

Research Bulletin

Engineering & Built Environment



INNOVATE

Inspiring Futures, Nurturing Possibilities

Volume 03 • January 2010

www.eng.ukm.my

Faculty of Engineering & Built Environment
Universiti Kebangsaan Malaysia

ISSN 1985-4854



9 1771985 485007

ISSN 1985-4854

Faculty of Engineering & Built Environment

Administration

Dean

Prof. Dr. Mohd. Marzuki Mustafa

Deputy Dean (Postgraduates, Student Affairs & Alumni)

Prof. Dr. Azah Mohamed

Deputy Dean (Undergraduates & Internationalisation)

Prof. Ir. Dr. Abdul Wahab Mohammad (Until 30th November 2009)

Prof. Ir. Dr. Mohd. Sobri Takriff

Deputy Dean (Research)

Chairman, Advanced Engineering Centre

Prof. Dr. Muhammad Fauzi Mohd. Zain

Head, Quality Management

Prof. Dr. Ahmad Kamal Ariffin Mohd Ihsan

Head, Industry & Community Partnerships

Assoc. Prof. Dr. Mohd Zaidi Omar (Since 1st October 2009)

Head, Department of Civil and Structural Engineering

Assoc. Prof. Ir. Dr. Zamri Chik

Head, Department of Chemical and Process Engineering

Prof. Ir. Dr. Mohd. Sobri Takriff (Until 30th November 2009)

Prof. Dr. Abu Bakar Mohamad

Head, Department of Mechanical and Materials Engineering

Prof. Dr. Norhamidi Muhamad

Head, Department of Electric, Electronic and Systems

Assoc. Prof. Dr. Hafizah Husain

Head, Department of Architecture

Ar. Mastor Surat

Coordinator for Unit of Fundamental Engineering Studies

Assoc. Prof. Dr. Azami Zaharim (Until 30th November 2009)

Dr. Zulkifli Mohd Nopiah

Head, Assistant Registrar

Rosafizah Mohamed Idrus

Board of Editorial

Chief Editor

Professor Dr. Muhammad Fauzi Mohd Zain

Editors

Professor Dr. Mohd Raihan Taha

Assoc. Professor Dr. Siti Masrinda Tasirin

Assoc. Prof. Dr. Mohd Syuhaimi Ab. Rahman

Dr. Taib Iskandar Mohamad

Sr. Dr. Adi Irfan Bin Che Ani

Mr. Abdul Halim Bin Ismail

Ms. Roslena Binti Mohd Zaini

Secretary

Ms. Sukmawati Binti Mohd Said

The Research Bulletin is published once a year by the Advanced Engineering Center, Faculty of Engineering & Built Environment, UKM. We are pleased to invite Faculty members to contribute their articles to our bulletin. Articles can be submitted to :

Advanced Engineering Center
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor Darul Ehsan, MALAYSIA
Tel : 603-8921 6454/6451
Fax : 603-8925 2546
Email : pghpkt@eng.ukm.my/roslena@eng.ukm.my

An electronic version of the Research Bulletin and guidelines to authors can be archived at www.pkukmweb.ukm.my/~pkt

From the Dean

Assalamualaikum W.b.t

Congratulations to the editorial team for the third issue of "INNOVATE", the research bulletin for the Faculty of Engineering and Built Environment UKM. The effort of the team and research contributions have continuously made "INNOVATE" an innovative publication for the academic community at large. All ongoing research, abstracts of PhD thesis, general research articles and research achievements from various fields of research niches of the Faculty are for all to peruse.



The year 2010 signals the end of the 9th Malaysian Plan. In the five years past, the Faculty has managed to secure grants worth more than RM40 million under the Ministry of Science, Technology and Innovation (MOSTI), RM4.5 million under the Ministry of Higher Education (MOHE), more than RM20 million under the operational research university grant and the rest under external agencies totaling around RM1 million. Apart from this, our researchers have also excelled in numerous national and international academic-related endeavors.

The tremendous achievements from our researchers are giant steps towards attaining world-class excellence in the field of research. The Faculty's achievements and development would not be possible without the significant contributions of its members and support of the university. Therefore, I would like to take this opportunity to thank all individuals in the Faculty for their continued efforts in driving the Faculty towards academic and research excellence.

Thank you.

Editorial Note

It is my great pleasure to welcome you all to the third issue of INNOVATE. Innovation in engineering and built environment can be spearheaded by research and development. The release of INNOVATE is a convenient way to stay informed about the most interesting and recent results from research of the Faculty of Engineering and Built Environment (FKAB).

The second issue of INNOVATE was published about a year ago. Since then, many favorable comments were received from members of the Faculty. The present issue, once again, reflects the wide-ranging interests of our researchers. This issue presents an overview of current research in the FKAB, research group activities, technical abstracts and abstracts of PhD thesis. It also highlights some award winning FKAB members. It is hoped that readers will be able to get, not just a glimpse, but also an in-depth look at how Faculty members have contributed to current research. It will nurture budding researchers in the engineering and built environment. It will also generate engineering and architectural knowledge and awareness of engineering and built environment issues for the nation.

Success is a journey - not a destination. The success of INNOVATE depends not only on the editors but also on the participation of the readers and contributors. We hope that you, the readers and contributors, will join us in this journey to make this an endeavor that is successful and useful to us and our community.

On behalf of the editorial board, I would like to take this opportunity to express our sincere gratitude to all authors, contributors and readers for their contributions to the improvement of the quality of INNOVATE. If you have any feedback or suggestions, please feel free to contact our editorial team.

• Chief Editor

STATEMENT ERROR

INNOVATE Research Bulletin, Volume 02 January 2009

Administration

Head, Department of Electric, Electronic and Systems
Assoc. Prof. Dr. Hafizah Husain

Corrected to:

Head, Department of Electric, Electronic and Systems
Prof. Dr. Aini Hussain

Contents

Current Research

Predicting Incipient Faults in Underground Power Cables Using S-Transform and Support Vector Regression	6
Modelling the Lock-on Range of Heat Seeker Missile	7
How to Shutdown the Semiconductor Laser Diode Remotely?	8
Polysulfone/Pluronic F127 Blend Ultrafiltration Membranes: Preparation and Characterizations	9
Development of Low Fouling Ultrafiltration Processes For Biomolecules Separation	10
Development of Membrane Process for Oleochemical Industry: A Case Study for Clarification of Glycerin-rich Solutions	11
Impact of Academic Exchange on Employability and Personality Development of Engineering Graduates	12
The Integration between Rainwater Harvesting and Public Water Supply	13
Framework to Assess Rainwater Harvesting Maintenance and Management	14

Technical Abstract

Immunity Level of Personal Computers and Fluorescent Lamps to Voltage Sags in the 240V/50Hz Distribution System	15
Application of Polymeric Solvent Resistant Nanofiltration Membranes For Biodiesel Production	18
Yeasts identification from Domestic Ragi for Bioethanol Production	21
Immobilisation of Malaysian Yeast Strain for Bioethanol	24
Integration of Characteristics for Urban Construction Materials: The Way to Mitigate Urban Heat Island	27
The Development of Quality Indicators for Housing Design (QIHD) in Karachi, Pakistan	30

Abstract of PhD Thesis

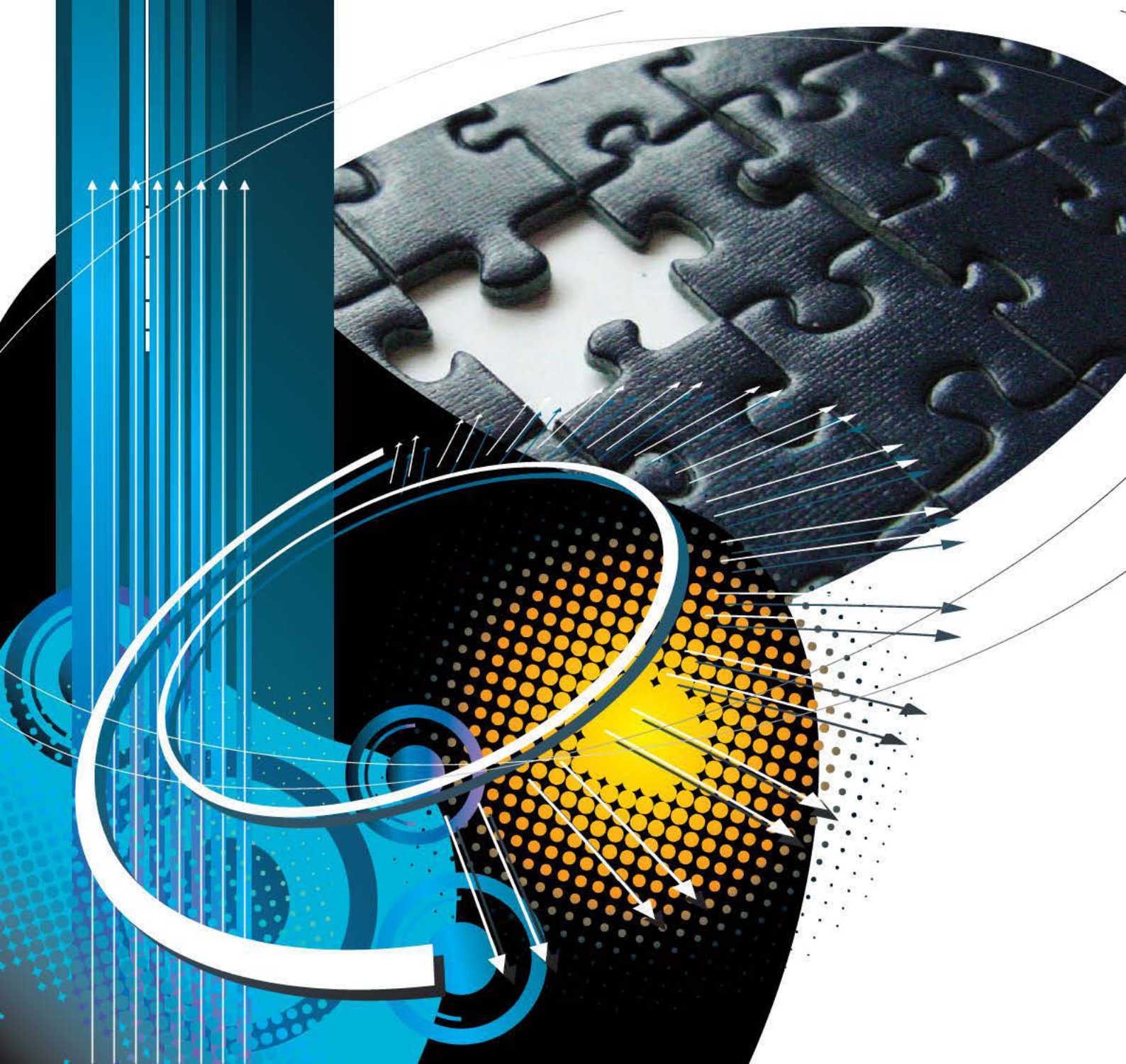
Evaluation of Flow Resistance in Channels with Flexible Vegetation Using Numerical Model	33
Life Cycle Assessment of Integrated Solid Waste Management (Plastic Electronic) in Malaysia	34
Fresh – Brine Water Effect on the Engineering Properties of Lisan Peninsula Marl – Dead Sea – Jordan	35

INNOVATE

Development of Sustainable High Performance Concrete Using Mineral and Chemical Admixtures	36
Leaching Tests for Evaluation of Metals Release from Solidified/Stabilized Contaminated Soil	37
Multidisciplinary Simultaneous Optimisation for a Free Piston Engine Design	38
End Milling Of Titanium Alloy Ti-6al-4v With Carbide Cutting Tool Using Response Surface Method	39
Evaluation of the Performance of Four Dual Pass Photovoltaic Thermal (Pvt) Solar Air Heaters	40
Development of an Optimisation Model for Production Capacity Using Cycle Time Information	41
Vulnerability Assessment and Control of Large Scale Interconnected Power Systems Using Computational Intelligence	42
Development of a Noninvasive Technique for Endothelial Dysfunction Assessment Using Photoplethysmography	43
Architectural Optimization of Mac for High Speed Digital Signal Processing and Multimedia Applications	44
Location Determining Techniques Using Timing and Signal Correlation for Universal Intelligent Positioning System in Cellular Networks	45
Intelligent and Advanced Monitoring Algorithm for Power Quality Instrument Based on Dsp for Real-Time Applications	46
The Vlsi Implementation of a Programmable Dsc Chip for High Speed Signal Processing: Ukm8051dsc	47
Hierarchical Control for Big Scale Industrial Processes	48
Synthesis and Application of Composite Membrane as Electrolyte In Proton Exchange Membrane Fuel Cell	49
Synthesis and Characterization of Hybrid Nylon 66 Membrane By Electron Beam Irradiation	50
Biogas and Chemical Production from Waste Using Biofilm Reactor	51
Awards 2009	52
Research Projects 2009	56
Research Products Commercialization	60

Current Research

Engineering & Built Environment





Predicting Incipient Faults in Underground Power Cables Using S-Transform and Support Vector Regression

Short circuits may occur due to damage or contamination that progressively weakens the integrity of network components and over time will lead to insulation failure. This type of short circuits is referred as incipient faults which usually emerge from partial discharges (PD) and eventually cause insulation degradation between two insulated cable cores. A typical example of the signatures of PD at underground cables is shown in Fig. 1. Early detection of incipient faults is of particular importance because insulation defects caused by incipient faults may lead to permanent faults in underground distribution networks. To perform automatic prediction of incipient faults in underground cable distribution network, a novel approach is proposed using the S-transform and the Support Vector Regression (SVR) techniques as depicted in Fig. 2. In the proposed approach, initial high frequency measurements of voltage and current responses are recorded from the installed power quality recorders in the Malaysian power supply networks. The recorded signals are then processed by the S-transform and the features that characterize the incipient faults are extracted. These features are then applied to the SVR to predict the existence of incipient faults.



Figure 1. Example of partial discharge transform between two cable cores

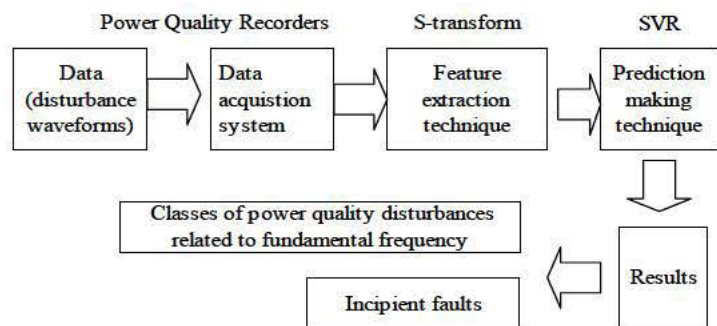
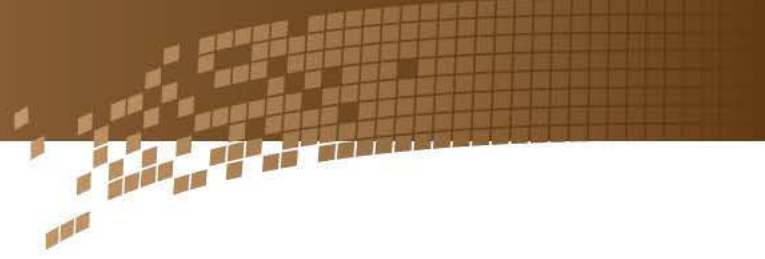


Figure 2. Prediction of incipient faults using S- and SVR

The performances of two types of SVR using the radial basis function (RBF) and the multi layer perceptron (MLP) kernel functions are compared for their abilities in making prediction for incipient faults. The results of the two experiments using RBF SVR and MLP SVR performed in this study prove that the RBF SVR (100%) is more accurate than the MLP SVR (85%) in the prediction of incipient faults. The developed novel approach using S-transform and SVR is proven to be very effective in analyzing and predicting the existence of incipient faults in underground cable system. The work carried out in incipient fault prediction is part of the research entitled 'Assessment of Equipment Sensitivity to Voltage Sags for Power Quality Improvement' and the work is supported through the UKM GUP research grant.

For further correspondence kindly contact:

Professor Dr. Azah Mohamed
 Department of Electrical, Electronic and Systems Engineering
 Faculty of Engineering and Built Environment
 Universiti Kebangsaan Malaysia
 43600 UKM Bangi, Selangor, MALAYSIA
 Tel: 603-89216006 Email: azah@eng.ukm.my



Modelling the Lock-on Range of Heat Seeker Missile

Abstract: The lock-on range (R) of infrared (IR) heat seeker missile within which there will be high kill probability against a target. When alerted visually or by a warning system the target attempts a last ditch maneuver actions. We investigated according to a new model the effect of some effective parameters on R.

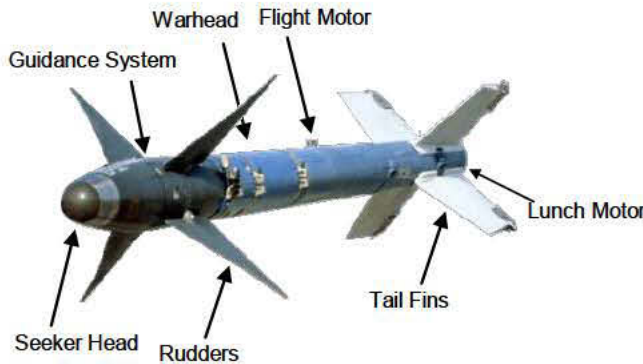


Figure 1. IR heat seeker missile

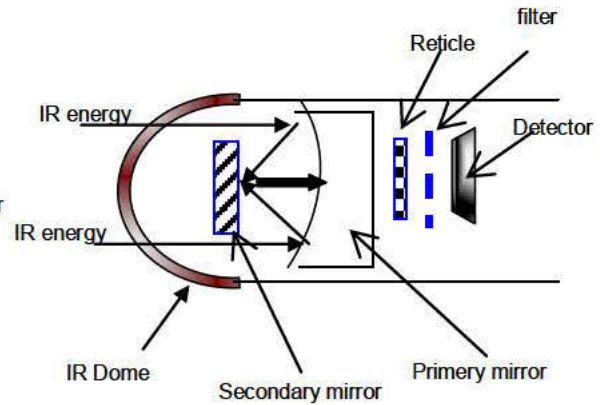


Figure 2. Block diagram of seeker head

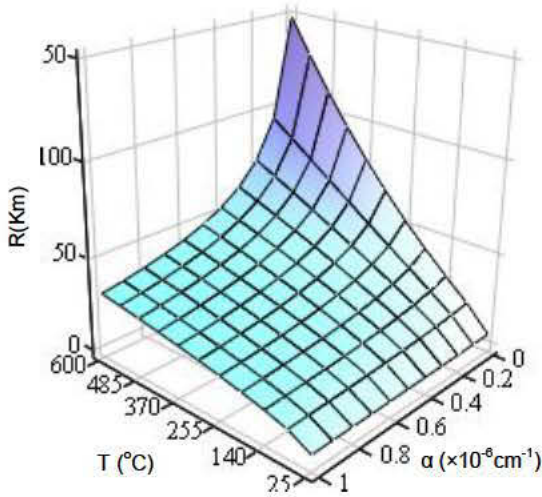


Figure 3. Lock-on range against the target temperature and attenuation coefficient

The decreasing of IR signature level of aircraft will decrease the lock-on range of heat seeker missile and provide longer time to the aircraft to manoeuvre, i.e. increase the probability of survivability. One of the methods used in aircraft protection is the reduction of jet engine IR energy via cooling the exhaust gases plume. This can be done by injecting H₂O to the exhaust stream. This leads to a decrease in the transmittance parameter due to increasing of attenuation coefficient α , and then decrease the lock-on range (R). Fig.3 shows the general effect of α and target temperature on R. It can be noted that even when T is high, the decreasing of α leads to reduce R significantly.

For further correspondence kindly contact:

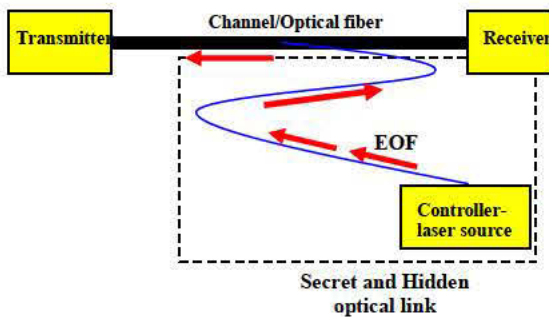
Dr. Mohammad Syuhaimi Ab-Rahman & Mazen R. Hassan
Computer & Network Security Research Group
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216448 Email: syuhaimi@eng.ukm.my/mrhassan@vlsi.eng.ukm.my



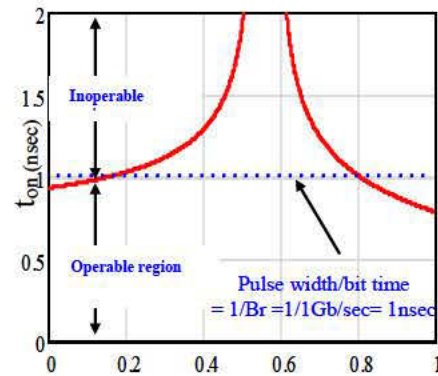
How to Shutdown the Semiconductor Laser Diode Remotely?

Abstract: A new technique is proposed which can be used effectively to control (turn-on/turn-off) the operation of laser source employed in optical communication system.

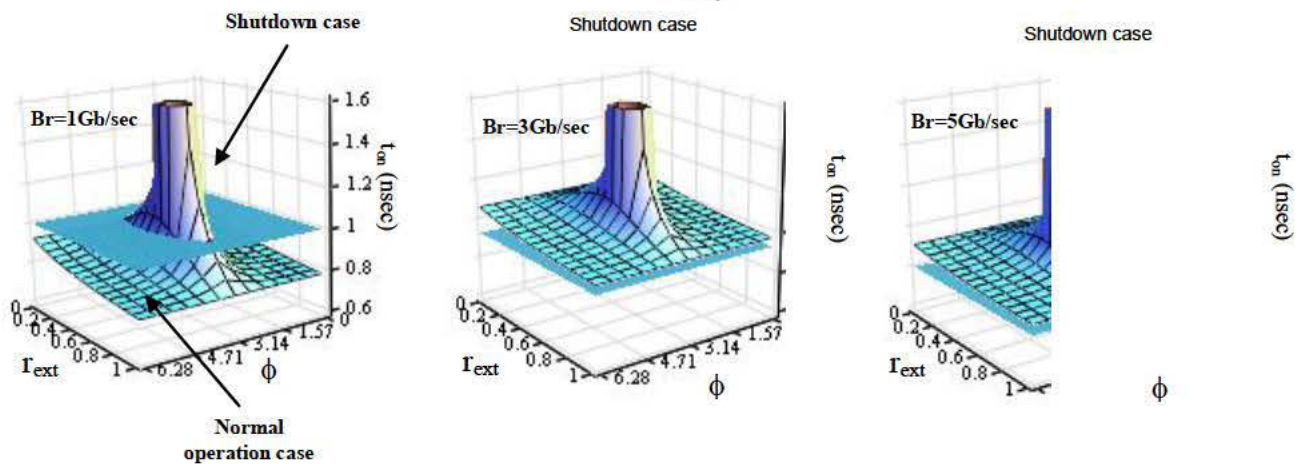
According to our proposed scheme, the designer can enable/disable OCS remotely by applying incoherent external optical feedback (EOF) to the laser source from relatively far distance. We show that at a specified value of external reflectivity, threshold carrier density (N_{th}) increases significantly leading to increase the turn-on time delay, t_{on} , of laser source, consequently, a failure of operation start, i.e. t_{on} is longer than the injected pulsewidth. Thus, by controlling the phase of reflected light, i.e. making it incoherent with respect to the emitted one, we show theoretically that it is possible to shutdown/turn-off the SLD compulsorily. This method can be used effectively even in presence of line coding is used or even when the laser source is biased slightly above threshold.



