Synthesis

Great Innovations from High Quality Research!

ISSN. 0127 – 9394 http://www.rmc.upm.edu.my

Hydrogen Production from Biomass Gasification - The Secret to a Sustainable and Cleaner Environment

Wire Rope Sensor

Camera Vision - Mechanising Agriculture Sector

Facial Expression Modelling

Identifying Defects in Wide-band Gap Semiconductor Crystals

Understanding Seaweeds for Future Benefits

Protein Crystallisation in Space

RESEARCH NEWS OF UNIVERSITI PUTRA MALAYSIA **ISSUE 26 3RD QUARTER SEPTEMBER 2009**

In this Issue

Editorial
Facts & Figures 3


Cover Story
• Protein Crystallisation in Space 4&5


• Identifying Defects in Wide-band Gap Semiconductor Crystals 6


• Understanding Seaweeds for Future Benefits 7


• Camera Vision - Mechanising Agriculture Sector 8


• Facial Expression Modelling 9

Research Happenings 10&11

Reportage 12&13

Feature 14


• Hydrogen Production from Biomass Gassification - The Secret to a Sustainable and Cleaner Environment 15


• Wire Rope Sensor 16

ICC Reports
• SRI's Five Disciplines of Innovation (DOI) 17

• Pertanika Call for Papers 18

Back Issues 19

What's Next

Highlights for the next issue –

- "Butterfly" Filter – Ultra High Speed Communication
- Emerging Infectious Disease - a Peril to the Animal Industry
- Bifidobacterium pseudocatenulatum G4: A Potential Probiotic for Gut Health
- MgB_2 – The Next Generation of High Field Magnetic Material

Photographs courtesy of Ahmad Fua'ad Alwi

Are you reading your own copy of the UPM R&D Digest?

Synthesis is the first and only quarterly R&D digest of Universiti Putra Malaysia published in March, June, September and December with the focus on award-wining innovations and high impact publications. It covers research happenings emerging from the various faculties and institutes across the university and provides a brief summary of some of the important research findings of the studies conducted at UPM. It brilliantly features special topics that are of national interest in various fields and disciplines.

Scientists must be made aware of how important the impact of their work is and its possible applications to the society and public opinion. It is hoped that this digest will provide the opportunity to interact particularly through feedback or direct mail to the scientist from either the private sector or by scientists from other government research institutions.

Synthesis is the official research bulletin of the University and is published by the Research Management Centre (RMC). It is available free of charge to the academic community.

Readership

Researchers, academicians, postdoctoral researchers, technicians, postgraduate studentships, research institutions, techno-entrepreneurs, venture capitalists and laypeople.

If you would like to receive a copy of the *Synthesis* for research updates every 4 months, or would like further information about the Research Management Centre (RMC), please contact the address given on this page or send an e-mail message to asfatimah@gmail.com with the only content in the body of the email message being "subscribe synthesis" to be added to the mailing list.

Letters to the Editors

If you have any comments about the content of the publication or any contributions that you may wish to make for the forthcoming issues, please send them to: The Editors, *Synthesis*, Publication Division, Research Management Centre, Tower II, UPM-MTDC Technology Centre, 43400 UPM, Serdang, Selangor, Malaysia or via e-mail to asfatimah@gmail.com. The editors reserve the right to edit articles for clarity and space before publication.

The opinions and views expressed in this publication are not necessarily those of *Synthesis* or the Research Management Centre (RMC). Acceptance and publication of articles in this publication do not imply recommendations by the RMC.

The publisher of *Synthesis* neither endorses nor is responsible for the accuracy or reliability of any opinion, advice or statement published in this digest. Under no circumstances will the publisher of this digest be liable for any loss or damage caused by your reliance on the advice, opinion or information obtained either explicitly or implied through the contents of this publication.

Editorial

A Proposal that Sells

Every researcher's nightmare is "How do I get further funding for my project?", etc. In order to get the funding, first you must have a good proposal. There are several types of funding to help you get your product to the market that are available in Malaysia from various ministries and agencies.

Knowing the roadmap of your technology is the first step towards deciding which funding you are targeting. A good proposal is not about filing up blanks in an application form. Before writing, you have to develop your concept. Develop your idea and do a thorough search to get opinion from others. Get all the necessary information and arrange your thoughts and ideas carefully. Do not rush into writing straight away even though sometimes this advice may not be practical as you have a due date to meet.

Always try to draw the big picture and think of how the project is going to benefit the society, not just focusing on what product or technology you are going to produce. Never make a statement that you cannot prove with a statistic or else you will run into trouble defending it during your presentation. It is important to have continuity throughout your proposal, for example, your outcome should not be too different from the objective of the project. Make sure all parts of your proposal are logically connected and leave no loose ends. The most important advice is to make the proposal simple yet precise and avoid jargons. If you have to use scientific words, make sure you explain them. Do not assume that the reader will understand what you meant.

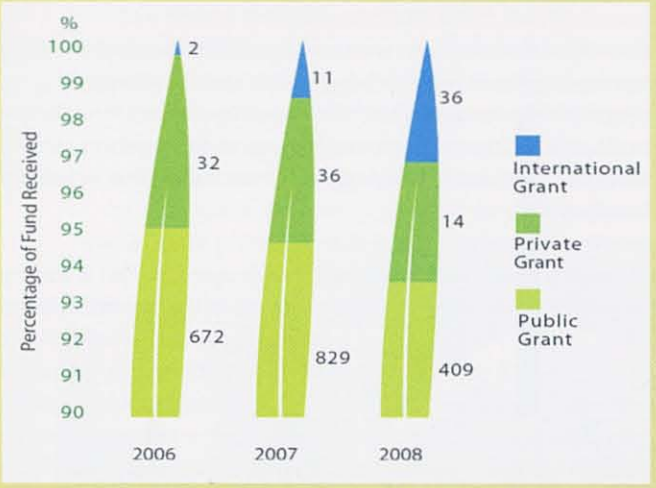
Bearing all these in mind, you can make an attempt to fill up the application form. Make sure you give sufficient details so that the evaluator will understand your goals, plans and expected outcome.

