, N.N. (January 23, 2010). Sungai Melaka tercemar. Utusan Online. Retrieved from http://ww1. utusan.com.my/utusan/info.asp?y=2010&dt=0123&sec=Selatan &pg=ws_01.tm
- [19] Ritchie, J.C. and Charles, M.C. (1996). Comparison of Measured Suspended Sediment Concentration Estimated from Landsat MSS data. Int. J. Remote Sensing. 9(3), 379-387.
- [20] Ritchie, J.C., Schiebe, F.R. and McHenry, J.R. (1976). Remote Sensing of Suspended Sediment in Surface Water. Photographic Engineering Remote Sensing. 42, 1539-1545.
- [21] River and Coastal Development Corporation Malacca Official Portal (n.d). River Information. Retrieved from http://ppspm.gov.my/versionBI/index.php/muziumperhutanan/informasi-sungai
- [22] Satellite Imaging Corporation Official Portal (n.d). Satellite Sensors. Retrieved from http://www.satimagingcorp.com/satellite-sensors/
- [23] Schalles, J.F., Gitelson, A.A., Yacobi, Y.Z., and Kroenke, A.E. (1998). Estimation of chlorophyll a from time series measurement of high spectral resolution reflectance in an eutrophic lake. J. of Physiology. 34, 383-390.
- [24] UNESCO Official Portal (n.d). Melaka and George Town, Historic Cities of the Straits of Malacca. Retrieved from http://whc.unesco.org/en/list/1223
- [25] UNESCO Official Portal (n.d). Eight new sites, from the Straits of Malacca, to Papua New Guinea and San Marino, added to UNESCO's World Heritage List. Retrieved from http://whc.unesco.org/en/news/450/
- [26] Usali, N. and Ismail, M.H. (2010). Use of remote sensing and GIS in monitoring water quality. Journal of Sustainable Development. 3(3), 228.
- [27] USGS Water Science School (n.d). The World's Water. Retrieved from https://water.usgs.gov/edu/earthwherewater.html
- [28] Wass, I.D., Marks, S.D., Finch, J.W., Leeks, G.J.L., and Ingram, J.K. (1997). Monitoring and preliminary interpretation of in river turbidity and remote sensed imagery for suspended sediment transport studies in the Humber catchment. The Science of The Total Environment. 194-195 & 263-283.
- [29] Strombeck, N. (2001). Water quality and optical properties of Swedish lakes an coastal waters relation to remote sensing. Acta Universitatis Upsaliensis. Comprehensive Summaries of Uppsala Dissertations from the Faculty of Science and Technology 633. 27 pp.

A Study on Customer Satisfaction: With Special Reference to Detergent Powder

Alaka Samantaray

Institute of Business and computer studies, Siksha 'O' Anusandhan University, Bhubaneswar, Orissa, India

ABSTRACT

Customer satisfaction is really a term which is generally utilized in marketing. Fundamentally, it is an evaluation in which the way the product or service supplied by a business fulfill or perhaps surpass customer expectancy. Companies must preserve current customers while directed at new customers. Measuring customer satisfaction offers an indicator regarding how prosperous this company is in delivering products or services to the marketplace. A product's excellent incorporates a major influence on the product or service performance; therefore it truly is related to any customer's value and full satisfaction (Kotler and Armstrong, 2010). Customers are trying to find trusted merchandise which matches the idea and competent to have the actual planned functions. The objective of this paper is to find out the gap between the expectation and actual performance of the product.

Keywords: Customer Satisfaction, Client Questionnaire, Throughout, Geographic Locations

I. INTRODUCTION

Customer satisfaction is defined as the actual "summary emotional point out resulting the feeling encircling disconfirmed anticipations can be coupled with the actual shoppers previous inner thoughts around the use experience"(Oliver, 2010). As a result, Hansemark and Albinsson (2004) claim in which "satisfaction is usually an all-round consumer frame of mind towards a service provider, or maybe a good emotive reaction to the actual distinction in between just what consumers assume and just what that they receive, regarding the satisfaction connected with many require, aim or maybe desire".

Today's retail store gives more importance to customer satisfaction throughout providing the right product or service in addition to services on the end-users would be the significant concern in the future development in the business. In our study a shot is enabled to discover the buyer fulfillment in the course of obtain throughout stores based on client questionnaire. (Das Prasun, 2009). Early customer care study normally identified satisfaction to be a post-choice evaluative view with regards to a selected purchase selection (Homburg along with Giering, 2001). Tse along with Wilton (1988) proposed in which satisfaction is a general emotional trend, conveying the emotive express resulting from an evaluation in the observed conflict involving preceding anticipation along with true effectiveness in the goods and services.

A lot of companies use customer care to be a qualifying criterion intended for checking out goods and services effectiveness and in some cases connect customer care ratings for you to account manager along with staff payment (Anderson along with Sullivan, 1993). Stores as a result identify in which customer care has an important purpose in a successful business tactic (Gomez et al. 2004) and it is as a result essential intended for operators to understand exactly what pushes customer care (Martinez-Ruiz et ing, 2010).

Objectives of the Study

To find the gap between customer expectation and performance of product attributes.

Hypothesis of the Study

• H₀₁: There is no significant difference between expectation and performance of detergent with relation to different product attributes.

II. METHODS AND MATERIAL

For this research study, the primary data is collected through questionnaire and personal comments from the respondents. The sampling procedure use for this study is stratified random sampling. The stratification is done on the basis of geographic locations. The instrument which is used for the collection of primary data is a questionnaire, which is coded in order to be analyzed. All the responses measured on a five-point Likert scale. The sample size taken for the study is 250.Basically the data was collected from major cities of Orissa. The data produced from the coded questionnaire is processed via analysis and interpretation, for the clarity of understanding. The software package SPSS was used to carry out the analysis based on Paired T-test.

III. RESULT AND DISCUSSION

Data analysis and interpretation Paired Samples Test

			Paired Differences								
			Std	Std Error	95% Confidence Interval of the Difference		95% Confidence Interval of the Difference				Sig (2-
		Mean	Deviation	Mean	Lower	Upper	t	df	tailed)		
Pair 1	b1i - b1p	308	1.160	.073	453	163	-4.197	249	.000		
Pair 2	b2i - b2p	408	1.339	.085	575	241	-4.818	249	.000		
Pair 3	b3i - b3p	268	1.177		415	121	-3.600	249	.000		
				.074							
Pair 4	b4i - b4p	132	1.366	.086	302	.038	-1.528	249	.128		
Pair 5	b5i - b5p	280	1.296	.082	441	119	-3.415	249	.001		
Pair 6	b6i - b6p	368	1.497	.095	554	182	-3.886	249	.000		

Interference : From the above table it is observed that the gap between expectation and actual performance of the attributes of detergent powder are highly significant in pair1(economical),2(good quality),3(good brand image), 5(attractive packaging),6(attractive advertisement)& not significant in 4(skin care). This implicates that there exists a significant difference between importance and performance of detergent powder category with relation many attribute considered.

Variables	Mean Expectation	Mean Performance
Economical/Less Priced	3.44	3.748
Good Quality	3.728	4.136
Good Brand Image	3.768	4.036
Skin Care	3.58	3.712
Attractive Packaging	3.556	3.836
Attractive advertisement	3.656	4.024



Interpretation: The above graph shows the gap between the customer expectation and actual performance of product attributes

Findings

- The result of the demographic factors shows that majority of the respondents are youth, & they belongs to the age group of 20-25(51%) & next belongs to 31-35 age group holder(11%),26-30 age groups (10%),36-40 & below 20 age groups (7%),41-45 age groups were being so busy on their work so respondents are (6%),46-49 age group response only (4%),due to lack of patience 50-55 & 56-59 responses (2%) & 60 age group people responses only (0%).
- Now a day's people were more conscious for their using products. So Home care products are taking high percentage in market. Both married & un-married are also involve in this practices. In this survey the percentage of Un-married is high (54%), where married responders are (46%).We can see here the differences between both are very less (8%) only.
- Education has a vital role to fill up the survey form/questionnaire. It guides the responders to go to the depth of the questionnaire & helps to answer properly. Maximum responses came from the Bachelors Degree holders (46%), Master degree (22%), intermediates (14%), high school (12%), and other section (6%).
- Professional factor plays a vital role in this survey because accordingly to people uses products & also conscious about the brand, services, personality effect etc. students are responded more here (37%), service holder (26%), Business (23%), house wife (13%), & others (1%).
- Income level plays a vital role for purchasing of the product. According to the income level a person can choose his/her right product. Which helps them to maintain its buying process, choosing brands &many, e.g: A high income person always preferred branded &

quality products where a middle income level person also uses branded product which permits his/her pocket. Income level between <5000 responses (39%), 10001-20000 responses (19%), 20001-30000 responses (16%), 30001-40000 responses (12%) & 5001-10000 responses (11%), 40001 & above responses (4%).

- It's purely a house-hold product. People use this to wash their clothes, so they choose good quality otherwise their clothes will be hell. We can found many brands in this product also & in different range. In survey most people use Surf-excel (35%).
- Customers are using the same brand for: More than five months (20%), more than a year (17%), more than two years (20%), more than four years (32%), others (11%).
- The gap between expectation and actual performance of the attributes of detergent powder are highly significant in pair1 (economical), 2(good quality), 3(good brand image), 5(attractive packaging),6(attractive advertisement. This implicates that there exists a significant difference between Expectation and performance of detergent powder category with relation to many attribute considered. So null hypothesis is rejected.

IV. CONCLUSION

Customers just like best value item in any price, and so business need to create most advanced technology for their goods. Because consumer purchasing actions would be the important aspect to help forecast this income involving any kind of merchandise in a very unique area. So organisation really should keep near eyes in the marketplace predicament. Yet, consumer had been value delicate; however the changing marketplace pattern and consumer view and preference proven of which consumer at the moment are quality delicate. They desire quality merchandise, very good companies, quick option of merchandise and much better efficiency because of the merchandise. Currently simply no involving consumer purchasing from department stores has been elevated. Furthermore this regularity to travel to this department store has been elevated substantially. So when consumer services are good enough to make consumer think likely crucial that the organization along with the group cares about them, subsequently just about all it'd produce positive image towards a brand name and ultimately customer satisfaction can be boosted.

V.REFERENCES

 Anderson, E. W., Fornell, C., Lehmann, D. R. (1994), "Customer satisfaction, market share, and profitability: Findings from Sweden", Journal of Marketing, Vol. 58, pp. 53-66.

18

- [2] Anderson, E.W. and Sullivan, M.W. (1993), "The Antecedents and Consequences of Customer Satisfaction for Firms", Marketing Science, Vol. 12, pp. 125–143.
- [3] Gomez, M. I., McLaughlin, E. W, Wittink, D. R. (2004), "Customer satisfaction and retail sales performance: an empirical investigation", Journal of Retailing, Vol. 80, pp. 265-278.
- [4] Henseler, J., Ringle, C. and Sinkovics, R. (2010). "The use of Partial Least Squares path modelling in international marketing" New Challenges to International Marketing, Vol. 20, pp. 277-319.
- [5] Homburg, C. and Giering, A. (2001), "Personal characteristics as moderators of the relationship between customer satisfaction and loyalty, an empirical analysis" Psychology & Marketing, Vol. 18, No. 1, pp. 43-66
- [6] Martinez-Ruiz, M., Jimenez-Zarco, A. and Izquierdo-Yusta, A. (2010). "Customer Satisfaction's Key Factors in Spanish Grocery Stores: Evidence from hypermarkets and supermarkets", Journal of Retailing and Consumer Services, Vol. 17, pp. 278-285.
- [7] Oliver, R.L. (1993). "A conceptual model of service quality and service satisfaction: compatible goals, different concepts". In Swartz, T.A., Bowen, D.E. and Brown, S.W. (eds), Advances in Services Marketing and Management: Research and Practice, Vol. 2, JAI Press, Greenwich, CT, pg. 65-85.
- [8] Oliver, R.L. (2010). "Satisfaction: A Behavioural Perspective on the Consumer", 2nd edition. McGraw-Hill, New York
- [9] Tse D. K., and Wilton P. C. (1988) "Models of consumer satisfaction formation: An extension", Journal of Marketing Research, Vol. 25, No. 2, pp. 204-212

Bacterial Blight Resistance in Rice: A Review

Mohammad Noroozi¹, Haj Beheshtizadeh² and A-Sattari³

¹Iranian Rice Research Institute, Deputy of Mazandaran, Amol, Iran ^{2, 3} Department of Agronomy and Plant Breeding, Faculty of Agriculture, Zabol University, Iran

ABSTRACT

Bacterial blight disease, caused by Xanthomonas oryzaepv.oryzae(Xoo), is one of the most serious diseases in rice producing areas. For combating the disease, the most effective and economical measure is exploitation of host plant resistance. To date, more than 38 R genes for BB resistance have been reported. Since the chemical control is not effective, the utilization of resistant varieties carrying resistance genes have been considered to be the most effective way to control the disease. With the development of a wide range of molecular techniques, marker assisted breeding is now used to enhance traditional breeding programs to improve crops. Among various PCR based markers, SSR markers are more popular in rice because they are highly informative, mostly mono locus, co-dominant, easily analyzed and cost effective.Besides disease management, bioagents also stimulate plant growth, even if there is no disease, which results in better yield. Antagonistic potential of different bioagents against bacterial leaf blight of rice has been reported by several workers. **Keywords: :** Rice, Bacterial Blight Disease, Resistance Genes, SSR Markers

INTRODUCTION

Rice (Oryza sativa L.) (2n = 24) belonging to the family Poaceae is the staple food for one third of the world's population that occupies almost one-fifth of the total land area covered under cereals (Chakravarthi and Naravaneni, 2006). Bacterial blight (BB), caused byXanthomonas oryzaepv.oryzae (Xoo), is a widely disributed and devastating diseases of both conventional and hybrid rice in south-eastern Asia (Mew, 1987;Nino-Liu et al., 2006). Bacterial blight disease is a systemic disease and can cause severe yield loss up to 50 % depending on growth stage, geographic localization and season (Gnanamanickam et al., 1999; Nino-Liu et al., 2006). In Taiwan, bacterial blight disease often occurs in the second crop season, and its annual incidence area is usually more than 20,000 hectares, accounting for approximately 4 % of the Taiwanese rice production area. Recently, this disease has become more and more serious because of climate change (Hsieh, 2003; Wang et al., 2013). At present, the prevention of bacterial blight includes field management, fertilizer control and resistance breeding. In practice, the cultivation of resistant rice varieties has been proposed to be the most effective strategy to prevent bacterial blight disease (Khush et al., 1989; Shen and Ronald, 2002; Yang et al., 2003). The durable and broad resistance of plants was found to be usually governed by multiple genes or quantitative trait loci (QTLs) (Johnson, 1984). Therefore, the discovery of a resistance gene against Xoois an important area of research leading to breeding programs. With the development of a wide range of molecular techniques, marker assisted breeding is now used to enhance traditional breeding programs to improve crops (Frey et al., 2004). Among various PCR based markers, SSR markers are more popular in rice because they are highly informative, mostly mono locus, co-dominant, easily analyzed and cost 2004). Simple Sequence effective (Gracia et al., Repeats (SSRs) or microsatellites are most suited to routine application in breeding programs. SSRs or microsatellite markers are proved to be ideal for making genetic maps (Islam, 2004; Niones, 2004), assisting selection (Bhuiyan, 2005) and studying genetic diversity in germplasm. Microsatellite marker analysis is promising to identify major gene locus for



BLB resistance that can be helpful for plant breeders to develop new cultivar.

Nucleotide Diversity Analysis of Three Major Bacterial Blight Resistance Genes in Rice

For combating the disease, the most effective and economical measure is exploitation of host plant resistance. To date, more than 38 R genes for BB resistance have been reported (Chen et al., 2008; Kumar et al., 2012). Diversity analysis of these genes in natural population will facilitate identification of allelic variations which can be exploited in resistance breeding programs (Iyer-Pascuzzi et al., 2007). Recent studies conclude that nucleotide changes in the non-coding and regulatory sites of Rgenes also contribute to resistance or susceptibility phenotypes of a disease in addition to nucleotide variations in the coding region (Gu et al., 2005; Romer et al., 2009).

Resistance to Bacterial Blight by Suppressing Auxine Biosynthesis in Rice

IAA, the major form of auxin in rice, is generally believed to play an important role in plant growth and development (Teale et al., 2006; McSteen et al., 2010). However, recent studies demonstrate that IAA acts as a negative regulator in the plant immune response (Yang et al., 2013; Navarro et al., 2006), as exogenous application of IAA or auxin analogs in rice and Arabidopsis sgnificantly promotes disease symptoms. Treatment with IAA and 2,4-dichlorophenoxyacetic acid (2, 4-D; an analog of IAA) in rice resistant to various types of bacterial blight significantly stimulates phytopathogenic Xoo proliferation, resulting in high susceptibility to these compounds (Ding et al., 2008). Similarly, treatment of resistant rice plants with IAA the infectivity of enhances Xanthomonas oryzaepv.oryzicola (Xooc) and Magnaporthe oryzaeto rice (Fu et al., 2011). In addition, exogenous application of 1-naphthalacetic acid (NAA) or 2,4-D on Arabidopsis accelerates the development of disease symptoms during infection by Pseudomonas syringaepv.tomato(Pto) DC3000 or Pseudomonas syringaepv.maculicola (Chen et al., 2007; Wang et al., 2007).

Genetic Analysis and Molecular Mapping of QTLs Associated with Resistance to Bacterial Blight in Rice The International Rice Research Institute has developed a series of near isogenic lines (NILs) which harbor various Xagenes (IRBB NILs) by using the susceptible cultivar, IR24, as the recurrent parent (Huang et al., 1997). Recently, the molecular markers linking Xa genes in IRBB NILs have been developed using comparative map methods for improving the resistance of commercial cultivars (Kottapalli et al., 2006; Sama et al., 2014). However, climate change has been proposed to affect the microflora of Xoo in the field, life cycle, and even the evolution of the pathogen (Garrett et al., 2006; Coakley et al., 1999). Our previous results also revealed that IRBB lines containingxa5or Xa7showed moderate resistance, while the NILs harboring a singleXa gene were highly susceptible after the inoculation of a Taiwanese local pathogen, suggesting that more Xa genes are necessary to provide resistance (Wang and Wang2009). Recently, a durable and broadspectrum resistance was reported by transmitting one resistance gene and pyramiding with 2-3 other resistance genes (Li et al., 2001; Perumalsamy et al., 2010).

Screening of Rice Varieties for Bacterial Leaf Blight Resistance by Using SSR Markers

Since the bacterial races vary continually influenced by the artificial and natural selection of genes resistance to bacterial blight, it is critical to explore and identify the new resistant resources to control the changeful races (Xia et al., 2012).Since the chemical control is not effective, the utilization of resistant varieties carrying resistance genes have been considered to be the most effective way to control the disease (Nino-Lui et al., 2006). Several molecular markers viz. RFLP, RAPD, SSRs, ISSRs, AFLP and SNPs are presently available to assess the variability and diversity at molecular level (Joshi et al., 2000). With the development of a wide range of molecular techniques, marker assisted breeding is now used to enhance traditional breeding programs to improve crops (Frey et al., 2004). Among various PCR based markers, SSR markers are more popular in rice because they are highly informative, mostly mono locus, co-dominant, easily analyzed and cost effective (Gracia et al., 2004). Simple Sequence Repeats (SSRs) or microsatellites are most suited to routine application in breeding

programs. SSRs or microsatellite markers are proved to be ideal for making genetic maps (Islam, 2004; Niones, 2004), assisting selection (Bhuiyan, 2005) and studying genetic diversity in germplasm. Microsatellite marker analysis is promising to identify major gene locus for BLB resistance that can be helpful for plant breeders to develop new cultivar.Bangladeshi rice varieties have been developed traditionally by selection, hybridization and back crossing with locally adapted high-yielding lines. The conventional methods of plant selection for BLB resistance are not easy because of the large effects environment and the low narrow sense of the heritability of BLB resistance.

Effect of Bioagent Application Time Against Bacterial Leaf Blight of Rice

Besides disease management, bioagents also stimulate plant growth, even if there is no disease, which results in better yield (Mishra and Sinha, 2000). Antagonistic potential of different bioagents against bacterial leaf blight of rice has been reported by several workers (Manmeet and Thind, 2002; Babu and Thind, 2005; Palaniyandi et al., Gangwar 2006; and Sinha, 2012a.b.c and Gangwar, 2013a,b). Time of application of bioagents may have effect on efficacy of bioagents as these are living entity and need a period of time for upsurge optimum population and establish on host. The level of management of disease depends on time of application of bioagents. Influence of time of bioagents in plant disease application of management was studied by several workers including Sindhan et al. (1997) and Vidhyasekaran et al. (2001). Present study was carried out to test the effect of time of application on efficacy of T. harzianum and P. fluorescens formulations against bacterial leaf blight of rice under field conditions.

REFERENCES

- [1] Babu AGC, Thind BS. 2005. Potential use of combinations of Pantoea agglomerans, Pseudomonas flourescenc and Bacillus subtilis as biocontrol agents for the control of bacterial blight of rice. Annals of the Sri Lanka, department of agriculture, 7: 23-37.
- [2] Bhuiyan MAR. 2005. Efficiency in evaluating salt tolerance in rice using phenotypic and marker assisted selection. M. S. Dissertation, Department of Genetics and Plant Breeding,

Bangladesh Agricultural University, Mymensingh, Bangladesh. 96p.

- [3] Chen S, Huang ZH, Zeng LX, Yang JY, Liu QG, Zhu X. 2008. High resolution mapping and gene prediction of Xanthomonas oryzae pv.oryzaeresistance gene Xa7. Mol Breed. 2008; 22: 433–441.
- [4] Chen Z, Agnew JL, Cohen JD, He P, Shan L, Sheen J, et al., 2007. Pseudomonas syringaetype III effector AvrRpt2altersArabidopsis thalianaauxin physiology. Proc Natl Acad Sci USA.
- [5] Coakley SM, Scherm H, Chakraborty S. 1999. Climate change and plant disease management. Annu Rev Phytopathol 37:399– 426.
- [6] Ding XH, Cao YL, Huang LL, Zhao J, Xu CG, Li XH, et al., 2008. Activation of the indole-3-acetic acid–amido synthetase GH3-8 suppresses expansin expression and promotes salicylateand jasmonate-independent basal immunity in rice. The Plant Cell. 20: 228–240.
- [7] Frey JE, Frey B, Sauer C Kellerhals M. 2004. Efficient low cost DNA extraction and multiplex fluorescent PCR method for marker assisted selection in reeding. Plant Breed. 123: 554-557.
- [8] Frey, JE, Frey B, Sauer C, Kellerhals M. 2004. Efficient low cost DNA extraction and multiplex fluorescent PCR method for marker assisted selection in breeding. Plant Breed. 123: 554-557
- [9] Fu J, Liu HB, Li Y, Yu HH, Li XH, Xiao JH, et al., 2011. Manipulating broad-spectrum disease resistance by suppressing pathogen-induced auxin accumulation in rice. Plant Physiol. 155: 589–602.
- [10] Gangwar GP, Sinha AP. 2012a. Comparative antagonistic potential of fungal and bacterial bioagents against Xanthomonas oryzae pv. oryzae. Ann. Pl. Protec. Sci.,20(1): 154-159.
- [11] Gangwar GP, Sinha AP. 2012b. Evaluation of Trichodermaspp. and fluorescent pseudomonads for the management of bacterial leaf blight of rice. Indian Phytopath., 65 (1): 89-91.
- [12] Gangwar GP, Sinha AP. 2012c. Effect of time of application on fungal and bacterial bioagents against bacterial leaf blight of rice. Agric. Sci. Digest., 32(2): 123-127.
- [13] Gangwar GP. 2013a. Efficacy of different isolates of fluorescent pseudomonads against bacterial leaf blight of rice. Afr. J. Agric. Res., 8(37): 4588-4591.
- [14] Gangwar GP. 2013b. Field efficacy of formulation of fungal bioagents against bacterial leaf blight of rice caused by Xanthomonas oryzaepv. oryzae(Uyeda and Ishiyama) Dowson. J. Appl. & Nat. Sci., 5(2): 423-426.
- [15] Garrett KA, Dendy SP, Frank EE, Rouse MN, Travers SE. 2006. Climate change effects on plant disease: genomes to ecosystems. Annu Rev Phytopathol 44:489–509.
- [16] Gracia AAF, Benchimol LL, Antonica M M, Geraldi IO, Deuza AP. 2004. Comparison of RAPD, RFLP, AFLP and SSR marker for d iversity studies in tropical maize inbred lines. Euphytica 108: 53-63
- [17] Gracia AAF, Benchimol LL, Antonica MM, Geraldi, IO, Deuza, AP. 2004. Comparison of RAPD, RFLP, AFLP and SSR marker for diversity studies in tropical maize inbred lines. Euphytica 108: 53-63.

- [18] Gu K, Yang B, Tian D, Wu L, Wang D, Sreekala C, et al., 2005.
 R-gene expression induced by a type-III effector triggers disease resistance in rice. Nature. 35: 1122–1125. PMID:15973413
- [19] Hsieh SPY. 2003. Rice bacterial blight. In: Cheng CH (ed) Plant protection illustrations 8: Rice Protection (The next book). Bureau of Animal and Plant Health Inspection and Quaratine, Council of Agriculture, Executive Yuan. Taipei, Taiwan, pp 317–338
- [20] Huang CL, Hwang SY, Chiang YC, Lin TP. 2008. Molecular Evolution of thePi-taGene Resistant to Rice Blast in Wild Rice (Oryza rufipogon). Genet.179:1527–1538. doi:10.1534/genetics.108.089805 PMID:18622033
- [21] Huang N, Angeles ER, Domingo J, Magpantay G, Singh S, Zhang G, Kumaravadivel N, Bennett J, Khush GS. 1997. Pyramiding of bacterial bligh t resistance genes in rice: markerassisted selection using RFLP and PCR. Theor Appl Genet 95:313–320
- [22] Islam MM. 2004. Mapping salinity tolerance genes in rice (Oryza satiya L.) at reproductive stage. Ph. D. dissertation.University of the Ph[1] ilippines Los Banos, College, Laguna, Philippines.150 p.
- [23] Islam MM. 2004. Mapping salinity tolerance genes in rice (Oryza satiya L.) at reproductive stage. Ph. D. dissertation.University of the Philippines Los Banos, College, Laguna, Philippines.150 p.
- [24] Johnson R. 1984. A critical analysis of durable resistance. Annu Rev Phytopathol 22:309–330
- [25] Joshi SP, Gupta VS, Aggarwal RK, Ranjekar PK, Brar DS. 2000. Genetic diversity and phylogenetic relationship as revealed by Inter simple sequence repeat polymorphism in the genus Oryza. Theor. Appl. Genet. 100:1311-1320.
- [26] Khush GS, Mackill DJ, Sidhu GS. 1989. Breeding rice for resistance to bacterial blight. Bacterial Blight of Rice. IRRI,Manila, pp 207–217
- [27] Kottapalli KR, Sarla N, Kikuchi S. 2006. In silico insight into two rice chromosomal regions associated with submergence tolerance and resistance to bacterial leaf blight and gall midge. Biotechnol Adv 24(6):561–589.
- [28] Kumar PN, Sujatha K, Laha GS, Rao KS, Mishra B, Viraktamath BC et al., 2012. Identification and fine-mapping of Xa33, a novel gene for resistance to Xanthomonas oryzae pv. oryzae. Phytopathol. 2012; 102:222–228.
- [29] Li ZK, Sanchez A, Angeles E, Singh S, Domingo J, Huang N, Khush GS. 2001. Are the dominant and recessive plant disease resistance genes similar? A case study of rice R genes andXanthomonas oryzaepv.oryzaeraces. Genetics 159(2):757– 765
- [30] Manmeet M, Thind BS. 2002. Management of bacterial blight of rice with bioagents. Plant Dis. Res., 17(1): 21-28.
- [31] McSteen P. 2010. Auxin and monocot development. Cold Spring Harb Perspect Biol. 2(3): a001479.
- [32] Mew, TW. 1987. Current status and future prospects of research on bacterial blight of rice. Annu. Rev. Phytopathol.25, 359— 382.
- [33] Navarro L, Dunoyer P, Jay F, Arnold B, Dharmasiri N, Estelle M, et al., 2006. A plant miRNA contributes to antibacterial resistance by repressing auxin signaling. Science. 312: 436–439.
- [34] Nino-Liu DO, Ronald PC, Bogdanove AJ. 2006. Xanthomonas oryzaepathovars: model pathogens of a model crop. Mol. Plant Pathol.7, 303—324.

- [35] Nino-Lui DO, Ronald P C, Bogdanove AJ. 2006. Pathogen profile Xanthomonas oryzae pathovars: model pathogens of a model crop. Molec.Plant Pathol. 7(5): 303-324
- [36] Niones JM. 2004. Fine mapping of the salinity tolerance gene on chromosome 1 of rice (Oryza sativa L.) using near-isogenic lines.M.S. dissertation.University of the Philippines Los Banos,College, Laguna, Philippines.78 p.
- [37] Niones JM. 2004. Fine mapping of the salinity tolerance gene on chromosome 1 of rice (Oryza sativa L.) using near-isogenic lines.M.S. dissertation.University of the Philippines Los Banos, College, Laguna, Philippines.78 p.
- [38] Palaniyandi V, Immanuel JE, Gnanamanickam SS, Thomashow L. 2006. Biological control of rice bacterial blight by plant associated bacteria producing 2,4-diacetylphloroglucinol. Canadian Journal of Microbiology, 52(1): 56-65.
- [39] Perumalsamy S, Bharani M, Sudha M, Nagarajan P, Arul L, Saraswathi R, Balasubramanian P, Ramalingam J. 2010. Functional marker-assisted selection for bacterial leaf blight resistance genes in rice (Oryza sativaL.). Plant Breed 129(4):400–406
- [40] Romer P, Recht S, Lahaye T. 2009. A single plant resistance gene promoter engineered to recognize multiple TAL effectors from disparate pathogens. Proc Natl Acad Sci USA. 106: 20526–20531.
- [41] Sama VS, Rawat N, Sundaram RM, Himabindu K, Naik BS, Viraktamath BC, Bentur JS. 2014. A putative candidate for the recessive gall midge resistance gene gm3 in rice identified and validated. Theor Appl Genet 127(1):113–124.
- [42] Shen Y, Ronald P. 2002. Molecular determinants of disease and resistance in interactions ofXanthomonas oryzaepv.oryzaeand rice. Microbes Infect/Inst Pasteur 4(13):1361–1367
- [43] Sindhan GS, Parasher RD, Hooda I. 1997. Biological control of bacterial leaf blight of rice caused byXanthomonas oryzae pv.oryzae. Plant Dis. Res., 12(1): 29-32.
- [44] Teale WD, Paponov IA, Palme K. 2006. Auxin in action: signalling, transport and the control of plant growth and development. Nature Reviews Mol Cell Biol. 7: 847–859. PMID:16990790
- [45] Vidhyasekaran P, Kamala N, Ramanathan P, Rajappan K, Paranidharan V, Velazhahan R. 2001. Induction of systemic resistance by Pseudomonas fluorescensPf1 against Xanthomonas oryzaepv. Oryzae in rice leaves. Phytoparasitica. 29(2): 155-166.
- [46] Wang CS, Wang AZ, Lin DG. 2013. The application of mutants in breeding disease resistance in rice. Paper presented at the Special issue or the symposium on important crop pathogen detection and management, Taichung
- [47] Wang D, Pajerowska-Mukhtar K, Culler AH, Dong X. 2007. Salicylic acid inhibits pathogen growth in plants through repression of the auxin signaling pathway. Curr Biol. 17: 1784– 1790.
- [48] Xia C, Chen, H, Zhu X. 2012. Identification, Mapping, Isolation of the Genes Resisting to Bacterial Blight and Breeding Application in Rice. Molecular Plant Breeding., 3(12): 120-130.
- [49] Yang DL, Yang YN, He ZH. 2013. Roles of plant hormones and their interplay in rice immunity. Mol Plant. 6: 675–685.
- [50] Yang Z, Sun X, Wang S, Zhang Q. 2003. Genetic and physical mapping of a new gene for bacterial blight resistance in rice. Theor Appl Genet 106(8):1467–1472

Viscosity Studies of Na₂So₄.10H₂O in Mixed Solvents at Different Temperatures

D. Sahu¹ and A. K. Patnaik^{*2}

¹Department of Chemistry, Faculty, V.N (auto.) College, Jajpur Road, Odisha, India ²Department of Chemistry Utkal University, Vani-Vihar, Bhubaneswar, India

ABSTRACT

SRST

The viscosity studies help to determine the ion-ion interaction and ion-solvent interaction between solute and the mixed solvent. The viscosity of the $Na_2SO_4.10H_2O$ at 10%, 20% and 30 %(w/w) of Propan-2-ol+Water mixture at 30°, 35° and 40°C has been measured. The ions appear to interact and the ion solvent interaction or structure breaking effect of the anions changes with the change in Propan-2-ol content.

Keywords: Viscosity, Mixed Solvents, Potassium Sulfate, Jones-Dole Equation

I. INTRODUCTION

Physiochemical Properties of solution provide a very useful tool in elucidating the structural interactions among the components. Such properties are dependent upon temperature and composition of the solutions. The addition of organic solvent to the aqueous solution of electrolyte brings a change in ion-solvent and reactivity of dissolved electrolyte.^{1, 2}Physiochemical properties involving determination of density, partial molar volume and viscosity provide important information in studying ion-ion and ion-solvent interactions and also help to examine the structure making and structure breaking effects of electrolytes. The present paper aims to measure the viscosity of the solution at different solvent composition to investigate ion-ion and ion-solvent interactions in the electrolytic solutions. The viscosity data are analysed which indicates theformation of transition state is accompanied by the rupture and distortion of intermolecular forces. From the viscosity measurement, A (Falkenhagen Co-efficient) and B (Jones-Dole Co-efficient) are calculated. A is measure of ionic interaction and B is measure of effective solvodynamic volume solvated ion which gives information about the structural effect induced by solute solvent interaction.

In the present communication, viscosity of Na_2SO_4 solutions at 10%, 20% and 30 %(w/w) of Propan-2-ol+Water mixture at 30°, 35° and 40°C have been studied and an attempt has been made to enquire about net structure breaking or net structure making effect in Propan-2-ol + water mixtures.

II. METHODS AND MATERIAL

Samples of analytical reagents Na_2SO_4 and K_2SO_4 were dried at 120°C. Solutions were then prepared from dried sample by distilled water. Analytical grade (E. Merck) was used for preparing solvent mixture. Before using the solvent, it was dried over molecular sieve and all solutions were prepared in double distilled water. Viscosity of the solution was measured by using a calibrated Ostwald viscometer at 30, 35 and 40 °C respectively with the help of water thermostat maintained at the required temperature accurate to within ±0.05K. The estimate error of the viscosity was of the order of±0.005%.

III. RESULT AND DISCUSSION

From Jones-Dole Equation, $\eta_r = 1 + A\sqrt{C} + BC$ Where $\eta_r =$ Relative Co-efficient of Viscosity C=Concentration of the solution A and B are constants

Or
$$\eta_r = 1 + A\sqrt{C} + BC$$

Or $\frac{\eta_r - 1}{\sqrt{C}} = A + B\sqrt{C}$

The relative co-efficient of viscosity of sodium sulphate in 10, 20 and 30% propan-2-ol-water at different temperature are shown in Table-1, 2 and 3 for comparison. The viscosity data are analysed in terms of Jones-Dole equation as the plot $(\eta_r-1)/C^{1/2}$ vs. $C^{1/2}$ is linear. The intercept and the slope gave the value of "A", which measures of ion-ion interaction and "B" measures of ion-solvent interaction in the **solution** and data are presented in Table-4 and Table-5 respectively.