In this technique (schematically shown on the left), the laser source can be enable/disable by controlling its turn-on time delay, t_{on} . The latter can increased significantly changing the external reflectivity (r_{ext}) of the incoherent EOF.



Turn-on time delay of SLD subject to incoherent EOF for bitrate $Br = 1 \text{ Gb/sec}$, injection current, $I_{inj} = 1.5I_{th}$. When the turn-on time delay exceeds the bit time/pulse width, the laser source will be in the inoperable region, i.e. it cannot start the work due to long time delay.



The above exhibits turn-on time delay of laser source vs. external reflectivity (r_{ext}) and phase of reflected light (ϕ) for different values of bitrates. The regions below and above the schematic interlude sheet point to the normal operation region and the inoperable region (shut down case). The schematic interlude sheet points to the pulsewidth/bit time.

For further correspondence kindly contact:

Dr. Mohammad Syuhaimi Ab-Rahman & Mazen R. Hassan
 Computer & Network Security Research Group
 Department of Electrical, Electronic and Systems Engineering
 Faculty of Engineering and Built Environment
 Universiti Kebangsaan Malaysia
 43600 UKM Bangi, Selangor, MALAYSIA
 Tel: 603-89216448 Email: syuhaimi@eng.ukm.my/mrhassan@vlsi.eng.ukm.my



Polysulfone/Pluronic F127 Blend Ultrafiltration Membranes: Preparation and Characterizations

Membrane fouling phenomenon is a major problem for efficient use of ultrafiltration membranes and resulted in reduction of throughput and performance. Hence, an attempt has been made to develop a low-fouling membrane material by blending polymers. A very potential triblock copolymers of poly(ethylene oxide) (PEO) and poly(propylene oxide) (PPO) (PEO-*b*-PPO-*b*-PEO) is known under trade name poloxamer or Pluronic®. PEO segments are hydrophilic whereas PPO segments are hydrophobic. Generally, it has been attractive in biomedical and cosmetic research because of its biocompatibility, strength, processability, low fouling potential, stability in temperature and pH as well as its ability to minimize protein adsorption and cell adhesion to surfaces. Further, this has been recognized widely as pharmaceutical multi-purpose excipients capable of increasing aqueous solubility and stability of drugs. These amphiphilic copolymers are available in a wide range of molecular weights and architectures, which determine their hydrophilic/lipophilic properties. Among the various Pluronic copolymers, Pluronic F127 was selected due to its appropriate hydrophilic/lipophilic balance value (HLB = 22), high molecular weight (Mw 12,600) and high extractability into aqueous phase. Blending of polysulfone (PSU) and Pluronic F127 was carried out to prepare membranes with hydrophilic and low-fouling property. PSU and Pluronic F127 were blended in 100/0, 90/10 and 80/20 compositions using N-methyl-2-pyrrolidinone (NMP) as solvent and membranes were prepared by the phase inversion technique. The membrane morphologies were characterized by scanning electron microscopy (SEM). The results showed an asymmetric morphology of PSU/Pluronic F127 membranes. The static contact angles of blend membranes were measured using a contact angle goniometer. The decrease of static water contact angle with an increase in Pluronic F127 content indicated an increase of surface hydrophilicity. The stability of Pluronic F127 in blend membranes was evaluated by Attenuated Total Reflection Fourier transform infrared spectrometer (ATR-FTIR). The results analysis confirmed that Pluronic F127 could exist stably in blend membranes. The permeation flux of pure water under different pressures was investigated. It was found that blend membranes have higher permeability than that of PSU-control membrane. The mechanical properties of the blend membranes were investigated by using tensile machine. The investigated mechanical properties include the tensile strength, tensile strain and Young's modulus. The results showed that the blend membranes are more elastic compared to the PSU control membrane. The surface roughness was characterized by atomic force microscopy (AFM) in contact mode. The analysis revealed that an addition of Pluronic F127 had increased the roughness of the membranes.

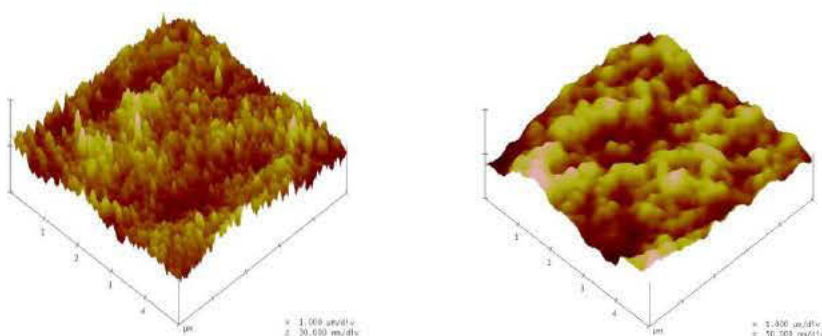


Figure 1. AFM 3D images of P-0 (left) and P-30 (right) on a scan area of 5 μm x 5 μm .

For further correspondence kindly contact:

Professor Ir. Dr. Abdul Wahab Mohammad/Rafeqah Raslan (MSc Student)
Scale-Up and Downstream Processing Research Group
Department of Chemical and Process Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89214529 Email: wahabm@vlsi.eng.ukm.my



Development of Low Fouling Ultrafiltration Processes For Biomolecules Separation

Gelatin is a heterogeneous mixture of high molecular weight, water-soluble protein derived from fibrous protein collagen which is the major constituent of skin, tendon, cartilage, bone and connective tissue. Application of ultrafiltration in gelatin concentration as partial substitution for evaporator has been extensively researched as an energy efficient alternative. However, strong flux decline generated by protein fouling adversely affect the performance and overall effectiveness of ultrafiltration processes. The extent of these phenomena strongly depends on membrane material, solution conditions, operating conditions and protein properties. Particularly, electrokinetic effects such as membrane and protein charge, pH and ionic strength, have been shown to greatly influence the membrane fouling, permeability and protein retention. The evidence of electrokinetic effects on membrane fouling is revealed in the flux decline profile and SEM image, illustrated in Figure 1 & 2.

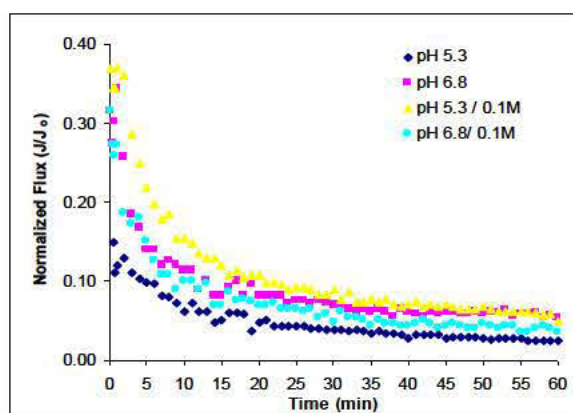


Figure 1. Flux decline profile at different solution chemistry during protein ultrafiltration

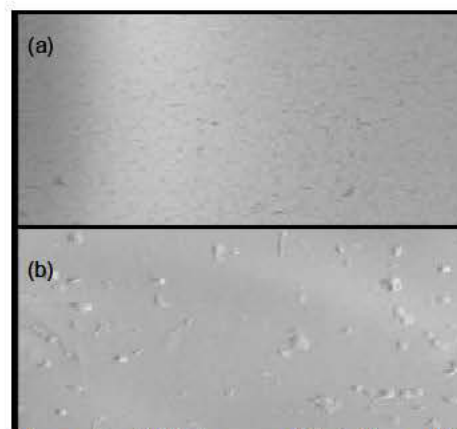


Figure 2. SEM Images of (a) Clean (b) Protein-Fouled at pH 5.3 UF Membrane

Indeed, protein fouling during ultrafiltration remains a very controversial topic, with considerable disagreement over both the mechanisms and rate of fouling. This is compounded with the fact that different proteins possess different physico-chemical properties, as do the membranes that filter them. Furthermore, these properties tend to vary with the prevailing feed solution conditions, resulting in the variety of membrane-protein and protein-protein interactions. While protein fouling using BSA as model protein in ultrafiltration is widely reported, study of protein fouling with gelatin is scarce. To the author's knowledge, limited study has been conducted on fouling characteristics and mechanism of gelatin ultrafiltration through manipulation of solution chemistry. Understanding the behavior of gelatin solution and the knowledge of the contribution of each of the fouling mechanisms as well as their dependence on the membrane material and ionic environment will be useful in minimizing the fouling phenomena in gelatin concentration processes. Therefore, this research aims to create a breakthrough in gelatin concentration process by studying the gelatin-membrane-ionic environment interaction in ultrafiltration process. A systematic approach will be carried out to determine the fouling phenomena quantitatively and qualitatively. Typical fouling models centered on pore-blocking and combined blocking models are used to examine the effects of solution chemistry on fouling mechanisms in gelatin ultrafiltration, while resistance-in-series models were employed to quantify the contribution of each fouling resistance in gelatin ultrafiltration processes.

For further correspondence kindly contact:

Professor Ir. Dr. Abdul Wahab Mohammad/Lim Ying Pei (PhD student)
Scale-Up and Downstream Processing Research Group
Department of Chemical and Process Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89214529 Email: wahabm@vlsi.eng.ukm.my



Development of Membrane Process for Oleochemical Industry: A Case Study for Clarification of Glycerin-rich Solutions

Membrane technology has been widely accepted in various industries especially for the purpose of water and wastewater treatment. Within the oleochemical industry, clarification of glycerin-rich solution (commonly known in industry as sweet water) is required and membrane technology may provide an alternative process to the conventional process which includes chemical treatment (Figure 1). This fact has been recognised by a few local oleochemical companies in Malaysia and subsequently membrane (ultrafiltration) modules have been installed for the purpose. Initial application of the UF modules showed promising results, however, long-term application has been hindered due to severe case of fouling since glycerin-rich solution contains hydrophobic solute like fatty acids and unreacted glycerides in varying quantities. The presence of fatty acid as minor components in the glycerin-rich solutions leads to severe fouling during the solution treatment. The objective of this study is to contribute towards a better understanding of membrane fouling in oleochemical industries by looking at the specific case study on sweet water clarification. The second is to study the role of small solute fatty acids as well as to investigate the effect of membranes hydrophobicity, molecular weight cut-off, pH and temperature to the membrane fouling.

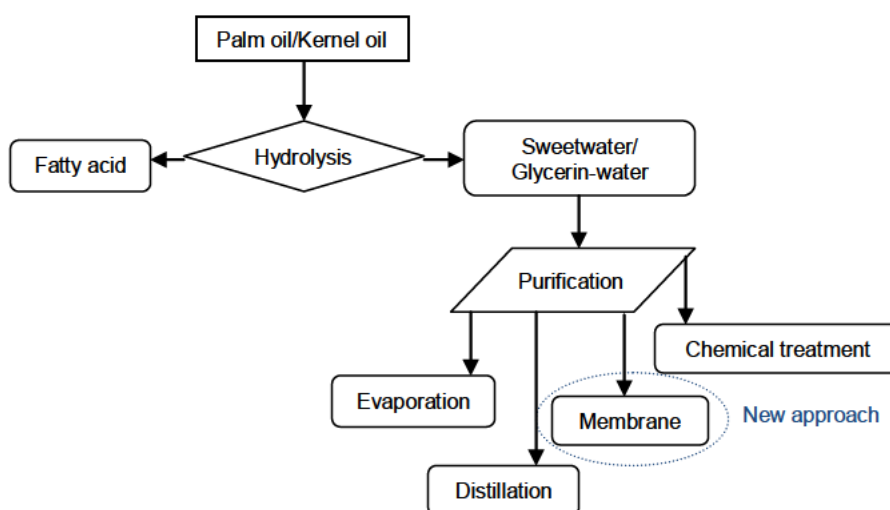


Figure 1. Production of glycerin and conventional purification process

Glycerin-rich solution with 15% glycerin and fatty acids such as palmitic acid, stearic and oleic acid was utilized for the study. In this study, the flux reduction was correlated for two different types of polymeric membrane material with different molecular weight cut-off (MWCO). The membrane materials were made of polyethersulphone (PES) and polyvinylidene fluoride (PVDF) with MWCO between 5, 20 and 25 kDa for PES, while 30 kDa for PVDF. Experiments were performed in a dead-end stirred cell pressurized with N_2 gas at different temperatures varied from 40-60°C.

For further correspondence kindly contact:

Professor. Ir. Dr. Abdul Wahab Mohammad/ In. Nurul Hasyimah Mohd Amin(PhD student)
Scale-Up and Downstream Processing Research Group
Department of Chemical and Process Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89214529 Email: wahabm@eng.ukm.my



Impact of Academic Exchange on Employability and Personality Development of Engineering Graduates

With initial funding from the German Academic Exchange Services (DAAD), a double degree programme in engineering has been implemented between two partners i.e. Universiti Kebangsaan Malaysia (UKM) and the University of Duisburg-Essen (UDE) in Germany since 2003. The double degree programme between UKM and UDE is currently in its sixth year of operation, comprising the disciplines of computer science and communication engineering, civil and structural engineering and mechanical engineering. The programme was conceptualised upon recognition of the need for intercontinental academic exchange for engineering students who in recent years will most likely partake in a competitive global economy upon graduation. Thus far, a total of 62 students from UKM have participated in the double degree programme and they have embarked on their German sojourn. Out of these, 39 have successfully graduated with the majority of them gaining employment in multinational companies (Figure 1).

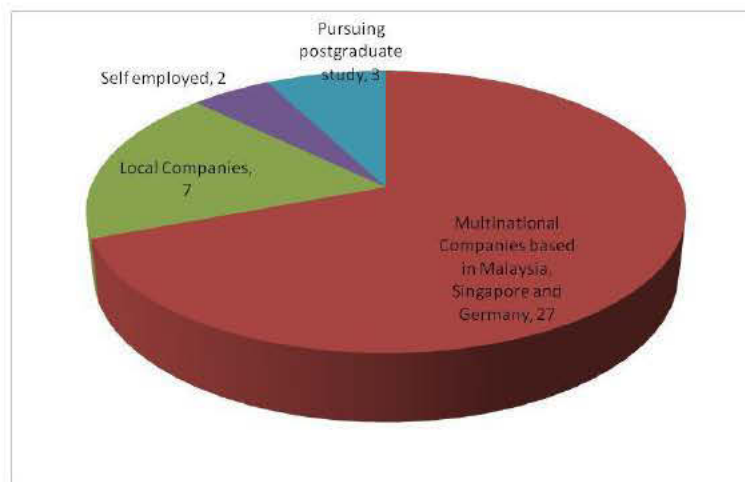


Figure 1. Employment of UKM students who participated in the double degree programme

The general perception is that a graduate with a strong international background will be more prepared to tackle her new working environment even when assigned to places with cultural differences from her own familiar ones. Previous studies on the UKM alumni of the UKM-UDE Double Degree Programme have also indicated positive benefits on graduate employability and personality development (Mughtar et al. 2009). However, an in depth study and close monitoring of the impact of academic exchange on the employability and personality development of UKM engineering graduates has not been attempted. This study thus proposes to study this aspect and make comparison between those students who embarked on an academic exchange to UDE and those who stayed back in UKM to complete their undergraduate study in engineering. The project is funded by a grant awarded by the University of Duisburg-Essen.

References:

- Mughtar, A., Omar, M.Z. & Hunger, A. 2009. Lessons from the Joint UKM-UDE (Malaysia-Germany) Student Mobility Programs. *European Journal of Social Sciences* 8 (3): 413-419

For further correspondence kindly contact:

Associate Professor Dr. Andanastuti Mughtar
Department of Mechanical and Materials Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216520 Email: mughtar@eng.ukm.my/tutimughtar@gmail.com



The Integration between Rainwater Harvesting and Public Water Supply

The Malaysian government is very serious in implementing rainwater harvesting for buildings. To date, the Ministry of Housing and Local Government (MHLG) encourages all new buildings to have their rainwater harvested. MHLG has also come out with the guidelines of rainwater harvesting. A step-by-step process is now being taken by the respective government agencies to promote rainwater harvesting in public buildings. In addition, the public is also being educated on this. In terms of implementation, one of the major problems encountered concerns the cost-effective automatic switching system between rainwater and public water supply. This is needed as a back-up supply when the rainwater runs dry. This is expected to happen since the calculation of rainwater to be harvested is based on the minimum rainfall per month. The concept of this integration in the proposed system of rainwater harvesting is depicted in Figure 1.

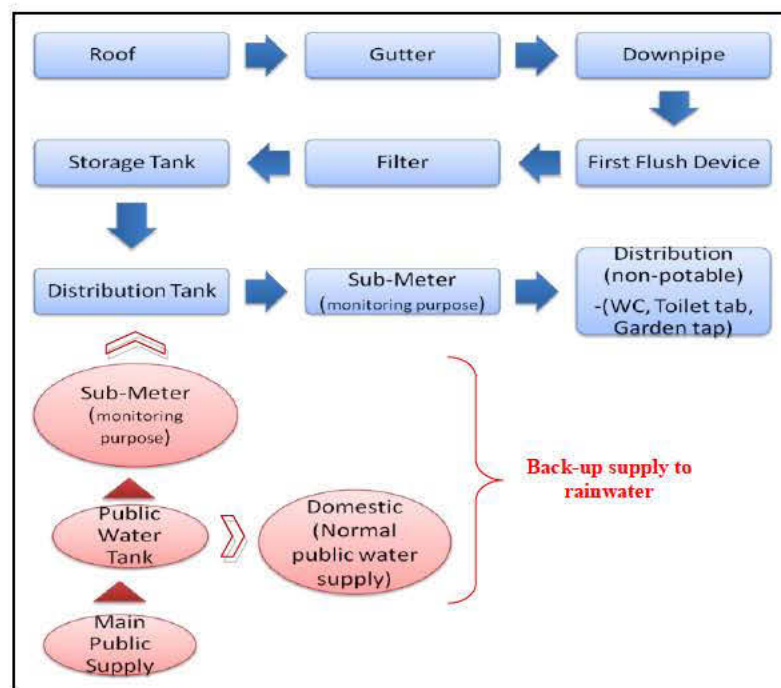


Figure 1. The integration between rainwater harvesting and public water supply (at distribution tank)

In this respect, there is a local supplier that brings this mechanism (automatic switching) into local practice at reasonable cost. This product is patented in Australia. Apart from the integration, the sub-meter is installed at both junctions i.e. rainwater and public water supply. This is to closely monitor the utilization of rainwater as well as the water for the back-up system. This integration of the rainwater harvesting system is one of the agenda to be implemented towards a sustainable campus and is one of the research conducted in UKM. A number of new projects in UKM are now planned for rainwater harvesting. Thus far, this research is supported by a university grant.

For further correspondence kindly contact:

Sr Dr. Adi Irfan bin Che Ani
Department of Architecture
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216595 Email: adiirfan@vlsi.eng.ukm.my



Framework to Assess Rainwater Harvesting Maintenance and Management

Maintenance is important for performance and protection of the rainwater harvesting (RWH) systems. Maintenance helps to prevent the system from damage or avoid malfunction of RWH systems. In order to get satisfactory quality of water the system requires adequate maintenance to ensure that water quality does not cause any illness to user. In order to keep the system efficient, maintenance is required throughout the functional life of the system.

Maintenance of rainwater harvesting is a periodic duty. The maintenance of RWH seems to be easily conducted by owner and it is necessary to all elements in rainwater harvesting. In addition monitoring the water quality and upgrading of systems is also necessary. Figure 1 shows the conceptual framework as to assess the maintenance of RWH.

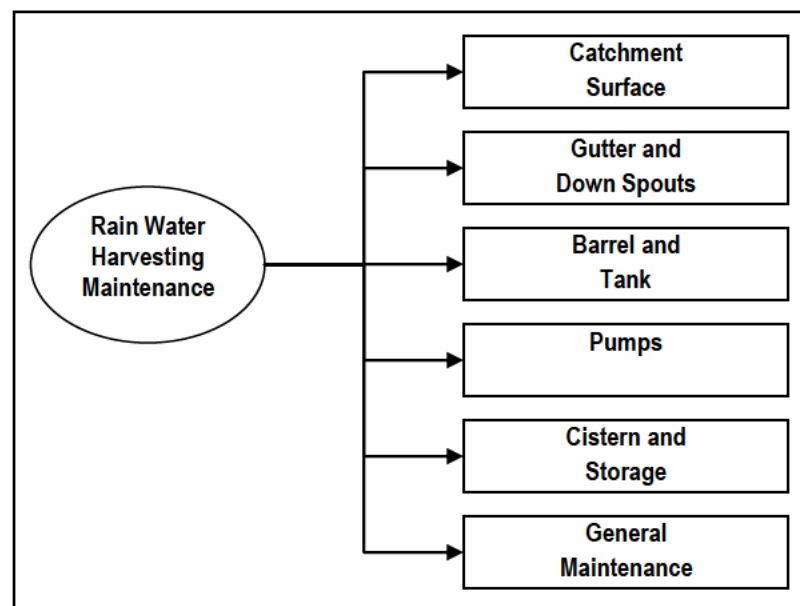


Figure 1. Conceptual Framework of Rainwater Harvesting Maintenance

The present research is aim at to study existing RWH maintenance practices via the approach of building condition survey i.e. the visual inspection to RWH systems. Apart from building inspection, this will help in improving the systems performance through collecting data from users of RWH system. The collected data would highlight the problems related to maintenance and management of RWH system in use.

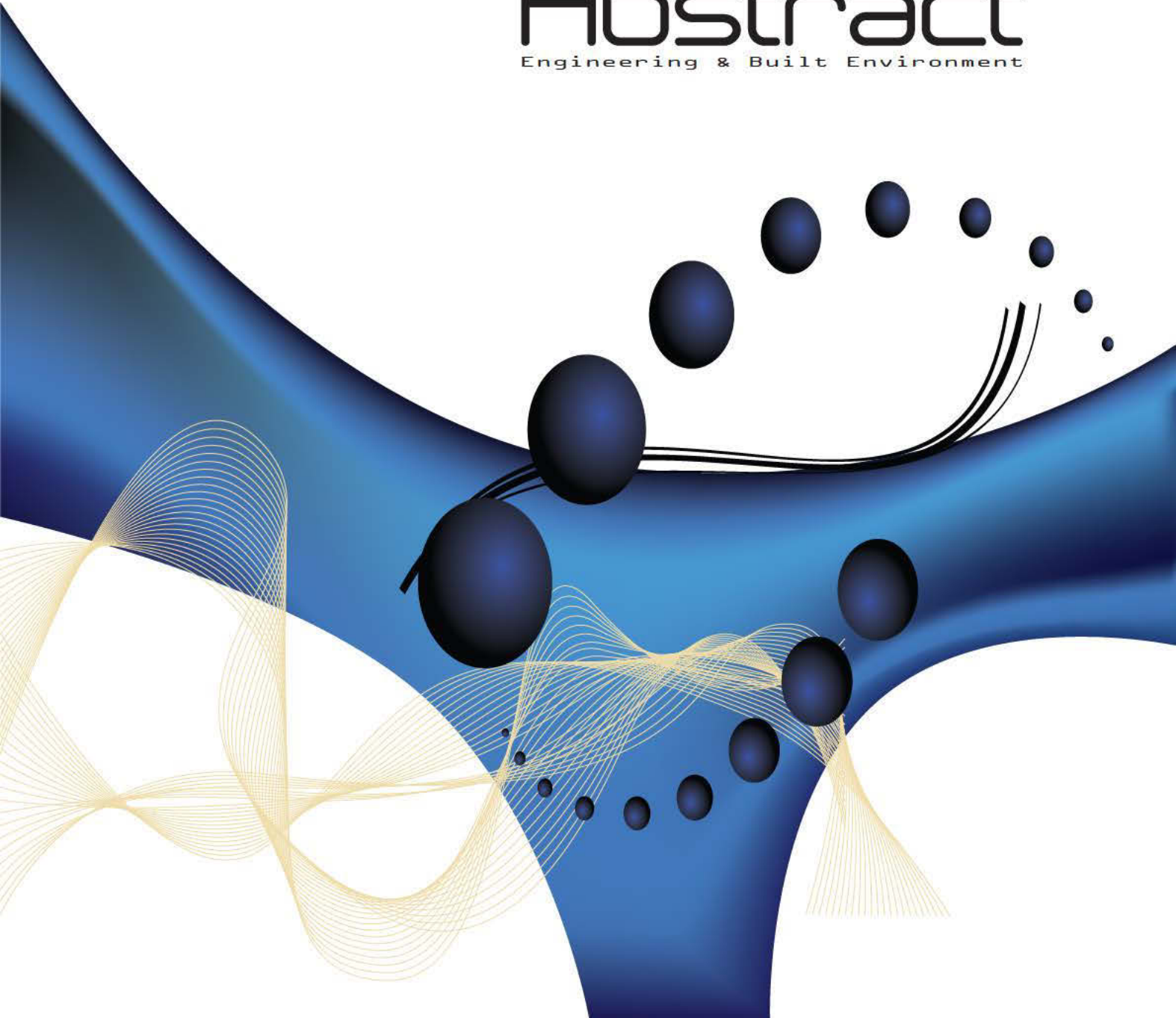
This framework helps to develop the successful model of RWH according to condition and challenges of Malaysian region. The end result of this research will also present the set of comparative analysis regarding Malaysia RWH policy towards adoption of RWH as popular system for modern day water needs in urban centers in Malaysia.

For further correspondence kindly contact:

Sr Dr. Adi Irfan bin Che Ani
Department of Architecture
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216595 Email: adiirfan@vlsi.eng.ukm.my

Technical Abstract

Engineering & Built Environment





Immunity Level of Personal Computers and Fluorescent Lamps to Voltage Sags in the 240V/50Hz Distribution System

Hussain Shareef, Azah Mohamed, Nazri Marzuki and Khodijah Mohamed
Department of Electrical, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
 Tel: 603-89216006 Email: azah@eng.ukm.my

ABSTRACT

This paper focuses on investigating the vulnerability of personal computers (PCs) and lighting sources to voltage sags in the context of local power supply system in Malaysia. Based on recent testing standards and utilizing a modern industrial power corrupter, extensive tests are conducted for a wide range of PCs and fluorescent lamps. Power acceptability curves of PCs and lamps are constructed and compared with the standard ITIC and SEMI F47 design goals. The experiment results show that the PCs and fluorescent lamps used in the local system have relatively high tolerance level to voltage sags when compared to the design goals of ITIC and SEMI F47 standards.

Keywords: Voltage tolerance curves, SEMI F47, ITIC, personal computer, fluorescent lamp.

INTRODUCTION

Voltage sag incidents can disrupt or damage sensitive equipments such as personal computers (PCs) and lighting sources. Sensitivity of PCs to voltage sags can be defined as the conditions where the PCs start to malfunction and cause nuisance loss of data or process interruption due to voltage sag appearing in the mains supply. Voltage sags may cause lighting sources to extinguish or twinkle that will likely cause nuisance and damage in some cases. As an effort to understand the immunity level of PCs and lighting sources, many works have been reported in the past. Current standards related to the testing of the equipment sensitivity to voltage sags suggest that the tests should be performed preferably at 0° point on wave of the voltage waveform (Djokic et al., 2005). Test results on standard restart/reboot malfunction criterion for computers due to voltage sags can be found in Saksena et al., (2005). It is reported that if the depth of voltage sag is greater than 30% and lasts more than 8 cycles, the voltage sag may cause a computer to restart. These tests were only carried out for the 120V/60 Hz systems. This paper focuses on investigating the vulnerability of PCs and fluorescent lamps to voltage sags in the local mains supply

240V/50 Hz. So far it has not been documented in the literature as to how PCs and fluorescent lamps used in Malaysia behave when subjected to voltage sags.

Extensive laboratory tests were conducted for evaluating the sensitivity of PCs and fluorescent lamps to voltage sags. These tests were carried out not only for standard PC restart/reboot malfunction criteria but also to examine the distortions on PC monitor and unacceptable audible noise generation. In order to evaluate the power acceptability or tolerance levels of the PCs and fluorescent lamps for the identified failure conditions, the test results are also compared with the design goals of ITIC and SEMI F47 standards.

The methodology that is used in the testing is generally based on the guideline followed by Djokic et al. (2005). The experimental set up consists of four components namely, sag generator, equipment under test, data acquisition system, and a computer to analyze the signals. In this case, an industrial power corruptor (IPC) from the Power Standards Lab is used. The IPC is a voltage sag generator combined with built-in data acquisition system which is capable of producing and interrupting voltages up to 480 V and current at 200 A in single or three phase systems. Fig. 1 shows



the real PC test environment where single phase local power supply at 240 V, 50 Hz is utilized. Five PCs with different specifications and three 18 Watt fluorescent lamps with different ballast types are tested to study the effect of voltage sags on the performance of the PCs and lamps.

The testing procedure considers initiating voltage sags in steps of 2.5% down to zero volts with the sag initiation phase angle and duration set to 0° and 1 cycle, respectively. The critical sag depth for each of the pre-defined malfunction criteria is determined by repeated testing for at least 3 times for a particular sag magnitude and duration. For each triggered sag event, voltage and current waveforms supplying the equipment under test are recorded.



Fig. 1: Actual PC test environment

RESULTS AND DISCUSSION

The test findings from the experiments on sensitivity of PCs and fluorescent lamps to voltage sags are presented as typical power acceptability curves. Based on the findings, a generic power acceptability curve for PCs is then constructed and compared with the ITIC and SEMI F47 standards as shown in Fig 2.

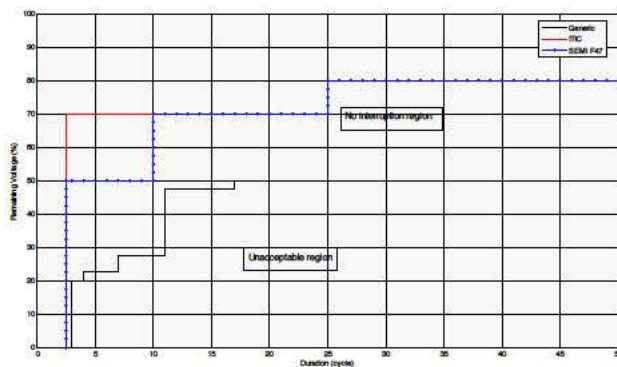


Fig. 2: Generic power acceptability curve for PCs

From the constructed acceptability curve for PCs depicted in Fig. 2, it can be noted that all PCs can tolerate short transient interruption which is less than 3 cycles. However, some sensitive PC may start to fail if it is a little greater than 3 cycles caused by severe sag with depth greater than 80%.

The designed power acceptability curves of tested lamps are presented in Fig. 3 as typical CBEMA-like curves. The upper region of these curves represents proper operation region while the lower region indicates unacceptable region for lamp operation considering light standard, lux ≥ 0.90 p.u.

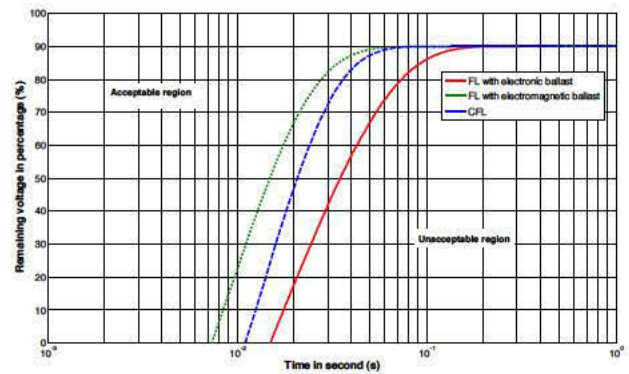


Fig. 3: Voltage acceptability curves for lamps considering light standard lux ≥ 0.90 p.u

CONCLUSION

From the results of the experimental study, power acceptability curves of PCs and lamps are constructed to describe the sensitivity of various PCs and lamps to voltage sags. It may be concluded that the voltage tolerance of the PCs used in the test varies over a wide range. Monitor image distortion, buzzing sound and black screen condition which is considered unacceptable seem to emerge only for short duration sags lasting less than 18 cycles. Long duration sags mainly lead to a computer reboot. According to the designed voltage acceptability curves of lamps, the lamp with electromagnetic ballast is found to be the most sensitive lamp whereas lamp with electronic ballast seems to be least immune to voltage sag disturbances. The curves provide a quick overview about the immunity level of PC and fluorescent lamps in a power distribution network.

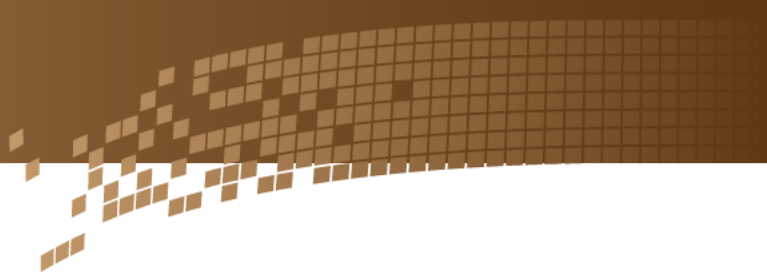


REFERENCES

- Djokic, S. Z., J. Desmet, , G. Vanalme, J. V. Milanovic, and K. Stockman, 2005. Sensitivity of Personal Computers to Voltage Sags and Short Interruptions. IEEE Trans. Power Del., 20: 375-383, 2005.
- Kyei, J., R. Ayyanar, G. Heydt, R. Thallam, and J. Blevins, 2002. The Design of Power Acceptability Curves. IEEE Trans. on Power Del., 17: 828–833, 2002.
- Saksena, S., B Shi, G.Karady, 2005. Effects of Voltage Sags on Household Loads. In the Proceeding Power and Energy Society General Meeting - Conversion and Delivery of Electrical Energy in the 21st Century, 12-16 June 2005, USA., 2456- 2461.

Detailed results of this study have been reported in:

Hussain Shareef, Azah Mohamed, Nazri Marzuki, 2009, Immunity Level of Personal Computers to Voltage Sags in the 240V/50 Hz Distribution Systems. Journal of Applied Sciences 9(5):931-937.



Application of Polymeric Solvent Resistant Nanofiltration Membranes For Biodiesel Production

Rahimah Othman¹, Abdul Wahab Mohammad¹, Manal Ismail¹ and Jumat Salimon²

¹Department of Chemical and Process Engineering, Faculty of Engineering and Built Environment

**²Department of Chemical and Food Technology, Faculty of Science and Technology
Universiti Kebangsaan Malaysia**

43600 UKM Bangi, Selangor, MALAYSIA

Tel: 603-89216102 Email: wahabm@eng.ukm.my

ABSTRACT

In this study, the potential of incorporating polymeric solvent resistant nanofiltration (SRNF) membranes for biodiesel separation processes was investigated. Eight types of commercial polymeric nanofiltration membranes (Solsep 030705, Solsep 030306F, Starmem 240, Starmem 120, Desal-DL, Desal-DK MPF-34 and MPF-44) were chosen and screened for their abilities to separate the methyl esters-rich effluent (biodiesel) from the mixture of the homogeneous catalyst, free glycerin and excess methanol after the transesterification process at various separation pressures and constant temperature. Scanning Electron Microscope (SEM) was used to examine any changes to all the membranes studied. In order to enhance the SRNF membrane performance, the transesterification product properties were modified by reducing the alkalinity value. Results showed that for 3 membranes (Solsep 030705, Solsep 030306F, Starmem 240), the permeability of transesterification product after the alkalinity modification increased linearly to the operation pressures. The other 5 membranes namely Starmem 120, Desal-DL, Desal-DK, MPF-44, MPF-34 membranes gave dismal results. Out of the eight tested membranes, it was found that Solsep 030705 membrane gave the most promising result. Analysis of the used membranes showed minor differences on morphology structures after the application.

Keywords: SRNF, permeability, selectivity, nanofiltration, biodiesel separation.

INTRODUCTION

Membrane-based separations are well-established technologies in water purification, protein separations and gas separations. Recently, polymeric solvent resistant nanofiltration (SRNF) membranes have been shown to provide a potentially viable alternative for separation and purification process in non-aqueous applications (Bhanushali et al. 2001). The new developments in the area of solvent resistant membranes should lead to many novel applications in the food and pharmaceutical industries for selective recovery of organics and recycle of solvent streams. Various applications have been studied on the use of membranes (including SRNF) to treat nonaqueous fluids for separation (Lobo et al. 2006). The well-investigated area is the dry degumming process which is to remove the

phospholipids in the hexane miscella by membrane ultrafiltration (Ochoa et al. 2001). Production of biodiesel is another important application in which membranes could be utilized in the separation and purification stages (Dub e et al. 2007).

In this work, biodiesel or also known as methyl ester was produced by transesterification process in which, RBD palm olein was reacted with anhydrous methanol in the presence of strong base catalyst of sodium hydroxide. The reversible reaction of the transesterification process was described in Figure 1. Based on the stoichiometry, the reaction needs a 3:1 molar alcohol-to-oil ratio, but the excess methanol is usually added to drive the equilibrium towards towards the products side.

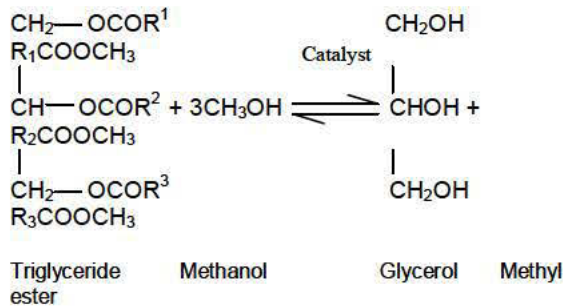


Fig.1 General equation of transesterification reaction.

The aim of this work is to describe the selection and experimental verification of the polymeric SRNF membranes performance on the permeation properties of transesterification product as well as modification on the transesterification product properties in order to enhance the performance of polymeric SRNF membranes in biodiesel separation and purification process.

RESULTS AND DISCUSSION

The permeation experiments were carried out to examine the permeability flux of the transesterification product or biodiesel mixture products through the polymeric SRNF membranes at constant separation temperature of 313.15 K and range of operating pressures (600-3000 kPa). To improve the performance of SRNF membranes for biodiesel mixture products separation, the permeability test was done by neutralizing the products separation using phosphoric acid prior to the permeation test at constant separation temperature of 40 °C and range of operating pressures (600-3000 kPa). The feed weight percentage of transesterification product after neutralization was triglycerides (TG), 1.0011 % wt, monoglycerides (MG), 0.0036 % wt, diglycerides (DG), 1.4179 % wt, free glycerin, 5.0440% wt, methyl esters, 92.3963 % wt and unreacted excess methanol was 0.1370% wt. The pH value of the transesterification product after neutralization was recorded at 8.68. Figure 2 presented that at the moderate levels of pressure (≤ 3000 kPa) the flux behavior for the modified transesterification product increased linearly with respect to the applied pressure through Solsep 030705, Solsep 030306 F and Starmem 240 membranes. However, no permeate flux was obtained through the other 5 listed membranes. The

data obtained show a linear profile which conforms to the Hagen Poiseuille equation (Machado et al. 1999).

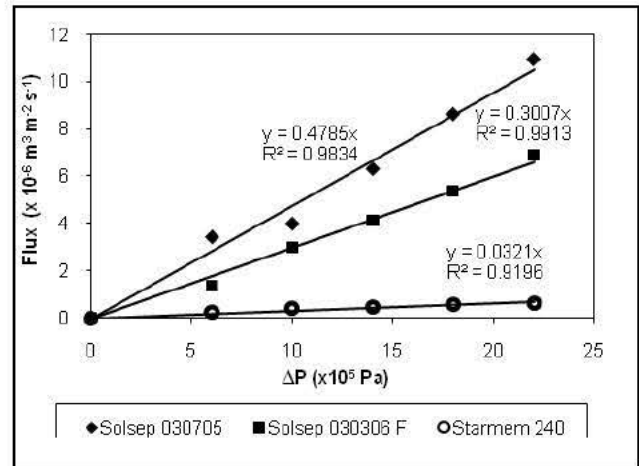


Fig.2 Modified transesterification product flux versus applied pressure.

For instance, the morphology of all tested polymeric SRNF membranes showed minor differences in their physical arrangement via SEM images of surface and cross-section for each clean and fouled membrane after the neutralized product mixture separation process as showed in Figure 3.

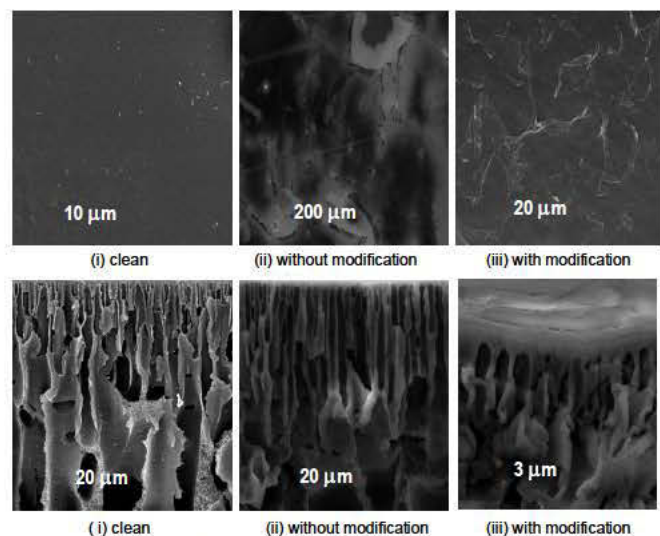
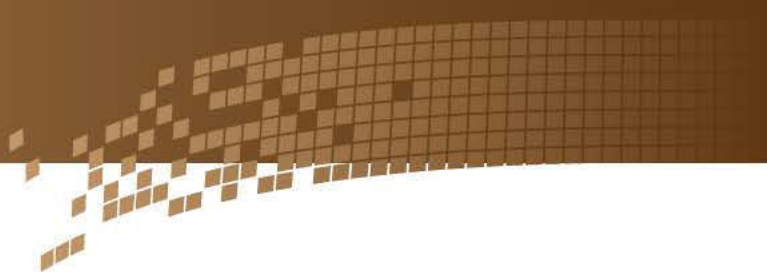


Fig. 3 The SEM images of Solsep 030705 membrane (a) surface (b) cross-section

CONCLUSION

This study showed that eight polymeric solvent resistant NF membranes were tested for their potential to be used within the biodiesel production process. The modification on the transesterification product alkalinity was found to be the key for the enhancement of the performance of polymeric



SRNF membranes in the biodiesel separation and purification process.

REFERENCES

- Bhanushali,D., Kloos,S., Kurth,C., Bhattacharyya,D. 2001. Performance of solvent resistant membranes for non-aqueous systems: solvent permeation results and modelling, *Journal of membrane science* 189, 1-21.
- Dubé, M.A.; Tremblay, A.Y.; and Liu, J. (2007). Biodiesel production using a membrane reactor. *Bioresource Technology*. 98: 639–647.
- Lobo, A., Cambiella, A., Benito, J.M., Pazos, C., Coca, J. 2006. Ultrafiltration of oil-in-water emulsions with ceramic membranes: influence of pH and crossflow velocity, *Journal of Membrane Science* 278, 328-334.
- Machado, D.R., Hasson, D., Semiat, R. 1999. Effect of solvent properties on permeate flow through nanofiltration membrane. Part I. Investigation of parameters affecting solvent flux, *Journal of Membrane*, vol.163, 93-102.
- Ochoa, N., Pagliero, C., Marchese, J., Mattea, M. 2001. Ultrafiltration of vegetable oils degumming by polymeric membranes, *Sep. Purif. Technol.* 22-23, 417-422.

Detailed results of this study have been reported in:

- Rahimah Othman, Abdul Wahab Ismail, Manal Ismail, Jumat Salimon. 2009. Application of polymeric solvent resistant nanofiltration membranes for biodiesel production, *Journal of Membrane*. In press.



Yeasts Identification from Domestic Ragi for Bioethanol Production

Siti Hajar Mohd Dayaon and Noorhisham Tan Kofli
 Department of Chemical and Process Engineering
 Faculty of Engineering and Built Environment
 Universiti Kebangsaan Malaysia
 43600 UKM Bangi, Selangor, MALAYSIA
 Tel: 603-89216401 Email: maverick@vlsi.eng.ukm.my

ABSTRACT

Ragi is one of the fermentation starters in food fermentation. Domestic ragi from Sarawak (for tapé and tuak making) and Pahang (tapé), are made from mixtures of rice floor, spices and water or sugarcane juice naturally contains filamentous fungi, bacteria and yeasts. This research is aim to identify the microorganisms in the domestic ragi by using API kit after screening and isolating the microbes by selected media (YPD and Sabaroud). From the results, *Cryptococcus humicola* and *Candida glabrata* are identified in the Sarawak (tapé) sample, while *Cryptococcus humicola*, *Saccharomyces cerevisiae*, *Candida glabrata* and *Rhodotorula glutinis* were identified in the Sarawak (tuak) sample and for Pahang (tapé) sample, *Cryptococcus humicola*, *Saccharomyces cerevisiae* and *Candida guilliermondii* was identified by using both API kit (20C AUX and ID 32C).