Table 1.VALUES $\text{OF}\eta_r\text{OF}\ \text{Na}_2\text{SO}_4\text{AT}\ 30^{0}$ C in propan-2-OL -

V۵	TER	
V P	A I EK	

Concentration	Propan-2	2-ol + wate	er (wt. %)		
	(η_r)				
(mol dm^{-3})	10%	20%	30%		
0.1000	1.0764	1.0805	1.0807		
0.0750	1.0583	1.0615	1.0616		
0.0500	1.0400	1.0421	1.0423		
0.0250	1.0213	1.0224	1.0225		
0.0100	1.0095	1.0100	1.0101		
0.0075	1.0075	1.0078	1.0079		
0.0050	1.0053	1.0056	1.0056		
0.0025	1.0031	1.0032	1.0032		
0.0001	1.0016	1.0016	1.0016		

Table 2.VALUES $\text{OF}\eta_r\text{OF}\ \text{Na}_2\text{SO}_4$ At 35 $^{\rm O}$ C in propan-2-OL -

WATER						
Concentration	Propan-2	2-ol + wate	er (wt. %)			
		(η_r)				
(mol dm^{-3})	10%	20%	30%			
0.1000	1.0743	1.0777	1.0811			
0.0750	1.0567	1.0593	1.0619			
0.0500	1.0389	1.0407	1.0424			

0.0250	1.0207	1.0217	1.0225
0.0100	1.0093	1.0097	1.0101
0.0075	1.0073	1.0076	1.0079
0.0050	1.0052	1.0054	1.0056
0.0025	1.0030	1.0031	1.0032
0.0010	1.0015	1.0016	1.0016

Table 3.VALUES $OF\eta_r OFNa_2SO_4AT 40^{0}C$ IN PROPAN-2-OL-

WATER						
Concentration	Propan-	2-ol + wat	er (wt. %)			
		(η_r)				
(mol dm^{-3})	10%	20%	30%			
0.1000	1.0722	1.0765	1.0817			
0.0750	1.0551	1.0584	1.0623			
0.0500	1.0379	1.0401	1.0427			
0.0250	1.0202	1.0213	1.0226			
0.0100	1.0091	1.0096	1.0101			
0.0075	1.0071	1.0075	1.0079			
0.0050	1.0051	1.0054	1.0056			
0.0025	1.0029	1.0031	1.0032			



Figure 1 : Plot of $\eta_r - 1/\sqrt{C}$ vs \sqrt{C} of sodium sulfate at 30 °C for 10% propan-2-ol +water [1] ,20% propan-2-ol+water[2] and 30% propan-2-ol +water [3]



Figure 2: Plot of $\eta_r - 1/\sqrt{C}$ vs \sqrt{C} of sodium sulfate at 35 °C for 10% propan-2-ol +water [1],20% propan-2-ol+water [2] and 30% propan-2-ol +water [3]



Figure 3. Plot of $\eta_r - 1/\sqrt{C}$ vs \sqrt{C} of sodium sulfate at 40 °C for 10% propan-2-ol +water [1] ,20% propan-2-ol+water[2] and 30% propan-2-ol +water [3]

Table:4 A X 10³(dm^{3/2}mol^{-1/2})Na₂SO₄.10H₂O

Solvent	Temperature	10%	20%	30%
	(°C)			
	(0)			
	20	24.2	22.4	22.2
	30	31.3	32.1	33.Z
_				
Propan-2-ol	25	20.2	21.5	22.1
	55	30.2	51.5	32.1
+water				
	40	20.1	30.1	31.2
	-10	23.1	50.1	51.2
	30	31.7	31.5	33.6
Dioxane				
	35	30.6	31.4	32.6

+water	40	29.5	30.4	31.6
Chucol	30	31.6	32.6	33.6
+water	35	30.6	31.7	33.2
	40	30.0	30.1	31.5
Glycerol	30	31.8	32.8	33.6
+water	35	30.9	31.9	33.3
	40	30.2	30.5	31.7

Table-5 $B(dm^3 mol^{-1}) Na_2SO_4.10H_2O$

Solvent	Temp (°C)	10%	20%	30%
Propan-2-ol	30	0.26	0.29	0.37
+water	35	0.27	0.30	0.38
	40	0.32	0.33	0.42
Dioxane	30	0.29	0.32	0.40
+water	35	0.30	0.33	0.41
	40	0.35	0.36	0.45
Glycol +water	30	0.30	0.35	0.44
	35	0.31	0.36	0.45
	40	0.37	0.39	0.50
Glycerol	30	0.32	0.37	0.46
+water	35	0.33	0.38	0.48
	40	0.39	0.41	0.53

A Values: A values are the measure of ion-ion interactions, which are positive for all electrolytes studied and increase with increase in concentration of organic solvent increases (Table-4). These values decrease with increase in temperature for all the salts which one should expect in view of more thermal agitation at higher temperatures and reduction of attractive forces.

Dependence of B on temperature: According to Stokes and Miles [7], the viscosity of a dilute

electrolytic solution incorporates that of the solvent plus the contribution from other sources. These values increase due to shape and size of the ion, alignment of orientation of the polar molecules of ionic field and the distortion of the solvent structure by the ions. Therefore, B coefficient can be discussed in terms of these viscosity effects at different temperatures.

The B coefficient of salts increases with increase in temperature. This indicates that the viscosity decreases due to solvent structure. (Table -5) The lesser the value of B, lesser is the distortion and hence the ion-solvent interaction. The ion-solvent interaction is of the order, $Br^{-} < NO_{3}^{-} < Cl^{-} < l^{-} < SO_{4}^{2^{-}}$. According to Stokes and Mills [7], the lesser the value of dB/dT, greater is the ion-solvent interaction in the present case, the plot of B vs. T is linear and dB/dT is of the order: $Br^{-} < NO_{3}^{-} < Cl^{-} < l^{-} < SO_{4}^{2^{-}}$. This indicates that the order of the ion-solvent interaction is $Br^{-} < NO_{3}^{-} < Cl^{-} < l^{-} < SO_{4}^{2^{-}}$.

Dependence of B on propan-2-ol content: The increase in B coefficient with increase in propan-2-ol content in the solvent mixture (Table-5) maybe attributed due to the large size of the solvent molecules and also to the strong association between water and propan-2-ol through hydrogen bonding and for solvated ions it would lead to larger values of and consequently, the B coefficient becomes larger with increase inpropan-2-ol content in the molecules.

Propan-2-ol is more basic and less acidic than water. A water molecule is hydrogen bonded with –OH of propan-2-ol molecule. A cation will react more strongly with the oxygen atom of propan-2-ol + water mixtures and an anion will react less strongly with hydrogen atoms. This type of ion-solvent interaction is in the primary sheath.

Addition of small amounts of propan-2-ol to water may give rise to one of these two effects: if propan-2-ol is accommodated, then it may cause a break down in the three dimensional water structure. It is seen from the viscosity data [10, 11, 12] that B coefficient are positive in propan-2-ol and water mixtures. The values also increase with increase in propan-2-ol content, but the difference in B does not remain the same which shows that the solvation sphere [13, 14] of the ion differs. This indicates that propan-2-ol is not accommodated in the solvent structure [15-20] and hence, it breaks down the three-dimensional water structures and the additive law does not hold good.

IV. ACKNOWLEDGEMENT

Authors are thankful to H.O.D of Chemistry, Utkal University for the permission to carry out the research work and the support received from all the fellow colleagues for assistance in various ways.

V.REFERENCES

- [1] B.G. Cox and W. E.Waghome, Chem.Soc. Rev.,9,381(1980)
- [2] Y. K. Lau, P.S. Sakejae and P.Kebearle , J.Am.Chem.Soc., 102, 7479 (1980)
- [3] H.S. Frank, and W.Y.Wen, Discussion Far. Soc., 24, 133 (1957)
- [4] L.Pauling, Nature of chemical bond, Cornell University Press, Nhaca (1960)
- [5] G.Nemetty and H. A.Schefega, I. Chem. Phys., 36, 3382 (1962)
- [6] P.B.Das, Electrochemica Acta, 22, 1975 (1977)
- [7] R.H.Stokes and R.Mills, The Int. Encyclopedia of Phys. and Chem.Phys, Vol. 3, Pergamon Press, New York (1965)
- [8] P.Assarson and F.R.Eirich, J.Phys. Chem., 72, 2710(1968)
- [9] R.S.Saha, B.Sinha, and M. N.Ray, J. Chem and Engg. Data55(10), 4536-4540(2010)
- [10] S Ranjbar,K.Fakhri , and J. B.Ghasemi, J.Chem. And Engg.Data54(12), 3284-3290(2009)
- [11] R.Mahanta,B.Dasand P.C. Pal, J. Acta Ciencia Indica XXIC, No. 2, 081 (2005)
- [12] M N.RayR.Chandra, B K.Sarkar, Russian J.Phys. Chem. A83(10) 1737-1746(2009)
- [13] S.Masood,R.Saeed,M.Ashfaq,Russian J. Phys.Chem.,88,2102-2107(2014)
- [14] Y.Akhtar, J.Sc.Tech. and Soc., 3, 6-9(2014)
- [15] A. Pandey, R. Srivastab, A. K. Sukal and A. R, Saksena, Int. J. Smart Home, 5,7-12 (2011).
- [16] S. Aswale and B. Ramtec, Int. J. Chem.Environmental and Pharma. Res., 3, 5863 (2012).
- [17] A. A. Mishra, V. D. Bhandakkar and O. P. Chimankar, J. Chem. Pharma. Res.,4,170-174(2012).
- [18] S. Punitha, R. Uvarani, J. Chem. Pharm. Res., 4,387-392 (2012).
- [19] S. D. Deosarkar, T. M. Kalaynkar, Russian J. Phy. Chem., 87 (6), 06 (2013).
- [20] Daniel M. Seo, O. Borodin, D. Balogh, M. O' Connell, Q. Ly, Sang. Din. Han, S. Passeriniand W. A. Henderson, J. the Electrochemical Soc., 160(8), A1061-A1070 (2013).

Comparision of MPC and PID Controls of Sirnak Water Supply Network System Bekir Cirak*

Siirt University, Faculty of Engineering & Architecture, Department of Mechanical Engineering, Kezer Campus, Siirt / TURKEY

ABSTRACT

This paper determines the application of a model predictive control (MPC) technique to improve the behavior of the water network supply system, to maintain stable operation of the water flow rate, and reduce the operational cost by manipulating the pump speed. The MPC algorithm is one of the most common automatic control system that has got a wide spread application in process industry. MPC is especially suitable for controlling these types of systems. MATLAB Packaged Program is utilized in the water supply system in Sirnak-Turkey. In this study has been a single input single output linear model of a water supply system considered and Comparised of controls with MPC and PID of water supply system in Sirnak-Turkey.

Simulations of MPC Control algorithms for coating process have been made and the results of these simulations were observed. There is a comparison of PID Controller and Generalized Predictive Controller results and there are comments about this comparison in these studies. The simulations and calculations of the algorithms are done in MATLAB Packaged Program Environment. An increasing demand for water due to population growth, industrial development and improvement of economic require management of water transfer and improve operation of water supply systems. The results show that the MPC technique gives improved performance over the PID control technique, moreover, the MPC structure can be modified to handle the constraints applied on the system. **Keywords:** (MPC) Model Predictive Control; PID; Matlab; Constraints; Water supply system.

I. INTRODUCTION

The optimal use of such water supply networks seems to be the best solution for the present and thus it is necessary to carefully manage water transfer [1, 2]. Most of the research in the field of water distribution has concerned with the optimal design of new networks [3], the main topic of this research has been mainly focused the design of optimized on configurations for pipe interconnected reservoirs concentrated on the scheduling of pumps, or however, the energetic efficiency will be sacrificed when the pumps operate under a variable load and hence under non-optimized conditions. [4,5]

The optimized operation of this kind of system usually results in a control strategy determination problem for the active elements from measuring the monitoring variable so that some performance target is reached (power minimization, pressure limitation to avoid Leakage, etc.).

Some researchers have developed techniques for the operational optimization of existing supply networks [6, 7]. The objective of this research is the contribution in controlling a water supply network systems using power full control algorithm such as the model predictive control (MPC) algorithm. Mohammed and Abdulrahman studied a MPC technique to improve the behavior of the water network supply system, to maintain



stable operation of the water flow rate, and reduce the operational cost by manipulating the pump speed.

The results of these studies are show that the MPC technique gives improved performance over the PID control technique, moreover, the MPC structure can be modified to handle the constraints applied on the system [1].

The MPC algorithm is an alternative to the conventional PID and other advance control algorithm such in [2, 3] as the H_{∞} control algorithm used by Ekar and Kara [4-7] for its superiority and robustness for controlling processes of multi-inputs multi-outputs and subjected to constraints. The idea of the MPC emerged in 1965, where Dawkins and Briggs [8] used weighting function as a system description for use in optimal control. However, it was rarely used as a controller in control engineering until the advent of digital computers.

There are different MPC algorithms that could be suitable for single and multivariable systems and are successfully applied to real life processes include dynamic matrix control (DMC) 1978 [9], and generalize predictive control (GPC) 1987 more review on these algorithms is given by Mackay etc. [10].

All of these classes of MPC have certain features in common, implementation of receding horizon to solve a finite horizon optimization problem, with differences occurring in the sequence of control implementation and in the underlying formulation of the models and constraints. Some of these MPC methods use non-parametric weighting function models forms during the prediction process, and others use parametric models [11].

Parametric predictive controllers allowed for a more efficient algorithm and making the incorporation of adaptive techniques more feasible, whereas non-parametric predictive controllers are very robust when compared to parametric models, at the cost of computation power. DMC uses non-parametric step response models to generate both the free and forced responses [12-15].

However, GPC uses the impulse response to generate the forced response, parametric controlled auto-regressive and integrated moving average (CARIMA) model to generate the free response. a different number of extensions to the original DMC have been incorporated to deal with constraints, multi-variable interactions and nonlinear systems and a review on the recent advances on MPC algorithm can be found in [16].

II. METHODS AND MATERIAL

2. Water Supply System

Water supply systems are generally composed of a large number of interconnected pipes, reservoirs, pumps, valves, and other hydraulic elements which carry water from retention to demand areas [1, 4]. The hydraulic elements in a supply system may be classified into two categories: active and passive. The active elements are those which can be operated to alter the flow rate of water in specific parts of the system, such as pumps and valves.

The pipes and reservoirs are passive elements, insofar as they receive the effects of the active elements. These elements in the supply systems play important roles in dynamic behavior of the water supply systems. Simulations of the water supply systems have been an indispensable work to understand their behavior to produce a feasible control solution as well as modeling.

The simulations can thus be used to generate deas in order to develop flexible management and design schemes. Consequently, this process may facilitate a better exchange of ideas among representatives of different professions. It also combines technical and financial viewpoints. The first step in simulation and control is to establish a mathematical model for the plant to be controlled. Furthermore, an adequate model is an important step in determining the behavior and producing a well MPC algorithm.

Hydraulic systems generally require complex models. Derivation of control strategies on the basis of the complex models is difficult. For these reasons, the plant model should be chosen to be simple with a minimum number of dominant variables, which, nevertheless, adequately reflect the dynamics of the plant. The plant can be described by the parameters that characterize its functioning such as the pumps discharges, water heads in the reservoirs, and flow rates through the system .Thus the simulation of the model that represents a water supply system may prove an efficient measure to contribute to the correct transfer of water and to reduce operational cost, as well as to improve the operation.

The active and passive elements are represented by dominant system variables. The main objectives are to ensure the proper operation of a water supply system and to regulate the water flow rates and heads by manipulating the water pumps. By assuming that the water is incompressible and the individual system components are stationary the hydraulic model of the supply system is composed of the following models for every component of the supply system.

2.1. Plant Definition

The water source from Mijin place of Senoba village is 41 km. distance from the Sirnak state in Turkey. Fig 1 shows the general scheme of the water supply system in which there are three pumping stations (PST-1, PST-2, PST-3) and three reservoirs (RS-1, RS-2, RS-3) in the supply system. The supply system is a one-line system, and any water is included or dispersed in the supply system.

3. Pumps

Head developed by n variable-speed pumps running in parallel varies nonlinearly with their speed N rpm and output water flow rate Q_p (t) m³/s.

$$h_p(N, Q_p) = A_o N^2 + B_o / n N Q_p - C_o / n^2 Q_p$$
(1)

where A_o , B_o , C_o are the constants for a particular pump depending on component characteristics [1, 4]. These constants can also be calculated using appropriate manufacturer's specifications.

4. Pipes

Consider a pipe section with length l_p (m) and crosssectional area A_p (m²). If the head difference Δh between two ends of the pipe section is considered, the following differential equation is obtained:

$$d Q(t) / dt = gAp/lp \left[\Delta h(t) - h_{loss}(t) \right]$$
(2)

Where $h_{loss}(t)$ parameters the total head loss along the piping section and g parameters the acceleration of gravity. The flow rate and head loss may be given as:

$$h_{loss}(t) = h^{o}_{loss}(t) + \Delta h_{loss}(t)$$

$$Q(t) = Q^{o} + \Delta Q(t)$$
(3)

Pipe Length (m)	Man. High (m)	Pump Speed (rpm)	Flow Rate (m ³ /s)	Pipe Dia. (m)	GravityAcce. (m/s²)	Pipe Sec. (m ²)	Reserv. Sec. (m ²)
$lp_1 = 789.05$	<i>hs</i> ₁ =234.5	$N_{so} = 945$	$Q_{so} = 2.25$	<i>D</i> = 1.2	<i>g</i> = 9.81	A _p =1.2178	$A_t = 525$
$lp_2 = 2156.34$	hs 2=367.3						
$lp_3 = 1578.05$	<i>hs</i> ₃ =341.7						
<i>lp</i> ₄ =3789.40	<i>hs</i> ₄ =295.8						

Table 1. The technical characteristics of the water supply system

Where choosen which steady-state operating point of pump speed is N_{so} = 945 rpm and flow rate is Q_{so} = 2.25 m³/ s). (.)^o parameters steady-state value and $\Delta h_{loss}(t)$ designates the variable head loss caused by the variable water flow rate ΔQ (*t*). Intercalarily, A_p is circular area of concrete type pipe and A_t is surface area of all resevoirs and D is inner diameter of concrete type pipe.

5. Water Reservoir

When a reservoir discharges under its own head without external pressure, the continuity equation simplifies to: $\rho dh(t)/dt = 1/c \left[\rho_i Q_i(t) - \rho_o Q_o(t) \right]$

30

(4)
Where ρ , ρi , ρo represent the water densities inside the reservoir, water inflow, and out flow, respectively, and these are assumed equal $(\rho = \rho_i = \rho_o) Q_i(t)$ m³/s and $Q_o(t)$ m³/s parameters reservoir input and output water flow rates, respectively, c (m²) parameters the capacity of the reservoir and h(t) (m) is the head in the reservoir [1].

Figure 1 shows scheme of the water supply system in Sirnak. A single input single output linear model of a water supply system considered in this study has been developed for the water supply system shown in figure 3. by Mohammed and Abdulrahman [1].



Figure 1: Schemes of the Sirnak water supply system

The input to the system is considered to be the pump speed N rpm and the ouptut of the system is the flow rate from the third reservoir $Q_o(t)$ m³/s. The numerical data about the water supply system are given in Table 1. The output water flow rate was measured at 1 hours intervals in a day, so 24 measurements were taken using a flow meter installed on the real system.

Using the data obtained, the average water flow rate is about $Q_o=2.25 \text{ m}^3/\text{s}$ (8100 m³/ h) and it changes between 8000 m³/h and 8200 m³/h. The pump characteristics were obtained from the pump's manufacturer. Head developed by the pump was calculated around the operating point using the characteristic curve as

$$H_p(N, Q_p) = 0.0001755 N^2 + 0.00489 NQ_p - 2.13 Q_p^2$$
 (5)

The linear model of the water supply system shown in figure 1 was obtained by linearizing the mentioned system using the Taylor series expansion method around a steady-state operating point ($N_{so} = 945$ rpm, $Q_{so} = 2.25$ m³/s). A detailed study on the system modeling is given by Mohammed and Abdulrahman [1]. The resulting equations (6 - 13) of the system using the above data and operating point in table 1 are as follows:

$$dQ_a/dt = 0.0058 N - 0.0197 h_{tl} - 0.4356 Q_a \quad (6)$$

 $d h_{t1}/dt = 0.0034 \ Q_a - 0.0034 \ Q_b \tag{7}$

$$dQ_b/dt = 0.0041 \ h_{t1} - 0.0041 \ h_{t2} - 0.0502 \ Q_b \quad (8)$$

$$dh_{t^2}/dt = 0.0034 \ Q_b - 0.0034 \ Q_c \tag{9}$$

$$dQ_c/dt = 0.0015 h_{t^2} - 0.0015 h_{t^3} - 0.0213 Q_c$$
 (10)

$$dh_{t^3}/dt = 0.0034 \ Q_c - 0.0034 \ Q_o \tag{11}$$

$$dQ_o/dt = 0.0027 \ h_{t3} - 0.0176 \ Q_o \tag{12}$$

$$y = Q_o \tag{13}$$

This system can be represented in state space matrix form such that the reservoir heads and flow rates can be considered as states. The canonical state space form of the above equations (6-13) is as follows:

$$\dot{x}(t) = A x(t) + B u(t), \quad y(t) = C x(t)$$
 (14)

where x(t) is the state matrix and A, B, C are the constant system matrices, u(t) is the system input, and y(t) is the system output. The state matrix x(t), input u(t), and calculated constant matrices A, B, C are as follows:

	-0.0176	0.0027	0	0	0	0	0)
	-0.0034	0	0.0034	0	0	0	0
	0	-0.0015	-0.0213	0.0015	0	0	0
A =	0	0	- 0.0034	0	0.0034	0	0
	0	0	0	-0.0041	-0.0502	0.0041	0
	0	0	0	0	-0.0034	0	0.0034
	0	0	0	0	0	-0.0197	-0.4356
	\sim						

6. Model Predictive Control

Model Predictive Control (MPC) is commonly used for control of highly stochastic processes where selection of control actions, based on optimization, is desired. The importance of MPC compared with traditional approaches is due to its suitability for large multivariable systems, handling of constraints placed on system input and output variables, and its relative easeof-use and applicability. In MPC, current and historical measurements of a process are used to predict its behavior for future time instances. The MPC is supported by commercial tools such as MATLAB (Mathworks 2010a).

It consists of a System Prediction Model and Optimizer. The error between future outputs and target trajectories (i.e., expected customer demand) is sent to the optimizer where optimized control outputs (referred to as manipulated variables) are calculated based on some constraints and objective functions over some time horizon—i.e., moving horizon (for manipulated variables) and prediction horizon (for controlled variables). This optimization will be repeated using the receding horizon concept once the new information is available. In addition, the MPC has a filter gain that can respond quickly to inevitable signal to noise ratio changes while avoiding undesirable oscillatory control regimes.

The predictive control for the first time step is sent to simulated system as well as the system prediction model. The above steps are repeated using the updated simulated system states and disturbances for a desired simulation period. MPC is not a specific control strategy but a wide class of optimal control based algorithms that use an explicit process model to predict the behavior of a plant. There is a wide variety of MPC algorithms that have been developed over past 30 years [14].



Figure 2: MPC of the basic logic structure

The basic elements of MPC are illustrated in Figure 2. and can be defined as follows:

1- An appropriate model is used to predict the output behavior of a plant over a future time interval or normally known as the prediction horizon (*p*). For a discrete time model this means it predicts the plant output from $\hat{y}_{(k+1)}$ to $\hat{y}_{(y|k+H|p)}$ based on all actual past control inputs $u_{(k)}$, $u_{(k-1),...,} u_{(k-j)}$ and the available current information $y_{(k)}$.

2- A sequence of control actions adjustments $(\Delta u_{(k/k-1)})...$ $\Delta u_{(k+m/k-1)})$ to be implemented over a specified future time interval, which is known as the control horizon (m)is calculated by minimizing some specified objectives such as the deviation of predicted output from setpoint over the prediction horizon and the size of control action adjustments in driving the process output to target plus some operating constraints. However, only the first move of computed control action sequence is implemented while the other moves are discarded. The entire process step is repeated at the subsequent sampling time. This theory is known as the receding horizon theory [15].

3- A nominal MPC is impossible, or in other words that no model can constitute a perfect representation of the real plant. Thus, the prediction error, $\varepsilon_{(k)}$ between the plant measurement $y_m(k)$ and the model prediction $y_{(k)}^{*}$ will always occur. The $\varepsilon(k)$ obtained is normally used to update the future prediction.

The Figure M. illustrated the error feedback of MPC. MPC methods is developed for optimization; is very important topic. If criterion square is depended on by inputs and outputs solutions, linear function is explained. If tere are no constratied valus, by using iteractive approach for solving the problems which is the methods long [16].

The proposed MPC algorithm is applied to control the water supply network system to provide stable operation, improve performance costs, and reduce the cost of operation and save electricity in the event of having many pumps operating simultaneously, by manipulating the speed of one of the pumps and letting the rest to operate at the minimal speed. For the closed-loop simulation, the control algorithm was set up with the linearized model described earlier in equation 14, and step response of the model is obtained.



Figure 3: PID Control Model by Simulink

The new set points were introduced. The tuning parameters were chosen so that the integrated square error (ISE) between the simulated output and set point is minimized, as follows: p = 15, m = 3, $\Gamma^u = 0.95$ and $\Gamma^y = 1$. The pump operation was constrained between maximum value of 1000 rpm and a minimum value of 900 rpm.

Where, *m* is control horizon and *p* is prediction horizon and Γ^{*} is the diagonal output weight matrix and Γ^{u} is the diagonal input weight matrix. Feedback control loop for PID controllers designed in SIMULINK. PID control loop designed using SIMULINK is given in Figure 3.

Feedback control loop for MPC controllers designed in SIMULINK. MPC control loop designed using SIMULINK is given in Figure 4.



Figure 4 : MPC Control Model by Simulink

7. PID Control

PID controllers are used in the designed control system. PID controllers are designed usingthe convolution models of the system by utilizing continuous cycling or Ziegler-Nichols method with modified Z-N settings.Therefore, the controllers are further fine tuned by trial error procedure.

The fine tuned PID control parameters $K_P = 0.2948$, $K_I = 0.1275$ and $K_d = 0.3925$ are accepted. These PID settings are very small and cannot be implemented on a nominal operating industrial plant controller. However, if a computer is used for the PID controller, then these settings can be implemented.

Therefore in this study for comparison with the MPC, also placed on PID outputs flow rate to be able to compare PID controller with the MPC. In the design and testing of Model Predictive Control MPC as for PID controllers, two parallel working SISO MPCs are constructed using the model predictive control toolbox of MATLAB. Fig. 5 and 6 illustrate the closed-loop response of the output flow rate of the system to a desired steady state values, it can be noticed that all the controllers takes the system response to the new values, but their performance are comparable.

However, the rising time of the closed-loop response is faster in the case of unconstrained MPC comparing to the constrained MPC and PID controller, the constrained MPC has a good settling time slower than the settling time for unconstrained MPC and faster than the settling time for the PID controller, moreover, the constraint are kept within their interval which makes MPC a success control technique for controlling this water supply network system.

In general, it can be said that the MPC algorithm adapt quickly to changing conditions of the water supply network system, the MPC structure can be modified to meet possible requirements concerning energy consumption and to handle the constraints applied to the system.



As can be seen at Figure 6 in references to the variable that is running under the process of MPC and PID control with the MPC there is a distinct difference between the answers of a more rapid response than the PID controller are given. MPC-line method, the reference value of thickness of less than 1% error with a permanent error with PID control method, permanently settled in around 1%. Describes the model predictive controller has a faster response than PID controller.



Figure 6 : Comparison of MPC and PID results (ref=2.22 m3/s -2.24 m3/s -2.25 m3/s -2.26 m3/s)

III. RESULT AND DISCUSSION

As a result of all this work 5% error rate remaining below the flow rate of the water supply systems, and literature are acceptable for the exchange of values is taken into account that the model predictive controller was developed to be reliable, the simulation results and performance of the best in the systems as well understood. As is clear from here the model predictive controller has faster response than а PID controller. Others studies in the literature, other MPC controller according to conventional controllers, and PID controller show that a new controller [16].

A proactive operation of the controller under different references, as defined in the system of restrictions and conditions for the simulations were defined. Constraints identified for water supply system. First, the control signals applied to the maximum and minimum values of the AC motor and supply pump (0-10 V, which corresponds) to 925-965 rpm and the constraints defined in system. The constrained and unconstrained responses of MPC controller show in Figure 7.



Figure 7 : Comparision of constrained and unconstrained MPC controller response

Figure 7. describes the unconstrained state has been % 6 pick after % 1.8 error and sit in 18. hours. Although the constrained state has been % 1 pick after % 1error and sit in 18. hours. The system has a structure that the constraints too. This control system, makes it difficult to be made with the classic multi-variable control algorithms. The results from this simulation and the

curve have been controlled successfully against the constraints of the MPC.



Figure 8. Changes of the Pump speed variables, ± 5% Output effect flow disturbance

The changes in the pump speed of the PST-1 shows by Figure 8. That occured a result of the square wave output load disturbance flow rate changes. The variable pump speed was reduced to 945 rpm at steady state when the PID and MPC controls were used.

IV. CONCLUSION

In this study, experimental and theoretical studies are done to design an inferential control scheme for the feedback control of flow rate in the water supply systems of Sirnak. The basic conclusions arrived are as follows:

For the two controllers designed, the analyses for robustness should be carried out also, in order to compare the controllers in this scope, which is also very important. Next to this, accomplishing comparisons of the results of the two controllers which are included in the linear model. Additionally, carrying out the real time applications by first discretizing the controller developed in this study, which are continuous, may be considered as a possible future work.

It is clear that the robust MPC technique with a moving optimization horizon, offer an effective means of dealing with the problem of water transfer operation to achieve goals such as flow rate regulation and cost minimization. This concept has the intrinsic ability to compensate for changes in water disturbance th at may occur at any point of the water supply system. As a result, the model predictive control (MPC), the desired water supply system is controlled within acceptable limits. Compared with PID controllers, PID controller, MPC observed that the control system, such as variable references under the system successfully. However, given the restrictions on the model predictive controller based PID controller concluded that a more healthy work.

V. FUTURE WORK

The water supply system, in addition to the variable the water quality of supply systems can be controlled in a structure can be converted to variables. In this way, input increasing the number of output, the control problem becomes a bit more complicated. Example, the hygein material or clour material rates variables and density rates variables in supply water, pump power and pump type with the participation of the system against the performance of predictive control algorithm is the effect of dead time can be tested.

VI. ACKNOWLEDGEMENT

This study was supported by Sirnak University Scientific Research Projects Center. The authors would like to thank Head Office of Sirnak Belediyesi for his advice during the conduct of this research and Mech. Eng. Mr V. Kis also of Sirnak University for her help in the preparation of this paper.

VII. REFERENCES

- N. G. N. Mohammed, A. Abdulrahman, Water Supply Network System Control based on Model Predictive Control, Proceedings of the Intern. Multi Conference of Engineers and Computer Scientists 2009; 2, Hong Kong
- [2] Cembrano, G., Wells, G., Quevedo, J., Perez, R., and Argelaguet, R., Optimal control of a water distribution network in a supervisory control system. 2000; 1177–1188.
- [3] Creasey JD (1988) Pump Scheduling in Water Supply: More Than a Mathematical Problem. In: B Coulbeck and CH Orr (eds.) Computer Application in Water Supply. Systems Optimization and Control. 2:279-289.
- [4] Ilyas Eker, Tolgay Kara, Operation and control of a water supply system, ISA Transaction, 42; 1 – 13, 2003.
- [5] Dawkins, J and Briggs, P. A. N, A method for using weighting functions as system description in optimal control,' IFAC Symposium on Self-Adaptive Control Systems, 1965, Teddington.
- [6] C. R. Cutler, B. L. Ramaker, Dynamic matrix control algorithm, AIChE 86th National Meeting. Houston, TX, 1978.

- [7] Cunha MC, Sousa J, Water distribution network design optimization, Simulated annealing approach. J. Water Resour. Planning and Manage. 1999; 4: 215-226.
- [8] Mousavi, H. and Ramamurthy, A. S., Optimal design of multireservoir systems for water supply. Adv. Water Resour. 2000; 23: 613–624.
- [9] Jowitt PW, Germanopoulos G, Optimal pump scheduling in water-supply, Asce J. Water Resour. Planning and Manage. 1992; 118: 406-422.
- [10] M. Mackay, M. Thomson and M. Soufian, Multivariable Model Predictive Control and Its Performance in The Presence of Inexact Modeling, Inst. Meas. Control, International Symposium: The application of Multivariable System Techniques, March, University of Bradford, 1994; 293-308.
- [11] Rahul Shridhar, Douglas J. Cooper, A Tuning Strategy for Unconstrained SISO Model Predictive Control, Ind. Eng. Chem. Res.1997; 36: 729-746.
- [12] Y. P. Gupta, Control of Integrating Processes Using Dynamic Matrix Control, Institution of Chemical Engineers Trans IChemE, 1998; 76: 465-470.
- [13] D. W. Clarke, C. Mohtadi, P. S. Tuffs, Generalised predictive control - Part II, extensions and interpretations, Automatica, 1987; 23: 149-160.
- [14] D. W. Clarke, C. Mohtadi, P. S. Tuffs, Generalised predictive control - Part I, the basic algorithm, Automatica, 1998; 2: 137-148.
- [15] M. A. Henson, Non-linear model predictive control: current status and future directions, Computers and Chemical Engineering, 1998; 2: 187-202.
- [16] Cirak B, "Model predictive control for robot manipulators of puma type using a neural network model", International Journal of Multidisciplinary Research and Development, Volume 2 Issue 3 Part B, pp.89-93, 2015

Microcrystal Tests for Detection of Nicotine in Hookah Bar Samples

¹Falguni Patel, Astha Pandey^{1*}

¹Research Scholar, National Institute of Occupational Health, Ahmedabad, Gujarat, India ^{1*}Assistant Professor, Institute of Forensic Science, Gujarat Forensic Sciences University, Gandhinagar, Gujarat, India

ABSTRACT

SRST

Microcrystalline test is hardly used in forensic science laboratory for the confirmation of drug or alkaloids present in the plants. Therefore an attempt was made to identify and confirm the presence of nicotine in hookah bar samples. Hookah bar samples are rampantly available in the market whose consumption has been found to be harmful to the youngsters and adults. Microcrystalline tests have been conducted for drugs like cocaine, morphine etc but neither on nicotine samples nor hookah bar samples it were done. Thus this study was done after performing the color tests and was found to be successful for the detection of alkaloids by microcrystal method and its sensitivity was found to be greater when compared to color tests.

Keywords: Micro-Crystal Tests, Small Cubic And Spherical Crystals ,Mercuric Chloride, Barium Nitrate, Picric Acid, Microcrystalline Test, NDPS Drugs, TLC, Chloroplatinic Acid

I. INTRODUCTION

A hookah is a water pipe used to smoke tobacco through cooled water. The tobacco is heated in the bowl at the top of the hookah and the smoke is filtered through the water in the base of the hookah. Alternate names for hookahs include: water pipe, goza, hubble-bubble, borry, arhile, and narghile. It has been found that compared to a single cigarette, hookah smoke is known to contain higher levels of arsenic, lead and nickel, 36 times more tar, and 15 times more carbon monoxide than cigarettes. This is because smoking a hookah requires taking longer and harder drags, increasing levels of inhaled nicotine and carcinogens in the lungs. The concept of hookah is thought to have originated in India [1].

Tobacco is smoked in hookahs in many villages as per traditional customs. Smoking tobacco molasses is now becoming popular amongst the youth in India. There are several chain clubs, bars and coffee shops in India offering a wider variety of mu'assels, including nontobacco versions. Hookah was recently banned in Bangalore. However, it can be bought or rented for personal usage or organized parties [2]. As hookah makes resurgence in India, there have been numerous raids and bans recently on hookah smoking, especially in Gujarat [3].

Finally, numerous studies indicate that young smokers are more likely to experiment with drugs such as alcohol marijuana, cocaine, heroin, or other illicit drugs. There is enormous usage of hookah bar samples with different flavours amongst the youth in Gujarat and different other places in India, inspite of the restrictions at various places. As stated by a daily newspaper in India, Indian Express, more than 80 hookah bar's premises have been raided in Haryana by the Drug Control Officers and seized 123 samples of tobacco molasses containing nicotine. Test reports of more than 100 samples have been received indicating presence of nicotine in these samples. These hookah bar samples are frequently received by the forensic science laboratory for the testing of NDPS drugs. There are several methods adopted the most common of which is color test and TLC but hardly any significance has been given to microcrystalline tests which are much better than color test in reactivity and sensitivity to a particular sample. Thus an effort was made to conduct microcrystal tests on 25 samples of hookah bar for the detection of alkaloid nicotine. Since these microcrystal tests give positive results to alkaloids it could also indicate the

presence of other alkaloids related to morphine, codeine, amphetamine etc NDPS drugs which requires confirmation through GC-MS. Our study is more focused on microcrystalline tests for alkaloids of nicotine but further scope lies in using it with combination of other instrumental techniques.

Microcrystalline tests are confirmatory tests in which a substance is identified by the formation of crystals with the use of a specific reagent. The crystals formed are observed under the microscope, thus it is called as microcrystalline tests. These tests have got several advantages like they are simple, do not take much time, chemical consumption is also less and most importantly they are non-destructive. In the year 1961 Charles C. Fulton did the study on identification of microcrystal test for certain drugs4. Of 41 opium alkaloids and derivatives described by Small and Lutz[10], eighteen are recorded as giving crystalline precipitates with chloroplatinic acid, nine with chlorauric acid, and fourteen with picric acid. In Stephenson's studies on fifty-four alkaloids, twenty two crystalline precipitates were obtained with chlorauric acid, nineteen with chloroplatinic acid and thirteen with picric acid5.