Keywords: ragi, yeasts identification, tapai.

INTRODUCTION

Tapé is a traditional fermented food in Asia (Malaysia, Indonesia, Philippine and Vietnam) made from starch and ragi, the microbial starter. Ragi is made from a mixture from rice floor, spices and water or sugarcane juice and naturally contains filamentous fungi, bacteria and yeasts (Kuriyama et al., 1997). Ragi tapé is used as inoculums in a production method where liquefaction and alcoholic fermentation occur simultaneously without any effort to control the fermentation. Suitable yeasts play an important roles in ethanol production thus the research on yeasts identification selection are critical in bioethanol industry enhancement and improvement of other industries productivities. Even though the development of yeasts research is progressing, but information on local yeasts strain is still limited in Malaysia. This research is aimed at identifying the specific strain of microorganism in ragi which is commonly used for fermentation of food.

RESULTS AND DISCUSSION

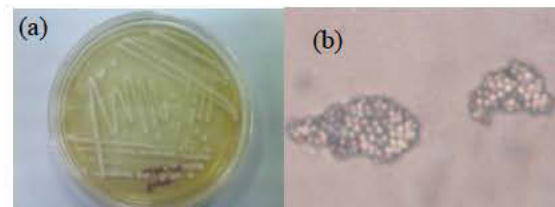


Fig 1 (a) Sample from Sarawak (tapé), (b) Tape sample under microscope (40x magnification).

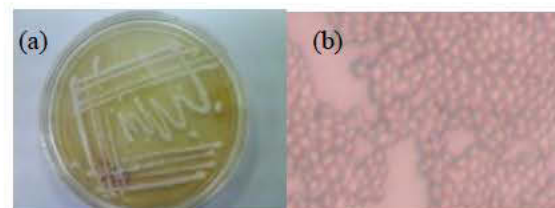


Fig 2 (a) Sample from Sarawak (tuak), (b) Tuak sample under microscope (40 x magnification).

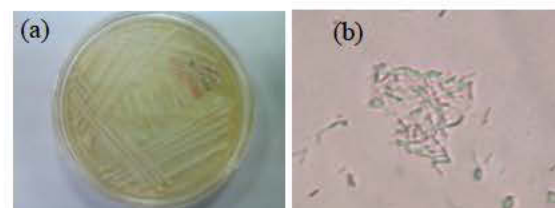
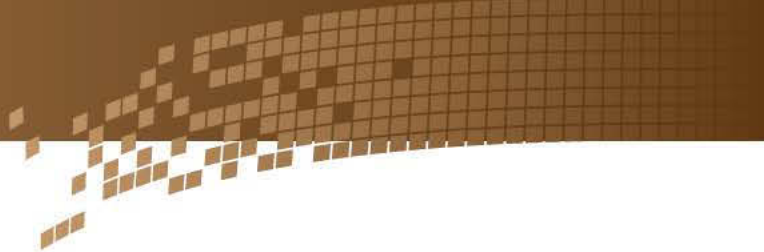


Fig 3 (a) Sample from Pahang (tapé), (b) Pahang (tape) sample under microscope (40x magnification).



Figures 1 to 3 showed the yeasts colonies from the different sources of *ragi* (fermentation starter) and yeasts microscopic under microscope (40 magnification). Samples from Sarawak (*tapai* and *tuak*) are not much different in microscopic study and were oval-shaped but samples from Pahang (*tapai*) had a long shape.

Table 1 Test results using API kit (ID 32C and 20C AUX).

Types of samples	API test		
	ID 32C	20C AUX	
Sarawak (<i>tapai</i>)	<i>Cryptococcus humicola</i>	<i>Candida glabrata</i>	
	<i>Candida glabrata</i>	<i>Cryptococcus humicola</i>	
		<i>Stephanoascus ciferrii</i>	
		<i>Candida famata</i>	
Sarawak (<i>tuak</i>)	<i>Cryptococcus humicola</i>	<i>Cryptococcus laurentii</i>	
	<i>Candida glabrata</i>	<i>Candida glabrata</i>	
	<i>Candida sake</i>	<i>Candida albicans 2</i>	
	<i>Candida silvicola</i>	<i>Candida pelliculosa</i>	
	<i>Saccharomyces cerevisiae</i>	<i>Trichosporon asahii</i>	
	<i>Rhodotorula glutinis</i>	<i>Saccharomyces cerevisiae</i>	
		<i>Cryptococcus humicola</i>	
		<i>Rhodotorula glutinis</i>	
	Pahang (<i>tapai</i>)	<i>Cryptococcus humicola</i>	<i>Candida guilliermondii</i>
		<i>Candida guilliermondii</i>	<i>Trichosporon mucoides</i>
<i>Saccharomyces cerevisiae</i>		<i>Cryptococcus humicola</i>	
		<i>Saccharomyces cerevisiae</i>	
		<i>Cryptococcus albidus</i>	
		<i>Stephanoascus ciferrii</i>	

From the study, *Saccharomyces cerevisiae* was identified in two samples (Sarawak (*tuak*))

and Pahang (*tapai*) and was known as found predominantly in alcoholic fermented beverages (Barnett et. Al. 2000; Battcock & Ali 1993) while *Candida glabrata* is the lower ethanol producing capacity (Dung et. al.). These species are known for their capabilities in producing ethanol. The DNA study on these strains isolated is still at beginning stage.

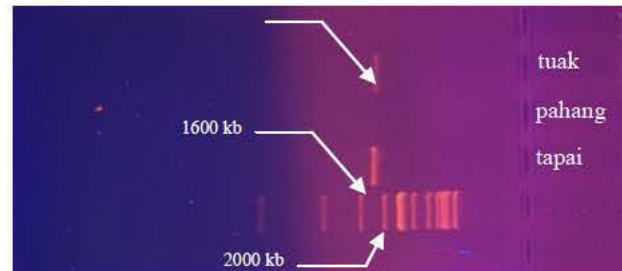


Fig. 4 Gel electrophoresis by using NS1 and F18SB1 primers (approximately 1.7 kb).

Figure 4 shows the gel electrophoresis and the entire length of 18S rDNA, approximately 1.7 kb in size and it was amplified by PCR using NS1 and F18SB1 for all samples.

CONCLUSION

From the study, *Cryptococcus humicola* and *Candida glabrata* were identified in the Sarawak (*tapai*) sample, while *Cryptococcus humicola*, *Saccharomyces cerevisiae*, *Candida glabrata* and *Rhodotorula glutinis* were identified in the Sarawak (*tuak*) sample and for Pahang (*tapai*) sample, *Cryptococcus humicola*, *Saccharomyces cerevisiae* and *Candida guilliermondii*.

ACKNOWLEDGEMENT

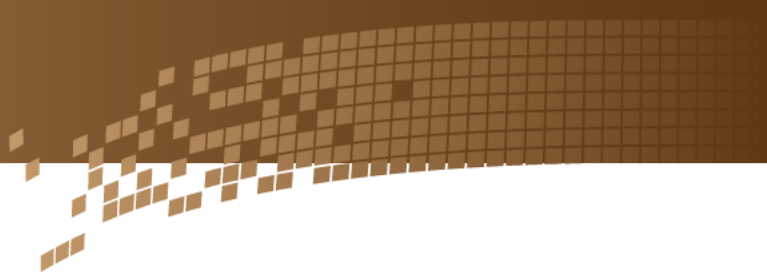
This research project is funded by Research University Grant code UKM-GUP-BTT-07-25-165

REFERENCES

Ardana, M. M. & Fleet, G. H. 1989. The microbial ecology of tape ketan fermentation. *International Journal Food of Microbiology*. Vol. 9:157-165.
 Dwidjoseputro, D. & Wolf, F. T. 1970. Microbiological studies of Indonesian fermented foodstuffs. *Mycopathologica et Mycologia Applicata*. Vol. 41: 211-222.
 Hesseltine, C. W. 1965. A millennium of fungi, food and fermentation. *Mycologia*. Vol. 2 : 149-198.



- Hesseltine, C. W. 1983. Microbiology of oriental fermented foods. *Annual Reviews of Microbiology*. Vol. 37: 575-601.
- Steinkraus, K. H. 1996. Indigenous fermented foods in which ethanol is a major product. In *Handbook of Indigenous Fermented Foods*, pg. 363-508. New York: Marcel Dekker Inc. New York.
- Sujaya, I. N., Amachi, S., Saito, K., Yokota, A., Asano, K. & Tomita, F. 2002. Specific enumeration of lactic acid bacteria in ragi tape by colony hybridization with specific oligonucleotide probes. *World Journal of Microbiology and Biotechnology*. Vol. 42: 481-491.
- Sujaya, I. N., Antara, N. S., Sone, T., Tamura, Y., Aryanta, W.R., Yokota, A., Asano, K. & Tomita, F. 2004. Identification and characterization of yeasts in brem, a traditional Balinese rice wine. *World Journal of Microbiology and Biotechnology*. Vol. 20: 143-150.
- Kuriyama, H., Sastraatmadja, D., Igosaki, Y., Watanabe, K., Kanti, A. & Fukatsu, T. 1997. Identification and characterization of yeast isolated from Indonesian fermented food. *Mycoscience*. Vol. 38: 441-445.



Immobilisation of Malaysian Yeast Strain for Bioethanol

Masniroszaim Md Zain and Noorhisham Tan Kofli

Department of Chemical & Process Engineering

Faculty of Engineering and Built Environment

Universiti Kebangsaan Malaysia

43600 UKM Bangi, Selangor

Tel: 603-89216041 Email: masnie@eng.ukm.my

ABSTRACT

Yeast is an important and useful organism for the commercial production of ethanol. In this study, the production of ethanol using local yeast strains (ST1, ST2 and ST3) was investigated by immobilizing the yeast cells via entrapment method using calcium alginate. The screening of Malaysian yeast strain was carried out from microflora of dry starter ragi that locally used for production of tapai (fermented food) and tuak (local alcoholic drink). Local yeast cells were grown in YPD medium until they reached the maximum growth of ST1 ($\mu=0.4963\text{ h}^{-1}$), ST2 ($\mu=0.4525\text{ h}^{-1}$) and ST3 ($\mu=0.5430\text{ h}^{-1}$) prior to the immobilization to produce rounded shape like beads (average diameter = 4.3 mm). Different glucose concentrations and agitation were performed on the immobilized beads capability in producing ethanol. The initial results indicated that the productions were affected by both factors.

Keywords: yeast, bioethanol, immobilization, alginate, fuel

INTRODUCTION

Large-scale substitution of world fossil fuel is needed and has created a surge of interest in alternative energy sources. The production of bioethanol by microbial fermentation has been viewed with particular interest since it can be used directly as fuel in existing motor and can replace the gasoline (Gyu et al., 1981). Since bioethanol for fuel been important as a result of fossil fuel depleting, production of ethanol as fuel is important.

Tuak is Sarawak rice wine where it is a special intoxicating drink for natives and is usually served during important occasions. It is made from a mixture of black and white glutinous rice using a dry starter which is locally called ragi tape. The ragi tape is veritably mixed cultures of molds, yeasts and bacteria that play essential roles. Molds produce the amylases that degrade the starch into dextrin and sugars, and yeast converts these sugars to alcohol (Dung, 2004). Bacteria mainly give the 'sweet' to the rice wine and are also a contaminant to the dry starter. However, the identification of the yeast that grows in tuak fermentation has never been published. Moreover, the manufacturing of the starter ragi is mainly on home-scale and domestic-style

production and the ingredients were passed from generation to generation. As a result there are limited information and knowledge about the starter ragi tuak.

The immobilisation technique exhibits advantages in producing high yields and products. It has been reported that the rate of producing bioethanol from immobilized cells is higher than free cells using *Saccharomyces cerevisiae* (Taherzadeh et al., 2001). Using immobilized cells, the production of bioethanol is 0.48 g/g with glucose consumption of 92% as compare to free cells that produced 0.4 g/g of bioethanol with glucose consumption of 79% (Taherzadeh et al., 2001). Among the different cell immobilization techniques, entrapment in calcium alginate gel is one of the most used matrices for whole cell due to its simplicity and non-toxic character. This simple and mild immobilization technique involves the drop-wise addition of cells suspended in sodium alginate onto a solution of calcium chloride whereon the cells are immobilized in precipitated calcium alginate gel in the form of beads (Gaksungur & Zork, 2000). Taking into consideration of local yeast from fermentation of tapai and tuak to produce low cost bioethanol, the objective of this study is to investigate the local yeast strains that have



potential to produce high ethanol concentration using simple immobilisation technique.

RESULTS & DISCUSSION

Isolated from ragi tape and purified in YPD agar, the strains selected were classified as ST1, ST2 and ST3. Observation under microscope was done and is shown in Figure 1.

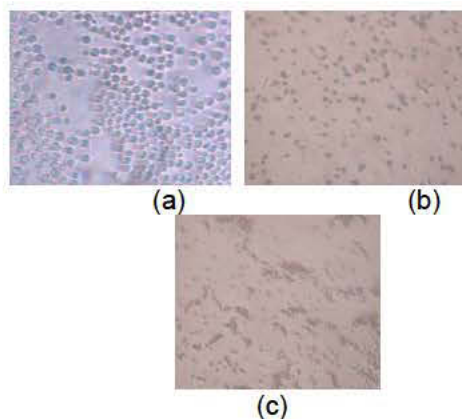


Fig.1 The observation of (a) ST1, (b) ST2 and (c) ST3 under microscope(x40)

Local yeast cells were grown in YPD medium with two different conditions (aerobic and semi aerobic). The growth rate for semi aerobic conditions of ST1 ($\mu=0.4963 \text{ h}^{-1}$), ST2 ($\mu=0.4525 \text{ h}^{-1}$) and ST3 ($\mu=0.5430 \text{ h}^{-1}$) and for aerobic condition the growth rate of ST1 ($\mu=0.4276 \text{ h}^{-1}$), ST2 ($\mu=0.4735 \text{ h}^{-1}$) and ST3 ($\mu=0.6108 \text{ h}^{-1}$).

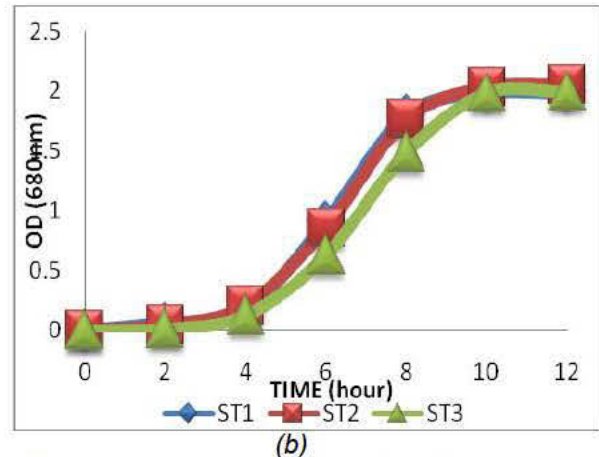
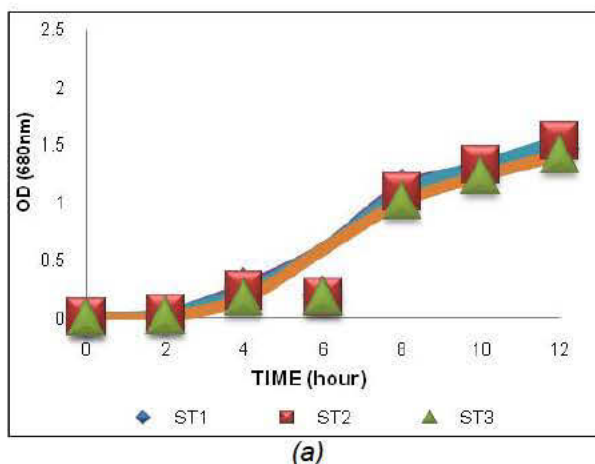


Fig.2 Comparison of growth curve in different condition (a) semi aerobic fermentation (b) aerobic fermentation

Ethanol production from the three strains was carried out and the maximum concentration of ethanol is shown in table 1 below.

Table 1- Concentration of bioethanol

STRAIN	ETHANOL CONCENTRATION (g/l)	
	SEMI AEROBIC FERMENTATION	AEROBIC FERMENTATION
ST1	5.005	6.295
ST2	4.944	7.137
ST3	4.382	6.390

CONCLUSION

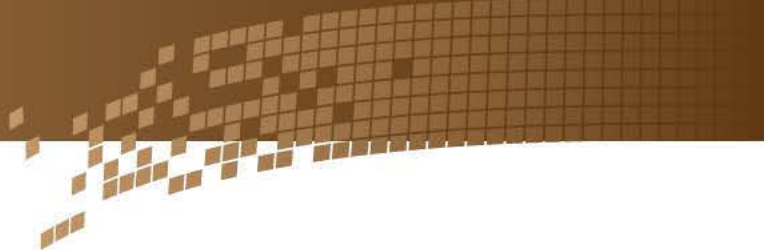
The observations detailed in this study highlight the local yeast strain from microflora ragi tape capability for production of bioethanol in aerobic and anaerobic fermentation. Further study is being carried to reaffirm these observations.

ACKNOWLEDGEMENT

The authors would like to acknowledge that this research is funded by Research University Grant (Code : UKM-GUP-BTT-07-25-165).

REFERENCES

Dung, N.T.P., Rombouts F.M. & Nout M.J.R. 2004. Characteristic of some traditional Vietnamese starch-based rice wine fermentation starters (men).
Goksungur Y., Zorlu N. 2001. Production of Ethanol from Beet Molasses by Ca-Alginate Immobilized Yeast Cells in a Packed-bed



- Bioreactor. Turkey Journal Biology 25 : 265-275.
- Jamai L., Ettabayi K., Yamani J.E & Ettabayi M. 2007. Production of ethanol from starch by free and immobilized *Candida tropicalis* in the presence of α -amylase. Bioresource Technology Vol 98: 2765-2770.
- Karimi K., Emtiazi G. & Taherzadeh M.J. 2006. Production of ethanol and mycelia biomass from rice straw hemicelluloses hydrolyzate by *Mucor indicus*. Process Biochemistry Vol 41: 653-658.
- Limtong S., Sintara S., Suwanarit P. & Lotong N., 2001. Yeast Diversity in Traditional Alcoholic Fermentation Starter. Abstract Book of the 9th International Symposium on Microbial Ecology, 26-31 August 2001. Amsterdam, Netherlands.
- Taherzadeh M.J., Ria M. & Claes N. 2001. Continuous Cultivation of Dilute-acid Hydrolysates to Ethanol by Immobilized *Saccharomyces cerevisiae*. Humana Press Inc.
- Tomas B., Carl J.F. & Lena G., 2004. The fermentation performance of nine strains of *Saccharomyces cerevisiae* in batch and fed-batch cultures in dilute-acid wood hydrolysate: Jurnal of bioscience and bioengineering Vol 98 (2): 122-125.



Integration of Characteristics for Urban Construction Materials: The Way to Mitigate Urban Heat Island

P. Shahmohamadi, A.I. Che-Ani, M.F.I. Mohd-Nor, N.M. Tawil and N.A.G. Abdullah

*Department of Architecture
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216595 Email: adiirfan@vlsi.eng.ukm.my*

ABSTRACT

Urban heat island effect is due to many factors such as inappropriate urban construction materials, resulting from the production and accumulation of heat, increasing of energy consumption and pollution in the urban mass. Different characteristics of materials, albedo, emissivity and porosity, can impact on formation of UHI. Using low albedo, emissivity and porosity materials in urban areas can extremely increase the effect of UHI. It means the quality of materials is in indirect ratio to UHI whereby increasing the quality of materials, the effect of UHI is decreased and vice versa. To achieve this aim, this paper explores the conceptual framework to show the correlation between UHI and urban construction materials and discusses about the integration of characteristics of construction materials which can mitigate UHI effects.

Keywords: Albedo, Emissivity, Porosity, Urban Construction Material, Urban Heat Island.

INTRODUCTION

Raised temperatures in the city derive from the altered thermal balances is mainly due to materials. Thus, heat transfer from absorptive surfaces within the city and the interception of outgoing long wave radiation by buildings contribute to create UHI (Bretz et al., 1997) and also the removal of green spaces can contribute to UHI by reducing shading and evaporative cooling.

According to the above perspective, by considering that rapid and huge construction growth in the near future, it becomes increasingly important to apply appropriate construction materials in order to reduce UHI effects. Hence, this paper investigates the correlation between UHI and construction materials by using low albedo and emissivity and the lack of porosity of materials broadly, the percentage of UHI formation increases and vice versa. Therefore, this paper proves this correlation by exploring a conceptual framework and then concludes that the existence of high albedo, high emissivity and high porosity together in materials can be more effective for reducing of UHI effects.

CONCEPTUAL FRAMWORK: URBAN HEAT ISLAND AND CHARACTRISTICS OF MATERIAL

The albedo of a surface is defined as its reflectivity, integrated hemispherically and over wavelength (Santamouris, 2001). Generally, urban surfaces tend to have lower albedo than surfaces in the rural environment (e.g. vegetation), thus, absorbing more solar radiation. This causes higher surface temperatures than air temperature; they can become 30-40°C higher than ambient air temperature (Akbari et al., 2001).

Emissivity controls the release of long-wave radiation to the surrounding. The albedo and emissivity, aspects related to the durability, cost, appearance and pollution emitted by the materials have to be considered. Many paints and coating emit volatile organic compound which combined with nitrogen oxides create ozone during the day. Table 1 gives the emissivity and the reflectivity (albedo) for selected materials (Bretz et al, 1997).

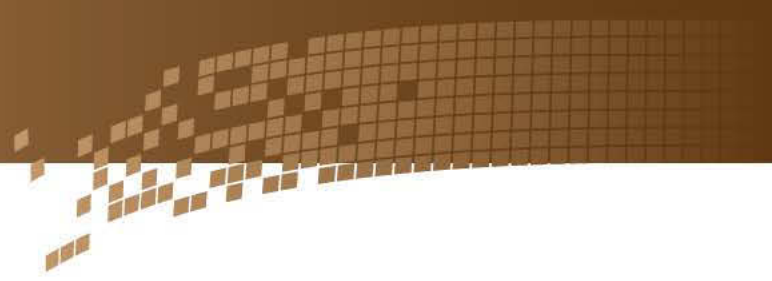


Table 1. Albedo and emissivity of surfaces (Bretz et al, 1997).

Material	Albedo	Emissivity
Concrete	0.3	0.94
Red brick	0.3	0.90
Building brick	-	0.45
Concrete tiles	-	0.63
Wood (freshly planed)	0.4	0.90
White paper	0.75	0.95
Tar paper	0.05	0.93
White plaster	0.93	0.91
Bright galvanized iron	0.35	0.13
Bright aluminum foil	0.85	0.04
White pigment	0.85	0.96
Grey pigment	0.03	0.87
Green pigment	0.73	0.95
White paint on aluminum	0.80	0.91
Black paint on aluminum	0.04	0.88
Aluminum paint	0.80	0.27-0.67
Gravel	0.72	0.28
Sand	0.24	0.76

Table 1 shows that dark-colored material can be up to around 7°C higher than the ambient air temperature while the light-color one is only around 2-3°C higher than the air temperature. A simulation reveals that the cooling load increases as the color of the façade changes from lighter to darker. A reduction of 7.48% of cooling energy was achieved when the color of the façade is changed from black to white aluminum façade (Wong, 2002). In midsummer, white-painted roads with an albedo close to 0.55 have almost the same temperature as the ambient environment, while unpainted roads with an albedo close to 0.15 were approximately 11 K warmer than the air (Berg and Quinn, 1978). Santamouris (2001) reported asphalt temperatures close to 63°C and white pavements close to 45°C. Higher surface temperatures contribute to increasing the temperature of the ambient air and the UHI intensity.

Porous surfaces absorb water (e.g. soil) account for quite significant latent heat flux in the atmosphere. Lack of porosity materials in urban surface, a high percentage of non-reflective, water-resistant surfaces and a low percentage of vegetated and moisture-trapping surface create an evaporation deficit in the city caused UHI intensity. Vegetation, especially in the presence of high moisture levels, plays a key role in the regulation of surface temperatures, even more than may

non-reflective or low-albedo surfaces (Goward et al. 1985) and a lack of vegetation reduces heat lost due to evapotranspiration (Lougeay et al. 1996).

According to above description, these three characteristics of materials are responsible for formation of UHI. Figure 1 shows that low quality of materials such as low albedo and low emissivity and the lack of porosity caused increased temperature, energy consumption, pollution and finally UHI, while Figure 2 and 3 show that by increasing the quality of materials, UHI intensity can be decreased. The existence of these characteristics of materials properly help to balance temperature, energy consumption and pollution in so far as reduce UHI effects (Figure 4). This process can be described in the following way:

$$Al. \downarrow + Em. \downarrow + Por. \downarrow = Temp. \uparrow + En. \uparrow + Pol. \uparrow = UHI \uparrow$$

$$Al. \uparrow + Em. \uparrow + Por. \uparrow = Temp. \downarrow + En. \downarrow + Pol. \downarrow = UHI \downarrow$$

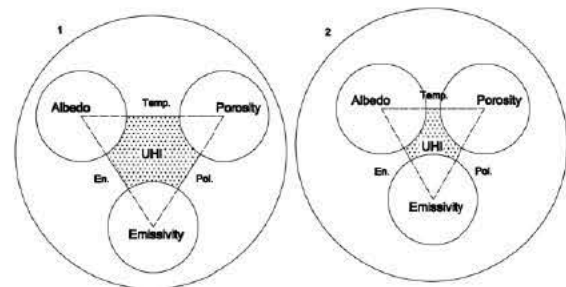


Fig. 1 & 2 Low quality of material and UHI intensity.

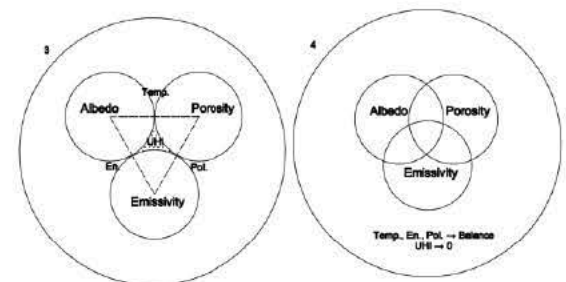


Fig. 3 & 4 Integration of characteristics of material, provision of balance and reduction of UHI intensity.

CONCLUSION

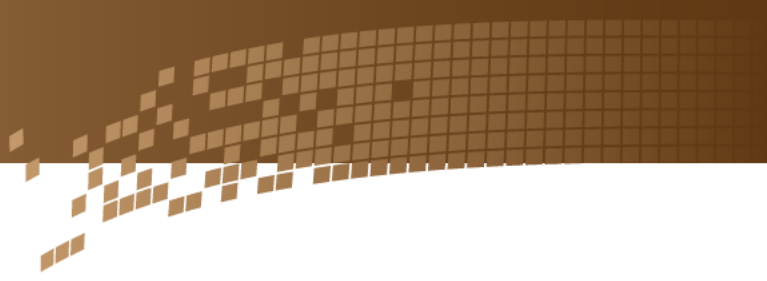
This study has shown, conceptually, that existence of all characteristics of materials and integration between them can extremely contribute to reduce UHI effects rather than existence of one characteristic. Although most research have focused on one or two



characteristics of materials, this paper introduces a model in order to study these three characteristics of materials and how they work together for achieving balance in temperature, energy consumption and pollution and then mitigating UHI intensity in the city.

REFERENCES

- Akbari H., Pomerantz M. and Taha H., 2001. Cool Surfaces and Shade Trees to Reduce Energy Use and Improve Air Quality in Urban Areas. *Solar Energy*, 70(3): 295–310.
- Berg, R. and Quinn, W., 1978. Use of Light Colored Surface to Reduce Seasonal Thaw Penetration beneath Embankments on Permafrost, *Proceedings of the Second International Symposium on Cold Regions Engineering*, University of Alaska.
- Bretz, S., Akbari, H. and Rosenfeld, A., 1997. Practical Issues for Using Solar-Reflective Materials to Mitigate Urban Heat Islands, *Atmospheric Environment*, 32(1): 95-101.
- Goward, S.N., Cruickshanks, G.D., Hope, A.S., 1985. "Observed Relation between Thermal Emission and Reflected Spectral Radiance of a Complex Vegetated Landscape", *Remote Sensing of the Environment*, 18: 137–146.
- Lougeay, R., Brazel, A., & Hubble, M., 1996. Monitoring Intra-Urban Temperature Patterns and Associated Land Cover in Phoenix; Arizona Using Landsat Thermal Data, *Geocarto International*, 11: 79-89.
- Santamouris, M., 2001. On the Built Environment-the Urban Influence. In *Energy and Climate in the Urban Built Environment* (M. Santamouris, eds), London, James & James Publication.
- Wong, N. H., 2002. *A Study of the Urban Heat Island in Singapore*, A Report of Heat Island Project, National University of Singapore.



The Development of Quality Indicators for Housing Design (QIHD) in Karachi, Pakistan

A.H. Chohan, A.I. Che-Ani, N.M. Tawil, M.F.M. Zain and N.A.G. Abdullah

Department of Architecture
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216595 Email: adiirfan@vlsi.eng.ukm.my

ABSTRACT

Underdeveloped countries are experiencing rapid industrial growth and are striving hard to prevent them from being swallowed by the big economies. This trend of underdeveloped nations results in unplanned growth development and law transient in almost all walks of life particularly in building industry and urban centers. An alarming rate of population growth is another problem faced by these countries which ultimately creates the demand for increased number of housing facilities. This research was planned to develop the relation between housing design quality, performance, user's satisfaction, and implicative design defects. Based on this relation the researcher shall work out the quality indicators for better affordable housing in Karachi Pakistan and shall also highlight the factors of low quality design which turns into implicative maintenance at post occupational stage of house.

Keywords: affordable housing, housing design, quality indicators

INTRODUCTION

Affordable housing is a term introduced to cater to a large group of people living in diversified condition, having income from low to modest levels. Perhaps the understanding of affordable housing varies from people to people and regions to region. But one fact is common that the term affordable housing has a capacity to demarcate and define the housing type for low to medium income groups.

The U.S. Department of Housing and Urban Development (HUD) defines the term affordable housing as, the housing that costs no more than 30 percent of a household's monthly income. That means rent and utilities in an apartment or the monthly mortgage payment and housing expenses for a homeowner should be less than 30 percent of a household's monthly income to be considered affordable. However the City Council of Calgary Canada (2002) approved and defines affordable housing as adequately suiting the needs of low- and moderate-income households at costs below those generally found in the market. It may take a number of forms that exist along a continuum

– from emergency shelters, to transitional housing, to non-market rental (also known as social or subsidized housing), to formal and informal rental, and ending with affordable home ownership.

Housing our People in Environment (HOPE) is a governmental organization in New Zealand working for betterment of built environment in New Zealand. HOPE (2007) defines affordable housing as, a residential activity whose cost to rent or own generally does not exceed 30% of the income of low to moderate income households and which reflects the established design criteria.

Design quality of built environment is commonly measured through the concentration of pleasant architectural effects and proportion of aesthetics in building. But according to Sir Lipton (2006), design is more than just a beauty; it is an integral part of the success of any project. Sir Lipton suggested that good design should produce high quality, durable and desirable space by embracing innovation and using modern methods of construction. But the question arises of what mechanism should be used to evaluate the design quality.



The report published by CABE (2001), has highlighted the importance of quality design in buildings and warned the people about possible repercussions of poor design. The report declares that absence of quality design is likely to have significant adverse environmental, social and economical effects. Furthermore the report adds that continuation of low quality design can lower the quality of life.

PROBLEM STATEMENT

This research considers that low-quality design is abundant in housing architecture, whereas low-quality design results in the form of defects and tax of maintenance. Quality Indicators for Housing Design (QIHD) can play its role to accomplish the conceived housing quality.

AIM OF RESEARCH

This research is intended to encompass various factors of good quality design and particularly housing design and to develop the framework of Quality Indicators for Housing Design (QIHD), to determine the design quality of housing at post occupational stage, as shown in Figure 1.

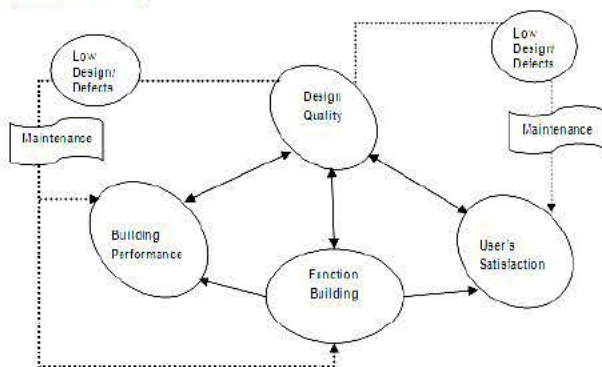


Fig. 1 Conceptual QIHD development
Source: This Research

BRIEF RESEARCH METHODOLOGY

In order to achieve the aim of this research, the methodology is constructed in three principal stages as listed below.

1. First, to encompass the theoretical framework of research through intense literature review and making analysis of available mode of design quality standards
2. Second, to evaluate the housing blocks at various locations through determined design quality indicators by user's participation.
3. Third, to check the validity of same design quality determinants through respondents such as architects/engineers /construction managers (A/E/C), for purpose of formulating QIHD framework for private housing in Karachi Pakistan.

SUMMARY

The outcome of this research, for the common layman as well as professionals, holds multi dimensional benefits which are shown in Figure 2.

1. To facilitate the common man to work out the best option for his investment in housing.
2. To provide opportunity to professional surveyors to conduct surveys.
3. A tool for the design community to work out the trends of design preference in a specific region.
4. Tool for valuator to ascertain the condition of building for various purposes, e.g. mortgage, dilapidation surveys etc.

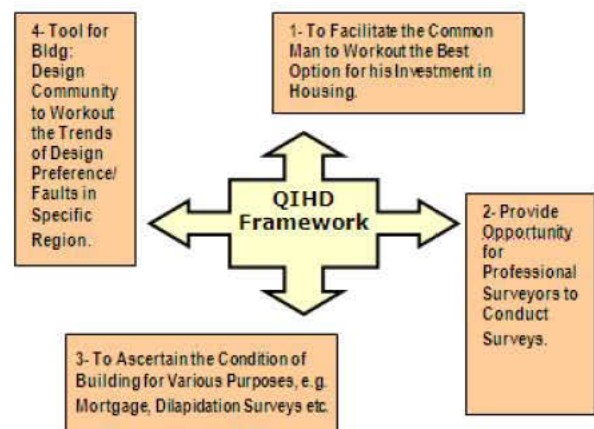
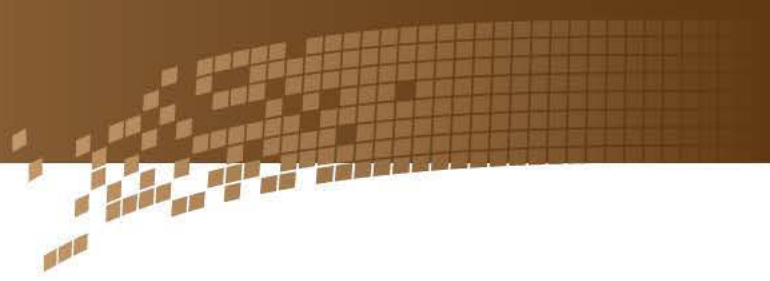


Fig. 2 Conceptual framework of research out come
Source: This Research



REFERENCES

- CABE. 2003. Design for Homes. The Commission for Architecture and the Built Environment. London 2003.
- City of Calgary. 2002. City of Calgary: Corporate Affordable Housing Strategy. Approved 2002 July 17 (CPS2002-57). Calgary: The City of Calgary, Corporate Properties and Community Strategies. 31 pp.
- HOPE. 2007. Guidelines for Housing our People in Environment New Zealand. Volume 2 . October 2007.
- HUD. 2004. Housing Quality Standards and Inspections. Washington DC: U.S. Department for Housing and Urban Development Housing Quality Standards (HQS). 2004.
- Sir Lipton, S. 2006. Affordable House Better by Good. London: Commission of Architects and built Environment. 2006.

Abstract of PhD Thesis

Engineering & Built Environment





Evaluation of Flow Resistance in Channels with Flexible Vegetation Using Numerical Model

by

Badronnisa Yusuf (P31647)

Doctor of Philosophy in Civil and Structural Engineering (Ph.D)

Studies on the effects of vegetation in open channel flows have been expanded progressively and the focus has been mainly on developing better and efficient methods for the evaluation of flow resistance due to the vegetation. Knowledge on the flow resistance and the way it responds to changing flow and vegetation characteristics, are essential and has many applications in the field of hydraulic engineering, especially in the design and management of vegetated waterways. Estimation of flow resistance due to vegetation is very challenging as vegetation impose variable degree of resistance depending on the size, distribution, density, flexibility and degree of submergence of the vegetation. Most related works in the past have been experimental based and only a few have attempted theoretical approach. Experimental works require proper laboratory setup, good instrumentation and high skilled manpower. As such, it is usually laborious, expensive and time consuming. The theoretical approach was not preferred then as it involves complex equations and often requires numerical solution. However recently, with the introduction of computational fluid dynamics (CFD) and advancement of computer technology, the use of numerical modeling in simulating flow in vegetated channel has gain serious attention. Thus, this research aims at further exploring the suitability of numerical modeling in estimation of flow resistance in open channel flows with flexible vegetation. The application of CFD uses lesser resources and enables the study in a wide range of situation to be done faster, with lower overall cost if compared to experimental approach. In this study, three dimensional (3D) numerical model based on arbitrary Lagrangian-Eulerian (ALE) approach has been employed to simulate the effects of various characteristics of selected flexible vegetations to the flow resistance. The modeling involved simultaneous solution of Navier Stokes equation for flow, stress-strain relationship for the vegetation structure and ALE algorithm for the deformed mesh, using finite element numerical method. The simulation has been carried out with an aid of commercial software package, COMSOL Multiphysics. The simulation results were validated using experimental data carried in the laboratory using real vegetations. Two types of common aquatic vegetation, namely Kercut (*Lepironia Articulata*) and Mensiang (*Scirpus Grossus*) grasses, of similar characteristics used in computer simulation, have been tested. The primary output from the simulation and experimental works are 3D velocity values along the channel. These results were then used to calculate flow resistance coefficient, *Manning n*. The accuracy of numerical model compared to experimental results was measured in terms of mean absolute error (MAE) and root mean square error (MRSE). The results show that the numerical model which combined the three applications as mentioned above was able to predict the velocity and the flow resistance coefficient with reasonable accuracy. The MAE and MRSE calculated for velocity is ± 0.02 m/s. The MAE and MRSE for *Manning, n* is also ± 0.02 . The success of 3D ALE based numerical model in estimating flow resistance in a channel with flexible vegetation, besides correct modeling techniques such as in setting up the boundary conditions and mesh specifications, is much depends on the computer operating system and its memory power.

For further correspondence kindly contact:

Professor Ir. Dr. Othman Karim
Department of Civil and Structural Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216213; Fax: 603-89216147; Email: othman@vlsi.eng.ukm.my



Life Cycle Assessment of Integrated Solid Waste Management (Plastic Electronic) in Malaysia

by
Norazli Binti Othman
Doctor of Philosophy in Civil and Structural Engineering (Ph.D)

The practice of the conventional method for disposing electronic solid waste in our country is by Landfill option. However, there are several disadvantages of using these option such as the inorganic characteristics of electronic waste which are not biodegradable, the hazardous content of the waste that will increase the pollution concentration in the leachate so as in the landfill gas and most probably there is a reaction between electronic waste and other waste at the landfill site. Therefore, there is a need to strategies sustainable management to manage the electronic waste. Basicly, the strategy should be based on the economic and technical capability of the country, competitive and also realistic. In order to implement that strategy, the concept of integrated electronic solid waste management should be considered. However, there is a need to develop infrastructure facilities such as waste collection, central sorting (MRF & RDF recovery facilities), recycling, thermal treatment (Refused Derived Fuel or Catalytic de-polymerization technology) and Landfill system to support the integrated concept. Thus, this resarch aim at implementing the integrated concept of managing electronic waste especially plastic waste that has been generated through municipal solid waste stream and industrial waste stream. The main objective of this research is to predict the existing of environmental and economic impact when implementing the integrated system. For this purposes, Life Cycle Assessment technique which able to predict both impact from the stage when waste has been generated until the disposal stage of the waste is adopted. In summary, the methodology of the study are divided into five parts which are survey study, laboratory test, data collection, design of model and program development. The survey study include the current practice of the electronic waste management and also the composition of electronic waste that has been generated and discarded in this country. Laboratory testing were include identification test of plastic resin and also physical and chemical characteristics analysis such as proximate analysis, ultimate analysis, neutron activation analysis and metal content analysis. Data collection were include collection data from laboratory analysis and also collection data from the site such as from the literature study and from the company like Recycling Energy Sdn. Bhd., Shajeran Resources (M) Sdn. Bhd., Kualiti Alam Sdn. Bhd. The design of model and program development will be based on the integrated solid waste management (IWM) with Life Cycle Assessment (LCA) application in order to predict the impact of the system from economic and environmental prospect.

Dr. Noor Ezlin Ahmad Basri (Main Supervisor)
Department of Civil and Structural Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216229; Fax: 603-89216147; Email: ezlin@vlsi.eng.ukm.my

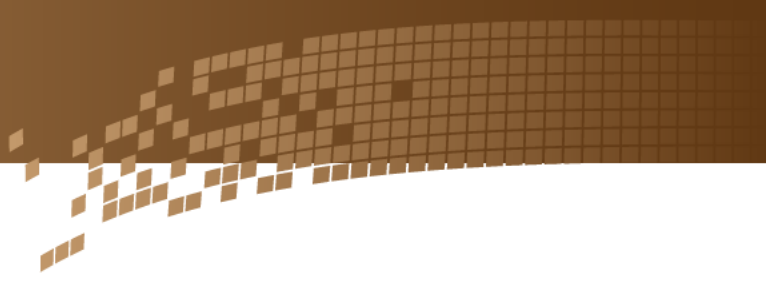


Fresh – Brine Water Effect on the Engineering Properties of Lisan Peninsula Marl – Dead Sea – Jordan

by
Ziad Mahmoud Mustafa Mansour (P37160)
Doctor of Philosophy in Civil and Structural Engineering (Ph.D)

On recently emerged platform resulted from regression of the Dead Sea, Arab Potash Company, Jordan constructed two large salt pans. These salt pans which are surrounded by large watertight dike structures made of marl are built on a soft silty clay foundation material named Lisan Marl. Soluble salts are major components in Lisan marl. This research was carried out to provide engineering parameters for the Lisan Marl aiming at accurate assessment of dike behaviour. Taking into account the changed material behavior due to leaching and consequently, the effect of leaching on dike stability and settlement during and after “staged” construction. To determine the engineering properties of Lisan Marl (CL – ML soil), the presence of soluble minerals in this soil shall be taken into consideration. The properties considered in this study for the marl as dike construction material were mineralogy, grain size distribution, consistency limits, moisture content – dry density relationship (Proctor test), specific gravity and unconfined compressive strength. The results showed that brine water significantly increased the maximum dry density and decreased the optimum moisture content. Liquid limit and the fine particles were decreased upon using brine as testing media compared with the standard methods. The unconfined compressive strength on the other hand, shows higher values upon molding the samples with fresh water compared with samples treated with Dead Sea brine water. Investigation of the effects of subjecting Lisan Marl as a dike foundation material due to fresh water is crucial especially for assessment of end and post construction settlement. For this purpose 12 Shelby tubes samples were collected from the concerned Dead Sea area. Laboratory tests including mineralogy, classification tests, unconsolidated undrained triaxial, drained direct shear test, compressibility and collapse potential evaluation by inundation and leaching were conducted to evaluate the effect of fresh water on the engineering behaviour of the material. Slightly collapsible behaviour upon inundation with distilled water was observed. Leaching the Lisan Marl with distilled water significantly increased the soil compressibility and the soil could be classified as a “problematic soil” with a collapse potential of 9.7%. Leaching under drained direct shear test showed negligible effect on internal friction angle. However, cohesion intercept was found to be increased upon leaching by 4 to 8 times. Nonlinear finite element modelling by using commercial software showed a reasonably good agreement with the laboratory experimental results. Triaxial test was modeled to study the effect of leaching on the stress-strain behaviour of the Lisan Marl. The triaxial model showed that leaching caused a decrease in the elastic modulus and nominal decrease in the effective friction angle. Dike modelling using stage construction method showed that leaching increased the magnitude of end construction settlement by about 42%.