Microcrystalline test for the detection of 4methylmethcathinone (mephedrone), benzylpiperazine (BZP) and 5, 6-methylenedioxy-2-aminoindane (MDAI) using aqueous solutions of mercury chloride was also described by Elie L. et.al (2011) [6]. In the identification of small amounts of suspected drugs the most valuable tests are of two kinds: color tests on the spot-plate, and crystal tests under the microscope. The former are especially useful for compounds of phenolic character, such as adrenalin, arbutin, aspirin, and the opium alkaloids. The micro-crystal tests are particularly useful for amines, such as all alkaloids, and amides, such as phenacetin and acetanilide. This method of identification by recognition of characteristic crystals under the microscope was begun by Wormley (1), Lyons (2), Behrens (3), and others, and developed in more recent years for the alkaloids especially by Grutterink (4), Stephenson (5), and Amelink (6).

More recently the use of microcrystal tests for identification of drugs has been criticized1, and SWGDRUG [2] is recommending that when identification of chemical species is performed using microcrystal tests and spot tests that these tests should be supplemented with an uncorrelated test such as gas chromatography or thin layer chromatography [2]. Others, however, argue that microcrystal testing is perfectly reliable [1, 3-5]. It is generally recognized that spot (color) tests, though quickly performed and useful for narrowing the number of possible drug classes to which the unknown sample belongs [6], lack of specificity can result in false positive or false negative conclusions [7-9].These tests are also subject to interference by adulterants and diluents commonly found in illicit drug samples [9-10].



Figure 1: Hookah

II. METHODS AND MATERIAL

Chemicals: Hookkabar flavored samples were collected from Ahmedabad, Chloroform (CHCl₃), Methanol (CH₃OH), Acetone (CH₃COCH₃), Potassium hydroxide (KOH), Strong Ammonia (NH₃) of Merck (AR) grade were used. Whatman filter paper no.41, Dragondroff's reagent, 0.05 N Hydrochloric acid (HCL) Kraut's Regent, Wagner's Reagent, Mayer's Reagent, Picric acid, Barium Nitrate, Mercuric chloride reagent were prepared accordingly.

Equipments and Apparatus

60 ml Separating Funnel, Porcelain dish (Spotting plate), 25 ml volumetric flask, Compound microscope, Micropipette, Glass slides were used.

Preparation of Reagents for microcrystal tests

a) Kraut's Reagent: 80 gm Bismuth nitrate, 200 ml Nitric acid, 272 gm KI in H2O

b) Wagner's Reagent: 10 gm Iodine, 50 gm KI, and 1000 ml H2O

c) Mayer Reagent: 1:100 Mercuric chlorides in H20 KI to dissolve PPT.

- d) Picric acid: 10 % solution of picric acid in methanol.
- e) Barium nitrate: Dissolve in water.
- f) Mercuric chloride: Dissolve in water

Extraction Method

For the sample preparation, the contents of hukka flavor was accurately weighed and transferred to a dry porcelain dish. Followed by which 0.5 gm or 500 mg of sample was taken and to this 0.5 ml of 0.5 M methanolic KOH solution was added and triturated well. The mixture was allowed to dry for 30 min. at room temperature. The content was then transferred to a 60 ml separating funnel and extracted with solvent CHCL₃:NH₃ (24:1). The extract was filtered through Whatman filter paper no.41 in to a 25 ml volumetric flask and the volume was adjusted with solvent. It was then evaporated to dryness and further reconstituted with 0.5ml.of CHCL₃.

Procedure

Microcrystal tests A drop of a reagent was added to a small quantity of the extract on a glass slide, followed by which the solution began to re-crystallize. The slide was then examined under the compound microscope at 10 X. The size and shape of the crystals were characteristic of the specific reagent.

Crystals were generally formed at once, though the slide was kept for 5 mins after adding the reagent to the sample of hookah bar. Precaution was taken that cover slip was not placed on the on the sample reagent solution, as crystallization is often accompanied due to concentration by evaporation. The following microcrystals were observed for the alkaloids in the hookah bar samples.



Figure 2: Kraut's Regent: Needle shaped crystals, often in Rosettes. In the more concentrated solutions, the crystals were large rods, light-yellow in color.



Figure 3: Wagner's Reagent: Needle and Rod shaped crystals



Figure 4: Mayer's Reagent: Small cubic and spherical crystals



Figure 5: Mercuric chloride: Small, clear-cut Rosettes of plates



Figure 6: Barium Nitrate: Rectangular, cubic, shape



Figure 7: Picric acid: The crystals are large Needle shaped.

III. RESULT AND DISCUSSION

Total 25 samples were collected of hookah bar which were tested for color test of nicotine followed by microcrystal test for nicotine with total six (6) reagents. All the six reagents gave positive for all the 25 samples of hookah bar. It was seen that kraut's reagent gave needle shaped crystals, often in Rosettes. In the more concentrated solutions, the crystals were large rods, light-yellow in color. Wagner's Reagent gave needle and rod shaped crystals. Followed by which Mayer's Reagent gave small cubic and spherical crystals indicating the presence of nicotine. Mercuric chloride reagent gave small, clear-cut Rosettes of plates as crystals of nicotine. Later Barium Nitrate reagent was used which gave rectangular, cubic, shaped crystals. Finally picric acid reagent was used which gave fine crystals of Needle shape.

As far as literature survey has been done it was found that there were no chemicals that produced a false positive relative to nicotine provided that the correct set of tests is performed properly. But for an analyst to reach an accurate conclusion the use of a more sophisticated analytical procedure might be required to present the evidence in the court apart from color and crystal test. In this regard, Wielbo and Tebbett⁶ have proposed the combined use of microcrystal testing with Fourier transform IR spectrophotometry being applied to product of the microcrystal the test. Gas chromatography/mass spectrometry (GC/MS) testing identifies compounds based on specific chemical structures, rather than on empirical and not clearly understood chemical reactions. Microcrystal testing of hookah bar samples may not allow for clear identification of compounds present in it apart from alkaloid nicotine, while GC/MS analysis would likely separate and accurately identify each component. In some situations, the identification of enantiomers, however, may be more easily accomplished using microcrystal tests¹³.

However, an initial microscopic examination of the sample as part of an integrated micro- chemical approach should help the analyst in detecting such mixtures. In criminal matters, the defendant's guilt must be established "beyond a reasonable doubt." Thus it would be appropriate that microcrystal test is used along with any other instrumental technique to ascertain confirmatively the presence of drug/poison or any other alkaloid of the plant which could assist the criminal justice system to use the best technology available to reach that level of proof.

IV. CONCLUSION

Most of the laboratories in India are utilizing preliminary screening test like colour test and TLC and confirmatory tests are being done using instrumentation. Thus there is an urgent need for the rapid and economical screening methods like microcrystal tests for drugs or poisonous toxins of forensic significance i.e. alkaloids present in various plant species.

The present study showed excellent results using microcrystal tests and therefore it gave a scope for further research to explore the potential detection methods like microcrystal test which is superior to conventional color test used in forensic science laboratories for the detection.

V.REFERENCES

- [1] "Origins"(2013) Article Niche History of Hookah. Retrieved 09-03.
- [2] "Business at hookah-less cafes go up in smoke"(2011) The Times of India. 7 June.
- [3] "Hookah",2008. Indian Express. Retrieved 06-08.
- [4] Fulton CC. Modern Microcrystal Tests for Drugs-The Identification of Organic Compounds by Microcrystalloscopic Chemistry, Wiley-Interscience, New York.
- [5] Small L F and Lutz RE, (1932) Chemistry of the Opium Alkaloids, U.S. govt Printing Office, Washington, Supplement no.103 to the Public Health Reports.
- [6] Stephenson CH and Parker CE, (1921).Micro chemical tests for alkaloids, J.B. Lippincott Co.Phil.
- [7] Elie L. et.al. (2011) Reversing microcrystalline tests-An analytical approach to recycling of micro crystals from drugs of abuse" Forensic Science International. Volume 207(1), 55-58.
- [8] De Forest PR.(1988) Letters to the Editor. Microscope; 36:373–81
- [9] SWGDRUG Methods and Reports Subcommittee Recommendations, Recommended Minimum Standards for Forensic Drug Identification, http://www.swgdrug.org.
- [10] Nichols RG, (1997) Drug proficiency test false positives: a lack of critical thought. Science & Justice; 37(3):191–6.
- [11] Hourigan J, Ascano M. Microcrystal test and quality control procedures employed at the LAPD narcotics analysis unit. In: Proceedings of the American Academy of Forensic Science.
- [12] McCrone WC, (2000) Chemical problem solving without FTIR, EDX, NMR, XRD, etc. or why I still use the polarized light microscope, PLM. Microscope; 48 (3):155–66.
- [13] Wielbo D, Tebbett IR, (1992) The uses of microcrystal tests in conjunction with Fourier transform infrared spectroscopy for the rapid identification of street drugs. J Forensic Sci; 37(4):1134–48.

- [14] Masoud AN, (1975) Systematic identification of drugs of abuse I: spot tests. J. Forensic Sci 64:841–4.
- [15] Johns SH, Wist AA, Najam AR, (1979) Spot tests: A color chart reference for forensic chemists. J Forensic Sci.; 24:631– 49.
- [16] Siegel JA. (1988) Forensic identification of controlled substances. In: Saferstein R, Editor. Forensic Science Handbook, Vol. II. Englewood Cliffs: Prentice Hall, 68–160.
- [17] Clarke EGC, (1955) Williams M. Microchemical tests for the identification of alkaloids. J Pharmacy and Pharmacology; 7:255–62.
- [18] Clarke EGC, (1969) Isolation and identification of drugs. London: The Pharmaceutical Press.
- [19] Fulton CC, (1969) Microcrystal tests. In: Sunshine I, editor. Handbook of analytical toxicology. Cleveland: The Chemical Rubber Co, 461–96.

Larvicidal Effect of Seeds of Myristica Fragrans (Houttuyn) on Larvae of Anopheles Gambiae

¹Romanus Umoh, ¹Samuel Offor, ²Nkechi Onyeukwu, ³Akwaowo Elijah, ²Hilary Otimanam, ⁴Timma Uwah, ⁴Clement Jackson

¹Department of Pharmacognosy and Natural Medicine, ²Department of Pharmacology and Toxicology,

³Department of Biopharmacy and Clinical Pharmacy, Department of Pharmaceutics and Pharmaceutical Technology, Faculty of

Pharmacy, University of Uyo, Nigeria

ABSTRACT

The Larvicidal Activity of Methanol extract and fractions of Myristica fragrans (Myristicaceae) was evaluated on larvae of Anopheles gambiae. The seeds were macerated in 100% redistilled n-hexane for 24 hours to extract the oil, then in 100% redistilled methanol for 72hours, filtered and concentrated to dryness. The methanol crude extract of *M. fragrans* seeds exhibited % mortalities range of $30.00 \pm 0.00 - 100 \pm 0.00$ and LC₅₀ of 0.02 mg/mL. N-hexane fraction of *M. fragrans* seeds was equally as active fraction with % mortalities range of 25+1.00-100+0.00 and LC₅₀ of 0.02mg/mL. The reference compound Nicotine had % mortality range of 15.00+0.00-100.00+0.00 with LC50 of 0.04mg/mL.

Keywords: Anopheles Gambiae, Myristica Fragrans, Larval Toxicity, % mortality and LC₅₀

I. INTRODUCTION

Malaria is one of the most devastating infections and represents a great health problem in tropical and subtropical climates, mainly in sub-saharan Africa, (Fradin & Day, 2002).

The morbidity and mortality associated with malaria is mostly experienced in sub-saharan African (Breman et al, 2001, WHO 2000). Annually, there is an estimated 2 million death from malaria which is highest in children under 5 years of years(WHO, 1998). One of the approaches for control of malaria is the interruption of its transmission, eliminating the malaria vector the female Anopheles gambiae mosquito.

The extensive use of these Synthetic insecticides has resulted in envioronmental hazards and development of resistance in vector Species.

This has necessitated the need for recovery and development of environmentally safe biodegradeable, economic viable and indigenous method for vector control. Some herbal Products such as nicotine obtain from tobacco leaves Nicotiana tabacum; anabasine and lupinine, two alkaloids extracted from Russian weed Anabasis aphylla, rotenone from Derris eliptica and Pyethrin from Chysanthemum cinerariifolum flowers have been used as natural insecticides even before the discovery of Synthetic insecticides(Ansari & Razdan, 1994).

Myristica fragrans is a plant of the family myristicaceae indigenous to thee molucca and neighbouring islands and is now extensively cultivated in other tropical regions including the west indies. It is also cultivated in Indonesia and Malaysia. M. fragrans seeds otherwise called nutmeg seeds contain fixed oil, 25 to 40% and volatile oil 8 to 15% which contains Myristicin and Safrol (Tyler et al, 1988). Nutmegs and their oils are used as carminative and flavouring agents. It is also used in the treatment of infantile diarrhoea.

This paper reports the larvicidal effect of M. fragrans seeds extract on larvae of Anopheles gambiae.



II. METHODS AND MATERIAL

Plant Material

The seeds of *Myristica fragrans* were purchased from Itam Market, Itu Local Government Area of Akwa Ibom State in September, 2013.

Plant Preparation and Extraction/ Fractionation

The seeds were pulverised, weighed and macerated in 100% redistilled n-hexane for 24 hours to remove the oil and in 100% redistilled methanol for 72 hours, filtered and concentrated to dryness. The methanol crude extract was then partitioned into n-hexane, chloroform, ethylacetate; the residue was considered as methanol/ water fraction and concentrated to obtain Solid fractions from the crude extract. Both the crude extract and fractions were kept in an oven $(40^{\circ}C)$ after estimation of percentage yields.

Preliminary Phytochemical Screening

The Phytochemical Screening was done using standard procedures (Trease and Evans, 1996; Sofowora, 2008)

Larval Collection

Larvae were collected from breeding sites in University of Uyo town campus, Akwa Ibom State and reared in Plastic buckets.

Larval toxicity Assay

Stock Solutions of both the methanol crude extract and fractions were prepared at 100mL with 1ml of ethanol and 99ml of untreated clean water. This was serially diluted to the final test concentrations of 1.0000-0.0078mg/mL. 24 instars larvae were introduced into each cup of 100ml solution and toxicity of extract and fractions were estimated by percentage (%) mortality. After 24 hours of exposure, the number of dead larvae in the cups was counted. Control experiments with 1% ethanol and Nicotine were run parallel. All the experiments were done in duplicates.

Bioassay-guided fractionation of Crude extracts

The active methanol crude extract was dissolved in methanol-water in the ratio 3:1 and partitioned successively with n-hexane, Chloroform, ethylacetate, the residue was considered as the methanol/water. All the fraction were concentrated to dryness and percentage yields obtained.

Statistical Analysis

Results were expressed as mean<u>+</u> SEM of two independent experiments. Larval toxicities were reported as LC_{50} obtained from Graph Pad Prism® Statistical Software.

III. RESULT AND DISCUSSION

Result

Preliminary Phyto chemical screening revealed the presence of alkaloids, Cardiac glycolsides, flavonoids and tannins.

The methanol Crude extract of *M.fragrans* at concentrations 1.0000-0.0078 mg/mL exhibited% mortality \pm SEM ranged of $30\pm0.00-100\pm0.00$ (table 1) with LC₅₀ of 0.02 mg/mL.

The n-hexane fraction at the same concentrations ranged from $25\pm1.00-100\pm0.00$ mg/mL and chloroform fraction ranged from $22.5\pm1.500-100\pm0.00$ mg/mL (table 2) with their LC₅₀ of 0.02 and 0.28 mg/mL respectively.

The reference compound (positive control) was Nicotine with % mortality of $15\pm0.00-100\pm0.00$ and LC_{50} of 0.04mg/ml, while 1% ethanol was used as negative control.

Discussions

Malaria affects the health and wealth of nations and individuals alike. It reduces work capacities, impairs physical and mental in man especially in children (United Nations, 1996).

The LC_{50} values of crude extract as well as the n-hexane and chloroform fractions are displayed in table 3.

The n-hexane fractions was the most active of the fractions evaluated and exhibited LC_{50} value of 0.02mg/mL as the crude extract; while the reference compound had an LC_{50} of 0.04mg/mL. This implies that the synergistic effect of the component of the seeds were responsible for the larvicidal activity as reported by Kumar and Maneenmegalai (2008) that the larvicidal activity of the leaves and flowers of *Lantana camara* Linn(verbenaceae) was attributed to the Phytochemicals sauch as the Cardiac glycosides, flavonoids, terpenoids and Saponins when tested on 3rd and 4th instar larvae of *Aedes aegypti* and *Culex quinquefasciatus* after 24 hours. The application of novel effective agents to sufficiently eliminate mosquitoes is imperative due to increasing resistance of the malaria vector to currently used

insecticides. In addition there are environmental concerns and unacceptability of currently used organophosphates and organochlorines and Synthetic Pyrethroids (Shaalan *et al*, 2005).

Moreover, the synergistic activity of phytochemical constituents of *M.fragrans* seeds methanol crude extract and n-hexane fraction exhibited intrinsic Larval toxicities and may serve as good alternative to vector control and activities displayed by both were concentration dependent and the results better than the toxicities exhibited by nicotine, indicating it could be considered for development of vector control agent for malaria.

Table 1: Larvicical effect of M.Fragrans seed methanol crude extract and NICOTINE on An. gambiae Larvae after 24 hours

Larval % Mortality + SEM

Concentration mg/mL	Methanol Crude Extract	Nicotine(+ve control)
1.000	100 <u>+</u> 0.00	100 <u>+</u> 0.00
0.500	100 ± 0.00	100 <u>+</u> 0.00
0.250	100 ± 0.00	100 <u>+</u> 0.00
0.125	100 ± 0.00	97.5 <u>+</u> 0.50
0.063	95 <u>+</u> 0.00	75 <u>+</u> 0.00
0.031	55 <u>+</u> 1.00	40 <u>+</u> 0.00
0.016	47.5 <u>+</u> 2.50	15 <u>+</u> 0.00
0.008	30 <u>+</u> 0.00	0.00 + 0.00

1% Ethanol 0.00+0.00(-ve control)

Concentration mg/ml	N-Hexane	Chloroform	Ethyl Acetate	Methanol/water
1.000	100.0 <u>+</u> 0.00	100.0 <u>+</u> 0.00	20.0 <u>+</u> 0.00	25 <u>+</u> 1.000
0.500	100.0 <u>+</u> 0.00	100.0 <u>+</u> 0.00	12.5 <u>+</u> 1.50	10 <u>+</u> 1.000
0.250	100.0 <u>+</u> 0.00	42.5 <u>+</u> 1.50	10.0 <u>+</u> 2.00	10 <u>+</u> 1.000
0.125	100.0 <u>+</u> 0.00	30.0 <u>+</u> 3.00	7.5 <u>+</u> 0.500	10 <u>+</u> 1.000
0.063	100.0 <u>+</u> 0.00	22.5 <u>+</u> 1.00	7.5 <u>+</u> 0.500	10 <u>+</u> 1.000
0.031	100.0 <u>+</u> 0.00	0.0 ± 0.00	0.0 ± 0.00	0.0 ± 0.00
0.016	25 <u>+</u> 1.00			
0.008	0.0 <u>+</u> 0.00			

Table 2: Larvicidal effect of M.fragrans seed solvent extracted fractions on An. gambiae larval After 24 hours

Table 3: Mean Lethal Concentrations(Lc₅₀) Of Methanol Crude Extract, N-Hexane fraction, Chloroform fractions And Nicotine (+ve control)

METHANOL CRUDE EXTRACT (mg/mL)	N-HEXANE FRACTION (mg/ml)	CHLOROFORM FRACTION (mg/ml)	ETHYL ACETATE FRACTION (mg/ml)	METHANOL/ WATER FRACTION (mg/ml)	NICOTI NE (mg/ml)
0.02	0.02	0.28	-	-	0.04

IV. CONCLUSION

The results of the study suggest that the methanol crude extract and n-hexane fraction are promising agents to be considered for the development as vector control agents for malaria as the crude extract and n-hexane fraction had over whelming activities compared to the reference compound.

V.REFERENCES

- [1] Abivami, D and Murugan K (2011). HPTLC quantification of flavanoids larvicidal and Smoke repellent activities of Cassia occidentalis L.(Caeslpiniaceae). Against malarial vector Anopheles Stephensi Journal of Physiology 3:60-72
- [2] Adodo, A (2008). Malaria Prevention and Management. The Herbal Doctor, Journal of African medicine 3: 14-16
- [3] Ajaiyeoba, E.O., Sama, W; Essien, E. E; Olanyemi, J. O; Ekundayo, O; Walker, M. T and Setzer, W. N(2008). Larvicidal Activity of Turmerone- Rich Essential oils of Curcuma longa leaf and Rhizome from Nigeria on Anopheles gambiae
- [4] Ajayeoba, E. O; Sama, W; Bakare, A. A and Akogbeto, M (2009). Larvicidal Properties of three Plants on Anopheles gambiae. Journal of pharmacy and Bioresources 6(2):50-53

- [5] Ansari, M.A; Vasudevan, P; Tendon, M. and Razdan, R. K (2000). Larvicidal and Mosquito repellent action of Pepper mint (Mentha piperita). Bioresource Technol 71: 267-271
- [6] Benoit- vical, F.(2005). Ethnomedicine in malaria treatment. The investigation drugs Journal 8:45-52
- [7] Bickii, J; Nijifutie, N; Foyere, J.A; Bosco, L.K and Ringwald, P(2000). In vitro antimalarial activity of limonoids from Khaya grandifolia C.D.C. (Meliaceae). Journal of Ethnopharmacology 69:27
- [8] Bowers, WS; Sener, B; Evans, P.H; Bingol, F and Endogani, G.H(1995). Activity of Turkish medicinal Plants against mosquitoes Aedes aegypti and Anopheles gambiae. Insect Sci Appl 16: 339-342.
- [9] Bray, D.H; Warchurst, S.C; Connonly, J.D; O'Neil, M.J and Philipson, J.D (1990). Plants as sources of Antimalarial drugs Part7. Activity of some Species of meliaceae plant and their constituents limonoids Phytotherapy Research 4:29-35
- [10] Breman, J.G; Aliolio, M.S and Mills, A(2004). Conquering the intolerable burden of malaria; what's new, what's needed: a summary? American Journal of Tropical medicine Hygiene 71:1-15
- [11] Breman, J. G; Egan, A and Kensch G(2001). The intolerable burden or malaria a new look at numbers. American Journal Tropical medicine of Hygiene 64:1-11
- [12] Burfield, T and Reekie S.L(2 005). Mosquito's malaria and essential oils. International Journal of Aromatherapy 15:30-41

- [13] Cabral, J.A; McChesney, J.D and Milhous, W.K(1993). A new antimalarial quassinoids from Samba quianensis. Journal of Natural Products 56: 1954-1961
- [14] Campbell, F.L; Sullivian, W and Smith, B.N(1993) The Relative toxicity of nicotine, anabasine and essential oil on culicini mosquito larva. Journal of economic entomology 26: 500-509
- [15] Chandra, F; Darriet, F; Darder, M and Cuany, A(1998). Pyrethroid resistance in Culex quinique fasciatus from west Africa. Medical and Vertenary Entomology 12: 359-366.
- [16] Federal Ministry of health(2004). National Malaria Control Policy for Nigeria, National malaria and vector control division Lagos, Nigeria.
- [17] Fradin, M.S and Day, K.F (2002): Comparative efficacy of insect repellents against mosquito bites. New England Journal of medicine 347:13-17
- [18] Gallup, J and Sacks, J (2001). Economic burden of malaria. American Journal of Tropical Medicine Hygiene 64: 85-96
- [19] HadjaKhoondi, A; Vatandoost, H; Khanari, M; Abaee, M.R and Karami, M(2005). Biochemical investigation of different extracts and larvicidal activity of Targete minuta L on Anopheles Stephensi larvae. Iranian Journal of Pharmaceutical Science Spring 1:81-84
- [20] HO, S.H; Wang, J; Sim, K.Y, Gwendoline, C. L; Imiyabir, Z; Yap, K.F; Sharri, K and Goh, S.H(2003). Meliternatin. Feeding deterent and larvicidal Polyoxygenated flavones from Melicope subunifoliata. Phytochemistry 62:1121-1124
- [21] Kumar, M.S and Maneemegalai, J (2008), Evaluation of larvicidal effect of Lantana Camara against mosquito species Aedes aegypti and Culex quinquefasciatus. Advances in Biological Research 2:39-43
- [22] Macedo, M. E; Consoli, R.A; Grandi, T.S.M; Aujos, A.M; de Oliveira, A.B;Medes, N.M;Quieiroz, R.O and Zani, C.L(1997).Screening of Asteraceae(compositae). Plant extracts for larvicidal activity against Aedes fluviatilis. Meinst Oswai Cruz Rio de Janeiro 92: 565-570.
- [23] Martin, A.E(200).Concise Colour Medical Dictionary. 3rd ed New York: Oxford University Press:409
- [24] Roll Back Malaria(2001-2010). United Nations Decade of Roll Back Malaria.
- [25] Saxena, S; Pant,N; Jain, D.C and Bahkuni, R.S (2003). Antimalarial agent from Plants: Current Science 85:1314-1329
- [26] Shaalan, E; Canyon, D.V;Faried, M.W; Abde-Wahab, H and Mansour, A (2005). A review of botanical Phytochemicals with mosquito larvicidal potential. Environmental international 31: 11409-1166
- [27] Sofowora, E.A(2008). Medicinal and Traditional Medicine in Africa. 3rd ed. Spectrum Books Ltd. Ibadan: 199-204
- [28] Steketee, R.W;Wirima, J.J and Campbell, C.C(1996). Developing effective Strategies for malaria Prevention programmes for Pregnant women. American Journal of Tropical medicine hygiene 55: 95-100
- [29] Trease, G.E and Evans, W.C (2002).Pharmacognosy. 15th ed. New York W.B. Saunder: 137-143
- [30] Tyler, V.E; Brady, L.R. and Robert, J.E (1988): Pharmacognosy.9th ed Philadelphia, PA 19106-4198 USA, 130-133
- [31] Usifoh, C.O.(2010). The burden of Malaria and Challenges/Opportunities. The Nigerian Journal of Pharmacy 43: 49-52

- [32] World Health Organisation (2007). World Health Organisation Fact Sheet, Geneva No.94
- [33] World Health Organisation (1998) World Health Report: Life in the 21st Century, Geneva. A vision for all. No. 90-104.,
- [34] World Health Organisation(2000). Technical Report Series. Expert Committee on malaria. World Organ. Tech. Rep. Ser 892: 1-74W3C Math: The reference site on MathML.

Network Reconfiguration for Loss Reduction of a Radial Distribution System

Laxmi. M. Kottal, Dr. R Prakash

Electrical & Electronics, Acharay Institute of Technology, Bengaluru, Karnataka, India

ABSTRACT

ISRST

By using network reconfiguration process many distribution system problems can be solved such as planning, energy restoration and loss minimization. This paper describes about loss reduction in a radial distribution system by doing network reconfiguration using new algorithm i.e. Gravitational Search Algorithm [GSA].GSA considers all the objectives in order to meet the reliability requirements. And because of this the processing time can be reduced also the quality of solution can be improved. The proposed approach has been applied to distribution test systems including IEEE 33 system.

Keywords: Network Reconfiguration; Distribution System; Loss Minimisation; Gravitational Search Algorithm.

I. INTRODUCTION

Distribution systems are designed to operate in a radial configuration only even though it is designed in meshed structure also. Because radial structure has many advantages over meshed structure like simple in construction, operation is simple and initial cost is less.

In a distribution system network reconfiguration is processes that chances the topological structure of feeder by managing the open/close status of the sectionalizing and tie switches in distribution system in order to minimize the losses. Usually sectionalizing switches will be in closed position and that of tie switches will be in open position. Obviously more the number of switches, there will be more options to do reconfiguration of the network in order to get better effects towards minimizing the losses.

Consumer demands vary with time of day, day of the week and season; therefore feeder reconfiguration enables load transfers from heavily to weakly loaded regions. Network reconfiguration can also be used in planning studies, in order to determine the optimal configuration of the network during the overall planning procedure. Furthermore, online configuration management becomes an important part of distribution automation when remote controlled switches are employed [1]. Since a typical distribution system may have hundreds of switches, a combinatorial analysis of all possible options is not a practical proposition. The radiallity constraint and the discrete nature of the switch values prevent the use of classical optimization techniques to solve the reconfiguration problem.

Network reconfiguration is done mainly due to:

- i. It can provide service to as many as consumer as possible even in the planned outage condition for maintenance purpose.
- ii. Avoid system over loading of network elements by balancing the loads.
- iii. System losses can be reduced.

Ganesh et al. [2] presented paper based on an efficient approach to feeder reconfiguration for loss reduction and voltage profile improvement in unbalanced radial distribution system. Enoque et el. [3] presented paper, how the application of loss minimization in network reconfiguration In distribution system can help to evaluate online reconfiguration benefits in each node of the system.

Dan Jiang et al. [4] presented paper on single comprehensive algorithm for distribution system switch reconfiguration and capacitor control. In this paper Simulated Annealing is employed to optimize the switch reconfiguration of distribution system. Zeng Rong et al. [5] used Minimal Nodal Voltage method and Genetic Algorithm for loss minimization in radial distribution system. Chang-Fu change [6] presented a paper to study distribution system operation by Ant Colony Search algorithm (ACSA). The ACSA is relatively new and power full Swarm intelligence method for solving optimization problems. They observed that the results of ACSA are better than SA and GA, and this method is suitable for large scale distribution system.

Yong-Jae Jeon et al. [7] presented paper on loss minimization by Simulated Annealing algorithm which is suitable particularly for large combinatorial optimization problem. A branch exchange type heuristic algorithm has been suggested by Civanlar et al [8], where a simple formula has been derived to determine how a branch exchange affects the losses. In Shirmohammadi and Hong [9] the solution method starts with a meshed distribution system obtained by considering all switches closed. Then the switches are opened successively to eliminate the loops.

II. PROBLEM FORMULATION

A. Objective function

The main objective is to minimize the losses in radial distribution system in order to improve the voltage profile.

 $Min f = min (P_{T,loss})$

Where $P_{T,loss}$ is the total real power loss of the system.

Constraints

i.Bus voltage limit.

 $V_{\min} \le V_i \le V_{\max}$

Where V_i is voltage magnitude at the ith node and V_{\min} and V_{\max} are the allowable voltage limits at the same bus.

ii. Feeder limit.

$$|I_{f,i}| \le I_{f,i}^{\max}$$
 i=1, 2...N_{feede}

 $|I_{f,i}| \le I_{f,i}^{max}$ $i=1, 2...N_{feeder}$ Where $I_{f,i}$ is the current amplitude and $I_{f,i}^{max}$ is maximum allowable current value in the ith feeder. And N_{feeder} is total number of feeders

iii. Radial structure of network.

$$N_{branch} = N_{bus} - N_{source}$$

Where N_{bus} is the number of buses, N_{source} is number of substations.

III. GRAVITATIONAL SEARCH ALGORITHM

A. Over view of GSA

GSA was introduced by Rashedi et al. in 2009 and is intended to solve optimization problems. The population based heuristic algorithm is based on the law of gravity and mass interactions. The algorithm is comprised of collection of searcher agents that interact with each other through the gravity force [1]. The agents are considered as objects and their performance is measured by their masses. The gravity force causes a global movement where all objects move towards other objects with heavier masses. The slow movement of heavier masses guarantees the exploitation step of the algorithm and corresponds to good solutions. The masses are actually obeying the law of gravity as shown in Equation (1) and the law of motion in Equation (2).

$$\mathbf{F} = \mathbf{G}(\frac{\mathbf{M}_1\mathbf{M}_2}{\mathbf{R}^2}) \tag{1}$$

a = F/M(2)

Based on Equation (1), F represents the magnitude of the gravitational force, G is gravitational constant, M1 and M2 are the mass of the first and second objects and R is the distance between the two objects. Equation (1) shows that in the Newton law of gravity, the gravitational force between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between the objects. While for Equation (2), Newton's second law shows that when a force, F, is applied to an object, its acceleration, a, depends on the force and its mass, M.

In GSA, the agent has four parameters which are position, inertial mass, active gravitational mass, and passive gravitational mass [1]. The position of the mass represents the solution of the problem, where the gravitational and inertial masses are determined using a fitness function. The algorithm is navigated by adjusting the gravitational and inertia masses, whereas each mass presents a solution. Masses are attracted by the heaviest mass. Hence, the heaviest mass presents an optimum solution in the search space. The steps of GSA are as follows:

Step 1: Agents initialization:

The positions of the N number of agents are initialized randomly

$$x_i = (x_i^1, x_i^2, \dots, x_i^d, \dots, x_i^N)$$
 where i=1, 2....N

 x_i^d represents the positions of the i^{th} agent in the d^{th} dimension, while n is the space dimension.

Step 2: Fitness evolution and best fitness computation:

For minimization or maximization problems, the fitness evolution is performed by evaluating the best and worst fitness for all agents at each iteration. Minimization problems:

Best (t) = min fit j (t) (4)
$$J \in \{1 \dots N\}$$

Worst (t) = max fit j (t) (5)
$$J \in \{1 \dots N\}$$

Maximization problems:

Best (t) = max fit j (t) (6)
$$J \in \{1 \dots N\}$$

Worst (t) = min fit j (t) (7)
$$J \in \{1 \dots N\}$$

fit j(t) represents the fitness value of the j^{th} agent at iteration t, best(t) and worst(t) represents the best and worst fitness at iteration t.

Step 3: Gravitational constant (G) computation:

Gravitational constant G is computed at iteration t

$$G(t) = G_0 e^{(-\alpha t/T)}$$
(8)

 G_0 and \propto are initialized at the beginning and will be reduced with time to control the search accuracy. T is the total number of iterations.

Step 4: Masses of the agents' calculation:

Gravitational and inertia masses for each agent are calculated at iteration t.

$$m_{i}(t) = \frac{fit_{i}(t) - worst(t)}{best(t) - worst(t)}$$
(9)

$$M_{i}(t) = \frac{m_{i}(t)}{\sum_{j=1}^{N} m_{j}(t)}$$
(10)

Step 5: Accelerations of agents' calculation:

Acceleration of the ithagents at iteration t is computed.

$$a_i^d(t) = \frac{F_i(t)}{M_i(t)} \tag{11}$$

 $F_i^d(t)$ is the total force acting on i^{th} agent calculated as:

$$F_{i}^{d}(t) = \sum_{i \in K_{hest}} rand_{j} F_{ij}^{d}(t)$$
(12)

Kbest is the set of first K agents with the best fitness value and biggest mass. Kbest will decrease linearly with time and at the end there will be only one agent applying force to the others.

$$F_{ij}^{d}(t) \text{ is computed as the following equation:}$$

$$F_{ij}^{d}(t) = G(t) \frac{M_{i}(t)M_{j}(t)}{R_{ij}(t)+\epsilon} ((x_{j}^{d}(t) - x_{i}^{d}(t))$$
(13)

 $F_{ij}^{d}(t)$ is the force acting on agent i from agent j at d^{th} dimension and ith iteration. $R_{ij}(t)$ is the Euclidian distance between two agents i and j at iteration t. G(t) is the computed gravitational constant at the same iteration while ε is a small constant.

Step 6: Velocity and positions of agents:

Velocity and the position of the agents at next iteration (t+1) are computed based on the following equations:

$$v_i^d(t+1) = rand_i v_i^d(t) + a_i^d(t)$$
 (14)

$$x_i^d(t+1) = x_i^d(t) + v_i^d(t+1)$$
 (15)

Step 7: Repeat steps 2 to 6

Steps 2 to 6 are repeated until the iterations reach their maximum limit. The best fitness value at the final iteration is computed as the global fitness while the position of the corresponding agent at specified dimensions is computed as the global solution of that particular problem. Fig. 1 shows the flowchart of GSA.



Figure 1: Flowchart of GSA

IV. RESULT AND ANALYSIS

For 33 bus-test system before doing network reconfiguration losses in 33bus test system was 79KW and after doing reconfiguration losses becomes 60KW. So after doing network reconfiguration the losses were reduced up to 23.6% for half load condition.

	Total	Loss after	%loss
	loss(KW)	reconf (KW)	reduction(KW)
Case 1:	78.74	60.1625	23.6%
half load			
Case 2:	360.4	264.46	26.6%
full load			
Case 3:	970.8	661.914	31.817%
over load			



Figure 2: single line diagram of 33bus test system



Figure 3 : single line diagram of 33bus test system after reconfiguration



A new powerful evolutionary algorithm has been presented in this paper for the DFR. The proposed DFR problem consists of minimizing the power loss. The considered constraints including the bus voltage limit, feeder limit and radial structure of the network are within their admissible ranges in this approach. The algorithm has been successfully tested for 33 bus test system for different loading condition in distribution network.

Main advantage of using GSA:

• The presented optimization algorithm has low computational time, allowing its application in the context of large scale distribution systems.

• The considered ENS objective function accompanied by other objectives paves the way to have a reliable and economic condition in distributed systems.