Assoc. Professor Ir. Dr. Zamri Chik (Main Supervisor)
Department of Civil and Structural Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216228; Fax: 603-89216147; Email: irzamri@vlsi.eng.ukm.my



Development of Sustainable High Performance Concrete Using Mineral and Chemical Admixtures

by

Lai Fook Chuan (Matrix: P21948)

Doctor of Philosophy in Civil and Structural Engineering (Ph.D)

Sustainable high performance concrete (HPC) is vital for maintaining the equilibrium for impact of environmental pollution, intelligent allocation of scarce resources, and the development of economy. The objective of this research is to produce sustainable HPC with the combination of mineral and chemical admixtures. Their performances in terms of cost/m³, compressive strength, workability, durability, abrasion resistant, water permeability and the development of adiabatic temperature were tested against the normal concrete that have been designed from grade 40 to grade 100. The synthesized co-polymer superplasticizer and the naphthalene base superplasticizer were chemically characterized by GPC, FTIR, NMR, UV. Water reduction efficiency and slump flow retention in concrete were tested according to the British Standard. The methodology of the mix design for the grade 40 to grade 100 for the sustainable HPC was in accordance with the mix designs from CANMET, Norway, Sedran, De Larrard, JCEN and Le Bris. Experimental results indicated that the sustainable HPC has lower cost/m³ than the normal concrete (as much as RM2.00/m³ to RM200.00/m³), high durability (RCP < 1000 coulomb), higher abrasion resistant (0.10 kg/m² – 0.62 kg/m²), lower water permeability (0.0mm – 21.5 mm), lower adiabatic temperature peak (1 °C - 37 °C) and has early strength (more than 16 MPa at 12 hours and 60 MPa to 100 MPa at the 28-day age). The sustainable self-compacting concrete (SCC) in precast concrete can save 50% of man-hours, reduce 72% of casting time, and save energy without steam curing. Chemical characterization indicated that the synthesized co-polymer superplasticizers is polycarboxylate-ether base in branching form, molecular weight distribution between 758g/mol to 20,835g/mol. Water reduction 100% more effective against the naphthalene base superplasticizer and suitable use for the sustainable SCC. All the testing results indicated that this sustainable HPC are very fruitful for economy, and parallel to the effort of universal sustainable development.

Professor Dr. Muhammad Fauzi Mohd. Zain (Main Supervisor)

Department of Architecture

Faculty of Engineering and Built Environment

Universiti Kebangsaan Malaysia

43600 UKM Bangi, Selangor, MALAYSIA

Tel: 603-89216453; Fax: 603-89252546; Email: fauzi@vlsi.eng.ukm.my



Leaching Tests for Evaluation of Metals Release from Solidified/Stabilized Contaminated Soil

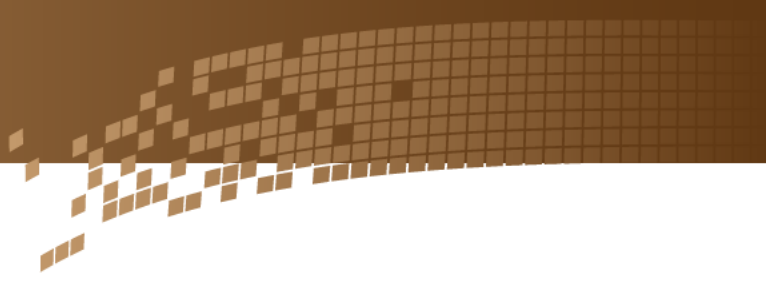
by

Ahmad Tarmizi Abd Karim (P23675)

Doctor of Philosophy in Civil and Structural Engineering (Ph.D)

In this study, a comparison of five different leaching tests, each characterized by different parameters such as liquid/solid ratio, pH, leachant, stirring conditions, duration time, has been performed on contaminated meta-sedimentary residual soil samples. These methods are Dynamic Leaching Test (DLT), Acid Neutralization Capacity Test (ANC), Toxicity Characteristic Leaching Procedure (TCLP), Synthetic Precipitation Leaching Procedure (SPLP) and Microwave Leaching Test (MLT). MLT is presented as a new leaching method to test the performance of stabilized/solidified samples. The advantage of MLT is its rapidity of testing which would prove valuable for regulatory purposes. The solidified samples were spiked with seven different heavy metals with various mixtures of sedimentary soils and ordinary portland cement as binder, and were cured for more than three months at 27 ± 3 °C and humidity of 75 ± 5 RH. Rubber wood bark ash (RBA) was also introduced into the mixture as cementitious supplementary material (CSM). The results of flow-around leaching experiments are reported and compared in this thesis. The results showed that, amongst all the considered experimental parameters, pH was found to have the greatest influence on metal release. In the case of the Dynamic Leaching (flow-around) test, the range of the diffusivities was $10E-18$ to $10E-9$ cm^2/s which indicated solid phase diffusion, and the variation of the diffusivity with time was not regular. In addition, both chemical solubility and physical transport are important factors affecting the flux of contaminants from the solid to the solution phase. The results also indicated that MLT may be able to augment or replace TCLP tests which normally consumed a substantial period of time (>18 hours) and in some cases, providing unreliable results.

Professor Dr. Mohd. Raihan Taha (Main Supervisor)
Department of Civil and Structural Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216218; Fax: 603-89216147; Email: drmr@vlsi.eng.ukm.my



Multidisciplinary Simultaneous Optimisation for a Free Piston Engine Design

by

Nuraini Abdul Aziz (Matrix: P25261)

Doctor of Philosophy in Mechanical and Materials (Ph.D)

This thesis presents a multidisciplinary simultaneous optimisation technique for a free piston engine using Monte Carlo simulation approach. The main objective is to develop a new design methodology of simultaneous multidiscipline optimisation in selecting appropriate engine design. Specifically, the study is to develop the piston movement and vibro-acoustic mathematical and stochastic modelling, new algorithm for optimisation process as well as to compare the obtained engine modal results with the finite element simulation and experimental method. This thesis describes the alternate free movement of the piston generated by a single combustion and air kickback cylinder system. This event was presented in mathematical modelling form using thermodynamic-dynamic approach. The piston movement creates vibration to the structure and radiate sound to the surrounding. The engine vibro-acoustic modelling utilized finite element method and boundary element method with the component mode synthesis approach. The identified uncertainties like the misfire and piston overtravel phenomenon factors were also considered in the modelling. These uncertainties were correlated through engine random variables including the piston size, piston-slider mass and the input heat energy using stochastic modelling approach. The new algorithm was created to process the simultaneous optimisation code that combined the uncertainties and multidiscipline using the Monte Carlo simulation technique. The experimental modal analysis was performed using impact hammer method to validate the newly developed optimisation result and also compared with finite element simulation. The obtained results showed the normal distribution with the acceptable scatter band of 95.5 percent. The results also indicated the correlation of the input variables with the output, vibration and acoustic properties of the engine. Moreover the finite element simulation and experiment results were similar with the obtained eigenvalue and eigenvector results. Finally, the predicted results are important especially in the early engine design stage in order to reduce the cost in the development of engine prototype. The results meet user needs and comply with the environmental laws and regulations.

Professor Dr. Ahmad Kamal Ariffin Mohd Ihsan (Main Supervisor)

Department of Mechanical and Materials Engineering

Faculty of Engineering and Built Environment

Universiti Kebangsaan Malaysia

43600 UKM Bangi, Selangor, MALAYSIA

Tel: 603-89217103; Fax: 603-89259659; Email: kamal@vlsi.eng.ukm.my



End Milling Of Titanium Alloy Ti-6Al-4V With Carbide Cutting Tool Using Response Surface Method

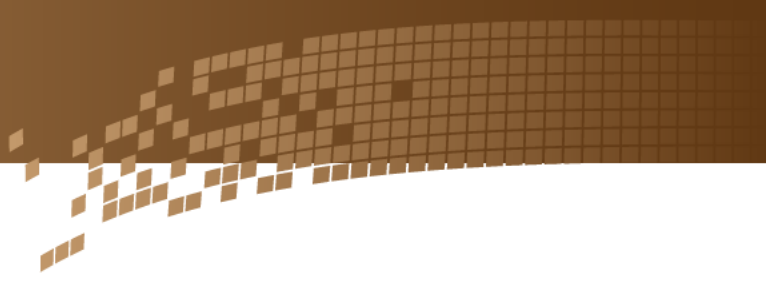
by

Nagi J. Elmaghrabi (P34492)

Doctor of Philosophy in Mechanical and Materials (Ph.D)

In this current work, end milling of titanium alloy Ti-6Al-4V has been investigated using uncoated carbide tools and PVD coated carbide tools under dry cutting conditions. The influence of cutting variables, such as cutting speed, feed rate and axial depth of cut were investigated during end milling operation on a CNC Vertical Machining Center. The study also includes analysis of the relationship between tool life, surface roughness and cutting force with the variable parameters mentioned above. The main objective of this study was to optimize the milling parameters in relation to machining response such as tool life, surface finish, and cutting force. Response Surface Methodology (RSM) was used to develop empirical models of tool life, cutting force and surface roughness using the data generated from the machining experiments. Box and Behnken technique was used for fitting the response surface. This design was formed by combining a factorial Design of Experiments with Response Surface Regression technique. The performance of the cutting tools is described using Response Surface Methodology and followed by the analysis on tool failure mode and wear mechanism. The result shows that the effect of the cutting speed and the feed rate on tool life is more dominant than depth of cut. The highest tool life occurred at cutting speeds between 50 to 65 m/min with feed rate from 0.1 to 0.12 mm/min. Furthermore, the coated insert performs better than the uncoated one. This may be due to the existence of the coating materials, which reduces the coefficient friction between the cutting tool and the chip. The evaluation on surface integrity shows that the surface roughness (R_a) of machined surface produced by uncoated carbide is ranging from 0.550-1.912 μm and by coated carbide is from 0.35-1.320 μm . The machined surface deteriorates when the feed rate is high. Surface roughness values improved slightly with an increase in cutting speed at low feed rate values. The result shows that a lower cutting force and a better surface finish of material would be possible with a combination of high cutting speeds between (77.5- 105 m/min), low feed rates (0.1 mm/min) and low depths of cut between (1- 1.5 mm). Microstructural analysis was carried out on the specimens using optical microscope and scanning electron microscope (SEM) with the aid of an energy dispersive analysis by X- ray spectroscopy (EDAX). The results have also shown that the grain size and orientation are affected by the high speed machining processes. This could be due to high temperature produced during these processes which is enough to cause the phase transformation processes to take place. Finally, predictive model equations for tool life and surface roughness for carbide tools have been developed and verified by performing a follow-up experiment at the optimal settings. Hence, the tool life for carbide tools when machining titanium alloy Ti-6Al-4V can be predicted by using this predictive model equation for the specified testing region.

Professor Dr. Che Hassan Che Harun (Main Supervisor)
Department of Mechanical and Materials Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216516; Fax: 603-89259659; Email: chase@vlsi.eng.ukm.my



Evaluation of the Performance of Four Dual Pass Photovoltaic Thermal (Pvt) Solar Air Heaters

by

Ebrahim M. Ali Alfegi (P34952)

Doctor of Philosophy in Mechanical and Materials (Ph.D)

Photovoltaic thermal (PVT) solar air heater is a collector that combines solar thermal collector and photovoltaic cells in one single hybrid generating unit. It generates both thermal and electrical energies simultaneously. Four configurations of the hybrid photovoltaic thermal solar air heaters were designed, fabricated and its performance were studied experimentally and theoretically. The four considered designs are the air flowing either on both sides of the absorber plate with Compound Parabolic Concentrator (CPC) located parallel to the air flow to enhance the radiation intensity incident onto the photovoltaic cells and with 29 rectangular fins attached to the bottom surface of the absorber to improve the heat transfer from the plate to flowing air in a single pass (Configuration 1) and without CPC (with fins only) (Configuration 2), or in double pass of the absorber with CPC and fins (Configuration 3) and without CPC (Configuration 4). In configurations 1 and 2, air enters through both sides of the absorber in single pass and in double duct at the same time. In configurations 3 and 4, air enters through the first channel and then through the second channel of the collector. The solar collectors have three essential static components: a glass plat on the top, 36 monocrystalline cells arranged in 4 rows and connected in series were pasted to an absorber plate made from aluminium and coated with black paint, and bottom plate insulated with glass wool. The collector has dimensions of 0.855 m width and 1.22 m length. The high of the upper channel is 0.165 m and 0.125 m for the lower channel. The total area covered by solar cells is 0.38 m². The rectangular fins, also made from aluminium, each has 0.025 m high, 1.22 m length, and 0.001 m thickness with fin density of 38.4 fins/m. The concentration ratio of CPC is 1.86. Collectors were tested under solar simulator which has 23 tungsten halogen lamps each rated of 500 W. The intensity of solar radiation was measured by Eppley pyranometer model 8-48 located parallel to the collector plane. Temperature at several positions of the system was measured by K-type thermocouples. The air supplied to the collector from electrical blowers and measured by flow meter model DAT 4200. The collectors have been operated at varying inlet temperature, air flow rate, and radiation conditions. The inlet temperature varies from 30 to 35 °C, the mass flow rate varies from 0.0316 kg/s to 0.09 kg/s, and solar radiation varies from 400 to 700 W/m². Five coupled of unsteady nonlinear partial differential equations takes into account the transfer of heat by conduction on each static element were formulated to predict the (PVT) solar air heaters at different parameters and conditions. Comparison between the experimental and theoretical results has been carried out and close agreement has been observed. An economic optimization model is developed for the cost-benefit study; that will give the designer ability to select the optimum design he needs. The combined efficiency varies from 42.56 % to 69.59 % for configuration 1, from 38.67 % to 63.34 % for configuration 2, from 57.21 % to 81.09 % for configuration 3, and from 54.71 % to 79.12 % for configuration 4. The results indicated that the double pass collectors have higher efficiency than single pass collectors. Also, collectors with CPC and fins have higher efficiency than collectors with fins only for single pass and double pass.

Professor Dr. Kamaruzzaman Sopian (Main Supervisor)
Department of Mechanical and Materials Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89214592; Fax: 603-89259659; Email: ksopian@vlsi.eng.ukm.my



Development of an Optimisation Model for Production Capacity Using Cycle Time Information

by

Muhammad Marsudi (P29169)

Doctor of Philosophy in Mechanical and Materials (Ph.D)

Stiff competition and increase in product variety in today's era of global competition has forced manufacturing industries to continually increase their efficiency in product development for competitiveness and sustainability. However, realisation of a new product is not a straight forward task. The process of developing a new product that includes modification to an existing product requires several stages of activities starting with identification of customer needs, product design and testing through to market introduction. As such, a new product development will normally require a longer lead-time and high development cost. In addition, the product development will require a different manufacturing system and production resources such as new machines and equipments. This situation forces the manufacturing industry to optimise the utilisation of existing manufacturing system. In this case, a manufacturing system capable of processing a combination of existing and new products will be necessary. Such a manufacturing system has a complex structure with multi-stage production lines such as in the automotive industry. The production capacity of this type of manufacturing system has to be optimised to support new product development. This study proposed the development of a support tool that can assist in reducing time for product design, optimising utilisation of multi-stage production line and analysis of the manufacturing cycle time. For the purpose of the study, industrial data is obtained from two local automotive component manufacturers that are involved in new product development. The support system is developed using mathematical modelling based on the network queuing theory. The tool which is based on cycle time information is equipped with Excel[®] database and Visual Basic[®] as the user interface. The tool is validated by comparison with ARENA[®] and results show that the model is valid for use and more user friendly. With input data such as batch size and quantity of production, the user will be able to determine the level of utilisation, manufacturing cycle time and work-in-process cost of a manufacturing system. The support tool is also designed as an intelligent system capable of providing suggestions for optimisation of the manufacturing system such as the quantity of input data to optimise the system. Results from the study show that the support tool is capable of optimising a mixed product, multi-stage production line system. With the use of the tool, reduction in cost and development lead time for a new product can be achieved.

Assoc. Professor Dr. Dzuraidah Abdul Wahab (Main Supervisor)
Department of Mechanical and Materials Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216118/6455; Fax: 603-89259659; Email: dzuraida@vlsi.eng.ukm.my



Vulnerability Assessment and Control of Large Scale Interconnected Power Systems Using Computational Intelligence

by

Ahmed Mohamed Ahmed Haidar (P35268)

Doctor of Philosophy in Electric, Electronic and Systems Engineering (Ph.D)

Power systems vulnerability assessment is to determine their ability to continue stable operation when an unforeseen catastrophic contingency occur. Vulnerability assessment of a power system has been of a great interest due to the blackouts in recent years in many countries which indicate that power systems today are vulnerable when they are exposed to an unforeseen catastrophic contingency. For any utility, vulnerability assessment is becoming an essential requirement for security control of power systems. To assess the level of system strength or weakness relative to the occurrence of an undesired event, a quantitative measure based on vulnerability index is often considered. The index combines information on the level of system security as well as information on a wide range of scenarios, events and contingencies due to which, a system is regarded vulnerable so that preventive and emergency control steps could be taken to minimize catastrophic power outages and ultimately blackouts. The research presented in the thesis focuses on the development of a new vulnerability index for assessing vulnerability of power systems when subjected to various contingencies. A fast and accurate vulnerability assessment method is also developed for large scale interconnected power systems using improved computational intelligent techniques. In addition, new control strategies for vulnerability control of power systems have been implemented. In the research work carried out in the thesis, initially a new vulnerability index is proposed based on total power system loss (PSL) which considers power generation loss due to generation outage, power line loss due to line outage and increase in total load. The performance of the proposed vulnerability index in assessing the vulnerability of sample power systems is compared with other known vulnerability indices based on anticipated loss of load as well as comprehensive system information of individual system components. Subsequently, different neural networks have been used to compare and estimate the performance of the Radial Basis Function Neural Network (RBFNN) and multi layer perceptron neural network in assessing system vulnerability. A new feature extraction method named as Neural Network Weight Extraction is proposed. The efficiency of the proposed feature extraction method was investigated and compared with various feature extraction methods. Finally, a preventive control method for load shedding based on fuzzy logic techniques is proposed. To illustrate the effectiveness of each proposed method, the results were verified on the IEEE 300 bus test system and a practical 87 bus test system using the power system analysis toolbox. The development of computational intelligence methods were implemented in MATLAB version 7 environment. Test results prove that the RBFNN gives better vulnerability assessment performance in term of accuracy and training time. The proposed feature extraction method decreases the training time drastically from hours to less than seconds. It is also concluded that the reduction in error is achieved by using PSL as an output variable of neural network, in all cases the error of RBFNN output by PSL is less than 4.87 % which is well within tolerable limits. Using the methods developed in this research will assist preventing a major system blackout and hence will improve the reliability and continuity of power supply which is essential for the economy and safety.

Professor Dr. Azah Mohamed (Main Supervisor)
Department of Electric, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216323/6300/6312; Fax: 603-89259659; Email: azah@vlsi.eng.ukm.my



Development of a Noninvasive Technique for Endothelial Dysfunction Assessment Using Photoplethysmography

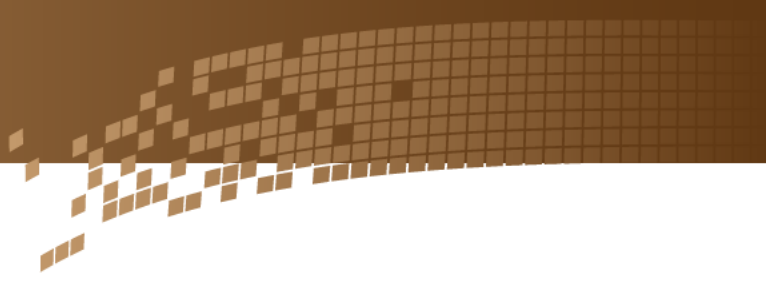
by

Rosmina Jaafar (P31483)

Doctor of Philosophy in Electric, Electronic and Systems Engineering (Ph.D)

The vascular wall is a complex organ which exhibits many properties including the ability to vasodilate in response to physiological and pharmacological stimuli - a phenomenon known as endothelial function (EF). Peripheral vascular EF such as in the brachial artery (BA) is commonly assessed by flow mediated dilation (FMD) measurement using high resolution Doppler ultrasound imaging. The BA FMD correlates with that of the coronary arteries and its dysfunction has been identified as a marker for cardiovascular disease (CVD). The ability to detect vascular EF impairments can help early disease diagnosis and better manage both therapeutic and preventative actions. Assessment of FMD by ultrasound is costly and operator dependent. The main objective of this research is to evaluate the potential use of photoplethysmography (PPG) - a noninvasive optical technique routinely utilized in a clinical setup - to assess the vascular EF. The proposed PPG technique is investigated concurrent with the established technique by ultrasound measurement. Simultaneous data acquisitions for PPG signals and right BA FMD measurements before (baseline condition) and after (reactive hyperemia) 4 minutes blood flow occlusion (by cuff pressure) were recorded from human subjects. The subjects are grouped into the CVD risk group (70 subjects) and healthy group (80 subjects). The right BA FMD data and PPG signals acquired from index fingers of the right arm (RA) and left arm (LA) were processed off-line by MATLAB (The Mathworks Inc.). Numerous steps of digital signal processing techniques namely detrending, band pass filtering, resampling, curve fitting, peak detection, and normalization were applied accordingly through several stages of data analysis. Statistical analysis (SPSS Inc.) was incorporated to identify significant findings ($P < 0.05$) within and between groups. The RA-LA correlation coefficients (R) during reactive hyperemia significantly decreased in the risk group ($P = 0.03$), but not in the healthy group. Changes in the high frequency component of PPG (AC component) exhibits similar response to FMD as measured by ultrasound. These similarities are: i. typical biphasic response after cuff release that comprises of fast increase followed by a slower decrease approaching the baseline condition, ii. significant decrease of peak response in the risk group compared to the healthy group, ($P < 0.05$), iii. insignificant difference in time to reach the peak response for both groups. However, the PPG-AC change reached the peak response significantly faster than the FMD. Graded FMD experiments by multivariable time for cuff occlusion revealed that 4 minutes cuff occlusion produced 96.4 ± 6.6 % peak PPG-AC and 86.7 ± 12.8 % peak FMD relative to the recommended 5-minutes cuff occlusion. This shows that a shorter time (4 minutes) cuff occlusion is able to induce measure able finger PPG-AC FMD response. The coefficients of repeatability (CR) and variability (CV) for PPG-AC (CR = 0.83 ± 0.13 , CV = 0.17 ± 0.13) are more stable than that of the FMD (CR = 0.74 ± 0.20 , CV = 0.26 ± 0.20). Finally, method comparison study by Bland Altman analysis confirms that PPG-AC and FMD measurements are within the mean $\pm 2SD$ limit of agreement. The results of this research show that PPG is a promising tool for EF assessment. It can be applied in the noninvasive and rapid assessment of vascular EF as an alternative low-cost, less operator dependent and better repeatability tool compared to ultrasound.