VI. REFERENCES

- [1]. López E., Opazo, H., García L. and Bastard, P., "Online Reconfiguration considering Variability Demand: Applications to Real Networks", IEEE Transactions on Power Systems, 2004, vol. 19, no. 1, pp. 549-553.
- [2]. G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (references)
- [3]. J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.
- [4]. I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.
- [5]. R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.
- [6]. Y. J. Jean and J. C. Kim, "An efficient simulated annealing algorithm for network reconfiguration in large-scale distribution systems," IEEE Trans. Power Del., vol. 17, no. 4, pp. 1070–1078, Oct. 2002.
- [7]. Civanlar, S., Grainger, J. J., Yin, H. and Lee, S. S. H. "Distribution Feeder Reconfiguration for Loss Reduction", IEEE Transactions on Power Delivery, 1988, vol. 3, no. 3, pp. 1217 – 1223.
- [8]. Shirmohammadi, D. and Hong, H. W., "Reconfiguration of Electric Distribution for Resistive Line Loss Reduction", IEEE Transactions on Power Delivery, 1989, vol. 4, no. 2, pp. 1492 – 1498.
- [9]. Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].
- [10]. M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

51

Data Swapping in Cloud Computing

Sachida Nanda Barik

M.Tech Computer science and Information Security, KIIT University, Bhubaneswar, Odisha, India

ABSTRACT

In the modern era of fast computing data storage and data retrieval is occurred due to cloud computing. Cloud computing is a pool of computing resources available on demand with the use of internet. it is a term used for the consumption of utility computing resources. it is used to maximize the effectiveness of the shared resources which is currently available on cloud. it relaxes the companies from investing money on heavy infrastructure rather they can used the same resources on shared basis. In the wide use of cloud computing threat comes to storage of data in the cloud server as it not known to the cloud user where there data will be stored they usually reluctant to store their data on cloud. To gain their trust cloud providers are facilitating various user confidentiality methods to stored their data. The purpose of data swapping is to create uncertainty in the minds of the intruder. it is a method to adjust the data values by swapping fraction of records between the records so that the intruder won't get the actual data rather gets scrambled data.

Keywords: Cloud Computing, Computing Data Storage, Erp, Mis, Cloud Storage Server, Infrastructure As A Service, Platform As A Service

I. INTRODUCTION

Today we are in the era of fast computing. We are widely using the concept of distributed computing over the internet which is called cloud computing. Cloud computing is a technology which uses the internet or intranet and central remote servers to maintain the data and applications. Now-a-days it is widely used to make simpler to daily life problems. Cloud computing collects all related information and computing resources and manages them automatically according to the need by using various software's. Through vast data repository around the globe cloud computing gives smart and intelligent services to its user's .by using the services of cloud computing the user can buy computing resources rather to set up vast infrastructure for their organisation without bothering about the setup complexity. the applications are upgraded very easily through internet. The user no needs to do it manually using the upgraded version software. Cloud computing is new utility which many enterprises wants to incorporates in order to improve their way of working. It implies sharing of computing resources to handle applications to make faster execution of their tedious works. by using cloud computing, organizations can use services of the provider and the data is being stored at any physical location outside their own control. It provides development of software environment, allocation and reallocation of existing resources when needed, vast storage and networking facility virtually.

Cloud computing is privileged by virtualization technology. Normally the term cloud computing was influenced by the symbol of cloud which is generally represented in the Internet using workflow steps and systematic diagrams. A specific movement over the clouds is being occurred over the years with the end users since past, minutely keeping a increasing number of personal data which includes bookmarks, various photographs, unlimited music files and many more, on remote servers made available through a network.[1]

II. CLOUD COMPUTING OVERVIEW

The cloud computing model involves three kinds of functional units or components as stated below:

A. Cloud service provider: this is a company, which maintains many Cloud Storage Server (CSS), having large storage space to store the clients data and with

high computation and greater accuracy power. its prime focus is to make profit and take care of sensitive information

B. Client/owner: It is an enterprises or entity or can be individual customer, whom have large data files to be stored in the cloud and relies on the cloud for data maintenance and computation. the client depends on cloud for maintaining their data.

C.User: is an individual who is registered with the service provider and uses the data of the owners data stored on the cloud. The user may be an owner itself also there are basically two models are available for cloud computing. these are service models and deployment models. Under service models there are three types of models are available viz. Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Platform as a Service (PaaS).

Infrastructure as a Service (IaaS) provides all necessary infrastructures on behalf of the customer. it offers on demand resources which are highly scalable which works on the principle of pay per use basis generally the amount of cloud resources being used by the customer. it enables the user to deploy and run various software including operating system software and application softwares.and the cloud user has mastery over various operating systems ,vast storage and already installed application and probably partial control over selected networking gadgets. Platform as a Service (PaaS). it provides a ready to use platform to the registered user to develop and manage customized web application having less complexity. here in cloud the user does not bother about underlying cloud infrastructure but it has the control over installed application and over the environment in which it is being installed. in Software as a Service (SaaS) the software's licence is subscribed for a certain period which is being accessed by the user. it gives the opportunity to use the service providers customized applications running on cloud. the cloud applications being accessed via many client gadgets through an user interface like accessing email on the web. it includes many application comes under SAAS are DBMS software ,MIS software,ERP software and Accounting software.

In cloud computing architecture basically there are four deployment models are present these are private cloud model. public cloud model ,community cloud model and hybrid cloud model according to the definition of Private cloud is being built for a single organisation can gives better control and effectively secure the data. Generally it is of two kinds .first is on site which is hosted within the providers data centre and will be best for the application which needs complete security and another is off site which is hosted outside the data centre of the service provider. Public clouds are maintained and operated by other than the service provider but supported by the service provider. It offers low cost and pay per use model. all the customer is share the pool of infrastructure within configuration. Hybrid cloud is the defined combination of both the private and public cloud .in this some resources are managed by the service provider and some are managed by the third party. it combines services and data from different cloud model to give a well-managed and unified cloud environment. in community cloud the infrastructure is shared among many organisation having common computing goals which forms a specific users community. it is a multi-tenant infrastructure [2].

III. CLOUD COMPUTING FEATURES

The benefits of cloud computing are cost effectiveness, unlimited storage, easy access of information and quick deployment.

A. Cost effective

Now a days it is the most cost efficient method to use, maintain and upgrade the software which is being used by the companies. it reduced the cost of licence software for the company because in cloud, everything is available at much cheaper rates and hence, can significantly lower the company's IT expenses.

B. Unlimited storage

Cloud computing gives almost unlimited storage capacity given by various clod server companies like amazon web services.

C. Easy access of information

Once you stored the information on cloud u can easily access the information with any devices with internet connection.

D. Quick deployment

The software needed by the client can be easily downloaded from the web and it can easily install in the client system within a matter of few minutes.

IV. DRAWBACKS OF CLOUD COMPUTING

Besides advantages there were short comings also in cloud computing described as follows

A. Fluctuation in downloading speed

As the Service Providers of cloud handles a huge traffic of customers every time as a result they get overwhelmed and may face difficulties occurred due to technical glitches and unable to serve request. Business process is being halted and the client unable to access information in that time.

B. Prone to security

Although the service providers for Cloud service providers implemented the best and sophisticated security standards and various industry certifications for accommodating sensitive data and files on its external or agent service providers always prone to risks as intruders are always in search of loop holes.

C. Less data privacy

.the client will always in search of a trust worthy service provider. Once the client upload their data on cloud then they lose direct access to their information and even don't know in which location and server their data is stored. the data can be modified by the service provider itself.

V. PRIVACY PRESERVATION IN CLOUD[7]

While accessing the information the privacy must be maintained as not every information is meant for public users. There are many techniques to preserve data privacy like anonymity method, public auditing schemes, method of multi-keyword ranked search and data combination privacy preservation in cloud to safe guard the interest of the client the service provider adopts many methodologies

VI. DATA SWAPPING

After using all the methods by different author one more prevalent method for data privacy is to swap the data or data swapping. it is a disclosure limitation technique. as it is very old methodology used in data mining concept but it can be used in cloud computing to preserve the data values which is being stored in cloud from the hackers the term Data swapping first introduced by Tore Dalenius and Steven Reiss in the year 1978 as one practical method for protecting disclosure among various data sets micro data (individual record) of databases. Again this concept is being modified by the same author in the year 1982 . it preserves confidentiality by partially modifying the fraction of records among many rerecords in a particular database by switching record attributes with another record pair. it is one types of masking technology in which the data values are not known to the intruder as values always changes.it reduces the chances of deletion of data to safeguard the sensitive data from public.[8]The purpose of data swapping is to retain the amount of information, but randomly perturb data values to maintain confidentiality. Data swapping begins by selecting target records at random, then proceeds by finding a swapping partner for each target record with similar characteristics, and, finally, swaps data values between the target records and their swapping partners.[9] the data swapping procedure has many properties. some of them are as follows:-

(1)it hides the relationship between the end user and the corresponding record. (2) this method can be applied on sensitive or important variable and no need to disturb the variable not related to this swapping.(3)it has designed to give data preservation where needed mostly.. (4) Implementation is very simple.

VII. SWAPPING METHODS[3]

There are two data swapping methods being widely used like Targeted swapping strategy and random swapping strategy

A. Targeted swapping strategy

In this method first check the disclosure level having same control variable between the source and the target variable using a specified swapping rate.

B. Random swapping strategy

here all the elements gets equal chance of being swapped by pairing of one element with other element having same control variable using the iterative loop procedure.

VIII. STEPS INVOLVED IN DATA SWAPPING[4]

Generally it has three steps

Step-I

First to decide whether to implement data swapping or not .if to use data swapping then it is to be used alone or combined with other available statistical disclosure control strategies.

Step-II

International Journal of Scientific Research in Science and Technology (www.ijsrst.com)

Once the data swapping method is being employed disclosure risk function and data utility measure must be selected to calculate the risk associated with the data going to be swapped.[5]

Step-III

For using of data swapping release rate must be well specified by using the following attributes

(i) swap rate:-the piece or fraction of records in the database where swapping is being occurred.

(ii) Swap attributes:-the values of the attributes which is randomly exchanged

(iii) Constraints:-it is used to distinguished between swapped and un swapped attributes.

IX. DATA SWAPPING ADVANTAGES[6]

The data swapping approach has underlying advantages.

- i. Data swapping hides the correct facts about every respective respondent.
- ii. It performs on all important variables (i.e., the variables whose attributes or values keeping together provides to the linking of records with its respondent),this method swapping abolishes all kinds of contact between their record and its respondent.
- iii. This process is very easy and need nothing ,just required couple of things a file containg micro data and a routine to generate arbitrary numbers at random number to implement. The programming is quite simple.
- iv. This swapping process could be applied on selected sets of one (or more) variables, not disconcerting the response which meant for the insensitive and unidentified fields.
- v. The swapping of regular variables delivers safety when most required. Occasional and unique

XI. REFERENCES

- Jensen, Meiko, et al. "On technical security issues in cloud computing." Cloud Computing, 2009. CLOUD'09. IEEE International Conference on. IEEE, 2009.
- [2]. Mell, Peter, and Tim Grance. "The NIST definition of cloud computing." National Institute of Standards and Technology 53.6 (2009): 50.
- [3]. Shlomo, Natalie, Caroline Tudor, and Paul Groom. "Data swapping for protecting census tables."

reactions are often used to determine respondents. These values are expected to be changed continuously. Mostly occurred responses are less expected to be changing for the intruder and have a few chances to be altered during swap.

vi. The process is not restricted or limited only too continuous or regular variables but to categorical variables (race, sex, and occupation) can be swapped. Care must be taken while swapping occurs in categorical variables; otherwise the usefulness of the files will be degraded as it loses true and correct information which in result will create a large number of strange combinations.

X. CONCLUSION

cloud computing is an emerging technology is being used by most of the organisations to save their cost of implementation and building infrasture deployment the client can download the required software or the information rather to develop all the software or to implement in infrasture as is it is time savvy. as there are many advantages in cloud but there were also major drawbacks are also prevailing in cloud .the main drawback is to secure the information and privacy of data and to make the cloud a trustworthy for clients. to preserve the data over cloud various preservation methodology is being used by many authors .the concept about this proposal is to secure the information over cloud using data swapping methods. but to control the disclosure data swapping methods can be used .in cloud for protection of the data using dataswapping is that it will swap or interchange randomly the fraction of information with another randomly so that the intruder will not be sure that what they got that was the correct piece of information.

Privacy in statistical databases. Springer Berlin Heidelberg, 2010.

- [4]. Gomatam, Shanti, Alan F. Karr, and Ashish P. Sanil.
 "Data swapping as a decision problem." JOURNAL OF OFFICIAL STATISTICS-STOCKHOLM- 21.4 (2005): 635.
- [5]. Skinner, Chris J., and M. J. Elliot. "A measure of disclosure risk for microdata." Journal of the Royal Statistical Society: series B (statistical methodology) 64.4 (2002): 855-867.
- [6]. Moore Jr, Richard A. "BUREAU OF THE CENSUS STATISTICAL RESEARCH DIVISION."

55

- [7]. Wang, Jian, et al. "Providing privacy preserving in cloud computing." Test and Measurement, 2009.
 ICTM'09. International Conference on. Vol. 2. IEEE, 2009.
- [8]. Swapping, Categorical Data. "NISS." (2003).
- [9]. Krenzke, Tom, et al. "Data Coarsening and Data Swapping Algorithms."
- [10]. Reiss, Steven P. "Data-swapping--A technique for disclosure control." J. Statistical Planning and Inference 6.1 (1982): 73-85.
- [11]. Fienberg, Stephen E., and Julie McIntyre. "Data swapping: Variations on a theme by dalenius and reiss." Privacy in statistical databases. Springer Berlin Heidelberg, 2004.
- [12]. Datta, Souptik. On random additive perturbation for privacy preserving data mining. Diss. University of Maryland, 2004.
- [13]. Carlson, Michael, and Mickael Salabasis. "A dataswapping technique using ranks—a method for disclosure control." Research in Official Statistics 6.2 (2002): 35-64.

Response Surface Methodology for Optimizing the Parameters of a Roasting Machine Using Maize (*Zea mays L.*)

*1Atere A. O., ²Olukunle O. J., ³Olalusi A. P.

^{1*}Department of Agricultural Engineering, Federal College of Agriculture, Ibadan, Nigeria ^{2,3}Department of Agricultural and Environmental Engineering, Federal University of Technology, Akure, Nigeria

ABSTRACT

A roasting machine performance was evaluated with the objective of investigating the optimal conditions of the factors (speed: 6.6, 12.8, 19, 24 and 30 rpm; temperature: 70, 100 and 150°C and moisture content: 20, 15.8 and 9.5%) that would best yield quality evaluation parameters (roasting capacity, RC; roasting efficiency, RE; conveyance efficiency, CE and quality efficiency, QE). The following instruments, infrared thermometer (digital type), thermocouple, tachometer, weighing balance, grain moisture meter and stop watch were used for temperature, speed, mass, moisture content and time respectively. Surface response methodology was used to study the relationship between the factors and the evaluation parameters. This was achieved by holding constant, conveyor speed, set temperature or moisture content of the maize. The results show that the set temperature, auger speed and moisture content of maize were all significantly influenced all the evaluation parameters. Increasing the auger speed and set temperature will yield a significant increase in the roasting efficiency and roasting capacity. From the study, it was observed that the optimal conditions required to achieve the optimum roasting efficiency were auger speed of 35 rpm and set temperature of 155°C. These conditions give the best roasting efficiency with coefficient of determination of R² equals 79%. **Keywords:** Roaster; Optimization; Surface Response Methodology; Parameters; Maize

I. INTRODUCTION

Maize (Zea mays L.) is a cereal crop, a member of the grass family. It is a domesticated grass that originated approximately 7000 years ago in what is now Mexico [1]. Maize is used primarily as a staple food for human consumption, animal feed and raw material for industrial use. The nutritional components of yellow dent maize are starch 61%, corn oil 3.8%, protein 8%, fiber 11.2% and moisture 16% [2]. Roasting is a cooking method that uses dry heat, whether an open flame, oven, or other heat source. Maize roasting has become popular postharvest operation to obtain highly commercial agricultural products and preserve the products for longer shelf-life [3]. The performances of roaster for different cereal crops were tested at various parameters and studied the characteristics of corn [4]; [5]; [6]; [7]; A number of the research work about properties, compositions and effect of roasting corn at different temperatures have been reported [8]; [9]; [10]; [11]; [12]. The moisture content and harvesting stage of the corn, moisture distribution due to drying have been described [13] and [14]. The principles of heat transfer are based on the energy sources and mode of transporting heat to the system [15]. Optimizing the performance of this roaster is necessary so that the roasting efficiency and quality

efficiency are set at maximum and mechanical damage set at minimum possible.

II. METHODS AND MATERIAL

Study Location

The study location was in the Agricultural Engineering department of the Federal University of Technology Akure. The Maize grains ART/98/SW06-OB-W was obtained from the Institute of Agricultural Research and Training, Moor Plantation, Ibadan. The variety was fortified with protein.

Description of the Roasting machine

The roaster, Figure 1 comprises of a double cylindrical body insulated in-between, an auger that convey the material from the inlet to the outlet, and the conveyor also stirs the material alongside in order to prevent heat concentration on one surface of the material. The roaster is provided with a control switch and it is powered by a speed reduction gear motor.

Measurement of parameters

The moisture content (MCdb) was determine using a microprocessor grain moisture meter, operating time with stopwatch, shaft speed of the roaster using photo/contact tachometer (DT-2236B), temperature which was regulated by temperature controller. The initial moisture content and final moisture content of maize were determined for maize at a pass for toasting machine.



Figure 1. Internal view of the toaster (A-Hopper, B-Auger, C-Shaft, D-Outlet, E-Frame, F-Pulley and G-Electric motor).

Experimentation

A known weight of maize sample was passed through the hopper into the roaster and exit after roasting. The initial moisture content of the grains was recorded before introducing it into the roasted and the temperature of the inside of the roasting chamber was recorded. The final weight and moisture of the product was measure. Part of the product that was left over in the roaster was retrieved and the weight was measured in order to check for the conveyance efficiency of the roaster. A split-split design (SSD) was used to present the data for this research. Each experiment was replicated five times for a chosen speed (6.6, 12.8, 19, 24 and 30 rpm), moisture content (20, 15.8 and 9.5%) and temperature (70, 100 and 150°C). The time taken for each experiment was recorded using a stop work. The roasting capacity (RC), conveyance efficiency (CE), roasting efficiency (RE) and quality efficiency (QE) were determined by the use of existing formulae.

Roasting Capacity
$$C_R$$
, $C_R = \frac{m_r}{t}$ 1

Where m_r is the final mass of collected product (kg) and t is the roasting time (min)

Conveyance Efficiency η_c , $\eta_c = \frac{m_c}{m_c + m_w} 100\%$

where m_w and m_c equal to the mass of maize retained and collected at the outlet respectively.

Roasting efficiency
$$\eta_R$$
, $\eta_R = \frac{m_r}{m_r + m_u} x 100\%$ 3

Where m_r is the mass of roasted product, m_u is the mass of unroasted maize

Quality Efficiency
$$\eta_{q}$$
, $\eta_{q} = \frac{m_{c} - m_{b}}{m_{i}} \%$ 4

Where m_c is the mass of product at outlet, m_b is the mass of broken maize and m_i is the mass of maize fed into the roaster.

Optimization

Surface response methodology was used to study the relationship between the explanatory variables (speed, temperature and moisture content) and the response variables (*RC*, *RE*, *CE* and *QE*). This was achieved by holding constant conveyor speed, set temperature or moisture content of the maize Design expert version 8.0.7.1 was used.

III. RESULTS AND DISCUSSION

Effect of speed, temperature and moisture content on roasting capacity, RC

The regression model obtained for roasting capacity RC:

RC = +3.73075 - 0.035424 * T + 0.39199 * v - 0.24582 * MC - 5.24990E-004 * T * v +2.82631E-003 * T * MC - 9.18911E-003 * v * MC with an R² of 49.95%.

There was a significant ($p \le 0.05$) influence of the 2FI factor of speed. It was observed from the statistical analysis that speed had significant ($p \le 0.05$) 2FI effect on the model. The model could explain about 49.95% of the variations in the roasting capacity level. Thus about 50% of the variation was due to other factors not included in the model. As shown in the response plots (Figure 2a-c), speed had significant effects on the roasting capacity. The roasting capacity was found to increase with increasing speed. The estimated responses surfaces (Figure 2a-c) confirm that the speed of the auger have a positive effect on the roasting capacity (RC) of the roaster. The set temperature has a neutral/constant effect. The moisture content of maize grains before roasting has a negative effect on the response but mainly at low and mild levels of set temperature. The effect of maize grains moisture is always 2FI in the studied range of temperature. Figure 10 show that it is possible to obtain a high RC of roaster for a low temperature $(65^{\circ}C)$ but at high speed (35 rpm).

2



Figure 2: Response surface contours for roasting capacity, RC of roaster. For each contour plots, the third variable is fixed.

Effect of factors on the roasting efficiency, RE of roaster

The model obtained for RE:

RE = +52.30983 + 0.48975 * temp - 0.71211 * speed - 3.72852 * MC - 0.010562*temp*speed-4.78808E-003*temp*MC + 7.70354E-003 * speed * MC - 3.59995E-004*temp² + 0.066662 * speed² + 0.11347 * MC² with an R² of 79.82%

There was a strong and significant influence of the quadratic factors of conveyor speed, moisture content of maize and temperature on the roasting efficiency. Statistical analysis conducted on the data showed that conveyor speed, moisture content of maize and temperature had significant ($p \le 0.05$) quadratic effects on the model. The model could explain 79.82% of the variations in roasting efficiency, meaning only 20.0% of the variation were due to other factors not included in the model. The response plots (Figure 3a-c) show that speed, moisture content and temperature, all had significant effects on the roasting efficiency of the roaster with significant interaction between all the factors. The response surface plots generated showed curvilinear plots with both conveyor speed and moisture content of maize (Figure 3a-c). This implies that the roasting efficiency of the roaster increased as speed and temperature increased.



Figure 3: Response surface contours for roasting efficiency, RE of roaster. For each contour plots, the third variable is fixed.

Effect of speed, temperature and moisture content on conveyance efficiency, CE

The regression model obtained for conveyance efficiency CE:

CE = +116.15936 -0.040800 * temp -0.53913 * speed - 0.82425 * MC with an R^2 of 47.26%

There was a significant ($p \le 0.05$) influence of the linear factors of conveyor speed, and moisture content of maize on the conveyance efficiency. It was observed from the statistical analysis that both conveyor speed and moisture content of maize had significant ($p \le 0.05$) linear effect on the model. The model could explain about 47.26% of the variations in conveyance efficiency. As shown in the response plots (Figure 4a–c), both speed, and moisture content had significant effects on the conveyance efficiency of the maize.



Figure 4 : Response surface contours for conveyance efficiency, CE of roaster. For each contour plots, the third variable is fixed.

Effect of speed, temperature and moisture content on quality efficiency, QE

The regression model obtained for quality efficiency QE:

QE = +94.18063 -0.23675 * temp +1.25776 * speed +1.45696 * MC +2.96819E-003 * temp * speed - 7.07416E-004 * temp * MC -0.13407 * speed * MC with an R^2 of 84.97%

The results of regression analysis show that all the factors did affect quality efficiency QE (p < 0.05), the analysis of variance reveals that regression was statistically significant at 84.97% confidence level, and the high coefficient of determination ($R^2 = 84.97$) demonstrates that the model could be used to explain 84.97% of the total variation in the response. As Figure 5 shows, quality efficiency QE optimization required simultaneous decrease in speed and temperature. The best QE values were attained working at low speed and low temperature, conditions under which a slight reduction in the parameters will yield a corresponding increase in the quality efficiency.



Figure 5 : Response surface contours for quality efficiency, QE of roaster. For each contour plots, the third variable is fixed.

IV.CONCLUSION

Surface response can be used to evaluate the effect of temperature, speed and moisture content on the optimal evaluation parameters during roasting. The results show that the set temperature, auger speed and moisture content of maize were all significantly influenced all the evaluation parameters. Increasing the auger speed and set temperature will yield a significant increase in the roasting efficiency and roasting capacity. From the study, it was observed that the optimal conditions required to achieve the optimum roasting efficiency were auger speed of 35 rpm and set temperature of 155° C. These conditions give the best roasting efficiency with coefficient of determination of R² equals 79%.

V. REFERENCES

- Brown W., and Darrah L., 1985. "Origin, adaptation, and types of corn," Natl. Corn Handbook. Cooperative Extension Service. Iowa State University. Iowa NCH-10.
- [2]. Davis K. S. 2001. "Corn Milling, Processing and Generation of Co-products," Technical Symposium,

60

Minnesota Corn Growers Association. Minnesota Nutrition Conference, September 11, 2001.

- [3]. Yang W., Winter P., Sokhansanj S., Wood H. and Crerer B. (2005). "Discrimination of hard-to-pop popcorn kernels by machine vision and neural networks," Biosystems Engineering, 91(1):, 1-8.
- [4]. Bennett A. S., Bern C. J., Richard T. L. and Anex R. P., 2007. "Corn grain drying using corn Stover combustion and CHP systems," Transaction of the ASABE, 50(6): 2161-2170.
- [5]. Bhattacharya S. (1995). "Kinetics of hydration of raw and roasted corn semolina," Journal of Food Engineering, 25: 21-30.
- [6]. Butkarev A. A. (2007). "Design of optimal (energy efficient) roasting systems," Steel in Translation, 37: 756-763.
- [7]. Jha S. N. (2005). "Mathematical simulation of roasting of grain." Journal of Food Engineering, 71: 304-310.
- [8]. Costa P. M. A., Jensen A. H., Harmon B. G. and Norton H. W. (1977). "Effect of roasting and roasting temperatures on the nutritive value of high-moisture corn for swine," Journal of Animal Science, 44:, 234-241.
- [9]. Felsman R. J., Harvey R. W., Linnerud A. C. and Smith F. H. (1976). "Effect of roasting temperature on corn grain characteristics," Journal of Animal Science, 42(2): 476-480.
- [10]. Karababa E. (2004). "Physical properties of popcorn kernels," Journal of Food Engineering, 72:, 100-107.
- [11]. Sacchetti G., Mattia C. D., Pittia P. and Mastrocola D. (2009). "Effect of roasting degree, equivalent thermal effect and coffee type on the radical scavenging activity of coffee and their phenolic fraction," Journal of Food Engineering, 90:, 74-80.
- [12]. Tonroy B. R. and Perry T. W. (1974). "Effect of roasting corn at different temperatures on grain characteristics and in vitro starch digestibility," Journal of Diary Science, 58(4):.566-569.
- [13]. Marton L. C., Tamas A. and Peter B. (2001). "Grain Moisture of Maize Hybrids in Different Maturity Groups at Various Harvesting Dates," Agriculture Research Institute of Academy and Science, Hungarian.
- [14]. Salunkhe D. K., Chavan J. K and Kadam S. S. (1985)."Postharvest Biotechnology of Cereals," CRC Press, Inc. Boca Raton, Florida.
- [15]. Gupta C. P. (2003). "Engineering Heat Transfer," Mechanical Engineering Department, University of Roorkee, India.

Speed Control of DC Motor Using Microcontroller

Katke S.P*1, Rangdal S.M²

 $$^{*1}\mbox{ Electrical Department, BMIT, Solapur , Maharashtra, India}2 Electronics Engineering Department, VVPIT, Solapur , Maharashtra, India

ABSTRACT

ISRST

Direct current (DC) motor has already become an important drive configuration for many applications across a wide range of powers and speeds. The ease of control and excellent performance of the DC motors will ensure that the number of applications using them will continue grow in future. This paper is mainly concerned on DC motor speed control system by using microcontroller PIC 16F877A. It is a closed-loop control system, where optical encoder (built in this project) is coupled to the motor shaft to provide the feedback speed signal to controller. Pulse Width Modulation (PWM) technique is used where its signal is generated in microcontroller. The PWM signal will send to motor driver to vary the voltage supply to motor to maintain at constant speed. Through this paper, it can be concluded that microcontroller PIC 16F877A can control motor speed at desired speed although there is a variation of load.

Keywords: DC Shunt Motor, Optical Encoder, Pulse Width Modulation (PWM), H-Bridge Using MOSFET, Peripheral Interface Controller (PIC).

I. INTRODUCTION

Direct current (DC) motors have variable characteristics and are used extensively in variable-speed drives. DC motor can provide a high starting torque and it is also possible to obtain speed control over wide range. It is important to make a controller to control the speed of DC motor in desired speed. DC motor plays a significant role in modern industrial. These are several types of applications where the load on the DC motor varies over a speed range. These applications may demand highspeed control accuracy and good dynamic responses.

DC motors are suitable for belt-driven applications and the applications where great amount of torque is required. In Train and automotive traction, fuel pump control, electronic steering control, engine control and electric vehicle control are good examples of these. In aerospace, there are a number of applications, like centrifuges, pumps, robotic arm controls, gyroscope controls and so on. For precise speed control of servo system, closed-loop control is normally used. Basically, the block diagram and the flow chart of the speed control are shown in Figure 1 & Figure 10. The speed, which is sensed by optical sensing devices (e.g., LED & Photo diode), is compared with the reference speed to generate the error signal and to vary the armature voltage of the motor.

II. SPEED CONTROL USING MOSFET

Figure 1 shows the block diagram of DC motor speed control by using MOSFET. The MOSFET is used to supply a variable DC voltage to motor, thus it can control the speed of motor. The average output of voltage is given by

$$V_{\rm ave} = \frac{V_{\rm m}}{2\pi} (1 + \cos\alpha)$$

where Vm = peak voltage of voltage supply and $\alpha = firing angle$



Figure 1: Block diagram of DC Motor speed control by using MOSFET

By controlling the firing angle, α , the average of output DC voltage can be varied. If the motor speed is low, the speed sensor frequency will be below the reference frequency. The frequency difference produces a change in the firing circuit that causes the MOSFET to fire sooner (firing angle, α is reduced). There is a resulting increase in motor speed which brings the output speed back up to the value which is equal to the reference signal.

Conversely, if the speed sensor output frequency is above the reference, then the firing circuit will be modified to allow the MOSFET to conduct for a shorter period of time, the decrease in conduction reduces the DC motor speed. The average of voltage that supply to DC motor is given by,

$$V_{ave} = \frac{t_{on}}{T} \times V_{in}$$

Where Vave = average voltage supply to DC motor

ton = time ON of switches (ie. Duty Cycle) T = period of PWM



Figure 2: PWM Signal

As the amount of time that the voltage is on increases compared with the amount of time that it is off, the average speed of the motor increases and vice versa. The time that it takes a motor to speed up and slow down under switching conditions is depends on the inertia of the rotor (basically how heavy it is), and how much friction and load torque there is.



Figure 3: PWM waveform at 10 to 100 % on DSO



Figure 4: Relation of armature voltage with motor speed

III. SPEED MEASUREMENT BY USING OPTICAL ENCODER



Figure 5: Optical Encoder

An optical encoder is a elector mechanical system which consist of a disc which is mounted on motor shaft & half surface of disc is covered with reflective material. An IR Emitter is a light emitting diode (LED) IR Receivers is also called sensors since they detect the wavelength and spectral radiation of the light from the IR emitter. Photo reflectors or reflective type sensors are side-by-side emitter-sensor (photo interrupter) devices that detect reflected beams from a surface. Reflected beam is converted into electrical pulses of 0-5V. Counting of pulses is converted into speed of motor in rpm.

IV. ISOLATION AND DRIVER CIRCUIT





Figure 6: Opto coupler as Isolator & Driver

An Optocoupler, also known as an Optoisolator or Photo-coupler, is an electronic component that interconnects two separate electrical circuits by means of a light sensitive optical interface.

The basic design of an optocoupler consists of an LED that produces infra-red light and a semiconductor photo-

sensitive device that is used to detect the emitted infrared beam. Both the LED and photo-sensitive device are enclosed in a light-tight body or package with metal legs for the electrical connections as shown. An optocoupler or opto-isolator consists of a light emitter, the LED and a light sensitive receiver which can be a single photodiode, or photo-transistor.

When pulse of PWM from PIC, current passes through the input LED which emits an infra-red light whose intensity is proportional to the electrical signal. This emitted light falls upon the base of the photo-transistor, causing it to switch-ON and conduct in a similar way to a normal bipolar transistor. The base connection of the photo-transistor can be left open for maximum sensitivity or connected to ground via a suitable external resistor to control the switching sensitivity making it more stable.

When the current flowing through the LED is interrupted, the infra-red emitted light is cut-off, causing the photo-transistor to cease conducting. The phototransistor can be used to switch current in the output circuit. R1 is 220 ohm & R2 is 2.2 K ohm. R1 is used to limit the current through optocoupler at input side which is 50 mA. At output side R2 - 2.2K is used to limit the current. Due to R2 the small curve like shape appears in the leading & trailing edge of PWM, Inverter CD 4069 is used invert the signal & makes the PWM edges sharp. By using this circuit we keep isolate the PIC circuit & driver circuit. Driver circuit is used to drive the power MOSFET, to turn on the MOSFET (IRFP 460) we require ± 20 V between gate to source (rated value). But ±12 V is also sufficient to conduct MOSFET. So output of inverter is connected to the gate of MOSFET, H-Bridge is consist of four MOSFET therefore four separate sections of Isolator & drivers are formed as shown in fig.6 actual photo of circuit

V. H-BRIDGE



Figure 7: H-Bridge



Figure 8: Actual H-Bridge Circuit

In general an H-bridge is a rather simple circuit, containing four switching element, with the load at the center, in an H-like configuration. The switching elements (Q1, Q2, Q3, Q4) are usually MOSFET. The basic operating mode of an H-bridge is fairly simple: if Q1 and Q4 are turned on, the left lead of the armature will be connected to the power supply, while the right lead is connected to ground. Current starts flowing through the armature which energizes the motor in (let's say) the forward direction and the motor shaft starts spinning. If Q2 and Q3 are turned on, the reverse will happen, the motor gets energized in the reverse direction, and the shaft will start spinning backwards.

Field winding of DC motor already connected to the fixed 200V DC supply. For controlling the speed of motor the controlled voltage is applied to the armature through switching elements such as MOSFET. For smooth operation it is necessary to connect capacitor across the load. The capacity of H-Bridge circuit depends upon the capacity of switching elements (MOSFET), in this project the IRFP 460 MOSFET's are used, which can support 500 V DC, 20 A. Current & voltage rating of MOSFET should twice than the motor rating of safe operation, otherwise MOSFET can burnout due to high current.

In this bridge, never close both Q1 and Q2 (or Q3 and Q4) at the same time. If we did that, just have created a low-resistance path between power and GND, effectively short-circuiting the power supply. This condition is called 'shoot-through' and it is quickly destroy bridge.

VI. METHODOLOGY



Figure 9: Functional Block Diagram

PIC 16F877A is the heart of the project, which compare actual speed of DC motor with reference speed. Optical encoder circuit converts actual speed in square wave form. As the motor speed changes frequency of the square wave also changes. Reference speed given to the system through PC. PIC 16F877A generate control signal which is proportional to the difference between actual and reference speed. The control signals are in the form of PWM wave having constant frequency.

PWM wave is used to turn ON/OFF the power MOSFET, connected in H- bridge configuration. This arrangement provides facility for speed reversal of DC motor. So the armature winding get average DC voltage which determine the speed of DC motor.



Figure 10: Basic flow chart of DC motor speed control

It is possible to obtain control the speed of motor over very wide range from few rpm to thousand rpm (depends up on the motor specification). Field voltage of DC shunt motor is kept maximum & armature voltage is varying i.e.160V, 180V, 200V etc. according to the PWM % speed of motor is directly proportional as shown in fig. 11.

VII. OBSERVATIONS AND RESULT

The results obtained are discussed as follows.





Figure 12: Set Speed at 600 rpm, response of PWM at mechanical load

When mechanical load is applied on motor then speed of motor decreases and PWM % start increasing to maintain constant speed. When mechanical load is removed speed of motor increased due to wider PWM % to maintain speed at set value, PWM % start decreasing. Fig. 12 shows set speed at 600 RPM, PWM 23 %, at 0.5 Kg load, speed decrease up to 360 RPM and PWM start increasing up to 33%. When load is removed speed increase up to 780 RPM, again PWM % start decreasing up to 23%. For 1 Kg load PWM increased from 23 % to 47 % and after remove of 1 Kg load current speed becomes 1020 RPM and PWM % start decreasing to maintain constant speed. This control action taken by controller after comparing set speed with current speed.

VIII. CONCLUSION

Recent developments in science and technology provide a wide range scope of applications of high performance DC motor drives in area such as rolling mills, chemical process, electric trains, robotic manipulators and the home electric appliances require speed controllers to perform tasks. DC motors have speed control capabilities, which means that speed, torque and even direction of rotation can be changed at anytime to meet new condition. The goal of this project is to design a DC motor speed control system by using microcontroller PIC16F877A. It is a closed-loop control system. The controller will maintain the speed at desired speed when there is a variation of load. By varying the
PWM signal from microcontroller (PIC 16F877A) to the motor driver, motor speed can be controlled back to desired value easily.

I. REFERENCES

- [1] Muhammad H. Rashid. Power Electronics Circuits, Devices and Applications. 3rd edition. United States of America: Prentice Hall. 2004.
- [2] Christopher A. Adkins and Michael A. Marra, Modeling of a Phase-Locked Loop Servo Controller with Encoder Feedback. IEEE Spectrum, August 1999. 51-56.
- [3] Moore, A.W. Phase-Locked Loops for Motor-Speed Control. IEEE Spectrum, April 1973. 61-67.
- [4] P. C. Sen and M. L. MacDonald. Thyristorized DC Drives with Regenerative Braking and Speed Reversal. IEEE Transactions on Energy Conversion, 1978, Vol. IECI-25, No. 4: 347-354.
- [5] http://homepages.which.net/paul.hills/SpeedControl/ Speed ontrollersBody.html.
- [6] Abu Zaharin Ahmad and MohdNasirTaib. A study On the DC Motor Speed Control by Using Back-EMF Voltage. Asia SENSE SENSOR, 2003, 359-364.
- [7] Iovine John. PIC Microcontroller Project Book. 2nd Edition. Singapore: McGraw-Hill. 121-123; 2000.
- [8] Sjhinskey, FG. Process Control Systems. 2ndEdition, Singapore: McGraw-Hill Book Company, 2003.
- [9] www.wikipedia.com

Quantitative Assessment on Fitting of Gumbel and Frechet Distributions for Extreme Value Analysis of Rainfall

N. Vivekanandan

Central Water and Power Research Station, Pune, Maharashtra, India

ABSTRACT

Rainfall frequency analysis plays an important role in hydrologic and economic evaluation of water resources projects. It helps to estimate the return periods and their corresponding event magnitudes thereby creating reasonable design criteria. Depending on the size, life time and design criteria of the structure, different return periods are generally stipulated for adopting Extreme Value Analysis (EVA) results. This paper illustrates the use of quantitative assessment on fitting of Gumbel (EV1) and Frechet (EV2) probability distributions to the series of annual 1-day maximum rainfall (AMR) data using Goodness-of-Fit (GoF) and diagnostic tests. Order Statistics Approach (OSA) is used for determination of parameters of the distributions. Based on GoF (using Anderson-Darling and Kolmogorov-Smirnov) and diagnostic (using D-index) test results, the study identifies the EV1 distribution is better suited for EVA of rainfall for Fatehabad and Hissar.

Keywords: Anderson-Darling, D-Index, Frechet, Gumbel, Kolmogorov-Smirnov, Rainfall

I. INTRODUCTION

Estimation of rainfall for a desired return period is a prerequisite for planning, design and operation of various hydraulic structures such as dams, bridges, barrages and storm water drainage systems. Depending on the size, life time and design criteria of the structure, different return periods are generally stipulated for adopting Extreme Value Analysis (EVA) results. For arriving at such design values, a standard procedure is to analyse historical annual 1-day maximum rainfall (AMR) data over a period of time (yr) and arrive at statistical estimates.

In probabilistic theory, the Extreme Value Distributions (EVDs) include Generalised Extreme Value (GEV), Gumbel (EV1), Frechet (EV2) and Weibull (EV3) is generally adopted for EVA of rainfall [1-3]. EVDs arise as limiting distributions for the sample of independent, identically distributed random variables, as the sample size increases. Out of number of parameter estimation methods, Order Statistics Approach (OSA) is applied for determination of distributional parameters because of the OSA estimators are having minimum variance. In

this paper, GEV and EV3 distributions are not considered for EVA of rainfall due to non-existence of OSA for determination of distributional parameters. Number of studies carried out different researchers illustrated that there is no unique distribution is available for EVA of rainfall for a region or country [4-10]. This apart, when different distributions are used for estimation of rainfall, a common problem is encountered as regards the issue of best model fits for a given set of data. This can be answered by quantitative assessment using Goodness-of-Fit (GoF) and diagnostic tests; and the results are quantifiable and reliable [11].

For quantitative assessment on rainfall within in the recorded range, Anderson-Darling (\mathbf{A}^2) and Kolmogorov-Smirnov (KS) tests are applied for checking the adequacy of fitting of EV1 and EV2 distributions to the series of AMR data. A diagnostic test of D-index is used for the selection of suitable probability distribution for estimation of rainfall. In this paper, quantitative assessment on fitting of EV1 and EV2 probability distributions is made to identify the best suitable distribution for estimation of rainfall for Fatehabad and Hissar.



II. METHODS AND MATERIALS

The Cumulative Distribution Functions (CDFs) of EV1 and EV2 distributions are expressed by:

$$F(R) = e^{-e^{-\left(\frac{R_G - \alpha_G}{\beta_G}\right)}}, \alpha_G, \beta_G > 0 \text{ (for EV1)} \qquad \dots (1)$$

 $F(R) = e^{-\left(\frac{R_F}{\beta_F}\right)^{(-\lambda_F)}}, \alpha_{F,\beta_F} > 0 \text{ (for EV2)} \qquad \dots (2)$

Here, α_G and β_G are the location and scale parameters of EV1 distribution. The rainfall estimates (R_G) adopting computed EV1 distribution are from $R_G = \alpha_G + Y_T \beta_G$ with $Y_T = -\ln(-\ln(1 - (1/T)))$. Similarly, β_F and λ_F are the scale and shape parameters of EV2 distribution. Based on extreme value theory, EV2 distribution can be transformed to EV1 distribution logarithmic transformation. Under through this transformation, the rainfall estimates (R_F) adopting EV2 distribution are computed from $R_F = Exp(R_G)$, $\beta_{\rm F} = \text{Exp}(\alpha_{\rm G})$ and $\lambda_{\rm F} = 1/\beta_{\rm G}$ [12].

Theoretical Descriptions of OSA

OSA is based on the assumption that the set of extreme values constitutes a statistically independent series of observations. The parameters of EV1 distribution are given by:

$$\alpha_{\rm G} = r^* \alpha_{\rm M}^* + r' \alpha_{\rm M}'; \qquad \beta_{\rm G} = r^* \beta_{\rm M}^* + r' \beta_{\rm M}' \qquad \dots (3)$$

where r^* and r' are proportionality factors, which can be obtained from the selected values of k, n and n' using the relations $r^* = kn/N$ and r' = n'/N. Here, N is the sample size of the basic data that are divided into k sub groups of n elements each leaving n' remainders; and N can be written in the form of N=kn+n'. In OSA, α_M^* and β_M^* are the distribution parameters of the groups and α_M' and β_M' are the parameters of the remainders, if any. These can be computed from the following equations:

$$\alpha_{M}^{*} = (1/k) \sum_{i=1}^{n} \alpha_{ni} S_{i} \text{ and } \alpha_{M}^{'} = \sum_{i=1}^{n} \alpha_{ni} R_{i} \qquad \dots (4)$$

$$\beta_{M}^{*} = (1/k) \sum_{i=1}^{n} \beta_{ni} S_{i} \text{ and } \beta_{M}^{i} = \sum_{i=1}^{n} \beta_{ni} R_{i} \qquad \dots (5)$$

where $S_i = \sum_{i=1}^{k} R_{ij}$, j=1,2,3,..,n. Here, R_i is the ith observation in the remainder group having n' elements, R_{ij} is the ith observation in the jth group having n elements. Table 1 gives the weights of α_{ni} and β_{ni}

used in determination of parameters of the distributions [13]. The parameters are further used to estimate the rainfall for different return periods. The Standard Error (SE) on the estimated rainfall is computed by:

SE =
$$[Var(R_T)]^{1/2}$$
 and $Var(R_T) = r^*R_n + r'R_{n'}$
 $r^* = \frac{1}{k} \left(\frac{kn}{N}\right)^2$ and $r' = \left(\frac{n'}{N}\right)^2$... (6)

Here, R_n and $R_{n'}$ are defined by the general form as $R_n = (A_n Y_T^2 + B_n Y_T + C_n)\beta_G^2$. Here R_T denotes the estimated rainfall by either R_G or R_F . The values of A_n , B_n , and C_n are given in Table 2.

Table 1 Weights of α_{ni} and β_{ni} for computation of distributional parameters

α_{ni} (or)			i			
β _{ni}	1	2	3	4	5	6
α _{2i}	0.91637	0.08363				
α _{3i}	0.65632	0.25571	0.08797			
α _{4i}	0.51099	0.26394	0.15368	0.07138		
α _{si}	0.41893	0.24628	0.16761	0.10882	0.05835	
α _{6i}	0.35545	0.22549	0.16562	0.12105	0.08352	0.04887
β _{2i}	-0.72135	0.72135				
β _{3i}	-0.63054	0.25582	0.37473			
β_{4i}	-0.55862	0.08590	0.22392	0.24879		
β _{5i}	-0.50313	0.00653	0.13046	0.18166	0.18448	
β _{6i}	-0.45927	-0.03599	0.07319	0.12672	0.14953	0.14581

TABLE 2 VARIANCE DETERMINATORS FOR $R_{_{\rm N}}$

n	A _n	$\mathbf{B}_{\mathbf{n}}$	C _n
2	0.71186	-0.12864	0.65955
3	0.34472	0.04954	0.40286
4	0.22528	0.06938	0.29346
5	0.16665	0.06798	0.23140
6	0.13196	0.06275	0.19117

Goodness-of-Fit Tests

The adequacy of fitting of probability distributions to the series of recorded AMR is evaluated by quantitative assessment using GoF tests statistic. Theoretical description of A^2 test statistic is as follows:

$$A^{2} = (-N) - (1/N) \sum_{i=1}^{N} \begin{cases} (2i-1) \ln(Z_{i}) \\ + (2N+1-2i) \ln(1-Z_{i}) \end{cases} \qquad \dots (7)$$

Here $Z_i = F(R_i)$ for i=1,2,3,...,N with $R_1 < R_2 < < R_N$, $F(R_i)$ is the CDF of ith sample (R_i) and N is the sample size. The theoretical value (A_C^2) of A^2 statistic for different sample size (N) at 5% percent significance level is computed from $A_C^2 = 0.757(1 + (0.2/\sqrt{N}))$. The KS statistic is defined by:

$$KS = Max_{i=1}^{N} (F_{e}(R_{i}) - F_{D}(R_{i})) \qquad \dots (8)$$

Here $F_e(X_i)$ is the empirical CDF of X_i and $F_D(X_i)$ is the computed CDF of X_i (Zhang, 2002). The theoretical value KS statistic for different sample size (N) at 5% significance level is available in the technical note on 'Goodness-of-Fit Tests for Statistical Distributions book' [14].

Test criteria: If the computed values of GoF tests statistic given by probability distribution are less than that of theoretical values at the desired significance level then the distribution is considered to be acceptable for EVA of rainfall at that level.

Diagnostic Test

The selection of a suitable probability distribution for EVA of rainfall is performed through D-index test [12], which is defined as below:

D-index =
$$\left(1/\overline{R}\right)_{i=1}^{6} \left|R_{i} - R_{i}^{*}\right|$$
 ... (9)

Here, \overline{R} is the average value of the recorded data whereas R_i and R_i^* are the highest recorded and corresponding estimated values by EV1 and EV2. The distribution having the least D-index is considered as better suited distribution for rainfall estimation [15].

III. APPLICATION

In this paper, a study was carried out to estimate the rainfall for different return periods for Fatehabad and Hissar adopting EV1 and EV2 distributions (using OSA). Daily rainfall data recorded at Fatehabad for the period 1954 to 2011 and Hissar for the period 1969 to 2011 was

used. From the scrutiny of the daily rainfall data, it was observed that the data for the intermittent period for Fatehabad and Hansi (1966 and 1967) and Hissar (2002) are missing. So, the AMR for the missing years were imputed by the series maximum value of 140 mm (for Fatehabad) and 256.5 mm (for Hissar) in accordance with Atomic Energy Regulatory Board guidelines and used for EVA. Table 3 gives the descriptive statistics of AMR recorded at Fatehabad and Hissar.

TABLE 3 DESCRIPTIVE STATISTICS OF AMR

Region	Descriptive statistics				
	\overline{R} (mm)	SD (mm)	Skewness	Kurtosis	
Fatehabad	61.2	28.0	0.571	0.266	
Hissar	90.0	51.0	1.674	2.909	
SD: Standard Deviation					

IV. RESULTS AND DISCUSSIONS

By applying the procedures as described above, a computer program was developed and used to fit the AMR recorded at Fatehabad and Hissar. The program computes the rainfall estimates for different return periods adopting EV1 and EV2 distributions (using OSA), GoF tests statistic and D-index values. Table 4 gives the rainfall estimates (ER) together with Standard Error (SE) adopting EV1 and EV2 distributions for the stations under study. From Table 4, it may be noted that the estimated rainfall by EV2 distribution is relatively higher than the corresponding values of EV1 for Fatehabad and Hissar.

TABLE 4
ESTIMATED RAINFALL WITH STANDARD ERROR ADOPTING EV1 AND
EV2 DISTRIBUTIONS (USING OSA) FOR FATEHABAD AND HISSAR

Return	Estimated rainfall (mm) with standard error (mm) for							
period		Fatehabad				Hissar		
(yr)	EV	/1	EV	/2	EV	V1	EV	V2
	ER	SE	ER	SE	ER	SE	ER	SE
2	57.5	3.4	50.4	3.5	85.3	7.0	74.7	6.9
5	82.1	5.4	82.2	9.3	129.4	11.2	129.9	19.6
10	98.5	7.1	113.6	17.2	158.7	14.8	187.4	38.1
20	114.1	8.9	154.9	29.7	186.7	18.4	266.3	69.1
50	134.4	11.2	231.4	57.4	223.0	23.3	419.6	142.0
100	149.6	13	312.7	91.5	250.2	27.0	590.0	237.0
200	164.8	14.7	422.1	143.0	277.3	30.7	828.5	388.1
500	184.7	17.1	626.9	252.7	313.0	35.6	1296.6	728.6
1000	199.8	18.9	845.3	383.8	340.0	39.3	1818.9	1158.3
2000	214.9	20	1139.8	435.2	367.0	43.7	2551.5	2226.2
5000	234.9	23.1	1691.9	980.6	402.7	48.0	3990.5	3294.1
10000	249.9	24.9	2281.1	1453.4	429.7	51.8	5597.0	5112.9

Analysis Based on GoF Tests

For quantitative assessment on fitting of EV1 and EV2 distributions to the recorded AMR data, GoF

tests statistic values were computed from Eqs. (7) and (8), and given in Table 5.

 TABLE 5

 COMPUTED AND THEORETICAL VALUES OF GOF TESTS STATISTIC

Region	A^2				K	S
	Compute	ed values	Theoretical value at	Compute	ed values	Theoretical value at
	EV1	EV2	5% level	EV1	EV2	5% level
Fatehabad	0.599	2.433	0.777	0.050	0.131	0.175
Hissar	0.947	0.913	0.780	0.070	0.122	0.203

From the GoF tests results given in Table 5, it may be noted that the KS test confirmed the use of EV1 and EV2 distributions (using OSA) for EVA of rainfall (Fatehabad and Hissar). Similarly, A^2 test confirmed the use of EV1 distribution for EVA of rainfall for Fatehabad. As regards EVA of rainfall for Hissar, A^2 test suggested the EV1 and EV2 distributions were not acceptable.

Analysis Based on Diagnostic Test

For the selection of a suitable probability distribution, Dindex values of EV1 and EV2 distributions are computed from Eq. (9) and given in Table 6. From the results, it may be noted that the D-index values of EV1 distribution are minimum when compared with the corresponding values of EV2 for the stations under study.

TABLE 6 D-INDEX VALUES OF EV1 AND EV2

Region	D-index		
	EV1	EV2	
Fatehabad	1.373	4.844	
Hissar	2.138	4.104	

Based on quantitative assessment using GoF and diagnostic tests, the study showed that the EV1 distribution is better suited for estimation of rainfall for Fatehabad and Hissar. Figures 1 and 2 give the plots of recorded and estimated rainfall using EV1 (OSA) with confidence limits at 84.13 percentage level for Fatehabad and Hissar.



FIGURE 1: RECORDED AND ESTIMATED 1-DAY MAXIMUM RAINFALL USING EV1 (OSA) DISTRIBUTION WITH 84.13 PERCENT LOWER AND UPPER CONFIDENCE LIMITS FOR FATEHABAD



FIGURE 2: RECORDED AND ESTIMATED 1-DAY MAXIMUM RAINFALL USING EV1 (OSA) DISTRIBUTION WITH 84.13 PERCENT LOWER AND UPPER CONFIDENCE LIMITS FOR HISSAR

V.CONCLUSIONS

The paper presented the procedures involved in quantitative assessment on fitting of EV1 and EV2 distributions (using OSA) for EVA of rainfall for Fatehabad and Hissar. The KS test results confirmed the fitting of EV1 and EV2 distributions to the series of AMR recorded at the stations under study. The A^2 test results suggested the use of EV1 distribution for EVA of rainfall for Fatehabad. The diagnostic analysis showed that the EV1 distribution is better suited for estimation of rainfall for Fatehabad and Hissar. By considering the design-life of the structure over the entire intended economic lifetime, the 10000-yr return period Mean+SE

(where Mean denotes the estimated rainfall and SE the Standard Error) values of about 275 mm (for Fatehabad) and 482 mm (for Hissar) computed from EV1 (OSA) distribution were suggested for design purposes.

ACKNOWLEDGEMENTS

The author is grateful to the Director, Central Water and Power Research Station, Pune, for providing the research facilities to carry out the study. The author is thankful to M/s Nuclear Power Corporation of India Limited, Mumbai and India Meteorological Department, Pune, for supply of rainfall data.

REFERENCES

- [1] E.J. Gumbel, Statistic of Extremes, 2nd Edition, Columbia University Press, New York, 1960.
- [2] J.A. Carta and P. Ramirez, "Analysis of twocomponent mixture Weibull statistics for estimation of wind speed distributions", Journal of Renewable Energy, Vol. 32, No.3, pp. 518-531, 2007.
- [3] N. Mujere, "Flood frequency analysis using the Gumbel distribution", Journal of Computer Science and Engineering, Vol. 3, No. 7, pp. 2774-2778, 2011.
- [4] M.C. Casas, R. Rodriguez, M. Prohom, A. Gazquez, and A. Redano, "Estimation of the probable maximum precipitation in Barcelona (Spain)", Journal of Climatology, Vol. 31, No. 9, pp. 1322–1327, 2011.
- [5] E. Baratti, A. Montanari, A. Castellarin, J.L. Salinas, A. Viglione, and A. Bezzi, "Estimating the flood frequency distribution at seasonal and annual time scales", Hydrological Earth System Science, Vol. 16, No. 12, pp. 4651–4660, 2012.
- [6] A. Peck, P. Prodanovic and S.P. Simonovic, "Rainfall intensity duration frequency curves under climate change: city of London, Ontario, Canada", Canadian Water Resources Journal, Vol. 37, No. 3, pp. 177–189, 2012.
- [7] L.S. Esteves, "Consequences to flood management of using different probability distributions to estimate extreme rainfall", Journal of Environmental Management, Vol. 115, No. 1, pp. 98-105, 2013.
- [8] B.A. Olumide, M. Saidu, and A. Oluwasesan, "Evaluation of best fit probability distribution

models for the prediction of rainfall and runoff volume (Case Study Tagwai Dam, Minna-Nigeria)", Journal of Engineering and Technology, Vol. 3, No.2, pp. 94-98, 2013.

- [9] V. Rahmani, S.L. Hutchinson, J.M.S. Hutchinson and A. Anandhi, "Extreme daily rainfall event distribution patterns in Kansas," Journal of Hydrologic Engineering, Vol. 19, No. 4, pp. 707– 716, 2014.
- [10] Zhanling Li, Zhanjie Li, Wei Zhao, and Yuehua Wang, "Probability Modeling of Precipitation Extremes over Two River Basins in Northwest of China," Advances in Meteorology, Vol. 13, Article ID 374127, pp. 1-13, 2015.
- [11] J. Zhang, "Powerful goodness-of-fit tests based on the likelihood ratio", Journal of Royal Statistical Society, Vol. 64, No. 2, pp. 281-294, 2002.
- [12] A.H. Ang, and W.H. Tang, Probability concepts in engineering planning and design, Vol. 2, John Wiley & Sons, 1984.
- [13] Atomic Energy Regulatory Board (AERB), Extreme values of meteorological parameters, AERB Safety Guide No. NF/SG/ S-3, 2008.
- [14] P.E. Charles Annis, Goodness-of-Fit Tests for Statistical Distributions, [http://www.statistical engineering.com/goodness.html], 2009.
- [15] United States Water Resources Council (USWRC), Guidelines for determining flood flow frequency', Bulletin No. 17B, 1981.

Contribution to the Method of Sugar Analysis in Legume Grains for Ensiling – A Pilot Study

Annette Zeyner^{*1}, Annett Gefrom², Dirk Hillegeist³, Manfred Sommer⁴, Jörg M. Greef³

*1Institute of Agricultural and Nutritional Sciences, Group Animal Nutrition, Martin Luther University Halle-Wittenberg, Halle (Saale), Germany ²State Research Centre of Agriculture and Fishery Mecklenburg-Western Pomerania, Gülzow-Prüzen, Germany ³Institute for Crop and Soil Science, Julius Kühn Institute, Federal Research Centre for Cultivated Plants, Braunschweig, Germany

⁴Chamber of Agriculture Lower Saxony, Hanover, Germany

ABSTRACT

The quotient of sugar content and buffering capacity (S/BC quotient) serves as an important predictor for the ensilability of green feed and cereal or legume grains. For this, reference values were given which base on the anthrone method for sugar analysis. This method has largely been replaced today, but the consistency of results from different methods is questionable. In this study, the sugar content of legume grains was determined by the anthrone method and compared with results from nowadays more common methods. For this, grains from lupine (Lupinus spp.; var. 'Bora', 'Borlu'), pea (Pisum sativum; var. 'Lisa', 'Phönix') and field bean (Vicia faba; var. 'Limbo') were analysed (n = 4 each) for sugar via anthrone method, a gravimetric method (GRAVI) and HPLC. Following HPLC, either glucose, fructose and sucrose (HPLC-1) or these monomers plus galactose (HPLC-2) or HPLC-2 plus oligomeric carbohydrates (raffinose, stachyose, verbascose; HPLC-3) as sum were referred to as sugar. Results were compared by one-way analysis of variance. None of the alternative methods provided results that are at least similar to the sugar content detected by the anthrone method (P > 0.05). HPLC-3 caused a clear overestimation whereas the other methods (VDLUFA, HPLC-1, HPLC-2) resulted in a remarkable underestimation compared to the anthrone method. The results from legume grains suggest that different methods of sugar analysis provide remarkably different results even though all methods are accepted and applied in routine analysis. Thus, i) sugar contents should not be interpreted without knowledge of the applied method, and ii) as long as reference values base on anthrone method, the forecast of ensilability via the S/BC quotient should only be performed when anthrone method was used to determine the sugar content. The comparison of results from different methods of sugar analysis should be extended to grasses and further more conventional material for ensiling.

Keywords: Legume Grain, Ensiling, Sugar, Buffering Capacity, Anthrone Method, HPLC

I. INTRODUCTION

Legume grains such as lupine, field bean and pea are valuable feedstuffs particularly because of their remarkable content of essential amino acids. These grains, however, mature at different rates even on the same field and furthermore contain several antinutritional factors such as oligomeric carbohydrates, tannins and alkaloids ([13], [16], [15], [25], [29]). Ensiling of moistly harvested legume grains mitigates the problem of inconsistent maturity and furthermore microbial fermentation may decrease the amount of some anti-nutritional factors ([1], [2], [5], [6], [7], [8], [10], [17], [22], [24]). The problem however is the regularly low quotient of sugar content and buffering capacity (S/BC) in legume grains.

The S/BC serves as important predictor for the ensilability of plant material. The background is that S/BC represents the ratio between the content of carbohydrates in the feed, which are beneficial for the microbial production of lactic acid on the one hand and the buffering capacity that stands for the ability of the feed to counteract lactic acid-induced pH reduction on the other hand. The S/BC quotient further substantially supports the decision whether silage additives such as molasses or other carbohydrate sources easily available for lactate-producing bacteria (LAB) are necessary for

the preparation of high-quality silages or not. For this, dry matter (DM) dependent references about the S/BC quotient are given, which, in the individual case, is the minimum required for the preparation of high quality silages ([27], [28]). These references, or at least recommendations, have been established by Weißbach ([27], [28]) on the basis of sugars according to the anthrone method ([4], [30]). This method has been adapted to quantify the totality of carbohydrates available for microbial fermentation in the initial period of the ensiling process. According to the anthrone method ([4], [30]), simple sugars in a feed sample are determined colorimetrically. Anthrone assay is based on condensation of furaldehyde derivatives, generated by carbohydrates in presence of a strong oxidizing sulfuric acid, with a reagent anthrone (9,10-dihydro-9ozoanthracene). This method determines both reducing and non-reducing sugars because of the presence of the strongly oxidizing sulfuric acid. In this case, an aliquot part of sugars reacts with the anthrone reagent to produce blue-green color compounds in linear relationship between the absorbance and the amount of sugar ([3]).

Because of several disadvantages, the anthrone method is at present only seldom used in both scientific and routine analysis. Alternatively, gravimetric or volumetric methods as described in the German key book for feed analysis (methods of the 'Verband Deutscher Landwirtschaftlicher Untersuchungs- und Forschungsanstalten' [VDLUFA] according to Naumann [18]) high-pressure and Bassler. or liquid chromatography (HPLC) are applied. The latter has the additional advantage that individual carbohydrate fractions can be both qualified and quantified.

Legume grains are particularly interesting in this concern because evidence exists that they contain large amounts of carbohydrates, which may be fermented by lactic acid producing bacteria, but not identified as sugar by common methods of sugar analysis besides anthrone method. Gefrom et al. ([6], [7], [8]) indeed produced high-quality silages from lupine grains, field beans and peas even without any silage additive although the sugar content (as sum of glucose, fructose and sucrose determined *via* HPLC) and thus the S/BC quotient of the lupine grains were critically low.

We hypothesized that different methods of sugar analysis and subsequent calculations may lead to dissimilar change with different contents of what is considered to as sugar and, thus, unequal and in individual cases inappropriate statements on the ensilability of the feed in question and the necessity of carbohydrate sources as silage additive. The aim of the recent pilot study was to compare sugar content and S/B of randomly selected legume grains of different sources and varieties determined by the anthrone method, as original method for S/BC calculation and references, with nowadays more common analytical methods.

II. METHODS AND MATERIAL

A. Feed samples and analytical fractions

Legume grains from lupine (Lupinus spp., varieties 'Bora' and 'Borlu'), pea (Pisum sativum, varieties 'Lisa' and 'Phönix') and field bean (Vicia faba, variety 'Limbo') from the harvest year 2012 were sampled from four different areas each. The grain was analysed for dry matter (DM), crude ash, starch, the oligomeric carbohydrates raffinose, stachyose and verbascose, total sugar and individual sugar fractions (glucose, fructose, sucrose, galactose), and the buffering capacity (BC). Sugar as a total fraction was detected and defined in different ways: i) via anthrone method ([27]; ANTHR), ii) by a gravimetric VDLUFA method ([18]; GRAVI; except for field bean, variety 'Limbo'), and iii) as sum of HPLC fractions. Following HPLC, either the sum of glucose, fructose and sucrose (HPLC-1) or the sum of these sugars plus galactose (HPLC-2) or HPLC-2 plus the determined oligomeric carbohydrates (HPLC-3) were referred to as sugar. Each determination was performed in five replicates.

B. Analytical methods and calculations

Prior to analysis the air dry samples were either milled through a mash with a size of 1 mm or, for analysis of individual sugars and starch, with a swing mill (MM 200, Retsch GmbH & Co. KG, Haan, Germany) for 5 minutes with a frequency of 30/sec.

1) Dry matter and crude ash: The contents of DM and crude ash were analysed according to Naumann and Bassler ([18]).

2) *Starch:* For the determination of starch, an enzymatic procedure was chosen using a 0.2% solution of thermo-

stable amylase (Thermamyl 120, Novo Nordisk A/S, Bagsvaerd, Denmark). The milled sample was swung in a water bath (90 °C) for 30 minutes and filtered (Rotilabo filter disc, Typ 13A, Carl Roth GmbH & Co. KG, 76185 Karlsruhe, Germany). 2 ml of 0.1% of amyloglucosidase solution was added to 2 mL of the filtrate and stored for 16 h in an incubator at 60 °C. Afterwards, the concentrations of mono- and dimeric carbohydrates were analysed by HPLC (Shimadzu-Deutschland GmbH, Duisburg, Germany; refraction index; column HPX-87P; Biorad, Hercules, CA, USA). From this, the likewise per HPLC determined content of mono- and dimeric sugars, which were already be present in the feed sample prior to amylase-treatment, was subtracted (starch = [mono- and dimeric sugars after amylase-treatment] - [mono- and dimeric sugars prior to amylase-treatment]). The procedure has previously been described by Schmidt et al. ([23]).

3) Glucose, fructose and sucrose: The milled material was transferred in a 100 mL volumetric flask. 100 mL of triple desalted water was added and mixed during the flask was swung in a water bath (23 °C) for 60 minutes, and afterwards filtered (Rotilabo filter disc, Type 13A, Carl Roth GmbH & Co. KG, Karlsruhe, Germany). The concentrations of fructose, glucose and sucrose were measured in the filtrate by HPLC as described above (see 'starch'; [7], [23]).

4) Galactose and oligomeric carbohydrates (stachyose, raffinose, verbascose): The chromatographic method for the detection of galactose and the oligomeric carbohydrates stachyose, raffinose and verbascose originates from Quemener ([21]) and was performed in a slightly modified way according to Kluge et al. ([14]). For this, 500 mg of the milled feed were transferred into 10 mL centrifugal glasses, 10 mL of distilled water were added and all together dispersed for 2 minutes (Ultra-Turrax; Polytron PT 1600E, Kinematika AG, 6014 Luzern, CH). After centrifugation (at 4,000 U/min for 5 min) 6 mL of the overlap were separated and centrifuged again (at 13,400 U/min for 5 min). To 5 mL of overlap 30 µl 1N HCl (pH 4.2) were added and the solution was centrifuged once more (at 13,400 U/min for 5 min). For precipitation of proteins, 30 µl Carrez I (21.9 g zinc acetate and 3 g vinegar (ice), dissolved in aqua dest., filled up to 100 mL with water) and then 30 µl Carrez II (10.6 g potassium ferro-cyanide dissolved in water and filled up to 100 mL with water) were added and all together centrifuged (13,400 U/min, 5 min). The overlap was frozen (- 20 °C) prior to analysis. The analysis was performed by HPLC (Shimadzu-Deutschland GmbH, Duisburg, Germany; refraction index; column HPX-87C; Biorad, Hercules, CA, USA; separation column: Merck KGaA 64271 Darmstadt; column chrospher 100 NH₂, 4 mm ID; 300 mm length; mobile phase: acetonitrile H₂O, 70 : 30; flow rate 1 ml/min; pressure 124 bar; temperature: 30 °C, RID detector).

5) Sugar via anthrone method: Anthrone assay was performed according to a modification described by Weißbach et al. ([27]). The method is non-stoichemetric and therefore it is necessary to prepare a calibration curve using a series of glucose standards of known carbohydrate concentration. For anthrone reagent 780 mL concentrated acid sulphur (w = 95 - 97%; $\rho = 1.84$ g/mL) were added under cool conditions to 330 mL aqua dest., further 1 g thiourea and 1 g anthrone were added, and the solution kept cool in a brown bottle for 5 days. 1 g of dried material was added with 200 mL aqua dest., mixed for 60 minutes at 180 vibrates per minute, filled up with aqua dest. to 500 mL and filtered in a 300 mL flask. 2 mL of Carrez-solution I and II were added to 50 mL (or 25 mL when a sugar content of > 18%of DM is expected) of filtered solution, 2 mL of Carrezsolution I and II were mixed and filled up with aqua dest. to 100 mL and filtered again. In every case 2 mL of the filtrate were pipetted in test tubes with screw-topped, cooled on ice and mixed with 10 mL of anthrone-reagent (by vortex for 30 seconds). The samples were boiled for 20 minutes and then cooled down for 10 minutes with help of a cold water bath. The value for absorbance was evaluated at 625 nm (1 cm cuvette, calibration by blank value). The content of water-soluble carbohydrates was calculated according to the calibration curve with glucose-standards.

6) Analysis of carbohydrates by gravimetric VDLUFA method: The analysis of sugars according to the official method of the VDLUFA was performed as described by Naumann and Bassler ([18]). For this, method no. 7.1.1 was taken ([18]). On principle, sugars are dissolved in diluted ethanol and clarified with Carrez-solutions I and II. After evaporation of the ethanol, sugars were determined before and after inversion with Luff-Schoorl reagent. As the result, the content of reducing sugars and total sugars following inversion was expressed as sucrose (after conversion of glucose with factor 0.95). 7) Buffering capacity: The BC was determined according to Weißbach (in-house method of the Institute of Crop and Soil Science, Julius Kühn-Institute, Federal Research Centre for Cultivated Plants). For this, in short, cocked distilled water was added to the sample of the dry and milled (1 g; sieve pore size 1 mm) feed in a 1:100 (feed:water) ratio and samples were mixed. 30-60 min thereafter, titration was performed with lactic acid (LA; 0.1 mol/L) until pH 4.0. The rate of total LA consumption (LA_{feed+water}) was documented 240 sec after reaching this pH endpoint. Differences between repeated analyses within the feed sample in question was accepted when less than 0.1 mL. In parallel the same titration procedure was performed with 100 mL of distilled water only and LA consumption until titration to pH 4.0 (LAwater) was noted. Factor of LA was daily determined. For this, 15 mL of lactic acid were diluted with 58 mL of distilled water and then titrated with sodium hydroxide solution (0.1 mol/L) until pH 9.0. The factor of LA was calculated as quotient of the set-point volume and the actual volume needed for titration. For calculation of BC the titration value (LA_{feed+water}) was corrected by blank value for water only (LA_{water}). The result was than based on feed DM (BC, in g LA/kg DM).

8) *S/BC quotient:* To calculate the S/BC quotient, the content of sugar according to the analytical method in question was divided by the BC.

C. Statistical Methods

Within each of the four individual legume grains, the sugar contents determined by different analytical methods were compared by one-way analysis of variance (SPSS 20.0; for Windows, Chicago, IL, USA). The level of significance was pre-set at P < 0.05. *Post hoc*-comparison of results was performed by the LSD test.

III. RESULT AND DISCUSSION

The legume grains tested here were characterized by contents of dry matter (DM), crude ash, and starch, with means ranging as follows: 890 - 905 g/kg, 28 - 36 g/kg DM, and 13 - 467 g/kg DM (table 1). Mean sugar contents analysed according to the different methods applied in this study are given in table 2. The sugar contents measured by the anthrone method varied between 56 - 95 g/kg DM with lowest and highest values with field bean and lupine grains, respectively. The gravimetric method and predominantly the HPLC methods, too, provided results that are not equivalent to that derived from the anthrone method. The sugar contents according to GRAVI, HPLC-1, HPLC-2 resulted in a remarkable underestimation (P < 0.05) compared to the anthrone method. HPLC-3 caused either a clear overestimation (P < 0.05) or a satisfactory agreement to anthrone sugar, but only in an individual case (for pea, var. 'Phönix'). The mean BC varied between 37.3 (field bean, var. 'Limbo') and 47.0 (pea, var. 'Phönix') g LA/kg DM (table 1).

Species (variety)	dry matter	crude ash	starch	buffering capacity
	[g/kg]	[g/kg dry matter]	[g/kg dry matter]	[g LA/kg dry matter]
Lupine ('Bora')	904	36	13	37.4
Lupine ('Borlu')	905	35	13	44.1
Pea ('Lisa')	890	32	455	39.1
Pea ('Phönix')	892	28	467	47.0
Field bean ('Limbo')	899	36	436	37.3
\pm pooled s.d.	2.11	1.8	15.6	2.37
I A - letie egid				

Table 1: Contents of dry matter, crude ash and starch, and buffering capacity of legume grains from different species and varieties

LA = latic acid

Table 2: Sugar content (in g/kg of dry matter) of legume grains analysed with different methods

Species (variety)	ANTHRO	GRAVI	HPLC-1	HPLC-2	HPLC-3	pooled s.d.
Lupine ('Bora')	86 ^b	53°	35 ^e	44 ^d	110 ^a	± 0.53
Lupine ('Borlu')	95 ^b	58 ^c	34 ^d	39 ^d	104 ^a	± 0.36
Pea ('Lisa')	61 ^b	38 ^c	24 ^d	31 ^c	78 ^a	± 0.68
Pea ('Phönix')	77 ^a	54 ^b	23°	23°	81 ^a	± 0.40
Field bean ('Limbo')	56 ^b	n.a.	21 ^d	34 ^c	65 ^a	± 0.29

ANTHRO: anthrone method; HPLC-1: glucose, fructose, sucrose; HPLC-2: sugars according to HPLC-1 plus 'galactose'; HPLC-3: sugars according to HPLC-2 plus raffinose, stachyose and verbascose; n.a.: not analysed; GRAVI: gravimetric method according to Naumann and Bassler ([18]), calculated as sucrose; ^{abcd} Means within different superscripts within a line differ with P < 0.05.