Professor Dr. Mohd. Alauddin Mohd. Ali (Main Supervisor)
Department of Electric, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216302; Fax: 603-89216146; Email: mama@vlsi.eng.ukm.my



Architectural Optimization of Mac for High Speed Digital Signal Processing and Multimedia Applications

by

Lakshmanan A/L Gurusamy (P20272)

Doctor of Philosophy in Electric, Electronic and Systems Engineering (Ph.D)

Fast and efficient Digital Signal Processing (DSP) implementation is among the main requirements for future high data rate processing such as in telecommunication applications. Over the years, the DSP implementations were made possible by the advances in System-on-a-chip (SoC) design and Very Large Scale Integration (VLSI) designs. These two technologies enable the realization of optimized DSP processors through the optimization of chip area, power consumption and also the speed of operation. The most important component in all DSP processor is the Multiplier Accumulator Unit (MAC) unit which is responsible for all arithmetic and logical operations. Therefore the optimization of MAC unit is critical in the realization of high speed data rate processing required in the future DSP applications. The objective of the research is to produce high data rate MAC unit that is capable of implementing fast DSP processor. The implemented DSP processor could be used in many future applications such as telecommunications, instrumentations etc. In achieving the above objective, several other minor objectives must be achieved, such as developing high performance optimized adder and multiplier (in terms of speed, power and area) that make up the MAC unit, to design an efficient MAC architecture and to implement the algorithms for MAC unit in technology-independent structural Verilog Hardware Descriptive Language (HDL). The proposed research methodologies are to develop algorithms for the MAC unit, to do a functional verification for the MAC unit using Matlab, writing verilog coding, simulate, validate and perform Application Specific Integrated Circuit (ASIC) implementation of the MAC unit and finally to test of the MAC unit to check its performance. The VLSI architecture for the optimized MAC unit for the fast DSP processor has some important features and the findings are: a fast adder that operates at 760 MHz for 32 bit, a fast multiplier operating at 243 MHz, an efficient overflow detector that works 4 times faster and has an area slashed by 320% compared with the traditional overflow detector circuit and a MAC unit that could process about 100 MIPS. In conclusion, a 16-bit fixed point single cycle instruction set MAC architecture at VLSI with an operating voltage of 1.62V, power consumption of 36.53 mW, total chip area of 0.78 mm² and operating at 100 MHz with a latency of 6 clock cycles has been successfully implemented. This MAC unit can be used for the development of future DSP processors.

Professor Dr. Masuri Othman (Main Supervisor)
Department of Electric, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216311; Fax: 603-89216146; Email: masuri@vlsi.eng.ukm.my



Location Determining Techniques Using Timing and Signal Correlation for Universal Intelligent Positioning System in Cellular Networks

by

Keeratpal Singh (P28382)

Doctor of Philosophy in Electric, Electronic and Systems Engineering (Ph.D)

The success factor of Location Based Services (LBS) is very much dependent on the accuracy of the Location Determining Techniques (LDT) to estimate mobile user's location. Universal Intelligent Positioning System (UIPS) is proposed as the complete architecture of LBS server, located in Cellular Provider's (Telco) network. The development of new LDTs for UIPS is the main emphasis of this research. Current available LDTs are Cell ID, Observed Time Difference of Arrival (OTDOA), uplink Time Difference of Arrival (uTDOA), Assisted Global Positioning System (A-GPS) and others. Time difference methods such as OTDOA and uTDOA require time measurements from at least three base stations (BS). Location servers in Telco network will then calculate these time differences as hyperbolic equations and thus estimating user's location. In 3G, when UE (User Equipment) is too close to the serving BS (Node B), it may not be able to hear more than three Node Bs. Trilateration techniques based on time difference measurements using OTDOA or uTDOA will not work when hearability is less than three Node Bs. The main objective of this research is to develop novel LDTs and evaluate the performance under different hearability of BS, such as time measurement obtained from one BS, two BSs, three BSs and signal strength measurement obtained from one BS. The developed LDTs shall also meet US FCC E-911 location accuracy requirements for network based positioning. In situation where three Node Bs are hearable, two new methods called Close Circle Correlation for 3 Circles (CCC3) and Newton Raphson's 3 Circles (NR3C) are introduced to solve time differences measurements. CCC3 is a geometric solver while NR3C is based on fast convergence. In situation where only two Node Bs are hearable, a method called Close Circle Correlation for 2 Circles (CCC2) is used with genetic algorithm comparator (or user's last known position) to match road/walk-path for first level of prediction. Then, second level of prediction uses Newton Raphson's 2 Circles (NR2C) method for accuracy improvement. In situation where hearability is limited to one Node B, round trip time with road data or walk-path data are matched to estimate mobile's location. Finally, a new technique called Signal Correlation Method (SCM) is introduced. Unlike fingerprinting technique, SCM only uses one BS received signal to be compared with stored signals in databases. Simulations of all the above new techniques were based on real data collected through drivetest for urban, suburban and highway areas, within Klang Valley. Performances of all new LDTs meet US FCC E-911 location accuracy requirements. When three BSs in good Line of Sight were used for measurements, NR3C produces the best accuracy within 1 m, and the processing time per estimate was several milliseconds. When only one BS was used, SCM was able to predict 95% of location estimations within 295 m, better accuracy than fingerprinting techniques that uses several BSs' signal measurements. UIPS's new LDTs effectively provide quality of accuracy for location estimation in different hearability conditions of 2G, 3G and beyond networks.

Professor Dr. Masuri Othman (Main Supervisor)
Department of Electric, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216311; Fax: 603-89216146; Email: masuri@vlsi.eng.ukm.my



Intelligent and Advanced Monitoring Algorithm for Power Quality Instrument Based on Dsp for Real-Time Applications

by

Mohammed E Salem Abozaed (P31394)

Doctor of Philosophy in Electric, Electronic and Systems Engineering (Ph.D)

The increased use of non-linear devices in power system such as personal computers and power electronics devices lead to the deterioration of power quality (PQ) which has become a major concern to all power utilities. The research presented in this thesis focuses on the investigation of existing methods used for detecting, monitoring and measuring of disturbance signals in power systems in order to develop a new more accurate and faster algorithm for PQ monitoring. In order to validate the research work presented in this thesis, detailed design for a new PQ monitor is carried out and presented. A PQ monitor should acquire the voltage and current waveforms, and from them identify the disturbances from the abnormality of the characteristics, effectively pin-pointing the causes of the problems. But to do all these in real time, special hardware is needed with massive computing power, sophisticated software to analyze the data and advanced signal processing techniques for classifying the disturbance signals. Due to the different possible types of disturbances and signals in power systems, various signal-processing techniques have been used for analyzing the data such as Continuous Wavelet Transform (CWT) and S-transform. The S-transform is an alternative algorithm to CWT and it is a time-frequency representation algorithm. Since the S-transform has better time-frequency and localization, power quality disturbances are detected and then classified in a simple and superior way than the recently used wavelet transform. This research work focuses on the development of DSP-based power quality algorithm to design an instrument for monitoring, detection and classification of power quality disturbances in real-time using powerful signal processing and artificial intelligent techniques. The PQ disturbance detection hardware is designed by considering the DSP hardware, a data acquisition device using an analog to digital converter (ADC) and signal-conditioning module to interface with the voltage and current probes. The system uses a signal-conditioning module for mains input isolation (voltage divider circuit), a TMS320C67-DSP in the DSK evaluation board and a high performance ADC. Code Composer Studio (CCS) software, C language and MatLab software are used to program the DSP. New implementation of S-transform algorithm has been done in DSP-based systems for power quality disturbance analysis in real-time. An implementation of CWT algorithm in DSP was compared with S-transform analysis. Harmonics and total harmonic distortion in real time were calculated using the fast Fourier transform based on DSP. For automated classification of power quality disturbances, some of the important features were extracted from the S-transform analysis. Based on the distinctive features, appropriate rules are formulated to classify the PQ disturbances. For verifying the classification obtained, more than 400 disturbed signals from previous PQ monitoring were tested on the new system with 99.02% accuracy obtained. The results of analysis and classification show that the implementation of the S-transform provides accurate analysis and classification of power quality disturbances. For a complete and portable instrument, the MatLab code was interfaced with the DSP using TMS320C67-DSP DSK evaluation board with a voltage divider circuit and gigabyte display monitor. For easy implementation of the PQ disturbance recognition, a power quality disturbance analysis (PQDA) tool was designed as a new software tool using a MatLab based graphical user interface. The PQDA was found to provide accurate, efficient and reliable monitoring, detection and classification of power quality disturbances.

Professor Dr. Azah Mohamed (Main Supervisor)
Department of Electric, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216323/6300/6312; Fax: 603-89259659; Email: azah@vlsi.eng.ukm.my



The Vlsi Implementation of a Programmable Dsc Chip for High Speed Signal Processing: Ukm8051dsc

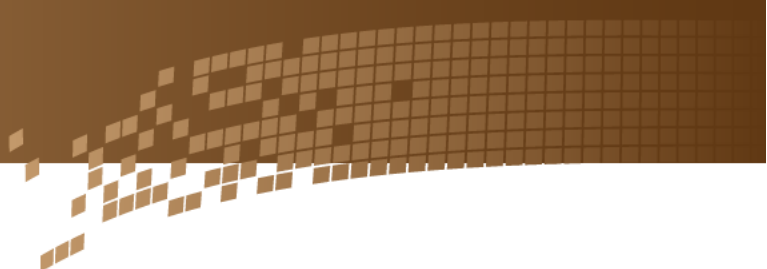
by

Ahmad Jamal Bin Salim (P29209)

Doctor of Philosophy in Electric, Electronic and Systems Engineering (Ph.D)

The main objective of this research is the development of a high performance system on a chip (SoC) compatible to an 8051 microcontroller (MCU) with the digital signal processing capability. In essence, this integration gave birth to the dual core digital signal controller (DSC) chip which is named as UKM8051DSC. This chip will combine the control capability of MCU 8051 with the digital signal processing capability of the DSP. The developed DSC is a multipurpose reconfigurable processor. RAM and ROM memories are also added to make it a system on a reprogrammable chip (SoRC). This design can be customised in the development of an embedded system such as the MP3 player, modem, disk drive and so on. The developed UKM8051DSC system chip will be an open intellectual property (IP) and can be used for university research. To produce an open IP, the original source code of a hardware description language (HDL) for the MCU 8051 and DSP must be developed without any encryption. Efforts have been done to obtain open IPs for both cores. The IP core Q8051 was obtained from a company called Quickcores and the IP core OpenDSP from a group of researchers at a university in Europe. Various methods of improvement and development were done to each cores for the compatible integration. All hardware tests were implemented in the field programmable gate array (FPGA) of Xilinx Virtex-II. At the end of the study stage, UKM8051DSC was also implemented in the application specific integrated circuit (ASIC) chip. The chip is designed for small general-purpose applications and tested to successfully work at a typical clock speed of 40 MHz and up to a maximum of 80 MHz in the Xilinx Virtex-II FPGA. In terms of processing power, the Q8051 core can operate at a maximum of 80 million instructions per second (MIPS, cf. 1 MIPS of original Intel 8051) of 1-byte instruction word while the OpenDSP core at a maximum of 20 MIPS of 2-byte instruction word (10 MIPS by the original designers). As UKM8051DSC is an open IP, it can be further developed, improved and commercialised without any worry from copyright claim or royalty payment and hence can reduce the high cost of embedded system design.

Professor Dr. Masuri Othman (Main Supervisor)
Department of Electric, Electronic and Systems Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216311; Fax: 603-89216146; Email: masuri@vlsi.eng.ukm.my



Hierarchical Control for Big Scale Industrial Processes

by

Andrew Yap Kian Chung (Matric: P11448)

Doctor of Philosophy in Chemical and Process Engineering (Ph.D)

The augmented two level technique is an extension of the previous two level method that widens the application of the algorithm to non-convex problems besides improving the convergence of certain convex problems. This technique calculates the Lagrange multipliers, λ , using Powell Conjugate Direction method without any derivation on process output with respect to the set point required. Optimum control system design for big scale processes, such as chemical plant, could be simplified by decomposition of the process to simpler sub-processes and solved in hierarchy structure manner. Three levels control algorithm structures based on normal Lagrangian without information exchange between local control units with output feed back and input-output feed back have been proposed by previous researcher. Two-level structure without information exchange between local control units is expanded from three-level structure with input-output information feed back. Even though the off-line computer calculation cost may increase, the advantage of these methods is the Lagrange multipliers, λ are determined by supreme level using Powell Conjugate Direction method without disturbing the process and could solve control problems with undifferentiable inequality constraint $G(c,y)$ with respect to output, y . The objective of this research is to expand the algorithms above using augmented Lagrangian so that the application of multi levels approach could be widened to non-convex problems besides improving the convergence of certain convex problems. Generally, these structures have two optimization loops, which are the external optimization loop and internal optimization loop. The external optimization loop determines optimum value of Lagrange multiplier, λ using Powell conjugate direction method without any derivation. The internal optimization loop determines optimum control set point, c for certain given value of λ using augmented Lagrangian method. All the proposed control structures have been tested using the same four simulation control problems. Simulation results show that appropriate combination between Lagrange multipliers for square terms, ρ and update coefficient ε could solve non-convex problem and reduce total optimization loop for certain convex problems. Update coefficient, ε between 0.9 to 1.5 is appropriate for the most studied cases in the two level structure. The three level control structures show that augmented Lagrangian function converges faster than normal Lagrangian method at certain Lagrange multiplier, ρ and update coefficient, ε for convex problems. Generally, control structure with input-output feed back having less control set points changes and converge faster compared with control structure with output feed back. The two level decentralized structure without information exchange between local control units shows that appropriate combination of the square term multipliers, ρ and update multiplier, ε could reduce the amount of optimization calculation loop for convex problems. However big value of ρ is needed to solve non-convex problem for all the control structures above.

Professor Ir. Dr. Mohd Sobri Takriff (Main Supervisor)

Department of Chemical and Process Engineering

Faculty of Engineering and Built Environment

Universiti Kebangsaan Malaysia

43600 UKM Bangi, Selangor, MALAYSIA

Tel: 603-89216417; Fax: 603-89216148; Email: sobri@vlsi.eng.ukm.my



Synthesis and Application of Composite Membrane as Electrolyte In Proton Exchange Membrane Fuel Cell

by

Mahreni Akhmad (P29251)

Doctor of Philosophy in Chemical and Process Engineering (Ph.D)

Composite membrane has widely been used in the separation process to yield pure component which had earlier been produced by cryogenic technology. In the analytical field study, composite membrane may be used as a sensor or as an electrolyte. Earlier studies have indicated that conductivity of the Nafion electrolyte membrane and the proton exchange membrane fuel cell (PEMFC) performance decrease when the water content in the membrane is reduced. To overcome the problem, a hygroscopic and highly conductive component is introduced in the cluster content and the cluster channel Nafion polymer matrix. The aim of this study is to synthesize a nanocomposite membrane using Nafion-SiO₂-PWA mixture in various compositions and apply the best membrane as electrolyte in PEMFC to observe its performances. The composite membrane was fabricated using sol-gel method with tetraethoxyorthosilicate (TEOS) solution and phosphotungstic acid (PWA) in Nafion polymer matrix. Several parameters that were studied are the effect of solvent evaporation temperature, temperature and time of annealing process, PWA/TEOS ratio and TEOS/Nafion ratio to the physical, chemical and electrochemical properties of the membrane. The membrane morphology is characterized by scanning electron microscopy and the membrane thermal properties were determined by the thermogravimetric analysis. The chemical structure of the membrane was determined by Fourier transform infra red spectroscopy while the chemical content in the membrane was analyzed by diffraction X-ray method. UV-VIS spectrophotometer has been used to examine the membrane transparency. The performance of the composite membrane as electrolyte was determined by attaching electrode on both side of composite membrane electrolyte and placing them in a single PEMFC at 30-90°C temperature ranges, 1-2 atm pressure and 40-100% humidity. Transparent composite membrane was obtained at solvent temperature of 80°C, annealing temperature of 140°C and annealing time of 10 hour for PWA/TEOS ratio of 45/100 (w/w). Nafion 112 membrane was used as bench-mark in making the comparison with the nanocomposite membrane being synthesis. The results showed that when the ratio of (TEOS/PWA)/Nafion increase, the water uptake and thermal resistance increase as well. The thermal resistance of Nafion membrane is 323°C which is the decomposition temperature bonded chain in the sulfonic group in the polymer, while the decomposition temperature of Nafion-SiO₂-PWA membrane with types NS10W, NS15W and NS20W are 364°C, 348°C and 343°C, respectively. The water absorption in the Nafion membrane is 26.52 (g water/g membrane) as compare to the water absorption of composite membrane Nafion-SiO₂-PWA types NS10W, NS15W and NS20W obtained at 30.25, 33.43 and 32.72 (g water/ g membrane). The result of thermogravimetry analysis showed that the content of inorganic residual component, namely, P, Si and W, in composite membranes NS10W, NS15W and NS20W were found to be 2.31, 2.61 and 6.16 (% weight) respectively. The morphology of all the composite membranes obtained are homogeneous in structural content. The results of chemical functional group analysis indicated that P, Si and W were bonded to the Nafion polymer matrix. The diffraction X-ray analysis also showed that P, Si and W were present in all the composite membranes obtained. The performance result of composite membrane in single stack PEMFC showed that at 100% humidity and 30-90°C temperature, the highest performance of 2.04 W is gained using Nafion 112 membrane, while at 40% humidity and 30-90°C it yielded the maximum power performance of 2.66 W for membrane NS15W. The results of the data analysis and optimized polarization curve model showed that the mechanism of proton movement in the Nafion membrane followed that of the vehicular model, whereas the mechanism in the composite membrane resembled the proton hopping model or Grotthus model. The PEMFC performance of the composite membrane Nafion-SiO₂-PWA was stable at low humidity operating between 30-90°C temperature. Since the humidity and operating temperature conditions were low, the PEMFC using nanocomposite membrane could be used as electrolyte with minimum requirement of external humidifier but yet produced high power as compared to the PEMFC using the Nafion membrane.

Professor Ir. Dr. Abdul Wahab Mohamad (Main Supervisor)

Department of Chemical and Process Engineering

Faculty of Engineering and Built Environment

Universiti Kebangsaan Malaysia

43600 UKM Bangi, Selangor, MALAYSIA

Tel: 603-8921 6410/6102; Fax: 603-89216148; Email: wahabm@vlsi.eng.ukm.my



Synthesis and Characterization of Hybrid Nylon 66 Membrane By Electron Beam Irradiation

by
Amilia Linggawati (P26033)
Doctor of Philosophy in Chemical and Process Engineering (Ph.D)

Considering subsequent developments and increasing demand for synthesized membrane, modifying membrane material by combining a basic property of organic and inorganic (hybrid) is a very interesting subject. This hybrid is predicted to be widely used and may provide solutions to overcome the weaknesses of organic or inorganic membrane. The main objective of this research was to prepare nylon 66 and hybrid nylon 66 as well as to investigate the effect of synthesized parameters on properties and performance of membranes product. This study was carried out in three stages which are firstly synthesis of nylon 66, secondly synthesis of nylon 66 hybrid and thirdly characterization of both type of membranes. Membranes were prepared from nylon 66 for organic material and aminopropyltriethoxysilane (APTES) for organic material using electron beam (EB) method. Parameters studied were composition of nylon 66/APTES (95/5, 90/10 and 80/20 %w/w) and radiation doses (60, 70 and 80 kGy). Membranes were characterized for their properties and filtration performance. Physical characterizations include determination of the gel content, swelling and water absorption, density using densitometry, while hydrophilic and hydrophobic properties were determined by contact angle. Chemical structure characterization was done using FTIR and EDX. Membrane morphology was observed using SEM. Thermal properties were determined using DSC and TGA. Mechanical dynamic properties were observed using DMA, while crystallization was determined using XRD. The performance of the membrane for separation was investigated by pure water permeation, rejection of raffinose, vitamin B12 and salt solution (NaCl, Na₂SO₄ dan MgSO₄). The results showed that for membranes irradiated at 70 kGy (N-70) and 80 kGy (N-80), the increase of radiation dose on membrane nylon 66 enhance the physical, thermal, mechanical and selectivity. However the permeability was decreased. Dose radiation also change the membrane nylon 66 from hydrophilic to hydrophobic condition (N-80). Membrane morphology change from spherulite globular to continuous structures due to cross-linking. The effect of radiation on hybrid nylon 66 were different, cross-linking or degradation according to silica composition (APTES) inside hybrid. On the highest dose and silica composition (H20-80 membrane), the membrane tended to degrade and this was detected by the drop in gel content, mechanical dynamic, thermal properties and selectivity of hybrid nylon 66 membrane. Based on water absorption, permeability and selectivity, generally hybrid nylon 66 membranes prepared by EB irradiation method are hydrophilic membrane with nanofiltration type.