From this, the S/BC quotient was calculated for each legume grain and sugar content according to the different analytical methods of sugar analysis (Fig. 1). Taking the anthrone method into account, S/BC quotients ranged between 1.46 (field bean, var. 'Limbo') and 2.30 (lupine, var. 'Bora'), with positive prognosis for ensilability (meaning S/BC quotient of > 2 g sugar/g lactic acid when ensiled with DM content of 65%; [27], [28]) with both lupine varieties only. The same prognosis was given for both lupine grains when the S/BC quotient was calculated by use of sugar determined via HPLC-3,



Figure 1: Quotient of sugar and buffering capacity (S/BC quotient; *the dashed line indicates positive prognosis for ensilability, meaning that the S/BC quotient amounted to at least 2 g sugar/g lactic acid [27], [28].)

but the S/BC quotient for lupine, *var.* 'Bora', was clearly higher than revealed following anthrone method. The S/BC quotients calculated by use of the other methods for sugar analysis applied here were in every case substantially lower (P < 0.05) compared to the anthrone-based S/BC quotient in question.

To produce high-quality silages with DM contents of around 65%, which might be achieved when harvested in an immature state under practical conditions, an S/BC quotient of 2 g sugar/g LA or more is required ([27]). Because of the low sugar but high protein content, however, the S/BC quotient of legume grains is frequently below this level, which in turn indicates poor ensilability. In the current study, the required S/BC quotient was only achieved by the grains of both lupine varieties, but the other legume sources were clearly below 2 g sugar/g LA. Calculations based on either reducing sugars or the sum of mono- and dimeric carbohydrates, with or without galactose, resulted in substantially lower S/BC quotients. The fraction appeared in the chromatogram as galactose, however, ranged from 0 (pea, *var*. 'Phönix') to 13 (field bean, *var*. 'Limbo') g/kg DM which was equivalent to up to 38% of the totally analyzed simple sugars. This is in a good agreement with Gefrom ([6], [7], [8]).

Despite of low S/BC quotients in the current study, all legume grains were nevertheless successfully ensiled which is in good agreement with the literature ([5], [6], [7], [8], [26], [28]). The authors demonstrated that not only simple sugars but also oligomeric carbohydrate fractions (raffinose, stachyose, verbascose) were decomposed to a remarkable degree by the fermentation process associated with ensiling. That might potentially also apply to carbohydrates with a degree of polymerization higher than verbascose. From literature it is known that about 3 and 15% of the DM of legume grains may consist of oligosaccharides ([6], [7], [8], [16]). Lowest (~ 3.0 - 3.5 g/kg DM) and highest contents (~ 5.5 - 7.0 g/kg DM) of stachyose plus raffinose and verbascose were found in field beans and lupine grains, respectively, with peas being in between. In the current study these oligomeric carbohydrates attributed after all with 48 - 72% to the totality of the low molecular sugars determined by HPLC, being a remarkably high percentage which should not be neglected.

The most prominent low molecular oligosaccharides in legume grains are indeed stachyose, raffinose and verbascose which are tri-, tetra- and pentasaccharides, respectively, with one, two and three galactose units within the molecule. Glucose and fructose units form the remaining of the individual molecule. In field bean, peas and lupine grains oligosaccharides seem to be dominated by varbascose, stachyolse and verbascose in an approximately balanced ratio, and stachyose, respectively ([6], [7], [8]).

Because previous studies already demonstrated that the oligosaccharides in question are largely be degraded by microbes involved in the process of ensiling ([5], [6], [7], [8], [26], [28]), it seems to be advisable to choose a method for sugar analysis that involves these oligosaccharides, particularly in legume grains. The S/BC quotient shall than be calculated on basis of that

kind of sugar analysis. The anthrone method is suitable to quantify simple sugars but can also be used for quantitative analysis of oligo- and polysaccharides provided they occur in the solution ([3]). Other polymer carbohydrates (> pentasaccharide), might not be determined although potentially useable for LA. Appropriate HPLC procedures may help to solve this problem. In terms of rapidity, specificity, sensitivity and precision, HPLC is currently one of the most powerful analytical techniques to characterize carbohydrates according to its type and quantity. However, it is a matter of choice and thus of our knowledge about fermentation biology which individual carbohydrate fractions are required to be analyzed and defined as sugars available for LAB in the early stage of ensiling. Beside of other factors the content of individual carbohydrates depends from the biological origin of the plant in question. In this way, when grasses from the local geographical latitude shell be characterized according to its S/BC quotient, fructans should additional recipients of HPLC analysis.

More sophisticated analytical methods may allow a highly specific sugar analysis, but the current S/BC recommendations were established on the basis of anthrone sugars. In the consequence this means that the progress in sugar analysis needs to be accompanied by experimentally based derivations on corresponding minimally required S/BC quotients and, thus, investigations on ensilability.

In this context one should be aware that added LAB may not only support the endophytic microbes by fermenting available sugars but they also may alter the kind of carbohydrate used for lactic acid production. As an example Lactobacillus plantarum (different strains) should be mentioned, which can ferment starch throughout the ensiling process ([7], [9], [11], [12], [19], [20]). Gefrom et al. ([7]) demonstrated that starch from field beans has been decomposed by ensiling without any additive to at most 14% whereby the use of L. plantarum (DSM 8862 and 8866) as silage additive increased the degree of starch degradation up to 47%. Despite all silages were of high quality, the lower pH in the silage prepared by use of L. plantarum reflected the use of extra carbohydrates. Contrary, the further addition of molasses had no continuing effect. Obviously interactions exist between the sugar source and the LAB in the plant material (whether added or not) according to their genotype, quantity and viability. It is questionable,

however, whether that is a matter of interest when the initial time period of the ensiling process is particularly addressed.

IV. CONCLUSION

From the results of this study with selected legume grains it can be speculated that different methods of sugar analysis provide different results with consequences for the calculated S/BC quotient and, thus, the prognosis of ensilability. As long as recommendations for the minimal required S/BC to produce high-quality silages base on anthrone sugars, such a forecast of ensilability should only be performed when indeed the anthrone method was used to determine the sugar content. More powerful and sophisticated methods for sugar analysis are highly welcome, but further studies on the ensilability of the plant material are requested i) to identify the relevant sugar fractions which need to be taken into account in terms of ensilability and, ii) to adjust S/BC recommendations to these fractions.

V.REFERENCES

- L. Ayed and M. Hamdi. 2002. Biotechn. Letters, vol. 24, pp. 1763-1765, 2002.
- [2] L. Camacho, C. Sierra, D. Marcus, E. Guzman, R. Campos, D. von Bäer, and L. Trugo. 1991. Int. J. Food Microbiol., vol. 14, pp. 277-286, 1991.
- [3] S.W. Cui. 2005. "Food Carbohydrates." Chemistry, Physical Properties, and Applications. Taylor & Francis Group. USA
- [4] Z. Dische and E. Borenfreund. 1951. J. Biol. Hem., vol. 192, pp. 583-587, 1951.
- [5] W. Duszkiewicz-Reinhard, E. Gujska, and K. Khan. 1994. J. Food Sci., vol. 59, pp. 115-117, 1994.
- [6] A. Gefrom, C. Balko, and A. Zeyner. 2014. Proteinmarkt.de, 7 pp.
- [7] A. Gefrom, E.M. Ott, S. Hoedtke, and A. Zeyner. 2013. J. Anim. Physiol. Anim. Nutr., vol. 97, pp. 1152-1160, 2013.
- [8] A. Gefrom, E.M. Ott, S. Hoedtke, and A. Zeyner. 2013. Züchtungskunde vol. 85(2), pp. 154-168, 2013.
- [9] E. Giraud, A. Champailler, and M. Raimbault. 1994. Appl. Envir. Microbiol., vol. 60, pp. 4319-4323, 1994.
- [10] M. Granito and G. Alvarez. 2006. J. Sci. Food Agric., vol. 86, pp. 1164-1171, 2006.
- [11] M. Granito, A. Torres, J. Frias, M. Guerra, and C. Vidal-Valverde. 2005. Europ. Food Res. Technol., vol. 220, pp. 176-181, 2005.
- [12] W. Hackl, B. Pieper, R. Pieper, U. Korn, and A. Zeyner. 2010.
 J. Anim. Physiol. Anim. Nutr., vol. 94, pp. 729-735, 2010.
- [13] M. Horbowicz and L. Obendorf. 1994. Seed Sci. Res., vol. 4, pp. 385-405, 1994.
- [14] H. Kluge, F. Hirche, and K. Eder. 2002. "NSP- und Oligosaccharidgehalte von Lupinen der Spezies L. angustifolius, L. luteus und L. albus." In: M. Rodehutscord (ed.), 7. Tagung

79

Schweine- und Geflügelernährung, Lutherstadt Wittenberg, 26.11.-28.11.2002, pp. 145-147. Germany

- [15] M.J. Lee, J.S. Pate, D.J. Harris, and C.A. Atkins. 2006. J. Exp. Botany, vol. 22, pp. 1-12, 2006.
- [16] C. Martinez-Villaluenga, J. Frias, and C. Vidal-Valverde. 2005. Food Chemistry, vol. 91, pp. 645-649, 2005.
- [17] H. Münte. 1931. "Einsäuerungsversuche mit grünen Lupinen." Kiel: Univ., Doctoral thesis. Germany
- [18] C. Naumann and R. Bassler. 2012. "Die chemische Untersuchung von Futtermitteln." VDLUFA-Methodenbuch III:
 8. Ergänzungslieferung. VDLUFA-Verlag Darmstadt, Germany
- [19] R. Pieper, W. Hackl, U. Korn, A. Zeyner, W.B. Souffrant, and B. Pieper. 2011. Anim. Feed Sci. Technol., vol. 164, pp. 96-105, 2011.
- [20] R. Pieper, W. Hackl, B. Pieper, and U. Korn. 2006. "Einfluss der Silierung von Feuchtkorn-Maisschrot mit Milchsäurebakterien (Lactobacillus plantarum) auf ausgewählte Fermentationsparameter und den Futterwert beim Schwein." In: M. Rodehutscord (ed.), 9. Tagung Schweine und Geflügelernährung. Halle, 28.11.-30.11.2006, pp. 274-276. Germany
- [21] R. Quemener. 1988. J. Agr. Food Chem., vol. 36, pp. 754-759, 1988.
- [22] F.C. Santana and J. Empis. 2001. Europ. Food Res. Technol., vol 212, pp. 217-224, 2001.
- [23] T. Schmidt, K. Krawielitzki, J. Voigt, and M. Gabel. 2005. Übersichten Tierernährung, vol. 33, pp. 87-100, 2005.
- [24] E.A. Shimelis and S.K.Rakshit. 2008. Int. J. Food Sci. Techn., vol. 43, pp. 658-665, 2008.
- [25] S. Smulikowska, B. Pastuszewsk, E. Swiech, A. Ochtabinska, A. Mieczkowska, V.C. Nguyen, and L. Buraczewska. 2001. J. Anim. Feed Sci., vol. 10, pp. 511-523, 2001.
- [26] L.C. Trugo, A. Farah, N.M.F. Trugo, C. Sierra, and L. Camacho. "Effect of germination and fermentation on the oligosaccharide composition of lupin seeds." Proc. 6th Int. Lupin Conf., Temuro Pucon, Chile, pp. 43-49, 1990.
- [27] F. Weißbach, L. Schmidt, and E. Hein, "Method of anticipation of the run of fermentation in silage making, based on the chemical composition of green fodder." Proc. XIIth Int. Grassland Congr., Moskov, Russia
- [28] F. Weißbach. 1968. "Beziehungen zwischen Ausgangsmaterial und G\u00e4rungsverlauf bei der Gr\u00fcnfuttersilierung." Rostock: Univ., Habilitation thesis. Germany
- [29] M. Wink. 2003. Phytochemistry, vol. 64, pp. 3-19, 2003.
- [30] E.W. Yemm and A.J. Willis. 1954. Biochem. J., vol. 57(3), pp. 508-514, 1954.

Comparison of Scanning Electron Microscopic Examination of Oats, Barley and Maize Grains with the Analyzed Degree of Starch Breakdown and Glycaemic Responses in Horses

Mandy Bochnia^{*1}, Sabine Walther², Hans Schenkel³, Kristin Romanowski⁴, Annette Zeyner¹

*¹Institute of Agricultural and Nutritional Sciences, Martin-Luther-University Halle-Wittenberg, Halle, Germany

²Institute for Geosciences Martin-Luther-University Halle-Wittenberg, Halle, Germany

³Regional Office of Agricultural Chemistry, University Stuttgart-Hohenheim, Germany

⁴Chair of Nutritional Physiology and Animal Nutrition, University of Rostock, Germany

ABSTRACT

Size and surface-structure of starch granules and their interconnections influence starch hydrolysis. In native grains, these factors depend mainly from the botanical origin. Previously, it has been demonstrated that microscopic examination of starch granules refers to precaecal starch digestibility. A comparison of the elevated morphological characteristics of starch granules in scanning electron microscopic pictures with the degree of starch breakdown and the glycaemic response in adult horses after feeding a defined meal offers a tool to explain differences in the responsibility to enzyme attack and starch degradation.

Keywords: starch granules, scanning electron microscope, cereal grains, glycaemic response, horse

I. INTRODUCTION

Starch is the main carbohydrate in human and animal nutrition. The nutritional value of starch strongly depends on processing and the state of starch [1]. The glucose release as a source of energy for the body and the timeline of digestion are the major physiological properties of starch [1]. The individual botanical structure of different starch granules influences primarily the small intestinal digestibility in horses [2] and in horses the amylase activity and the capacity for starch digestion in the small intestine is very small [3]. Consequently a high small intestinal digestibility of cereal starch is the precondition for mono-gastric animals to maximize starch utilization [4]. Evidence exists that morphological properties of diverse starch granules according to scanning electron microscopy (SEM) may have a predictive value regarding the small intestinal digestibility of different starch sources in horses [2]. To our knowledge a comparison of SEMpictures between different starch sources of cereal grain with the aid of proven labor analysis and blood parameters has not been reported before.

Aim was to investigate oats, barley and maize grains by SEM and to compare obtained starch characteristics with the analyzed degree of starch breakdown (DSB) and the glycaemic response to these cereal grains measured previously in adult horses.

II. METHODS AND MATERIAL

Starch granules embedded in surrounding structures deriving from grains of oats (variety 'Melody'), barley (variety 'ACK2927') and maize (variety 'M_002') were visualized by SEM (German Patent and Trademark Office; Brief disclosure for the Patent Application 10 2013 016 050.2) and further analyzed for DSB [5]. Conclusions from this were compared with the glycaemic response during the initial glucose raising period in six horses consuming meals from the same batches of cereal grains (mean of 0.8, 1.0 and 2.0 g starch/kg body weight; area under the glucose curve [AUC_{gluc}] up to 120 min pp. [6]. Prior to SEM, grains were crushed, spread out on a microscope slide, air dried and sputtercoated with gold. So-called secondary electron (SE) pictures were taken to characterize



morphologic properties of starch granules and their embedding in surrounding structures.

III. RESULTS AND DISCUSSION

Starch is organized in concentric alterning semicrystalline and amorphous layers in granules of various sizes within the endosperm [4]. Sizes of the starch granule also may affect digestibility, as the relationship between surface and starch volume, and this contact between substrate and enzyme, decreases as size of granule increases [7]. Cereals with small granules (oats and rice) have greater starch digestibility than maize, wheat and potato with larger granules [8] and show higher enzymatic susceptibility regardless of botanical origin [9]. A high content of small granules with identical magnitude (Fig. 2a-b; Fig. 3a) provide a better contact surface for enzyme attack. A large and smooth surface as well as a very strong, uniform connection (IN, DS) explains the resistance of maize granules (Fig. 1a, 1b) against enzymatic digestion and this corresponds to the lowest DSB and AUC_{gluc} (Table 1).

A certain content of giant granules (GG; $19,1 - 29,1 \mu m$) in oats and barley (Fig. 2b, 3b) may delay the starch degradation but previous studies revealed that starch digestion take place not only on the surface of the starch granule but also in the interior of the granule through channels and amorphous regions [10], [11]. However, this may reduce the dependency of a large surface on rate of starch digestion.

 Table 1: DSB, AUCgluc and morphologic characteristics of starch granules from different oat grain varieties and their embedding in surrounding structures

	c	ereal grair	ı
	barley	maize	oats
DSB [%]	7.7	5.5	10.5
AUC _{gluc} [mmol/L min ⁻¹]	713ª	668 ^b	697 ^{ab}
Morphologic Character	ristics of S	tarch Grai	nules
BO	X	-	Х
GG	Х	-	Х
DS	-	XXX	х
CS	XX	-	Х
IN	X	XX	Х

BO, bondings; CS, coverings and/or matrix structures; DS, well defined structures; GG, giant granules; IN, interconnections; -, not-existent; x, weak; xxx, strong;

Means with unlike superscripts are significantly different (P<0.05).

Furthermore several non-starch components are associated with the starch granule. These components, in the actual study named coverings and/or matrix structures (CS), may also represent a challenge during digestion. A significant portion of lipids were found on the surface of the starch granule [12]. In comparison to maize the surfaces of oat grains and barley are not smooth, coverings and/or matrix structures were noted (Table 1). Assuming that a certain content of the observed coverings are lipids, existing lipid:starch complexes may influence digestion by reducing contact between enzyme and substrate. The quantity of lipid:starch complexes is negatively associated with the extent of swelling (gelatinization), probably due to an increasing hydrophobicity [13]. However, the strong connection and identical magnitude as well the smooth surface of starch granules in maize delay enzyme attack and decrease digestibility in comparison to the loosen connection in oat grains or barley, where enzyme attack seem to be easier or unobstructed.

SEM pictures and from those extracted characteristics (Table, Figures) revealed differences between the grain sources which tended to correspond with conclusions from DSB and AUC_{gluc} (densest visible structure as well as lowest DSB and AUC_{gluc} in maize grain).



Figure 1a: SEM-picture from maize 'M_008' (x 1000)



Figure 1b: SEM-picture from maize 'M_008' (x 3000)



Figure 2a: SEM-picture from oat grains 'Melody' (x 1000)



Figure 3a: SEM-picture from barley 'ACK2927' (x 1000)



Figure 3b: SEM-picture from barley 'ACK2927' (x 3000)



Figure 2b: SEM-picture from oat grains 'Melody' (x 1000)

IV.CONCLUSION

The extent of starch degradation cannot be estimated *via* SE pictures but they may help to explain differences in the responsibility of individual starch sources to enzymatic attack. The SEM may help to estimate degradability by body-own enzymes and thus may offer a tool to select favorable genetic and treatment variants, respectively.

Acknowledgements

The work was supported in the framework of Grain Up by funds of the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) based on a decision of the Parliament of the Federal Republic of Germany via the Federal Office for Agriculture and Food (BLE) under the innovation support program.

V. REFERENCES

- Lehmann, U. and Robin, F. (2007) slowly digestible starch – its structure and health implications: a review. Trends in Food Science & Technology 18, 346-355
- [2]. Kienzle, E., Pohlenz, J, Radicke, S. (1998): Microscopy of starch digestion in the horse. J. Anim. Physiol. a. Anim. Nutr. 80, 213-216
- [3]. Kienzle, E., Pohlenz, J., Radicke, S. (1997): Morphology of starch digestion in the horse. J. Vet. Med. A 44, 207-221
- [4]. Svihus, B., Uhlen, A.K., Harstad, O.M. (2005) Effect of starch granule structure, associated components and processing on nutritive value of cereal starch: A review. Animal Feed Science and Technology 122, 303-320
- [5]. Naumann C., Bassler R. (2012): Analytical Methods III Book III, Method No. 7.2.6 (VDLUFA)
- [6]. Romanowski, K., Vernunft, A., Orgis, A., Gottschalk, J., Einspanier, A., Fürll, M., Zeyner, A. (2013) Effect of feeding different amounts of starch from crushed oats of selected varieties on the glycaemic and insulinaemic response of horses.Proc. Soc. Nutr. Physio. 22, 13
- [7]. Manelius, R., Bertof, E. (1996)The effect of Ca2+ions on the alpha-amylolysis of granular starches from oats and waxy-maize. J. Cereal Sci. 24,139-150
- [8]. Bednar, G.E., Patil, A.R., Murray, S.M., Grieshop, C.M., Merchen, N.R., Fahey, Jr., G.C. (2001) Starch and fiber fractions in selected food and feed ingredients affect their small intestinal digestibility and fermentability and their large bowel fermentability in vitro in a canine model. J. Nutr. 131, 276-286
- [9]. Franco, C.M.L., do Rio Preto, S.J., Ciacco, C.F. (1992). Factors that affect the enzymatic degradation of natural starch granules: effect of the size of granules, Starch/Stärke, 44, 422-426
- [10]. Lynn, A., Cochrane, M.P. (1997) A evaluation of confocal microscopy for the study of starch granule enzymatic digestion. Starch 49, 106-111
- [11]. Fuwa, H., Sugimoto, Y., Takaya, T. (1979): Scanning electron microscopy of starch granules, with or without amylase attack. Carbohydrate Res. 70, 233-238
- [12]. Baldwin, P.M., Melia, C.D., Davies, M.C. (1997) The surface chemistry of starch granules studied by time-offlight secondary ion mass spectrometry. J. Cereal Sci. 26, 329-346
- [13]. Vasanthan, T. and Bhatty, R.S. (1996).
 Physicochemical properties of small and large granule starches of waxy, regular and high amylose barleys.
 Cereal Chem. 73, 199-207

Case Study on Improving Overhaul Performance of CAT 3412 Marine Engine by Six Sigma Program

Chin-Chiuan Lin^{*1}, Chang-Jiang Lee², Liang-Yu Chueh³

^{*1} Professor of Department of Business Administration, Kun Shan University, Tainan, Taiwan
 ² General Manager of Capital Machinery Limited Co., Tainan City, Taiwan
 ³ Manager of Overhaul Department of Capital Machinery Limited Co., Tainan City, Taiwan

ABSTRACT

Present study developed improving steps of overhaul process of CAT 3412 marine engine which conducted by Six Sigma program. The research procedure includes four stages: analyze the current status, establish improve steps, implement improve step, and confirm improved status after implement improve step. The wastes of overhaul plant was confirmed and the improving steps was established after analyze the current status. After implement the improving steps, the overhaul workforce efficiency was increased about 14% and increased about 4% of profit. The results were confirmed that the overhaul performance of marine engine can be improved by the improving steps which conducted by six sigma program.

Keywords: Overhaul Performance, Marine Engine, Six Sigma Program.

I. INTRODUCTION

Since 1987, the Taiwan government permit the people go to China to visit their relatives. At 1992, further permit the businessmen to invest China. The Mini-Three-Links also started at 2001 and fully opened (liberalization) the tourists and cargos at 2008. The tourists and cargos needed between China and Taiwan begin speedily increase. However, until now, the air transport has been unable to compete with the passenger freighter due to the cost factors, especially in the freight transport. Therefore, the passenger freight became the majority transport tools of the cross-strait transportation.

Marine engine (Fig.1) is the indispensable equipment on ships (passenger/cargo freight). The overhaul of the marine engine is costly. Hence, the overhaul income is one of the most importance revenue for the case company (about 10 percent of the total revenue). For example, there are about NT\$ 200 million of total revenue per year was come from overhaul, and more than half of income was come from marine engine. However, the average overhaul performance was loss about NT\$ 5 million compare to the target at 2012. Therefore, the present study was aim to improve the overhaul performance of the case company.



Figure 1: The illustration of marine engine

II. SIX SIGMA PROGRAM

Six Sigma program is a top-down management style, usually, the company's chief executive to lead the implementation. The composition are includes champion, master black belt, black belt, and green belt. The champion is usually assigned by the general manager and is the high level manager, therefore, responsible for the success of the Six Sigma implementation. The master black belt is responsible for a specific area of work of Six Sigma, they need to set goals, and then select the black belt for the project and at the same time training and supervision the black belt. Black belt is the implementation of the specific issues and the team leader.

Using Six Sigma program to improve and increase the good ratio of products or services. Further, Six Sigma's success lies in the leadership and commitment of top managers; focus efforts to achieve the target set by the enterprise. Then use the tools to solve problems to complete strategic business outcomes.

Kwak and Anbari (2006) indicated that to understand the benefits, obstacles, and future of the Six Sigma program enabled the organizations to better support of its strategic direction, training, and constantly demand. Effective Six Sigma principles, practices, and constantly improve the organizational culture will succeed. Before that, they must strongly implanted the organizational culture change takes time and commitment.

Six Sigma program basically followed the five logical steps:

- (1) MAIC: Measurement, analysis, improve, and control to improve the current status of the organization.
- (2) DMAIC: Define, measurement, analysis, improvement, and control to strengthen the definition of the improvement in the existing system.
- (3) DMADV: Define, measurement, analysis, design, and validation to break through the status of the innovation and change outside the system.
- (4) DEOVI : Define, evaluate, optimize, validate, and incorporate and using the most efficiency ways to achieve the goal of the company.
- (5) DFSS : Design for Six Sigma. The purpose is to obtain the accumulated experience of product design, the effective transformation and upgrading.

Figure 2 shows the DMAIC process of Six Sigma.



Figure 2: DMAIC Process of Six Sigma

III. RESEARCH PROCEDURE

The present was aim to improve the overhaul performance of the case company. The research procedure was shown in Figure 3. The present study firstly investigated the goals of business and customers. Secondly, the present study employed Six Sigma program to improve overhaul performance. Finally, confirm the improving steps and results (efficiency and profit).





Table I shows the research stage and contents of improving overhaul process, which includes four stages: analyse the current status, establish improving steps, implement improving step, and confirm the improved status after implement the improving step.

Table I

RESEARCH STAGES AND CONTENTS OF THE IMPROVING STEPS OF OVERHAUL PROCESS

Research stage	Research contents		
Analyze the	Analyze the current status of overhaul		
current status	performance of CAT 3412 marine engine.		
Establish the	According to the current status analysis		
improving stops	and conducted six sigma program to		
improving steps	establish the improving steps.		
Implement the	Implement improving steps which		
improving steps	established in above stage.		
	Compared the different of overhaul		
Confirm the	performance between current and after		
improved status	improved and confirmed the improving		
	steps.		

IV. IMPROVEMENT PROCEDURE

A. Analyze the Current Status

1) CAT 3412 marine engine

Figure 4 and Table II shows the structure details and names of CAT 3412 marine engine.



Figure 4: Structure detail of CAT 3412 marine engine

Table II

STRUCTURE NAMES OF CAT 3412 MARINE ENGINE

(1) Turbochargers	(2) Air filter elements
(3) Fuel transfer pump	(4) Crankcase breather
(5) Lifting eyes	(6) Electronic control
	module
(7) Cooling system filler	(8) Air intake shutoff
cap	
(9) Injection actuation	(10) Engine oil filler
pressure control valve	
(11) Unit injector hydraulic	(12) Flywheel housing
pump	
(13) Engine oil level gauge	(14) Heat exchanger
(15) Fuel priming pump	(16) Primary fuel filter
(17) Secondary fuel filters	(18) Jacket water heater
(19) Crankcase oil drain	(20) Engine oil filters
plugs	
(21) Crankshaft vibration	(22) Auxiliary water pump
damper	

2) CAT 3412 marine engine overhaul procedure

Table III shows the Partial illustration (fuel filter base) of overhaul operation procedure analysis of CAT 3412 marine engine.

Table III

PARTIAL ILLUSTRATION (FUEL FILTER BASE) OF OVERHAUL OPERATION PROCEDURE ANALYSIS OF CAT 3412 MARINE ENGINE

Operation	Operation procedure	Check criteria	
Disassembly the fuel filter base	 Disconnect the fuel supply system. Disassembly the O ring of the fuel pressure sensor and fixation. Disassembly the base of the fuel filter. Disconnect the pipe. Disassembly the fuel filter. 	Check the fuel filter worthy of use or not, disassembly and clean the parts.	
Assembly fuel filter base	 Assembly fuel filter base on base. Connect the fuel supply system. Assembly the base of the fuel filter. Assembly the O ring of the fuel pressure sensor. Assembly the fixation, Open fuel system. Exclude the air in the system. 	 Do not contaminate the parts. the locked torsion is 10±2Nm. 	

3) Eight types of waste

Try to find the eight types of waste (I-U-WE-TO-DO) of the overhaul plant. Table IV shows the items and contents of eight types of waste which developed by case company.

Table IV

ITEMS AND CONTENTS OF THE EIGHT TYPES OF WASTE

Waste items	Waste contents
Inventory	Excess raw material, work-in-process or finished goods.
Unused creativity/ capability	Lost opportunities due to poor safety and an underutilized workforce.
Waiting	Lost time due to poor product and/or process flow-shortages, bottlenecks, down machines and errors.
Excess motion	Waste movement made while working.
Transportation	Excess and inefficient movement of work-in-process.
Over processing	Work that adds no value to the customer or business.
Defect	Production or rework of out-of- specification parts. Rework due to information errors or processes not adering standard work.
Over	Excesssupply beyond the requirements
Transportation Over processing Defect Over production	 Excess and memoral movement of work-in-process. Work that adds no value to the customer or business. Production or rework of out-of-specification parts. Rework due to information errors or processes not adering standard work. Excesssupply beyond the requirements of the next process.

4) Current wastes status of the overhaul plant

There are four major wastes in current status: (1) waiting: due to the weight of components usually geaterthan 40 kgs, therefore, must used hydraulic dray to transportation the location in order to obey the labor legislation. However, there are only 1 hydraulic dray and 1 stacker. The transportation task must wait the hydraulic dray and stacker to carry out. This resulted about 2 technicians and 10 working hours waiting for each excavator. (2) Excess motion: the sizes of the components were not the same, therefore, usually have to use 2 technicians to transport the components. This caused the excess motion waste about 2 technicians and 4 working hours for each marine engine. (3) Transportation: due to the inefficient movement of work-in-process. This resulted about 1 technicians and 2 working hours waste for each excavator. Table V shows the PQVC analysis of the wastes and the objects of the overhaul plant.

Table V

PQVC ANALYSIS OF THE OVERHAUL PLANT

Wastes	Objects
Unfamiliar with assembly procedures	People
Parts list is incorrect	Quality
Marked untrue	Velocity
Inefficiencies and excessive overtime hours	Cost

B. Established the Improving Steps

1) Lead time

Generally, in time-based competition measure, usually focus on the lead time of manufacture, supply chain, information flow, and R&D (Bicheno, 2004). The lead time also includes work-in-process between production batch, waiting time, processing time, and transfer time. Takahiro (1999) also indicated that company must focus on the difference of manufacture system and information transfer in time-based competition measure.

2) Supply chain management

The supply chain management played a vital role in pull system. If the company can establish efficiency supply chain, it can improve their operation performance and competition ability (Tan et al., 1998). Kerin and Sethuraman (1998) indicated that long-term cooperation partnership can result better cooperation performance, reduce transaction costs, and increase customer value.

3) Smooth the production flow

This production flow gives the customer value, and covered the product, information, and services in the production system. The process of normalized production refers to the actual demand for the product according to the period, balanced flow and output in the production line, minimum waiting time of customers, minimize the shortage, and avoid insufficient capacity during the peak period. Equalization the staff working time, so that production workers will not sometimes faster or slower (Womack and Johns, 1994). The concept of production flow includes smooth the production flow and pull production system the common approach of improving production systems.

4) Pull production system

This pull production system and smooth the production flow are the two main principles of just-in-time production system. The kanban is the most important tool and the information transfer tool in the pull production system among the processes (Monden, 1983).

5) Multi-skill workers

McDonald (2004) indicated that multi-skill worker training allows field workers more flexibility when needs change. Multi-skill worker training also allows workers to better understand the function of the overall team (Volpe, 1996), increasing work flexibility (Womack and Johns, 1994), and improving productivity (Majchrzak and Wang, 1996).

6) Statistical process control

Statistical process control (SPC) has become an important tool of practitioners to solve manufacturing process and product standards, improve quality and continuous improvement.

7) Manufacturing operating performance

Lean production program has a significant contribution for the overall manufacturing performance, which is likely to enhance manufacturing capacity, improve product quality and rapid speed to market, and better ability to respond to customers (Womack and Johns, 1994). The plant used lean production program, such as multi-skill workers or small batch production, not only can manufacture in a wide range of products, but also can retain the high quality and productivity (Panizzolo, 1998). Hunter (2003) indicated that the four properties of lean production program: reduced unit costs, one hundred percent of the high quality, the shortest cycle time, and maximum the output flexibility. The advantages of lean production program includes: enhance productivity and product quality, shorten customer lead time, shorten the cycle time, and reduce costs (Shah and Ward, 2003).

C. Implement the Improving Steps

The present developed and proposed several improving steps based on lean production program. Table V shows the PQVC analysis of the overhaul plant. And, Figure 5 shows the partial illustrations and statements of the improving steps of the overhaul plant.



Figure 5(a): Before improved of marine engine after overhaul



Figure 5(b): After improved of marine engine after overhaul

D. Confirm the Improved Status

Table VI shows the improved status of the overhaul plant. After seven months improved, the overhaul performance had significantly improved. The overhaul workforce efficiency was increased about 14% and increased about 4% of profit after implement the improving steps with three stages.

Table VI

THE IMPROVED STATUS OF THE OVERHAUL PLANT

Baseline	Stage 1	Stage 2	Stage 3
Quality, costs, profit, satisfaction	Overhaul quality Reduce cost	Service quality Reduce cost	Delivery time Customer satisfaction
A%	A+4%	A+8%	A+14%

V. CONCLUSION

The purpose of present study is to develop overhaul improving steps to reduce the total overhaul cost, to and to increase the profit, and increase customer's satisfaction. After implement the improving steps about seven months, the overhaul workforce efficiency was increased about 14% and increased about 4% of profit. The results were confirmed that the overhaul performance of marine engine can be improved by the improving steps which conducted by Six Sigma program.

VI. REFERENCES

- [1] Bicheno, J., 2004. The new lean toolbox: toward fast, flexible flow, 3rd edition, PICISIE Books.
- [2] Hunter, S. I., 2003. An introduction to a lean production system, FDM Management, 75(13): 58-60.
- [3] Kerin, R.A. and Sethuraman, R., 1998. Exploring the brand value-shareholder value nexus for consumer goods companies, Journal of the Academy of Marketing Sciences, 26: 260-273.

- [4] Kwak,Y.H. and Anbari, F.T., 2006. Benefits, obstacles, and future of six sigma approach, Technovation, 26(5-6): 708-715.
- [5] Majchrzak, A. and Wang, Q., 1996. Breaking the functional mind-set in process organizations, Harvard Business Review, 74(5): 93-99.
- [6] McDonald, T.N., 2004. Analysis of worker assignment policies on 102 production line performance utilizing a multi-skilled workforce, Blacksburg, Virginia.
- [7] Monden, Y., 1983. Toyota production system, Industrial Engineering Management Press.
- [8] Panizzolo, R., 1998. Applying the lessons from lean manufacturers- the relevance of relationships management, International Journal of Production Economics, 55: 223-240.
- [9] Shah, R. and Ward, P.T, 2003. Lean manufacturing: context,

practice bundles, and performance, Journal of Operations Management, 21: 129-149.

- [10] Takahiro, F., 1999. The evolution of a manufacturing system at Toyota, New York: Oxford University Press.
- [11] Tan, K., Kannan, V.R., Handfield, R.B. and Ghosh, S., 1999. Supply chain management: an empirical study of its impact on performance, International Journal of Operations and Production Management, 19(10): 1034-1052.
- [12] Volpe, C.E., 1996. The impact of cross-training on team functioning: an empirical investigation, Human Factors, 38(1): 87-100.
- [13] Womack, J.P. and Jones, D.T., 1994. From lean production to the lean enterprise, Harvard Business Review, 72(2): 93-103.

"Bio-medical waste Disposal"- A Survey to assess the Knowledge, Attitude and Behaviour among Dental personnel in kanpur City, (U.P.), India Dr. Lakshmana Rao. Bathala¹, Dr. Rajashekar Sangur², Dr. Tanu Mahajan³,

Dr. Pawanjeet Singh Chawla⁴, Dr. Ankit Mehrotra⁵, Dr. Parul Singhal⁶

¹ Department of Prosthodontics, Lenora Institute of Dental Sciences, Rajahmundry-533103, (A.P), India

^{2,3,4,5} Department of Prosthodontics, Rama Dental College, Hospital & Research Centre, Kanpur-20824, (U.P.), India

⁶ Dept. of Prosthodontics, RUHS, College of Dental Sciences, Jaipur (Govt. Dental College), Rajasthan, India

ABSTRACT

SRST

Objective: To investigate the knowledge, attitude and behaviour of dental personnel in Kanpur city, (U.P), India towads bio-medical waste disposal management in dentistry.

Method : A Cross-sectional descriptive study was conducted over a period of 3 months from November 2012 to Jan 2013 A pre-tested Self administerred questionnaire was given to a total number of 423 dental personnel includes Faculty ,Post graduate students, Interns, Under graduate clinical students of a teaching institute and Private Practitioners in Kanpur city,India .

Results : A total of 406 dental personnel, including 41Faculty, 36 post graduate students, 93 interns, 149 Clinical under graduate students and 87 Private practioners participated in the study.Statistics was analysed by Dichotomisation analysis.

Conclusion : All the dental personnel required to undergo continuing training programme on bio-medical waste management.

Keywords: Rapid development, effectiveness, assessment, monitoring, management, planning

I. INTRODUCTION

Hospital waste management has been brought into focus in India recently, particularly with the notification on the bio-medical waste (management and handling) rules 1998[1], the rule which made it mandatory for all the health care establishments to segregate, disinfect and dispose their waste in an eco-friendly manner[2].Dental clinics generate a number of biomedical wastes, including blood-soaked materials, human tissue, and the materials like scrap amalgam, photochemical waste (developer & fixer),lead foil from traditional x-ray packets, and disinfectants etc used in the dentistry are challenging to the environment and wisely handling and disposal them is critical[3],[4].

The World Bank's health care waste management guidance note lists, four steps to healthcare waste

management: 1) segregation of waste products into various components that include reusable and disposable materials in appropriate containers for safe storage; 2) transportation to waste treatment and disposal sites; 3) treatment; and 4) final disposal [5],[6].

II. METHODS AND MATERIAL

A Pre-tested self administerred questionnaire was developed after literature search and review (Appendix-1).The questionnaire was distributed to a total of 423 dental personnel includes Faculty, post graduate students, Interns, clinical undergraduate students (third and final year) from a private dental collge and local private practitioners in Kanpur, over a period of 3 months from December 2013 to February 2014. A total of 406 people responded. 12 private practioners rejected and 5 personnel responded after 3 months which were excluded from the study. All data management and analysis was carried out using Dichotamization Analysis.

III. RESULT AND DISCUSSION

Results

The results show that, awareness about the Legislative act of the bio-medical waste (management and handling) Rules 1988, which is applicable to the safe management of bio-medical waste was known to only few (16%) participants, and majority (84%) stated that they were not aware of it. (Fig-1).Regarding waste management plan, 79% mentioned that their health care set up having the waste management plan(Fig-2). About bio-medical waste management practices concern, it was found that majority claimed that they were following burning procedure (65%), followed by autoclaving (48%), deep burial (26%), segregation (9%), and the least was incineration (8%) (Fig-3). 97% were of the opinion that bio-medical Waste should be segregated in to different categories (Fig-4), and majority (50%) felt that it is the responsibility of auxiliary staff. Regarding colour coding, 72% agreed that they use colour coding for the biomedical waste disposal, but only 7% were able to match the colour coding exactly, when they asked to match the colour coding (Fig-5). In relation to bio-hazard symbol, 82% stated that they were aware of it, but in realty 77% were not in position to identify the symbol correctly (Fig-6). 38% of the participants stated that, they were disposing the bio-medical waste in to municipal corporation bin, (31%) as in general waste, (29%) in to hospital waste collection and only 2% mention about other ways of disposing.

None of the participants claimed that, they were disposing the silver amalgam waste separately, and they were not having any facilities like amalgam separators, filters in their health care set up. Used x-ray fixer and developer solutions were directly pouring in to the drain, but none of them were having the facilities to send the solution for recycling. 61% declared that they have not undergone any training program on bio-medical waste management, and 56% mentioned that they are not receiving any literature on annual bio-medical waste management, but everybody wanted to attend the training program. 100% participants vaccinated for Hepatitis B.

While assessing the attitude towards the safe management of bio-medical waste, majority (81%)

agreed that the safe management of bio-medical waste is an issues. 79% agreed that it is the responsibility of the generator, and 94% felt that it is a team work. 72% were of the opinion that it is extra burden of work and 53% felt that it is an increase of financial burden on health care setup (Fig-7). In the present study majority of the respondents were not aware of legal issues involved. But the positive sign regarding attitude assessment was majority percentage accepted that it is an issue and that needs to be tackled and effective management is based on team work.

Discussion

In many countries the dentists are not following properly the bio-medical waste disposal methods. Dumping directly either in to the domestic rubbish stream or in to the waste paper bin and contaminated sharp items are in to general house hold waste. According to Punchanuwat K et al [7] stated, in Bangkok the most waste was disposed of in to the domestic rubbish stream. Treasure et al[8]identified in their study on Newzealand dental practices, majority dentists are disposing contaminated bloody swabs in to the waste paper bin, and contaminated sharps items(nearly 25%) in to general house hold waste. Farmer GM et al[9] in their pilot study in Melbourne found that, up to 91% of total waste contains was cross infection control items, such as gloves, single-use cups, and protective coverings.

It is the duty of the dentist to evaluate each waste generates from their practice should be determine whether it is hazardous waste or not. A waste that has not been evaluated must be assumed to be hazardous. Thousands of tons of hazardous and non-hazardous waste producing in the world every year. According to World Health Organization during 1999-2000, Searo and the 11 south-east Asian countries together produce both hazardous and non-hazardous waste around 3, 50,000 tons per year. [2].

Teeth with amalgam fillings should be neutralized ideally with "**tuberculocidal disinfectant solution**" by immersion method for 30 minutes in a sealed container, because amalgam vapours release during sterilization. Treated teeth can be rinsed with water and are ready to disposal. Teeth without amalgam restorations can be placed directly in to a biohazard bag or sharp container [11],[12].

According to Rowe NH et al amalgam particles are a source of mercury, which is known to be neurotoxic, nephrotoxic and bio-accumulative[13] metal.As per Chin G et al [14] the environmental impact of dental mercury is mainly due to the poor management of dental amalgam waste. Amalgam waste should be placed in "white rigid" receptacles with a mercury suppressant, and it should be sent to mercury recovery process prior to final disposal[15]. To minimize amount of mercury vapour emitted from waste amalgam, ADA recommends that it should be stored under a small amount of "photographic fixer" in a closed container. Unused elementary mercury should be stored in a tightly sealed container, and should be sent for recycling. Scrape amalgam should be stored in "sponge type Mercontainer tm". All the dental clinics should use some type of basic filtration system to reduce the amount of mercury solids passing into the sewer system. The amalgam separators can remove 95% of mercury waste which is entering in to the sewer system [16].

X-ray fixer is a hazardous material and should not be rinsed down the drain. Used fixer solution contains approximately 4000mg of silver per litre, and should compulsorily be sent for recovery unit. The '**de-silvered'** fixer can be mixed with water and disposed down the sewer. Spent/ used developer can be diluted with water and then poured in to the drain. Unused x-ray film can be sent to recycler. Lead containing foils should be sent for recycling, because there is a possibility of leaching of lead [16].

The needles should be destroyed by needle destroyers or by using syringe melting and disposal system. The mutilated sharps should be placed in puncture proof sharp container with 1%Naocl for disinfection [17].Sharps are regarded as highly hazardous health care waste since they can cause injuries and puncture wounds. Due to exposure of the contaminated sharps, the risk of transmission of blood borne pathogens, such as HIV, Hepatitis B and C is always possible. According to W.H.O many cases of infection with various pathogens due to exposure to improperly managed health care waste was documented .According Darkish R.O et al[18] reports from U.S environmental protection agency (EPA), the no. of viral Hepatitis B infections resulting from exposure to sharp injuries among U.S dentists is less than 1% and in dental assistants 5-8%.

Pharmaceutical waste is considered to be hazardous non-infectious waste and it should be disposed off properly. Glutaral dehyde and Ortho-ptithaldehyde(Opa) which are the active ingredients of several brands of sterilizing solutions, before pouring them into the sanitary sewer, they should be neutralize with 'glycine'. Electronic devices, batteries, fluorescent lamps etc comes under **"universal wastes"** and considered, as hazardous wastes, should be managed under the universal waste management regulations [16]. B.Graphs :



IV. CONCLUSION

It is our duty to respect and safe guard the environmental health. The proper disposal of infectious waste is a growing problem in many developing countries; the situation will become worse if it is not managed in a sustained way. Every concerned health personnel are expected to have proper knowledge, practice, and capacity to guide others for waste collection, proper handling techniques and management. The involved personnel must be trained in appropriate handling, storage and disposal methods. Dentists are encouraged to follow best management practices when disposing hazardous wastes. All the dental personnel as required to undergo continuing training programme on bio-medical waste management.

V.REFERENCES

- [1] The Gazette of India. Bio-Medical Waste (Management and Handling) Rules 1998. No 460 July 27 th 1998 and Amended No.375 June 2nd 2000. Or Govt. of India, "Bio-medical waste (management and handling) rules". The gazette of India. Ministry of Environment and Forests.1998.
- [2] Sharma M: Hospital Waste Management and Its Monitoring, 1 st ed. New Delhi, India, Jaypee brother's Medical publication; 2002.
- [3] Best management practices for hazardous dental waste disposal.Novascotiadentalociationwebsite.http://www.nsdental. org/media_uploads/pdf/95.pdf. Accessed November 2, 2009.
- [4] Taiwo JO, Aderinokun GA. Assessing cross infection prevention measures at dental clinic, university college hospital, Ibadan. Afr J Med Sci 2002; 31 (3): 213-7.
- [5] Pichay TJ. Dental amalgam: regulating its use and disposal. J Calif Dent Assoc. 2004; 32(7):580-582.
- [6] Johannessen LM, Dijkman M, Bartone C, Hanrahan D, Boyer G, Chandra C. health care waste management guidance note. Washington Dc: The International Bank for Reconstruction and Development/The World Bank; 2000.
- [7] Punchanuwat K, Drummond BK, Ttreasure ET. An investigation of the disposal of dental clinical waste in Bangkok. Int Dent J1998; 48(4):369-73.
- [8] Treasure ET, Treasure P. An investigation of the disposal of hazardous wastes from Newzealand dental practices. A Community Dent Oral Epidemiol 1997; 25(4):369-73.
- [9] Farmer GM, Stankiewicz N, Michael B, Wojcik A, Lim Y, Ivkovic D et al. Audit of waste collected over one week from ten dental practices. A pilot study. Aust Dent J 1997; 42(2):114-7.
- [10] Survey of hospital waste management in SEA region. WHO: Health situation in the South East Asia Region. 1998-2000.Khanna publishers, New Delhi 1999. p 1-34.
- [11] US department of labor, occupational safety and health administration. 29 cfr part 1910.1030 blood borne pathogens.

Occupational exposure to blood borne pathogens; needle stick and other sharps injuries, final rule. Federal register, 2001; 66 (12):5317-5325. As amended from and including federal register 1991; 29 cfr part 1910.1030.

- [12] Horsted-Bindslev P. Amalgam toxicity--environmental and occupational hazards. J Dent 2004; 32(5):359-65.
- [13] Rowe NH, Sidhu K S, Chadzynski L, Babcock R F. Potential public health risks related to mercury/amalgam discharge from dental offices. J Mich Dent Assoc. 1996;78(2):32-6.
- [14] Chin G, Chong J, Kluczewska A, Lau A, Gorjy S, Tennant M. The environmental effects of dental amalgam. Aust Dent J 2000; 45(4):246-9.
- [15] Agarwal B, Kumar M, Agarwal S,Singh S, Shekhar A. Biomedical waste and dentistry. j oral health comm dent 2011;5(3):153-5.
- [16] National guidelines on hospital waste management. Biomedical waste regulations. Environmental regulations and best management practices; available from: http://www.crd.bc.ca. [last accessed on 2011 Sep 21].
- [17] Management of sharps. Available from: http://www3.5ho.int/injecion_safety/en/. [last accessed on 2009 Dec 03].
- [18] Darkish RO, Al-Katib AL. Evaluation of dental waste management in two cities in Palestine. East Meditterr Health J 2006; 12(2):217-22.

An Experiment to Improve Classification Accuracy Using Ensemble Methods

Bhavesh Patankar*1, Dr. Vijay Chavda², Maulik Dhandhukia³

*¹Department of M.Sc. (IT), Kadi SarvaVishwaVidyalaya, Gandhinagar, Gujarat, India.
 ²NPCCSM, Kadi SarvaVishwaVidyalaya, Gandhinagar, Gujarat, India
 ³Department of M.Sc. (IT), Kadi SarvaVishwaVidyalaya, Gandhinagar, Gujarat, India.

ABSTRACT

Data mining is the practice of analyzing huge quantities of data and shortening it into constructive knowledge. Data Mining is an eternal process which is quite useful in finding understandable patterns and relationships amongst the data. There are various classification techniques available. It is observed that all the techniques don't work well with all datasets. It is found that when the classifiers are used alone, they are not performing as good as when they are combined using ensembles. Ensemble methods are renowned techniques in order to improve the classification accuracy. Bagging and Boosting are the most common ensemble learning techniques used to improve the classification accuracy. Here, a study on the classification accuracy improvement is carried out in which an experiment is performed using boosting with different datasets from UCI repository.

Keywords: Data mining; classification; ensemble learning; boosting, Adaboost;

I. INTRODUCTION

Data mining refers to extracting knowledge from large amounts of data available from various data sources which are accumulated in data warehouse. It is an interdisciplinary field, which covers variety of areas like data warehousing, statistical methods, database management systems, artificial intelligence, information retrieval, data visualization, pattern recognition, spatial data study, digital signal processing, image databases and many more other application fields, like business, economics, and bioinformatics.[1]

In data mining, Classification is a classical problem extensively studied by statisticians and machine learning Researchers. Classification is tasks in which we have to find patterns. In Classification, first of all model construction is carried out after that model usage is done. The general steps in classification are given below.

- 1. Create a model from training data. This usually involves an algorithm that searches for the "best fit" to the training data.
- 2. Evaluate the model on test data. This usually involves estimating the accuracy of the model.
- 3. Apply an acceptable model on the target datasets.

Accuracy of classification is one of the important features. To improve the classification accuracy, various strategies have been identified. Ensemble learning is one of the ways to improve the classification accuracy. Ensembles are learning techniques that builds a set of classifiers and then classify new data sets on the basis of their weighted vote of predictions. The ensemble learning techniques include Bagging, boosting etc.[2]. In this paper reviews for these methods have been made and explained why ensembles can often perform better than single classifiers. Combining outputs from multiple classifiers, known as ensemble learning, is one of the standard and most important techniques for improving classification accuracy in machine learning. Out of these,

superior to data partitioning methods (e.g. bagging and boosting) in ensemble learning. There are a growing number of publications that investigate performance of classifier ensembles trained using attribute AdaBoost is a one of the ensemble learning which is the end

bagging and boosting are the most popular methods of

ensemble learning. In bagging, from the training data, a

training set is randomly sampled k times with

replacement which produces k training sets with exactly

the same size as what we have in original training set.

As the original data set is sampled with replacement, it

may happen that some training instances are repeated in

the new training sets, and it is quite possible that some

are not present at all. The obtained sample sets are used to train base classifiers like CART etc. which in turn

will give k different predictors. These k different

The classification for each data instance is obtained by

equal weight voting on all k predictors. Voting gives a significant improvement in classification accuracy and

stability. Boosting, on the other hand, induces the

ensemble of classifiers by adaptively changing the distribution of the training set based on the accuracy of

the previously created classifiers and uses a measure of

classifier performance to weight the selection of training

Various empirical studies, suggest that combining classifiers gives optimal improvements in accuracy if the

classifiers are not correlated. It is stated in Ref. [3], the

most effective method of achieving such autonomy is by training the members of an ensemble on qualitatively

different feature (sub) sets. In other words, attribute

partitioning methods are capable of performance

examples and the voting.

predictors are used to classify the new dataset.

more practical towards the boosting approach. Adaboost requires lesser instability than bagging, because Adaboost can make much larger changes in the training set.[5] A number of studies that compare AdaBoost and bagging suggest that AdaBoost and bagging have quite different operational profiles (Bauer and Kohavi 1999; Quinlan 1996). In general, it is found that bagging is more consistent, increasing the error of the base learner less frequently than does AdaBoost. However, AdaBoost appears to have greater average effect, leading to substantially larger error reductions than bagging on average. Generally, bagging tends to decrease variance without unduly affecting bias (Breiman 1996; Schapire et al. 1998; Bauer and Kohavi 1999). On the contrary, in empirical studies AdaBoost appears to reduce both bias and variance (Breiman 1996; Schapire et al. 1998; Bauer and Kohavi 1999). Thus, AdaBoost is more effective at reducing bias than bagging, but bagging is more effective than AdaBoost at reducing variance.

The decision on limiting the number of sub-classifiers is important for practical applications. To be competitive, it is important that the algorithms run in reasonable time.

Tu. et. al[3] proposed the use of bagging with decision tree C4.5 algorithm and with Naive Bayes algorithm to identify the heart disease of a patient and compare the effectiveness, correction rate among them. They studied the data collected from patients with coronary artery disease.

Kittler et. al[4] has developed a common theoretical framework for combining classifiers which use different pattern representations and show that many existing schemes can be considered as special cases of compound classification where all the pattern representations are used jointly to make a decision. Comparison of various classifier combination schemes demonstrates that the combination rule developed under the most restrictive assumptions-the sum rule-outperforms other classifier combinations schemes. An analysis of the various schemes to estimation errors is carried out to show that this finding can be justified theoretically.

Nguyen et. al[5] have compared two classifiers (decision tree and Bayesian network) to predict students GPA at the end of the third year of undergraduate and at the end of the first year of postgraduate from two different institutes. Each data set has 20,492 and 936 complete student records respectively. The results show that the decision tree outperformed Bayesian network in all classes. The accuracy was further improved by using resampling technique especially for decision tree in all cases of classes. In the same time it able to reduce misclassification especially on minority class of imbalanced datasets because decision tree algorithm tends to focus on local optimum.

Thomas [6] performed experiments which show that in situations where there is little or no classification noise,

randomization is competitive with (and perhaps slightly superior to) bagging but not as accurate as boosting. In situations with considerable classification noise, it is found that bagging is much better than boosting.

II. METHODS AND MATERIAL

Boosting

Boosting is a practical approach towards machine learning based on the idea of creating a highly accurate prediction regulation by combining many relatively weak and inaccurate regulations.

The AdaBoost algorithm of Freund and Schapire [7] was the first practical boosting algorithm, and still remains one of the most widely used and studied, with applications in various fields. Over the years, a great variety of attempts have been made to "explain" AdaBoost as a learning algorithm, that is, to understand why it works, how it works, and when it works (or fails). AdaBoost generally used to boost weak learning algorithm into strong learning algorithm. AdaBoost generates an ensemble of classifiers, the training data of each is drawn from a distribution that starts uniform and iteratively changes into one that provides more weight to those instances that are misclassified. Each classifier in AdaBoost focuses increasingly on the more difficult to classify instances. The classifiers are then combined through weighted majority voting.

AdaBoost is a popular boosting algorithm. Let say, we need to boost the accuracy of some learning routine. Also, it is given D, a dataset of d class labeled tuples (A1, b1), (A2, b2), (A3, b3)..... (Ad, bd), where yi is the class label of tuple Ai. Firstly, AdaBoost assign each training tuple an equal weight of 1/d. In order to generate k classifiers for the ensemble requires k rounds throughout the rest of the algorithm. In the round i, the tuples from D are sampled to make a training set, Di, of size d. sampling with replacement is used - the same tuple may be selected more than once. The probability of each tuple of being chosen is based on its weight. A classifier, Mi, is consequent from the training tuples of Di. Its error is then calculated using Di as a test set. The weights of the training tuples are then accustomed according to how they were classified. If a tuple were wrongly classified, its weight is augmented. If a tuple was appropriately classified, its weight is reduced. A tuple's weight reflects how hard it is to classify – the higher the weight, chances of misclassification is higher. These weights will be used to produce the training samples for the classifier of the next iteration. The general thought is that when we build a classifier, we want it to focus more on the misclassified tuples of the previous iteration. Some classifiers may be superior at classifying some "hard" tuples than others. In this way, we build a series of classifiers that harmonize each other [8].

III. RESULT AND DISCUSSION

We have chosen Weka tool to perform the experiment. Weka (Waikato Environment for Knowledge Analysis) is a popular machine learning tool developed in JAVA. It is one of the free open source softwares available under the GNU General Public License. Here, the experiment is performed on base classifier and then accuracy is measured. After that experiment is performed on the classifier with boosting. The experiment is carried out using dataset collected from UCI machine repository. Lastly, results are compared and conclusion is derived.

In our experiment, we've taken following datasets from the UCI Machine Learning Repository.

Sr N	Dataset Information			
0	Dataset	Instanc	Attribu	
		es	tes	
1	Iris	150	5	
2	Diabetes	768	9	
3	Breast-Cancer	286	10	

The experiment is carried out on RepTree, Decision Sump and J48 classifier. The datasets are chosen and no filter is applied while carrying out the experiment. Firstly experiment is carried out using single base classifier then experiment is carried out using single base classifier with bagging. The experiment is carried out using weak 3.6.12.

Accuracy of the base single classifier and base classifier with bagging is measured which is displayed in below table.

	Datasets			
Classifier	Iris	Diabetes	Breast- Cancer	
Decisionsump	66.67	71.87	68.53	
Decisionsump with AdaBoost	95.33	74.34	70.27	
OneR	92.00	71.48	65.73	
OneR with AdaBoost	92.67	70.18	68.53	

We can see the result of the classifiers when used alone and when used with boostig. The columnar chart clearly shows the effect of base classifier with bagging.



Figure 1: Decisionsump and Decisionsump with AdaBoost comparison

It is clearly seen that when Decisionsump is used alone with iris, diabetes and breast-cancer dataset, the accuracy of classifier is lesser than when it is used with AdaBoost.



Figure 2: OneR comparison with OneR with AdaBoost

It is clearly seen that OneR is used alone with iris and breast-canceer dataset, the accuracy of classifier is lesser than when it is used with AdaBoost. Here one exception is there that is when same thing is performed with Diabetes dataset the ensemble accuracy goes down. So from above experiment, we can say that boosting improves the classification accuracy.

IV. CONCLUSION

The paper shows the effect of boosting (here AdaBoostM1) on classification accuracy by using different classifiers. The experiment was carried out using weak 3.6.12 and showed the effect of AdaBoostM1 on various base classifiers. Adding to it, it was observed that for all the three datasets, the classification accuracy increases when we use ensemble learning instead of a single classifier, exception was the diabetes dataset with OneR classifier. In conclusion, ensemble learning technique of boosting helps in improving the accuracy of classification. Future directions can include the effects of changing the base classifier learner like naive bayes, neural network, CART etc.

V.REFERENCES

- [1] Han, Jiawei, and Micheline Kamber. "Data mining: concepts and techniques (the Morgan Kaufmann Series in data management systems)." (2000).
- [2] Dietterich, Thomas G. "Ensemble methods in machine learning." Multiple classifier systems. Springer Berlin Heidelberg, 2000. 1-15.
- [3] Tu, My Chau, Dongil Shin, and Dongkyoo Shin. "A comparative study of medical data classification methods based on decision tree and bagging algorithms." Dependable, Autonomic and Secure Computing, 2009. DASC'09. Eighth IEEE International Conference on. IEEE, 2009.
- [4] Kittler, Josef, et al. "On combining classifiers." Pattern Analysis and Machine Intelligence, IEEE Transactions on 20.3 (1998): 226-239.
- [5] Nguyen Thai Nghe, P. Janecek, and P. Haddawy, "A comparative analysis of techniques for predicting academic performance", ASEE/IEEE Frontiers in Education Conference, pp. T2G7-T2G12, 2007.
- [6] Dietterich, Thomas G. "An experimental comparison of three methods for constructing ensembles of decision trees: Bagging, boosting, and randomization." Machine learning 40.2 (2000): 139-157.
- [7] Freund, Y., Schapire, R.E.: A decision-theoretic generalization of on-line learning and an application to boosting. Journal of Computer and System Sciences 55(1), 119–139 (1997)
- [8] Oza, N.C. AveBoost2: Boosting with Noisy Data. In F. Roli, J. Kittler, and T. Windeatt (Eds.), Proceedings of the Fifth International Workshop on Multiple Classifier Systems, 31-40, Berlin, 2004.

Optimized Architecture for Centralized MIS for Distributed Database Systems

Maulik R. Dhandhukia

Department of Computer Science, Kadi Sarva Vishwadiyalaya, Gandhinagar, Gujarat, India

ABSTRACT

The Web applications offer multiple advantages like centralized application deployment, upgrades without need to install the application at the each client machine, easy data transmission over HTTP so no problem from corporate firewalls and higher security. On the other hand Windows based Applications offer other advantages like rich GUI controls, hardware-interaction and higher performance for data access. So, a need for an architecture arises which can offer advantages of both these architectures to the end users. Also, the corporate MIS needs to be a Web based solution as the MIS reports need to be accessible by the Managers from wide spread geographical locations and with high security. In today's world where the Enterprise usually is divided into multiple physical locations spread across geographical area, there arises a need for distributed databases, yet catering the need for a centralized view of the data in the centralized corporate MIS. There arises a need for Data Warehousing for the Enterprise data so that the MIS reporting can be done in adequate response time and also not affecting the performance of the transaction processing of the Enterprise data. So, all these situations give raise to the need of a "Comprehensive Architecture for Enterprise" which is "Optimized" and can cater to the needs of these multiple stakeholder for the Enterprise data in different functions. So, as part of this research an "Optimized Architecture for centralized MIS for distributed database systems" is proposed so that this architecture can fulfill the needs of all role players in the Enterprise in different functions.

Keywords: Centralized MIS, Distributed Database Systems, ClickOnce, Optimized Architecture

I. INTRODUCTION

Web UI brings certain benefits to an application and so you wish to target a Web browser. When you are developing with the Web, it allows you to use standard HTML elements. Most potential users are familiar to Web pages look and feel and are familiar with browsing the Internet.

Over the HTTP protocol as compared to other proprietary protocol, it is much easier to export data through corporate firewalls, if you have to make an application that remote users can utilize.

You get much better set of UI controls than you do with HTML, when you program using a desktop UI. The UI can be made to look like almost anything you want. You can develop many controls that make creating a rich UI

SRST

very easy e.g. Tab controls, input masking controls and editable grids. The exact positioning of screen elements can also be controlled.

You can take benefit of the hardware that is already on the machine, when making a desktop application. If you are thinking of making a game, you will need to do this. It is very difficult in a browser to interface directly with the video card, which is required in Games. You will also need to interface directly with the machine's hardware, if you are developing a Computer-Aided Drawing or Computer Aided Manufacturing application. As the screen is drawn using local resources in the desktop and only the data changes, performance is usually faster on a desktop. In Desktop applications, a lot of screen data coming from the server to the client is prevented, which in turn was consuming time to display the data.

Smart Clients

The capability to create Smart Clients with ease is made available by the .NET Framework i.e. Windows Forms and the .NET Compact Framework. Similar architecture can be implemented by other technologies to provide smart client applications. A smart, flexible and convenient platform is created for your application by utilizing Smart Client concept.

The best features available in both the Web based and Windows based architectures are combined in the Smart Client applications.

Features of Smart client applications are as follows:

- Connected Smart client applications are always member of a larger distributed solution and are never standalone. There are specific services that help maintain the application and provide installation and update services to the Smart Client application.
- Offline Capable One of the key benefits that smart client applications provide is that they can work even when the user is not connected because they are running on the local machine. The smart client application can better performance and usability by buffering data and managing the connection in an intelligent way, even when the client is connected.

Role of ClickOnce

• By clicking a link in a web page the user can deploy and execute a Windows application using Microsoft's ClickOnce technology. Smart clients are applications which follow this approach. ClickOnce supports installing applications created with Windows Forms or Windows Presentation Foundation and is a part of Microsoft .NET Framework 2.0 and later.

II. METHODS AND MATERIAL

Clickonce Deployment Process

Smart client applications handle their deployment and upgrades in a much more intelligent way than traditional rich client applications.

Components

A Smart client application will have two parts

1. The actual application hosted on a Web Server build using Strong named assemblies

2. A thin client application to be installed locally

Process involved

The process which happens when the user opens a Smart client Application is described below,

- 1. The User opens the Application.
 - 2. The application references an assembly hosted on a Web Server
 - 3. The .NET Framework checks if the previously downloaded assembly is the latest one.

The central ClickOnce deployment framework is based on two XML manifest files: an application manifest and a deployment manifest.

The application developer creates the application manifest by utilizing the Publish Wizard in Visual Studio or the manifest generation tool in the .NET Framework SDK.

After it is deployed to the deployment folder, end users can download and install the application by clicking an icon indicating the deployment manifest file on a Web page or in a folder. The administrator modifies the deployment manifest to point to the folder of the new version of the application.

ClickOnce Publish properties are utilized to indicate when and how frequently the application should inquire for updates. Also, Publish properties can be used to make updates mandatory or to revert back to an older version.

Updater Application Block

The updater block is a library that you include in your application to manage the download of the application parts through HTTP.

It has some benefits compared to the original Framework implementation:

- It executes as an application on local machine and is available all the time with no performance consequences.
- Modifications are transacted; i.e., all the files of a new version must be successfully downloaded on the local machine before the new version becomes available.
- All the application files are noted in a manifest.
- It executes as a complete trust application; you need not interfere with client's security policy.

On the other hand, there are also some disadvantages:

• You must modify your application considerably in order to use it.

• It is not supported by Microsoft.

ClickOnce and HREF EXEs : Comparison

When compared to HREF EXEs, a ClickOnce application has the below given benefits:

- It has good integration with Visual Studio .NET, consisting of the ability to create the required extra files and tools that assist to figure out which security rights your application requires in order to execute.
- It comes with a bootstraper executable that can download required components, even the .NET Framework if required.
- It can have Start menu shortcuts.

Proposed Architecture

The proposed architecture for Centralized MIS for distributed database systems is as given below,



The Web applications offer multiple advantages like centralized application deployment, upgrades without need to install the application at the each client machine, easy data transmission over HTTP so no problem from corporate firewalls and higher security. On the other hand Windows based Applications offer other advantages like rich GUI controls, hardware-interaction and higher performance for data access. So, in this Architecture, "Clickonce" deployment is suggested using Windows Based Applications, so that benefits of both the Windows and the Web based architectures can be combined.

In today's world where the Enterprise usually is divided into multiple physical locations spread across geographical area, there arises a need for distributed databases, yet catering the need for a centralized view of the data in the centralized corporate MIS. So, in this architecture decentralized database design is suggested. The data that is collected at the site servers with the decentralized design is then passed on to the central server using Transactional Replication.

The magnitude of the data being generated from the Enterprise transactions is so high that running the corporate MIS from a centralized server may not be feasible from the performance of data access point of view. Hence, in the architecture a separate MIS server is suggested and the data from the centralized server is data modeled as per the Datawarehousing principles and stored on the MIS server for the reporting purposes.

Also, the corporate MIS needs to be a Web based solution as the MIS reports need to be accessible by the Managers from wide spread geographical locations and with high security. So, in this architecture, Web based access to the MIS reports is suggested.

In this architecture, only data is exchanged by the client side component with the server and the code for rendering of the components is not exchanged between the client and the server. This leads to fast performance of the application. Also as only data is exchanged, the refresh rate of the client side components with data is also faster. In this architecture, as the pre-compiled code is run, there is no need for compilation of the components when the code is run for the first time.

In this architecture, the geographic area for usage of the application is equivalent to Web applications i.e. LAN, WAN and Internet. Also, the application can be available on different platforms and different devices. Application can exchange data through HTTP i.e. port 80 and so generally, the problems related to firewalls on intermediate servers is not faced.

In this architecture, there is centralized deployment of components and new versions of the application, so there is no need for manual deployment on all user machines. Also, when the user starts the application new version is automatically checked by the application. The updated components are downloaded automatically by the application.

In this architecture, due to clickonce, rich GUI components are available. Windows controls and other complex controls like tabs, grids etc is available. Input

masking controls can also be used just like windows applications.

In this architecture, due to clickonce, the application can integrate with the hardware and electronic equipments like scanners, cameras, medical systems etc. Also, it is easy in this architecture to load shared DLLs from local machine and integrate with other applications like Microsoft office applications etc.

In this architecture, the application can run in its own sandbox security so it is more secure for the client machines. Also, in this architecture, the port access for database can be restricted through the firewall on the database server to increase the database security.

In this architecture, for increasing the performance, the processing of the client side logic can be divided amongst multiple clients and the processing of the database queries can be divided amongst multiple distributed servers.

In this architecture, a separate server is used for Data Warehousing and so the OLTP and OLAP parts of the application are divided. Processing of the complex queries for reporting purposes can be run on separate server having may be denormalized data. In this architecture, the data is replicated from multiple servers to the central server to get a centralized view of the data of the whole organization and it is possible to replicate only the transactional part instead of replicating the whole database.

Also, in this architecture, for optimizing the resource utilization, connection pooling and object pooling can be implemented and caching can be done in the intermediate servers between the client and the targeted server.

III. RESULT AND DISCUSSION

A comparative Analysis of the proposed architecture with the existing architectures viz. Windows Based – Three Tire and Web Based Distributed Database architectures, which had the highest service points, is given below.

Sr. No.	Feature offered by Architecture	Windows Based Three Tier Architecture	Web Based Architecture, Distributed Database	Proposed Architecture
	Deployment			
1	Centralized deployment of components and new versions of the application so no need for tedious deployment on all user machines.	Ν	Y	Y
2	Automatic checking of new version by the application when the user starts the application	Ν	Ν	Y
3	Automatic downloading of the updated components for the new version by the application	Ν	Y	Y
	Richness of GUI			
4	Rich GUI components available	Y	Ν	Y
5	Windows controls (i.e. Operating System API controls) can be used	Y	Ν	Y
6	Complex controls like Grids, Tab panes etc can be used with standard Windows GUI look and feel	Y	Ν	Y
7	Input masking controls can be used	Y	Ν	Y
	Hardware Interaction			
8	Possibility of hardware interaction from the application	Y	Ν	Y
9	Ease of integration with electronic systems like scanners, cameras, medical systems etc.	Y	N	Y

Comparative Analysis of the Proposed Architecture with the existing architectures
10	Easy to load shared DLLs from the local machine in the application	Y	Ν	Y
11	Easy to integrate with other desktop based applications like Word, excel, PowerPoint etc.	Y	Ν	Y
	Speed of Transactions			
12	The screen is drawn using local components and only data is exchanged with the server	Y	Ν	Y
13	The rate of refresh of components with data is faster	Y	Ν	Y
	Pre-compiled code is run, so there is no need for			
14	compilation of code when the code is run for first time	Y	Ν	Y
15	The code for rendering of components on the screen is not exchanged between the local machine and the server	Y	Ν	Y
	Geographical Area for access			
16	Application is available even outside the Local Area Network (LAN)	Ν	Y	Y
17	Application is available in different branches of the same organization on a private Wide Area Network	Ν	Y	Y
18	Application is available on internet i.e. world wide web.	Ν	Y	Y
19	Application is available on variety of devices like mobiles, palmtops, notebooks, etc. using browser support.	Ν	Y	Y
20	Application generally exchanges data over port 80 of HTTP communication to go beyond the different firewalls of various servers between server and the client	Ν	Y	Y
21	Easy integration of Web services so that variety of applications running on different platforms can interact with the application running on the server	N	Y	Y
	Security			
22	Application can run in its own sandbox security so that it is more secure for the client machine	Ν	Y	Y
23	The ports access for the Database listener can be restricted for machines on the network through firewall on the server for increasing the security for the database data	Y	Y	Y
24	Secure Socket Layer (SSL) protocol support is easily available.	Ν	Y	Y
	Distribution of Processing/Performance			
25	The processing of the client side logic is divided amongst many client side machines	Y	Ν	Y
26	The processing of the database load and database queries is divided amongst multiple database servers.	N	Y	Y
	Data Warehousing/Replication features			
27	A separate server is used for Data Warehousing/Data Mining.	Ν	Y	Y
28	OLTP and OLAP data are considered separate with separate data structures and data tables.	Ν	Y	Y
29	De-normalized data is used for analytical purposes	Ν	Y	Y

30	Processing of the complex queries for complex data reports is done by database engine separate from the main online sever processing all transactions	N	Y	Y
31	Data is replicated between different database servers for getting centralized view of the whole organization data	Ν	Y	Y
32	It is possible to get transactional updates for replication purpose instead of replicating the whole database	Ν	Y	Y
	Optimization of Resources			
33	The architecture can implement connection pooling for optimizing the connections to be established for database connection	Y	Y	Y
34	The architecture can implement middle layer object pooling for optimizing the memory used for middle layer components	Y	Y	Y
35	Different intermediate servers between the client and the final server can cache contents to increase the performance at the client side	N	Y	Y
	Total Service Points	16	21	35

IV. CONCLUSION

The Web applications offer multiple advantages like centralized application deployment, upgrades without need to install the application at the each client machine, easy data transmission over HTTP so no problem from corporate firewalls and higher security. On the other hand Windows based Applications offer other advantages like rich GUI controls, hardware-interaction and higher performance for data access. So, a need for an architecture arises which can offer advantages of both these architectures to the end users. Also, the corporate MIS needs to be a Web based solution as the MIS reports need to be accessible by the Managers from wide spread geographical locations and with high security. In today's world where the Enterprise usually is divided into multiple physical locations spread across geographical area, there arises a need for distributed databases, yet catering the need for a centralized view of the data in the centralized corporate MIS. The magnitude of the data being generated from the Enterprise transactions is so high that running the corporate MIS from a centralized server may not be feasible from the performance of data access point of view. Hence there arises a need for Data warehousing for the Enterprise data so that the MIS reporting can be done in adequate response time and also not affecting the performance of the transaction processing of the Enterprise data. So, all these situations give raise to the need of a "Comprehensive Architecture for Enterprise"

which is "Optimized" and can cater to the needs of these multiple stakeholder for the Enterprise data in different functions. So, as part of this research an "Optimized Architecture for centralized MIS for distributed database systems" is proposed so that this architecture can fulfill the needs of all role players in the Enterprise in different functions.