Professor Ir. Dr. Abdul Wahab Mohamad (Main Supervisor)
Department of Chemical and Process Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-8921 6410/6102; Fax: 603-89216148; Email: wahabm@vlsi.eng.ukm.my



Biogas and Chemical Production from Waste Using Biofilm Reactor

by

Norazwina Zainol (P23687)

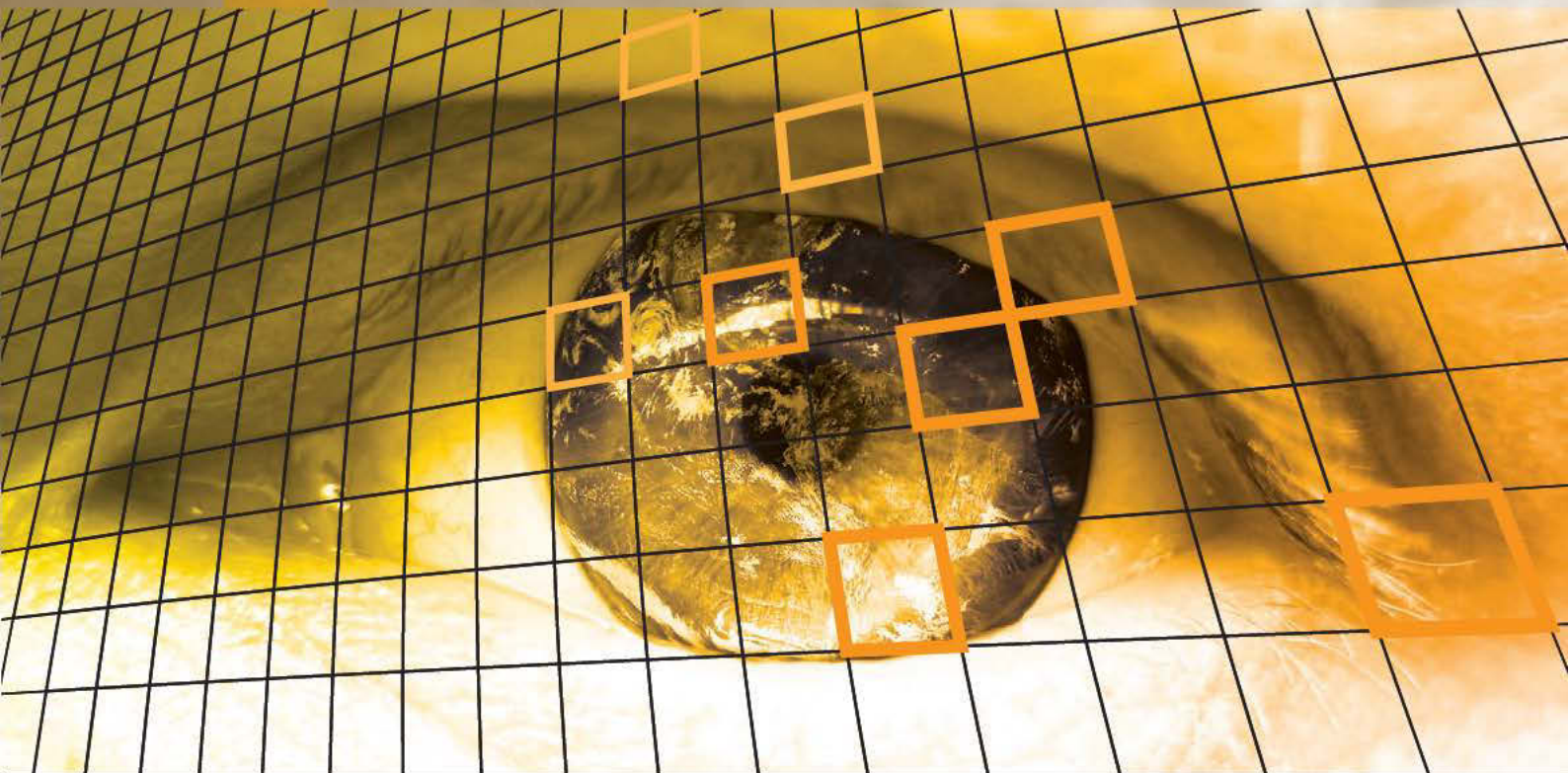
Doctor of Philosophy in Chemical and Process Engineering (Ph.D)

The performance studies of anaerobic one stage and anaerobic two stage bioreactor systems in cellulose recovery and biogas production (CBP) using banana stem waste as feedstock were investigated. In the one stage system (OSP) the CBP was done in one bioreactor, while in the two stage system (TSP) the two processes were done in two separate bioreactors which were the cellulose recovery bioreactor (CRR) and the biogas production bioreactor (BPR). In the TSP the CRR also acts as the acid hydrolysis bioreactor. The mixed culture inoculum for this study was obtained from banana plantation soil and acclimatized in anaerobic conditions. The performance of the OSP was tested under conditions of various temperature constant set-points (T) (26°C-40°C), organic loading rates (OLR) (0.4 g TS/l.d-2 gTS/l.d), and hydraulic retention times (HRT) (3 d-20 d). In the TSP, CRR was tested under conditions of various OLR (1 g TS/l.d-7 gTS/l.d) and HRT (3 d-15 d) and BPR was tested under various T (35°C-60°C) but using the same values of OLR and HRT that were used for the CRR. The Design-Expert Software Version 6.0.4 was used to design the experiments and optimize the processes. The application of factor analysis to the experimental variables of each of the two systems showed that all the experimental variables studied (OLR, HRT and T) have significant effects on the CBP process. This indicates that the mixed culture is sensitive to any changes involving concentration, flow rate and temperature. The mixed culture broths from both the OSP and TSP were later analyzed. The analysis included bacteria isolation, gram staining and bacteria identification. All isolated bacteria were facultative anaerobic type which is classified in the acetogenesis group. The process optimization has been performed to both OSP and TSP. In the OSP, cellulose content and biogas yield have been separately maximized. The optimum conditions for cellulose recovery were as follows: HRT 4.86 d, OLR 1.054 gTS/l.d and T of 31.2°C and for biogas production were as follows: HRT 11.66 d, OLR 1.422 gTS/l.d and T of 35.8°C. For the TSP, cellulose recovery and acetic acid production were maximized in the CRR while biogas production were maximised in the BPR. The results showed the yields of cellulose and acetic acid from each CRR does not have a maximum with respect to the levels of the experimental variables used. However, there exist minimum points for both cellulose content and acetic acid concentration. The biogas yield in the BPR could not be optimized because of the lack of additional experimental points to make the rotatable composite design, as constrained by the output from CRR. The TSP could handle higher loading rate than OSP and produced better biogas yields and quality. The consumption of cellulose by mixed culture in the acidogenesis process contributed to low cellulose content in the TSP. However, the TSP gave better lignin degradation performance than OSP. Cellulose fiber obtained from this study has been showed to be of good quality and comparable to other non-wood cellulose fiber. A kinetic model to represent the hydrolysis, acidogenesis and methanogenesis steps of the anaerobic digestion process of banana stem waste was proposed on the basis of the TSP data obtained. The kinetic constants obtained could be used to represent and estimate the mixed culture activity in CBP for BSW. In conclusion, the TSP of CBP gives good biogas yield and cellulose quality. This research also proved that lignin degradation could be performed anaerobically using mixed culture.

Professor Dr. Rakmi Abdul Rahman (Main Supervisor)
Department of Chemical and Process Engineering
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor, MALAYSIA
Tel: 603-89216402; Fax: 603-89216148; Email: rakmi@vlsi.eng.ukm.my



Awards 2009



Engineering & Built Environment



AWARDS 2009

The Outstanding Contribution to the Drying Community 2009 Award
The 6th Asia-Pacific Drying Conference
19th – 21st October 2009, Bangkok, Thailand

No.	Researcher	Award
1.	Prof. Ir. Dr. Wan Ramli Wan Daud	Award for Outstanding Contribution to the Drying Community 2009

20th International Invention, Innovation & Technology Exhibition (I.TEX 2009)
15th – 17th May 2009, Kuala Lumpur Convention Centre

No.	Researchers	Research Title	Award
1.	Azimin Tazilan Bin Mohd Tazilan, Prof. Dr. Hood Salleh, Prof. Dr. Ibrahim Komoo, M Tajuddin M Rasdi, Zafri Azran Abdul Majid, Prof. Dr. Kamaruzaman Sopian & Chia Lin Lin	escPOSE™ : Multi-Integrated Street Pedestrian Light Post on Eco-Street Sustainable Micro-Architecture	Gold & Special Award – International Award Winner INPEX USA
2.	Dr. Mohd Syuhaimi Ab. Rahman, Hadi Guna, Mohd Hazwan Harun & Prof. Dr. Kasmiran Jumari	Cost Effective Hand-Made Polymer Optical Fiber Based Splitters for Small World Communication Application	Gold
3.	Dr. Hussein Shareef & Prof. Dr. Azah Mohamad	Voltage Sag Ride Through Device for PC and Lamps	Gold
4.	Assoc. Prof. Dr. Zahira Yaakob, Prof. Ir. Dr. Wan Ramli Wan Daud, Lin Kean Long & Zetty Aziza Ahmad <i>(In collaboration with the Fuel Cell Institute)</i>	Renewable Hydrogen Production Using Waste Aluminium	Gold
5.	Dr. Manal Ismail, Dr. Jamaliah Md. Jahim, Prof. Madya Dr. Siti Kartom Kamarudin, Prof. Ir. Dr Wan Ramli Wan Daud, Siti Norhana Shaari, Lim Swee SU, Tewarajan A/L Malaysia & Mimi Hani Abu Bakar <i>(In collaboration with the Fuel Cell Institute)</i>	Industrial Wastewater as the Fuel for Power Generation Using a Biological Fuel Cell	Gold
6.	Assoc. Prof. Dr. Norbahiah Misran, Dr. Mohammad Tariqul Islam, Baharudin Yatim & Mohammed Nazmus Shakib	Gain Enhanced Slotted Microstrip Antenna	Silver



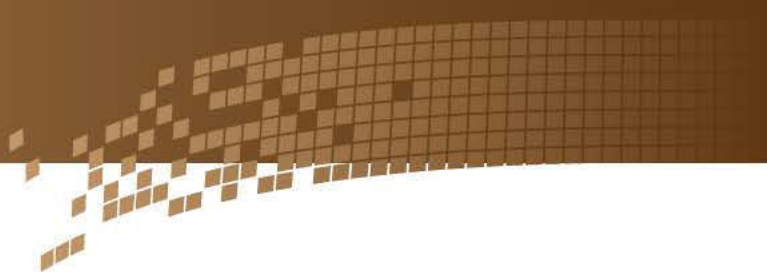
7.	Prof. Dr. Mohd Alauddin, Dr. Edmond Zahedi, Dr. Mohd Syuhaimi, Pn. Rosmina, Pn. Kalaivani, En. Gan Kok Beng, Cik. Aida Baharuddin & En. Rahimie	Assessment of Vascular Function Using Photoplethysmography (PPG)	Silver
8.	Prof. Engr. Dr. Amiruddin Ismail, Abbas Mahde Abd Najim & Assoc. Prof. Dr. Zamri Chik	Expert System for IMS	Silver
9.	Prof. Dr. Azah Mohamed, Ismail Adam & Hilmi Sanusi	Low Cost Web Based Power Quality Monitoring Instrument	Silver
10.	Assoc. Prof. Dr. Jaharah A. Ghani, Dr. Mohd Zaki Nuawi, Prof. Dr. Che Hassan CHe Haron, Ahmad Sayutib & Muhammad Rizal	Monitoring of Machining System Performance – MoMac 2	Silver
11.	Prof. Dr. Sahbudin Shaari, Tan Fent Fent & Abang Annuar Ehsan <i>(In collaboration with the Institute of Microengineering and Nanoelectronics)</i>	Distributed Multiple CATV Entry Points for Fiber-to-the-home (FTTH) PON System	Silver
12.	Assoc. Prof. Dr. Siti Kartom Kamarudin, Prof. Ir. Dr. Wan Ramli Wan Daud, Assoc. Prof. Dr. Zahira Yaakub, Norhafiz Hashim, Sahriah Basri, Mismi Suraya & Umi Azmah <i>(In collaboration with the Fuel Cell Institute)</i>	Micro Direct Methanol Fuel Cell Tool Kits: Small Power	Silver
13.	Prof. Dr. Kamaruzzaman Sopian, Dr. Nowshad Amin, Shamsul Ezan Zairi, Mohd Latif Ibrahim & Saleem Zaidi <i>(In collaboration with the Solar Energy Research Institute)</i>	PV as Cottage Industry	Silver
14.	Dr. Nowshad Amin, Prof. Dr. Kamaruzzaman Sopian, G. Amor, C. Brahim & Mohd Yusof Sulaiman <i>(In collaboration with the Solar Energy Research Institute)</i>	Solar Powered Hovercraft	Silver
15.	Dr. Mohd Nizam Ab. Rahman, Rosmaizura Mohd Zain, Dr. Zulkifli Mohd Nopiah, Suriani Abdul Rahman, Prof. Dr. Nurhamidi Mohamad, Assoc. Prof. Dr. Baba Md Ros, Assoc. Prof. Dr. Jaharah A. Ghani, Ir. Ahmad Rasdan Ismail & Nor Kamaliana Khamis	STATPRO-S	Bronze



16.	Dr. Manal Ismail, Prof. Ir. Dr. Abdul Wahab Mohammad, Jumat Salimon & Rahimah Othman	Application of Polymeric Solvent Resistant Nanofiltration	Bronze
17.	Prof. Dr. Salina Abdul Samad, Prof. Dr. Aini Hussain, Syed Abdul Rahman Al Haddad & Mohd Ridzuwary Zainal	An Automatic Malay Speech Recognition System for Disordered Speech	Bronze
18.	Prof. Dr. Abu Bakar Mohamad, Prof. Dr. Abdul Amir H. Kadhum, Prof. Ir. Dr. Wan Ramli Wan Daud, Nurhaswani Bahaman, Siti Rahmah Mokhtaruddin & Zaihasrah Masron <i>(In collaboration with the Fuel Cell Institute)</i>	MEA Fabrication Using Novel Easting Machine	Bronze

Malaysia Technology Expo (MTE 2009)
19th – 21st February 2009, Putra World Trade Centre (PWTC) Kuala Lumpur

No.	Researchers	Research Title	Award
1.	Prof. Dr. Burhanuddin Yeop Majlis <i>(In collaboration with the Institute of Microengineering and Nanoelectronics)</i>	Micropump for Precise Liquid Handling	Gold
2.	Dr. Mohd Nizam Ab. Rahman	SMES on STAT	Silver
3.	Dr. Mohd Syuhaimi Ab. Rahman	Wireless CATV Tester Unit for Fiber-to-the-Home Application	Silver
4.	Dr. Mohd Syuhaimi Ab. Rahman	Customer Access Protection Unit (CAPU)	Silver
5.	Dr. Mohd Syuhaimi Ab. Rahman	Customer Mode POF Passive Optical Splitter for Small World Communication	Silver
6.	Prof. Dr. Kamaruzzaman Sopian <i>(In collaboration with the Solar Energy Research Institute)</i>	Pico-Hydro – Small Streams Are Big Enough	Silver
7.	Dr. Nowshad Amin <i>(In collaboration with the Solar Energy Research Institute)</i>	Cost Effective Inverter Development for One-Panel-House Application in Developing Countries	Silver



8.	Prof. Dr. Burhanuddin Yeop Majlis <i>(In collaboration with the Institute of Microengineering and Nanoelectronics)</i>	CMOS-MEMS Pressure Sensor for Glaucoma Analysis	Silver
9.	Prof. Dr. Burhanuddin Yeop Majlis <i>(In collaboration with the Institute of Microengineering and Nanoelectronics)</i>	MEMS Tactile Pressure Sensor Array for Fingerprint Imaging	Silver
10.	Prof. Dr. Burhanuddin Yeop Majlis <i>(In collaboration with the Institute of Microengineering and Nanoelectronics)</i>	MEMS Speaker for Hearing Aids	Silver
11.	Assoc. Prof. Dr. Siti Kartom Kamarudin	μ DMFC: An Alternative Power Source for Handphone	Silver
12.	Assoc. Prof. Dr. Zahira Yaakob	High Funtional Polyol and Polyurethane Elestomer Based On Vegetable Oil-Oleic Acid	Bronze
13.	Assoc. Prof. Dr. Zahira Yaakob	Novel NaOH/SiO Solid Catalyst For Jatropa Oil Transesterification	Bronze
14.	Assoc. Prof. Dr. Zahira Yaakob	Production of Alkyd Resins From Jatropa Oil	Bronze
15.	Assoc. Prof. Dr. Jaharah A. Ghani	Monitoring of Machining System Performance-MOMAC1	Bronze
16.	Dr. Mohd Nizam Ab. Rahman	5S SMATLAB	Bronze
17.	Dr. Mohd Syuhaimi Ab. Rahman	Smart Access Network – Testing, Analysis, Database (SANTAD)	Bronze
18.	En. Azimin Samsul Mohd Tazilan	Ecspose TM : Eco-Sustainable Street Post on Self Energy	Bronze
19.	Assoc. Prof. Ir. Dr. Zamri Chik	Innovative Tomography Surface Wave System for Engineering Assessment of Geotechnical Structures	Bronze
20.	Dr. Nowshad Amin <i>(In collaboration with the Solar Energy Research Institute)</i>	Intelligent & Cost Efficient Charge Controller for Stand-alone Solar Powered Rural and Remote Areas	Bronze
21.	Dr. Jamaliah Md. Jahim <i>(In collaboration with the Fuel Cell Institute)</i>	Prototype of Microbial Fuel Cell for Power Generation	Bronze



Research Projects 2009

Engineering & Built Environment



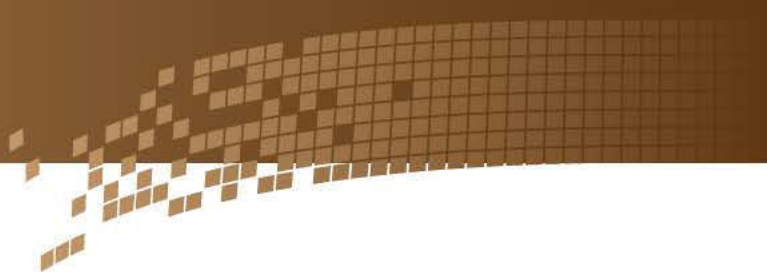
RESEARCH PROJECTS 2009

TechnoFund Funded by Ministry of Science, Technology and Innovation

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Prof. Dr. Mohd Alauddin Mohd Ali	TF0109C012 Real Time Self-Automated Intelligent Hardware Implementation of Energy Efficient Green Motion Controller	4,500,000.00
2.	Assoc. Prof. Dr. Shahrir Abdullah	TF0608C073 Computationally Optimised Fuel-Efficient Concept Car	4,999,600.00
3.	Prof. Dr. Salina Abd Samad	TF0109C003 Dev. of Intelligent Sensors and System for Automated Vehicle Classification in the Toll Industry	1,830,189.00

ScienceFund Funded by Ministry of Science, Technology and Innovation

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Ms. Wan Mimi Diyana bt Wan Zaki	01-01-02-SF0563 Robust Video Movement Recognition System for Non- Rigid Objects	106,300.00
2.	Dr. Ir. Muhammad Mukhlisin	01-01-02-SF0570 Modeling Rainfall Induced Landslide as Effects of Development Soil Porosity and Hydraulic Conductivity: Case Study of Slope Failure on Mountain ranges of Ulu Kelang and Selangor	285,000.00
3.	Dr. Ahmed Hussien Kamel El-Shafie	01-01-02-SF0581 Development of a Non-linear Model Based on Artificial Neural Network for River Streaming Flow Forecasting at Klang Gate Dam	119,800.00
4.	Dr. Md. Mamun bin Ibne Reaz	03-01-02-SF0611 Hardware Prototyping of Multi-point Vascular Monitor System Using Photoplethysmography	172,000.00



Fundamental Research Grant Scheme (FRGS)
Funded by Ministry of Higher Education

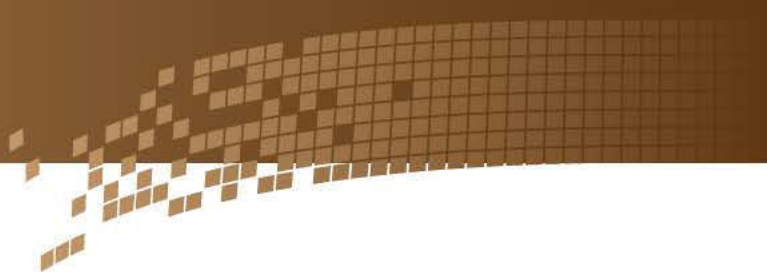
No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Dr. Huda Abdullah	UKM-KK-07-FRGS0026-2009 Growth of Nanostructured Colossal Magnetoresistive Material For Low-Field Magnetic Sensing Device	44,000.00
2.	Dr. Abu Bakar Sulong	UKM-KK-02-FRGS0124-2009 Development of A Novel Method To Produce Polymer Fiber Using Electrospinning	50,000.00
3.	Dr. Ahmed H. El-Shafie	UKM-KK-02-FRGS0125-2009 Development of a Non-linear Theoretical Model Based on Artificial Neural Network for Streaming Water Quality Prediction Model	50,000.00
4.	Ms. Norliza Abdul Rahman	UKM-KK-02-FRGS0126-2009 Development of A Fixed-Bed Reactor With Artificial Intelligence (AI) Technique For Control and Monitoring In A Heterogeneous Enzymatic Reaction	50,000.00
5.	Dr. Md. Mamun Ibn Reaz	UKM-KK-02-FRGS0127-2009 A New Method For Fetal Monitoring Using Artificial Neural Network and Correlation	50,000.00
6.	Ms. Shuhaida Harun	UKM-KK-02-FRGS0128-2009 Production of Fermentable Sugars From Lignocellulosic Rice Straw Using AFEX Pretreatment and Enzymatic Hydrolysis	50,000.00
7.	Mr. Nuryazmin Ahmat Zainuri	UKM-KK-02-FRGS0129-2009 The Identification of Time Series Behaviour In Fatigue Variable Amplitude Loadings (VA) Data	50,000.00
8.	Mr. Azli Ariffin	UKM-KK-02-FRGS0130-2009 A Study on Fundamental Vibro-Acoustic Signal Analysis For Internal Combustion Engine	50,000.00
9.	Dr. Mohd Zaki Nuawi	UKM-KK-02-FRGS0131-2009 Novel Signal Analysis for Characterisation of Compressed Natural Gas (CNG) Injection System	50,000.00



10.	Ms. Maslina Jamil	UKM-KK-02-FRGS0132-2009 A Study on Utilisation of Sustainable Materials in Construction Industry in Malaysia	50,000.00
11.	Dr. Fatihah Suja'	UKM-KK-02-FRGS0133-2009 Preliminary Studies on Simultaneous Removals of Nitrogen and Phosphorus in a High Capacity Treatment of a Partially Packed Biological Aerated Filter	50,000.00
12.	Mr. Kamarudin Abu Taib	UKM-KK-02-FRGS0134-2009 Optimization of Horizontally Curved Prestressed Industrialised Building System (IBS) For Beams and Girders	50,000.00
13.	Dr. Ir. Muhammad Mukhlisin	UKM-KK-02-FRGS0135-2009 Analysis Changing of Soil Porosity and Slope Stability as Effect of Earthquake	50,000.00

**Arus Perdana (Research University Grant)
Funded by Ministry of Higher Education**

No.	Researcher	Research Code/Project Title	Amount Approved (RM)
1.	Assoc. Prof. Dr. Norhamidi Muhamad	UKM-AP-NBT-11-2009 Penggunaan Proses Penyuntikan Serbuk Mikro untuk Menghasilkan Komponen untuk Rawatan Pergigian	827,800.00
2.	Prof. Ir. Dr. Hj. Wan Ramli Wan Daud <i>(In collaboration with the Fuel Cell Institute)</i>	UKM-AP-TK-05-2009 Bahan Baru dalam Sel Fuel dan Tenaga Hidrogen	730,000.00
3.	Prof. Dr. Kamaruzzaman Sopian <i>(In collaboration with the Solar Energy Research Institute)</i>	UKM-AP-TK-06-2009 Development of Back Contact Nanostructured High Efficiency Thin Film Solar Cells and Panels for Grid-Connected and Standalone Applications	1,000,000.00
4.	Prof. Dr. Mohd Alauddin Mohd Ali <i>(In collaboration with the Space Science Institute)</i>	UKM-AP-TKP-07-2009 Development of Medical Instrumentations Based on Photoplethysmography	276,000.00



Funded by External Agencies or Internal Funds

No.	Researcher	Research Code/Project Title	Source of Funding	Amount Approved (RM)
1.	Prof. Dr. Mahamod Ismail	PKT3/2009 The Regulatory Measures to Enable the Introduction of Software Defined radio and Cognitive Radio	Suruhanjaya Komunikasi Multimedia Malaysia (SKMM)	6, 000.00
2.	Prof. Ir. Dr. Abdul Wahab Mohammad	PKT2/2009 Development of Hard-Gel Capsule Based on Mannan Gums Including the Galactomannans and the Glumannans	Konyaku Sdn. Bhd.	26, 500.00
3.	Assoc. Prof. Dr. Andanastuti Muchtar	PKT1/2009 Impact of Academic Exchange on Employment & Personality Development of Engineering Graduates	University Duisberg Essen (UDE)	50, 525.00



RESEARCH PRODUCT COMMERCIALISATION

Three research products from the Faculty have been selected to be commercialised through Syarikat Terbitan Universiti (STU) in collaboration with the Malaysian Technology Development Corporation (MTDC). Congratulations to the researchers.

No.	Researcher	Product
1.	Prof. Dr. Kamaruzzaman Sopian	Advanced Solar Collectors
2.	Dr. Nowshad Amin	An Intelligent Solar Charge Controller
3.	En Azimin Samsul Tazilan	ecsCUBE : Micro-Architecture for Echo-Street Sustainable Unit Base Energy