The limitation of this architecture is that it can be applied only in an enterprise wide solution i.e. a large scale enterprise or project has to adopt this architecture and implement this to realize its benefits.

The following are the highlights of this Architecture,

- "Clickonce" deployment is suggested using Windows Based Applications, so that benefits of both the Windows and the Web based architectures can be combined.
- In this architecture decentralized database design is suggested. The data that is collected at the site servers with the decentralized design is then passed on to the central server using Transactional Replication.
- In the architecture a separate MIS server is suggested and the data from the centralized server is data modeled as per the Datawarehousing principles and stored on the MIS server for the reporting purposes.

• In this architecture, Web based access to the MIS reports is suggested.

V.REFERENCES

- [1] R. Balter, P. Berard, P. Decitre, Why control of the concurrency level in distributed systems is more fundamental than deadlock management, Proceedings of the first ACM SIGACT-SIGOPS symposium on Principles of distributed computing, p.183-193, August 18-20, 1982, Ottawa, Canada [do10.1145/800220.806696]
- [2] D. Barbara and H. Garcia-Molina, "How expensive is data replication? An example", in Proc. 2nd Distributed Comput. Syst., Feb. 1982.
- [3] Philip A. Bernstein, Nathan Goodman, Concurrency Control in Distributed Database Systems, ACM Computing Surveys CSUR, v.13 n.2, June 1981 [do 0.1145/356842.356846]
- [4] Philip A. Bernstein, Nathan Goodman, A Sophisticate's Introduction to Distributed Concurrency Control, Proceedings of the 8th International Conference on Very Large Data Bases, September 08-10, 1982
- [5] Michael J. Carey , Miron Livny, Distributed Concurrency Control Performance: A Study of Algorithms, Distribution, and Replication, Proceedings of the 14th International Conference on Very Large Data Bases, August 29-September 01, 1988.
- [6] B. Ciciani, D. M. Dias, and P. S. Yu, "On hybrid distributed--Centralized database systems." in Proc. IFIP Conf. Distributed Processing, Oct. 1987. New York: Elsevier Science.
- [7] E. G. Coffman, E. Gelenbe, and B. Plateau, "Optimization of the number of copies in a distributed system," IEEE Trans. Software Eng., vol. SE-7, no. 1, Jan. 1981.
- [8] D. M. Dias, P. S. Yu, and B. T. Bennett, "On centralized versus geographically distributed database systems," in Proc. 7th Int. Conf. Distributed Comput. Syst., Berlin, West Germany, Sept. 1987.
- [9] B. I. Galler and L. Bos, "A model of transaction blocking in databases," Perform. Eval., vol. 3, 1983.
- [10] J. Gray, P. Homan, R. Obermarck, and H. Korth, "A straw man analysis of probability of waiting and deadlock," IBM Res. Rep. RJ 3066, San Jose, CA.

A Review of Sequential Extraction Method for Lead in Samples: A Case Study of Artisanal Mines of Sokoto Basin (Zamfara State)

Y. M. Ahijjo^{*1}, A. N. Baba-kutigi², M. Momoh^{3,} A. U. Moreh⁴

*¹Department of Physics, Usmanu Danfodiyo University, Sokoto, Sokoto State, Nigeria
²Department of Physics, Federal University, Dutsin-Ma, Katsina State, Nigeria

^{3,4} Department of Physics, Usmanu Danfodiyo University, Sokoto, Sokoto State, Nigeria

ABSTRACT

This paper reviews the speciation of Lead which is a stable trace metal with alpha and beta particle emitting radioactive isotopes known to have drawn global attention in Zamfara state and recently in Niger state all in Nigeria for poisoning thousands of villagers and leading to numerous death tolls. It is termed as a pollutant environmentally, as it could be subsequently absorbed into food chain of organisms and thereby posing a health concern to the public. Acceptable threshold of lead is also a global concern due to its potency even at lower concentration in ppm. This calls for frequent environmental assessment and consumables for a precise reference to its occurrence. This paper hence, reviews the occurrence of lead and sequential extraction method to ascertaining environmental vulnerability free of lead.

Keywords: Radioisotope, Sequential-Extraction, Environment, Zamfara and Lead-Poisoning

I. INTRODUCTION

Lead is one of the known trace metal which has caused an epidemic of poisoning in some parts of Zamfara state, Nigeria [1]. During a childhood lead poisoning outbreak related to gold ore processing that was confirmed [2]. High toxicity have been attributed to environmental pollution by lead from the activities of miners in search for alluvial minerals [3]. Similar epidemics of lead poisoning was also reported to have claimed 23 children lives in a village in Niger state, Nigeria [4]. Exposure to radiation emitting elements like lead has been linked to mortality rate due to various ailments in recent times [5]. Hence, the study of their concentration and speciation method becomes imperative in empirical terms. Exposures to radiation emitting trace metals like lead have been thought to emanate from the search of natural sources [6]. Nigeria is a country endowed with numerous mineral resources [7,8]. There are proven reserves of both alluvial and primary deposit of the world's major demanded minerals which during mining and extraction, various metal and their relative

radioactive emitting isotopes are exposed to the public health detriments. At present, exploitation of alluvial deposits is being undertaking mostly by illegal and artisanal miners in different location in Zamfara and other parts of the country [9,10,11,12].

II. LEAD CONCENTRATION

The concentration of lead in living systems can result in a number of structural and behavioural abnormalities, neurophysiological disturbances, genetic alteration of cell (mutation), tetratogenesis and carcinogenesis [3,13]. There is common mode of accumulation of metals like lead in both natural and anthropogenic samples. Thus posing herculean task to isolate and determine the origin of various metals present in a given samples [14]. Although their concentration my point o their overall presence in a given sample, but it is difficult to ascertain information regarding the chemical nature or potential mobility and availability in biological systems [15,16,17,18].



In a deemed desperate situation, single extractions is used generally to provide a rapid evaluation of the exchangeable metal function in sample [19,20]. Sequential extraction method is a frequent approach to evaluate metal distribution base on reactive form present in a solid phase [18]. In principle, to determine lead concentration using normal extraction method possess high level of uncertainties than to do the procedures in which the total content Is determined in a direct mode [21]. This is due to the following reasons:

- 1. The task in separating the compounds to be studied from their substrates
- 2. The probability of upsetting the equilibrium between the different chemical species embedded in the system;
- 3. The analytical inadequacy in sensitivity of the adopted techniques especially when trace elements are found at very low concentrations
- 4. The unavailability of certified reference materials [22,21].

III. OVERVIEW OF SEQUENTIAL METHOD

However, different demanding task of sequential extraction method have been used to report more detailed information associated with metal phase [23,24,25]. Although often discard due to problem of specificity of extraction [26].

In essence, several studies have been conducted in this direction, this paper aims to review sequential extraction method for solid phase lead in soil sample as it affects remediation and analytical methods used as well as to compare results of other experiments of metal speciation.

IV. METALS (Lead) and POLLUTION

The biological potentially pollutions that are released into the environments have tracing pathways and, ultimately, the bioavailability of both radioactive and non-radioactive pollutants is of paramount consideration [27]. If individual or organisms are not exposed to pollutant or contaminants, or the level of exposure is slight, then the impact of these pollutants is likely to be insignificant or non-existent [28,29,30]. Availability of information about the degree of exposure of one to a source or sources of pollution of all type is central to the success measured of their environmental impact [31]. Common pollution pathways are generally air, water, food or soil through the environment and consequently to living organisms [32]. The degree of concentration of lead depends on the type of activity taken place in a particular area. In Nigeria, several pathways have been identified through which specific heavy metal can be of pollution to living species [33].

Lead is a toxic metal which exists in trace amount in some part of the globe but very significant in polluting environment. It can cause a grave damage to the brain, kidney, bone marrow, and other body systems in humans, especially among young children [34]. Lead exposure among children is associated with developmental problems including impaired cognitive function, reduced intelligence, impaired hearing, and reduced statue; with no safe level of toxicity known in blood lead level (BLL) [35,36]. As leaded gasoline is still popularly patronized, the consequence is that a great contribution to the number of cases of childhood lead poisoning will be anticipated. However, numerous studies have been reported that efforts to reduce leaded gasoline remain a mere theory and not in practice in most developing world [37]. Organic lead contents when undergoes contribution, the leaded gasoline is oxidized to lead oxide as shown in the equation (1) below

 $2Pb(C_2H_5)_4+270_2 \longrightarrow 2PbO+1bCO_2+2OH_2O$ (1) [33]

The subsequent oxide from the above reaction reacts with halogen carrier to form lead halides Viz: PbCl₂, PbBr₂, PbBr, which are given off through vehicles exhaust pipes. Lead contamination form automobile have well long been documented [33]. Developing countries like Nigeria are faced with major sources of exposure to lead through lead mining smelting, paints, battery recycling and traditional medicine [38,39].

V. GROUND VALUE/ QUALITY FACTOR

This is a value usually determined by miners in a particular field. As there are no miners without an outlined procedure. This procedure was adopted from Carthcat and McGreary (1959). They looked into the weight of $1M^3$ of mineralized units (e.g shale/siltstone, phosphate rock e.t.c) they also adopted a valid calculation for one hectare as shown in the equation (2) below.

$$\frac{10,000 \times 1m^3 \times Qtonnes}{1000}$$
(2)

VI. ANALYTICAL METHOD

The amount of pollutant exposed to the environment and it include relative metal (Lead). The soil, water (stream, river, well) and the atmospheric air are the receivers of every pollution because of their abundance which is capable of diffusion, dilution and reduction of the toxic substances introduced with time [40.41.42]. Nevertheless, the dissolution and selective destruction of collected sample components is unavoidable in any sequential extraction technique, due to non-specificity of addition and possibility of the redistribution of metals during the extraction [43]. Since the early 1980s and 1990s sequential extraction method has been adopted to determine speciation of metals in samples [24,44]. This is because of the fact that the total concentration of metals often does not accurately represent their characteristics and toxicity. In order to overcome the said obstacles it is helpful to evaluate the individual fraction of the metals to fully understand their actual and potential environmental effects [24]. However, to cub the problem of mobility of heavy metals in sediments, various sequential extraction procedures have been developed [45,46,47]. Interestingly, this analysis could not be impressive without a mention of noble methods of investigating the distribution of heavy metals in sample by the 5 steps Tessier et al., [24] and the 6-step extraction method, laerstin and Frontier [48]. Which were widely used to harness these two noble schemes, some modified procedures with different sequences of reagents or experimental conditions have been developed [49,50].

Wang et al., [51], adopted the modified Tessuer procedure of sequential extraction method to investigate the distribution and speciation of Cd, Cu, Pb, Fe and Mn in the shallow sediments of Jinzhou Bay, Northeast of China [51].

VII. STATISTICAL ANALYSIS

Fanasidez et al.,[21], aimed at to test the European Community Berean of Reference usually called BCR technique for the determination of the concentration of 11 elements including lead from fine soil samples. Labeled 3Ah, 3Bwk 6Ap 6Be and 6Bw. So as to calculate the BCR total concentration, C^{α} , of each element in each sample according to the following expression.

$$C^{\alpha} = \sum_{i=1}^{3} C_i + r^{\alpha}$$
(3)

Where { $C_i i = 1, 2, 3$ } represents the concentrations determined in each of the three BCR steps and r^{α} signifies that of the residue. The super-index α reforms to the time residues (A and B) describe earlier. The corresponding uncertainties, $\sigma(C^{\alpha})$. Were calculated as the quadratic sun of the respective errors of the concentrations resulting from each of the BCR steps and the residue

$$\sigma(C^{\alpha}) = \sqrt{\sum_{c=1}^{3} \left[\sigma(C_{i})\right]^{2} + \left[\sigma(r^{\alpha})\right]^{2}}$$
(4)

Fernandez et al.,[21].

The resulting value were compared to the reference values provided by the total analysis, which gives us the total concentrations, T, as well as the corresponding uncertainties, σ (T), for each element in each soil sample [21].

In addition to the direct comparison of the values found, they have calculated, for each element and each soil, the quality

$$r = \frac{C^{\alpha} + T}{\sqrt{\left[\sigma\left(C^{\alpha}\right)\right]^{2}} + \left[\sigma\left(T\right)\right]^{2}}$$
(5)

From Frodesen et al., [51] it could be shown that if the total concentrations determined with two methods derived from the same parental distribution, the variable r should be a Gaussian distribution centred at O with variation 1. [21]. Finally, for each step of the BCR method, they calculated the correlation between the concentrations of each element and the soil characteristics listed in the table (1) below, by means of the Pearson's linear correlation coefficient [52].

Table 1

Comp. Hor.	Clay	CaCO ₃	pН	Fine Silt and Clay	Organic Matter
Error %	5.0	2.0	0.2	5.0	0.2
3Ah	47.4	11.4	8.0	76.4	2.71
3Bwk	57.6	21.7	8.0	87.3	1.43
6Ap	51.5	9.6	8.2	73.8	2.57
6Bw	51.7	7.6	8.1	85.3	1.07
6Bx	65.9	7.5	8.1	71.4	1.71

*Table 1. Was adapted from Ferna'ndeza et al., (2004) for the Purpose of review with slight modifications not intended to alter the prior work for claim of ownership

$$r_{i} = \frac{\Sigma \left(C_{i} - \overline{C}\right) \left(r - \overline{v}\right)}{\sqrt{\Sigma \left(C_{i} - \overline{C}\right)^{2} \sqrt{\left(v - \overline{v}\right)^{2}}}}$$
(6)

Where the sum for the fine soils analysed, C is the mean of the values C_i for those soils, refers to the soil characteristics and v is the corresponding mean value. Also, the uncertainty for those correlation coefficients was determined following a Monte Carlo technique. For each C_i value, Fernandez et al., [21] generated a random value according to the Gaussian distribution centred on it, with variance. The some procedure was performed for each r value. Which gave new sets of values $C_i^{(k)}$ and $v^{(k)}$ for the five soils considered by Fernandez et al., [21]. By repeatedly using equation (5), they obtained a set of values. While the uncertainly of the original linear coefficient r_i is given by the standard derivation of these N values. They verified that N=1000 was adequate for convergence in the results [52,53].

VIII. CONCLUSION

This paper has reviewed the analytical and statistical methods for sequential extraction method of lead in a given sample. The review has highlighted various effects, occurrence and a number of speciation methods to determine concentration of lead among other metals and their mobility in different fractions. It could also be concluded based on the bounden of pollutant and environmental vulnerability at may part of the globe if not most locations that inhabitants of such localities are also vulnerable to radioactivity of varying sources.

Although leads as a metal has been identified as a health potent trace metal in the environment, but very limited literatures are available on the systemic effect that sound as nearing to artisanal mines and illegal mines in developing world.

IX.REFERENCES

- [1] Médecins Sans Frontières (MSF) (2010) Field News; LEAD POISONING IN ZAMFARA STATE, NIGERIA; Nigeria / 16.07.10. Available from corresponding website; HTTP://WWW.MSF.ORG.AU/FROM-THE-FIELD/FIELD-NEWS/FIELD- NEWS/ARTICLE/LEAD-POISONING-IN-ZAMFARA-STATE-NIGERIA.HTML.
- [2] Vanguard Newspaper, 400 children death from lead poisoning, Vanguard publication, Nigerian Daily Newspaper, 2011.
- [3] Okoro H. K., Fatoki O.S., Adekola F.A., Ximba B.J. and Snyman R.G., (2012). A Review of Sequential Extraction Procedures for Heavy Metals Speciation in Soil and Sediments. 1: 181. doi:10.4172/scientificreports.181
- [4] Daily Trust. Category: Health Published on Tuesday, 03 March 2015 05:00 Written by Victoria Onehi & Mulikatu Mukaila
- [5] Rehani N. and Haji R. (2011) Reducing Mercury Exposures and Transitioning Miners Away from Mercury Use, Anglophone West Africa Regional Awareness-Raising Workshop on Mercury in Artisanal & Small-Scale Mining, http://www.unep.org/hazardoussubstances/Portals/9/Mercury/D ocuments/ASGM/Nigeria/Presentations/Tech%20session/Haji_ Rehani_Reducing%20emissions%20&Transitioning%20from% 20mercury.pdf.
- [6] Nero, A.V., Schwehr, M.B., Nazaroff, W.W., and Revzan, K.L. (2012). Distribution of Airborne Radon-222 Concentrations in U.S. Homes. Science 234: 992-997. physical model for the transport. Geophysics 47, 1444–1452.
- [7] Kogbe, C. A. (1982). Geology of the Southeastern (Sokoto) Sector of the Iullumineden Basin. *Bulletin*, 32, 420.
- [8] Kogbe, C.A. (1972). Geology of the Upper Cretaceous and Lower Tertiary sediments of the Nigerian sector of the Illummeden Basin (West Africa), *Geol. Rdsch.* 62, 197 – 211.
- [9] Akande, S.O., Fakorede, O. and Muckey, A. (1988). Geology and genesis of gold bearing quartz veins at Birni Yauri and Okolom in the Pan-African domain of western Nigeria. *Geologie en Mijnbouw* 67. Pages 41-51.
- [10] Danbatta, U.A. (2008). Precambrian crustal development in the northwestern part of Zuru schist belt, northwestern Nigeria. *Journal of Mining and Geology*. 44 (1), pages 45-56.
- [11] Dan'Azumi S. and Bichi M.H. (2009). Industrial Pollution and Heavy Metals Profile in North-Western States, Nigeria. Accessed at www.trisanita.org/asespaper2010/ases03v5n1y2010.pdf (8 August 2010).
- [12] Umar A.M., Onimisi M.Y., Jonah S.A. (2012). Baseline measurement of natural radioactivity in soil, vegetation and water in the industrial district of the Federal Capital Territory (FCT) Abuja, Nigeria. British Journal of Applied Science & Technology.;2(3):266-274.

- [13] Bubb JM, Lester JN (1991) The impact of heavy metals on lowland rivers and the implications for man and the environment. Sci Total Environ 100 Spec No: 207-233.
- [14] Idris AM, Eltayeb MAH, Potgieter-Vermaak SS, Grieken R, Potgieter JH (2007). Assessment of heavy metal pollution in Sudanese harbours along the Red Sea coast. Microchemical. J 87: 104-112.
- [15] Vijver, M.G., Van Gestel, C.A.M., Lanno, R.P., Van Straalen, N.M., Peijnenburg, W.J.G.M., 2004. Internal metal sequestration and its ecolotoxicological relevance: a review. Environ. Sci. Technol. 38,4705–4712.
- [16] Jin, C.W., Zheng, S.J., He, Y.F., Zhou, G.D., Zhou, Z.X., 2005. Lead contamination in tea garden soils and factors affecting its bioavailability. Chemosphere 59, 1151–1159.
- [17] Powell, K.J., Brown, P.L., Byrne, R.H., Gajda, T., Hefter, G., Sjoberg, S., Wanner, H., 2005. Chemical speciation of environmentally significant heavy metals with inorganic ligands. Part1: The Hg2+, Cl_, OH_, CO2_ 3, SO2_4, and PO3_4 aqueous systems. Pure Appl. Chem. 77, 739–800.
- [18] Silveira M.L., Alleoni L.R.F., O'Connor G.A., Chang A.C.(2006). Heavy metal sequential extraction methods—A modification for tropical soils, 0045-6535/\$ - see front matter _ 2006 Elsevier Ltd. All rights reserved.doi:10.1016/j.chemosphere.2006.01.018.
- [19] Quevauviller P, Olazabal J (2002) Links between the water framework directive, the thematic strategy Soil protection and Research trends with focus on pollution issues. J. of soil and Sed 3: 243-244.
- [20] Sahuquillo A, Rigol A, Rauret G (2003) Overview of the use of leaching, extraction tests for risk assessment of trace metals in contaminated soils and sediments. Trend Analytical Chemistry 22: 152-159.
- [21] Ferna'ndeza E., Jime'neza R., Lallenab A.M., Aguilara J., (2004). Evaluation of the BCR sequential extraction procedure applied for two unpolluted Spanish soils. Environmental Pollution 131 (2004) 355e364.
- [22] Pickering, W.F., 1995. General strategies for speciation. In: Ure, A.M., Davidson, C.M. (Eds.), Chemical Speciation in the Environment. Chapman & Hall.
- [23] Tessier A, Campbel PGC, Bisson M (1979) Sequential extraction procedure for the speciation of Particulate trace metals. Anal Chem 51: 844-851.
- [24] Templeton DM, Ariese F, Cornels R (2001) IUPAC guidelines for terms related to chemical Speciation and Fractionation of elements. Pure. Appl. Chem 72: 1453–1470.
- [25] Bordas F, Bourg ACM (1998) A critical evaluation of sample for storage of Contaminated Sediments to Be investigated for the potential mobility of their heavy metal load. Water. Air. Soil. Poll 103: 137-149.
- [26] Beckett, P.H.T., 1989. The use of extractants in studies on trace metals in soils, sewage sludges, and sludge-treated soils. Adv. Soil Sci. 9, 143–176.
- [27] Luigi M., Patrick B., John E.B., Nicole G., Rudie H., Alexander K., Ivan K., Gennady L., Marilyne L., Raul P., Francoise S., and Mark Z., (2008). Testing Models for Predicting the Behaviour of Radionuclides in Aquatic Systems. Applied Radiation and Isotope Journal, 66 (2008) 1736-1740.
- [28] Piacditelli, G.M and Amandus, H.E (1990) Respirable dust exposures in US surface coal mines (1982-1986). Arch. Environ Health. 45 (4): 202-209.
- [29] Amandus, H.E and Peterson, M.R (1989) Dust exposures at US surface coal mines in 1982 – 1983. Arch Environ Health 42(6):374-81.
- [30] Peterson, P.E and Henmar, P. (1988). Oral conditions among workers in the Danish granite industry. Scan J. Work Environ Health. 14 (5): 328-331.
- [31] Shaw G. (2005). Applying radioecology in a world of multiple contaminants. Journal of Environmental Radioactivity 81 (2005) 117e130

- [32] Ayodele, J.T. and Abubakkar, M.B. (2001); Trace metal levels in Tiga lake, Kano, Nigeria. Trop. Environ. Res. 3: 230 – 237.
- [33] Galadima, A. and Garba, Z.N. (2012). Heavy metals pollution in Nigeria: causes and consequences. *Elixir Pollution 45* (2012) 7917-7922
- [34] Needleman H. (2004). Lead poisoning. Annu Rev Med 55(1):209–222.
- [35] Canfield R.L., Henderson Jr. C.R., Cory-Slechta D.A., Cox C., Jusko T.A., Lanphear B.P.(2003). Intellectual impairment in children with blood lead concentrations below 10 μg per deciliter. N Engl J Med 348(16):1517–1526.
- [36] Jusko T.A., Henderson C.R. Jr., Lanphear BP, Cory-Slechta DA, Parsons PJ. Canfield RL. (2008). Blood lead concentrations <10 µg/dL and child intelligence at 6 years of age. Environ Health Perspect 116:243-248.
- [37] Orisakwe, O.E (2009) Environmental pollution and blood lead levels in Nigeria: Who is un-exposed. International Journal of Occupational and Environmental Health, 15,3 315-317.
- [38] Falk H. (2003). International environmental health for the pediatrician: case study of lead poisoning. Pediatrics 112(1):259-264.
- [39] Meyer PA, Brown MJ, Falk, H. (2008). Global approach to reducing lead exposure and poisoning. Mutat Res 659(1-2):166-175.
- [40] Fatoki OS, Mathabata S (2001) An assessment of heavy metals pollution in the East London and Port Elizabeth harbours. Water SA 27: 233-240.
- [41] Fukue M, Nakamura T Kato Y, Yamasaki S (1999) Degree of pollution for marine Sediments. Engineering Geology 53: 131-137.
- [42] Fan W, Wang WX, Chen J (2002) Geochemistry of Cd, Cr, and Zn in highly contaminated sediments and its influences on assimilation by marine bivalves. Environ Sci Technol 36: 5164-5171.
- [43] Sheppard, M.I., Stephenson, M., 1997. Critical Evaluation of Selective Extraction Methods for Soils and Sediments, Contaminated Soils. INRA (Les Colleagues, 85), Paris.
- [44] Coetzee PP (1993) Determination and speciation of heavy metals in sediments of the Hartebeespoort Dam By sequential extraction. Water SA 19: 291-300.
- [45] Salmons W, Forsstner U (1980) Trace metal analysis on polluted sediments. Part II:evaluation of Environmental impact. Environ Technical letter 1: 14-24.
- [46] Li X, Thornton I (2000) Chemical partitioning of trace and major elements in soils contaminated by mining and smelting activities. Applied geochemistry 16: 1693-1706.
- [47] Kiratli N, Ergin M (1996) Partitioning of heavy metals in surface Black Sea sediments. Applied Geochemistry 11: 775-788.
- [48] Kersten M, Frostner U (1986) Chemical fractionation of heavy metals in anoxic estuarine and coastal sediments. Water. Sci. Technol 18: 121-130.
- [49] Borovec Z, Tolar V, Mraz L (1993) Distribution of some metals in sediments of the central part of the Labe (Eibe) River: Czeech Republic. Ambio 22: 200-205.
- [50] Gomez–Ariza JL, Giraldez I, Sanchez- Rodas DE, Morales E (2000) Metal sequential Extraction Procedure optimized for heavy metal polluted and ironoxide rich sediments. Anal Chim Acta 414: 151-164.
- [51] Wang S, Jia Y, Wang S, Wang X, Wang H, et al. (2010) Fractionation of heavy metals in shallow marine sediments from Jinzhou Bay, China. J Environ Sci (China) 22: 23-31.
- [52] Press, W.H., Tukolsky, S.A., Vetterling, W.T., Flannery, B.P., 1992. Numerical recipes in Fortran. The Art of Scientific Computing, second ed. Cambridge University Press, New York.
- [53] Frodesen, A.G., Skjeggestad, O., To⁻⁻ fte, H., 1979. Probability and statistics in particle physics. Universitetsforlaget, Bergen.

Scanning Electron Microscopic Examination of Different Varieties of Oat Grains in Comparison with the Analyzed Degree of Starch Breakdown and Glycaemic Responses in Horses

Mandy Bochnia^{*1}, Sabine Walther², Hans Schenkel³, Kristin Romanowski⁴, Annette Zeyner¹

*¹Institute of Agricultural and Nutritional Sciences, Martin-Luther-University Halle-Wittenberg, Halle, Germany
²Institute for Geosciences Martin-Luther-University Halle-Wittenberg, Halle, Germany
³Regional Office of Agricultural Chemistry, University Stuttgart-Hohenheim, Germany
⁴Chair of Nutritional Physiology and Animal Nutrition, University of Rostock, Germany

ABSTRACT

Starch granules of different varieties of oat grains were observed by a scanning electron microscope (SEM) in order to provide information about morphologic characteristics e.g. the surface and interconnections of the granules to evaluate a possible enzyme attack and degradation, respectively. Additional information about the analyzed degree of starch breakdown and the glycaemic responses in horses after feeding the oat grains were used as parameters for comparison. The SEM has been used as an effective tool in determination of shapes and surface structures of various starch granules, in particular the description of differences within one variety.

Keywords: starch granules, scanning electron microscope, oat grains, glycaemic response, horse

I. INTRODUCTION

Starch from cereal grains is the most abundant energy source for the majority of domestic animals. A high small intestinal digestibility of cereal starch is the precondition for maximal starch utilization in monogastric animals [1]. Particularly in horses, the amylase activity and the capacity for starch digestion in the small intestine is critically low [2]. Starch granules have a complex and highly ordered semi-crystalline structure. Besides other important morphological characteristics the last-mentioned appears to be an important barrier to starch digestion. More details about starch microstructure and digestion can be found elsewhere [3]. It can be distinguished between exo-corrosive alterations where signs of starch destruction can be found at the granules' surface only and endo-corrosive alterations where digestive enzymes have access

through small pin holes in the granules [4]. These types of corrosion are largely independent from the amylase source [5], but the starch granules' particle size and the structure and integrity of the surface area play an important role for the efficacy of enzymatic hydrolysis [6].

Evidence exists that starch characteristics according to scanning electron microscopy (SEM) may have a predictive value regarding the small intestinal digestibility of different starch sources in horses [7]. Previous studies investigated whether small intestinal starch digestibility corresponds to the microscopic starch structures in feed and chyme of horses, but the proven feedstuffs included either native or processed cereal grains (e. g. whole, broken, grounded, expanded) or corn silage [2]. To our knowledge a comparison of SEM-pictures from starch granules deriving from different oat grain varieties has not yet been published and certainly not a comparison of those pictures with laboratory scale and *in vivo* results, however, related to starch digestibility in the small intestine of horses.

The aim of the study was to characterize and compare starch granules from quite distinct oat grain varieties *via* SEM and to compare these with results from the degree of starch breakdown (DSB) measured in the laboratory and the *in vivo* determined postprandial (ppr.) glycaemic response to starchy meals in adult healthy horses.

II. METHODS AND MATERIAL

Starch granules and their embedding in surrounding structures deriving from four varieties of oat grains were visualized by SEM and the pictures further interpreted (German Patent and Trademark Office; Brief disclosure for the Patent Application 10 2013 016 050.2). Prior to SEM, grains were crushed, spread out on a microscope slide, air-dried and sputtercoated with gold. The studied oat varieties can be characterized as follows: 'Energie', high fat content; 'Melody', high content of ß-glucans; 'Scorpion', high starch-content; naked oats 'Sandokan', particularly low fiber content. DSB was determined according to [8]. SEM and DSB results were compared with the mean glycaemic response of six adult healthy horses. For this, the horses received crushed oat grains from the above mentioned varieties according to a cross over design where further 1.0, 1.5, and 2.0 g starch/kg body weight were fed from each variety and the overall mean from these ingested quantities was taken [9]. The respective area under the plasma glucose curve was than calculated starting from the baseline level at time point 0 min up to 300 min ppr. [AUC_{gluc}].

III. RESULTS AND DISCUSSION

The starch grains from different oat varieties were individual regarding their size and the occurrence of bondings, coverings, matrix structures, particularly well-defined structures and interconnections (Tab. 1, Fig. 1 – 4). Giant granules (GG; 22.2 – 29.1 μ m diameter) were observed in the varieties 'Scorpion' and 'Melody' (Fig. 2 and 3), which might suggest delayed digestion. For example a large and smooth surface explains the resistance of potato granules to enzymatic breakdown [10]. Smaller granule sizes on the other hand indicate higher susceptibility for enzymatic breakdown regardless of the botanical origin [11]. A high percentage of such small sized granules were found in 'Energy' and 'Sandokan' (Fig. 1a and 1b, Fig. 4a and 4b).

In previous studies 95% ethanol were used to suspend individual starch granules [12] and wash out potential coverings or matrix structures. In the present study not any solvent was used, the preparation was limited to rough crushing and drying of the grains only, because an excess of water and high temperature during processing alter the original structure including coverings and any kind of embedding and may cause starch gelatinization [13].

Table 1: DSB, AUC_{gluc} and morphologic characteristics of starch granules from different oat grain varieties and their embedding in surrounding structures

	Variety of oat grains				
	Energie	Melody	Scorpion	Sandokan	
DSB [%]	6.8	19.0	10.0	8.7	
AUC _{gluc}	1,635 ^c	1,648 ^c	1,926 ^a	1,800 ^b	
[mmol/					
$L \min^{-1}$]					
morphologic characteristics of starch granules					
BO	Х	-	-	Х	
GG	-	Х	Х	-	
DS	-	Х	Х	-	
CS	Х	Х	Х	х	
IN	XXX	Х	Х	XXX	

BO, bondings; CS, coverings and/or matrix structures; DS, well defined structures; GG, giant granules; IN, interconnections; -, not-existent; x, weak; xxx, strong; ^{a,b,c} Means with unlike superscripts are significantly different (P < 0.05).



Figure 1a: SEM-picture from oat grains 'Energie' (x 1000)



Figure 1b: SEM-picture from oat grains 'Energie' (x 3000)



Figure 2: SEM-picture from oat grains 'Melody" (x 1000)



Figure 3: SEM-picture from oat grains 'Scorpion' (x 1000)



Figure 4a: SEM-picture from oat grains 'Sandokan' (x 1000)



Figure 4b: SEM-picture from oat grains 'Sandokan' (x 3000)

For example, the surface of 'Melody' and 'Scorpion' did not appear smooth, but coverings and/or matrix structures were clearly present (Table 1).

SEM-pictures and starch characteristics (Fig. 1 - 4, Tab. 1) showed highest similarity between 'Energie' and 'Sandokan' (occurrence of bonding) on the one hand and 'Scorpion' and 'Melody' (giant granules; well defined granule structures) on the other. The particularly high glycaemic response following feeding of 'Scorpion' and 'Sandokan' was not reflected by the interpretation of the morphological characteristics of starch granules and further did not correspond to DSB.

IV.CONCLUSION

Within the different varieties of oat grains no apparent relationship has been determined between SEM-based characterization of starch granules, the DSB and the *in vivo* measured glycaemic response. The nevertheless demonstrated differences between the individual varieties of oat grains regarding their morphometric characteristics should motivate further research.

Acknowledgements

The project was supported in the framework of GrainUp by funds of the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) based on a decision of the Parliament of the Federal Republic of Germany via the Federal Office for Agriculture and Food (BLE) under the innovation support program.

V. REFERENCES

- [1]. Svihus, B., Uhlen, A.K., Harstad, O.M. (2005) Animal Feed Science and Technology 122, 303-320
- [2]. Kienzle, E., Pohlenz, J., Radicke, S. (1997): Morphology of starch digestion in the horse. J. Vet. Med. A 44, 207-221
- [3]. Bulèon, A., Colonna, P., Planchot, V. (1998): Starch granules: structure and biosynthesis. International Journal of biological Macromolecules, 23, 85-112
- [4]. Fuwa, H., Sugimoto, Y., Takaya, t. (1979): Scanning electron microscopy of starch granules, with or without amylase attack. Carbohydrate Res. 70, 233-238

- [5]. Dreher, M.L., Dreher, C.J., Berry, J.W. (1984): Starch digestibility of foods: a nutritional perspective. Crit. Rev. Food Sci. Nutr. 20, 47-71
- [6]. Colonna, P., Leloup, V., Buleon, A. (1992). Limiting factors of starch hydrolysis. European Journal of clinical nutrtion, 46, S17-S32
- [7]. Kienzle, E., Pohlenz, J, Radicke, S. (1998): Microscopy of starch digestion in the horse. J. Anim. Physiol. a. Anim. Nutr. 80, 213-216,
- [8]. Naumann C., Bassler R. (2012): Analytical Methods III Book III, Method No. 7.2.6 (VDLUFA),
- [9]. Romanowski, K., Vernunft, A., Orgis, A., Gottschalk, J., Einspanier, A., Fürll, M., Zeyner, A. (2013) Effect of feeding different amounts of starch from crushed oats of selected varieties on the glycaemic and insulinaemic response of horses. Proc. Soc. Nutr. Physio. 22, 13
- [10]. Oates, C.G. (1997): Towards an understanding of starch granule structure and hydrolysis. Trends in Food Science and Technology, 8, 375-382
- [11]. Franco, C.M.L., do Rio Preto, S.J., Ciacco, C.F. (1992). Factors that affect the enzymatic degradation of natural starch granules: effect of the size of granules, Starch/Stärke, 44, 422-426
- [12]. Jane, J., Kasemsuwan, T., Leas, S., IA, A., Zobel, H., IL, D., Robyt, J.F. (1994) Anthology of starch granule morphology by scanning electron microsocopy, Starch/Stärke 46 (4), 121-129
- [13]. Englyst, K.N., Vinoy, S., Englyst, H.N., Lang., V. (2003) Glycaemic index of cereal products explained by their content of rapidly and slowly available glucose. British Journal of Nutrition, 89, 329-339



International Journal of Scientific Research in Science and Technology

(International Journal Bimonthly Publication)

www.ijsrst.com

Published by : TechnoScience Academy (The International Open Access Publisher) www.technoscienceacademy.com

Web Site : www.ijsrst.com

Email : editor@ijsrst.com