However, if you ever run into trouble, we are happy and very much welcome to help you. In ICC, we will give you advice on suitable funding for research ideas, pre-commercialisation and commercialisation of your technology. We can also advice you on writing a good proposal to get further funding and bring your product to the market.

Dr. Seri Intan Mokhtar,
Deputy Director for Commercialisation,
Innovation and Commercialisation Centre (ICC),
Universiti Putra Malaysia.

Facts & Figures

Research Grant



Graph 1: Total Number of Approved Projects according to the University Funds Received, 2006 - 2008

Research grants received for 2008 worth **RM 61, 660, 455** covering 459 projects.

Graph 2: Total Number of Approved Projects according to the University Funds Received, 2008 (RM Mil)

Protein Crystallisation in Space

Industrial biotechnology is a multi-disciplinary area employing biotechnology knowledge for industrial and commercialisation purposes. One of the focal practices includes the production of industrial products through the use of cells or component of cells namely enzymes. Industrial enzymes of microbial origin are highly demanded due to their applications in a wide variety of processes.

Enzyme-mediated reactions are attractive alternatives to the more tedious and expensive chemical methods. Being high in specific activity, efficiency and biodegradability coupled with the low level by-product formations and the capability to work under mild conditions, enzymes are widely used in a range of applications such as in detergent, food and feed industries, human and animal health, waste treatment and the production of fine chemicals.

The largest segment within the industrial enzyme market is the market for technical enzymes, whereby nearly two-third comprises detergent additives. In the aforementioned scenario, microbial enzymes such as proteases and lipases have dominated the world market owing to their hydrolytic and synthetic reactions. In addition, lipases with their biocatalytic potentials in both aqueous and non-aqueous media have shifted industrial fronts towards utilising this enzyme for a variety of reactions of immense importance, such as in the production of specialty chemicals through organic synthesis. As such, organic solvent-tolerant enzymes are preferred as they have fundamental process advantages over other enzymes.

At UPM we have conducted an extensive screening programme for thermophilic microbes, mainly for fungi and bacteria, as possible sources for microbial lipases and proteases for industrial applications. In addition, our focus is also on the isolation of thermophilic and organic solvent-tolerant microorganisms producing thermostable and organic solvent-stable enzymes to be used in synthetic reactions. Samples are obtained from many sources such as soils with unique properties, palm oil mill effluents, hot springs and garbage disposal sites around the country.

Expert's snapshots

Professor Dr. Raja Noor Zaliha hails from Arau, Perlis and graduated with Doctor of Engineering from the Kyoto University, Japan in 1998. Currently she is the Deputy Dean (Research and Graduate Studies), Faculty of Biotechnology and Biomolecular Sciences. Her main research interest includes the acquisition of novel microbial enzymes, with particular interest in the isolation of microbes producing thermostable and organic tolerant proteases and lipases. This work has enabled her to publish over 100 publications in referred international journals, filed more than 25 patents with 5 patents granted. Besides that, she supervised 65 post graduate students, out of which 15 PhD and more than 20 Masters students have graduated. Prof. Dr. Raja Noor Zaliha has won more than 75 medals at exhibitions held locally and internationally, including the National Intellectual Property Award 2008 First Prize and the recent conferment of Knight Degree of the International Order of Merit of Inventors. In the *Nasional Angkasawan* Programme, she was one of the Principle Investigator and headed the 'Protein Crystallisation in Space' project which was a huge success.

Thermal inactivation is the most important mode of enzyme deactivation. Therefore, thermostable microbial enzymes in particular can provide the solution over stability problems encountered at elevated temperatures in biotechnological applications, whereas organic tolerant enzymes can be used under non-aqueous solutions. Locally isolated lipases and proteases exhibiting stabilities at temperatures as high at 75°C are amongst the studied enzymes. In addition, enzymes that are active or stable in organic solvents have been successfully isolated and characterised. These lipases and proteases exhibited stability and enhancement in various organic solvents which have greatly expanded their potential in the syntheses of useful products. A total of 20 novel lipases and proteases isolated from local microorganisms are currently available in our laboratory.

It is an important assignment in the new era of life science to elucidate the structure, function and structural organisation of biological machinery. Solving the structure of a protein and subsequently comparing it against those of known proteins in the protein structure databases can subsequently reveal its functional, biochemical and evolutionary properties that were previously not evident at the sequence level. A detailed knowledge of the structures of proteins is essential for applications in biotechnology. Critical understanding on how the structure is formed and the parameters affecting the conformation is the fundamental knowledge which can lead to further innovations such as designing novel drugs for medical and industrial purposes.

One of the most widely used methods of studying protein structures is X-ray crystallography which can provide insight into protein structures and functions from global folds into the atomic details of bonding. Protein crystals are analysed by X-ray diffraction to determine their structures, but this procedure is only possible for large and relatively pure proteins. Our T1 lipase was the first protein to be crystallised in this country. As a thermostable enzyme, crystallisation of T1 is proven possible up to 60°C which was the first to be reported on high temperature crystallisation. The influence of gravity on Earth distorts the shape of the crystals ending in imperfection of the structures. Lack of gravity or a microgravity environment can provide an ideal condition for the growth of crystals. No gravity-induced effects such as sedimentation and convection that disrupt the growth of these fragile protein crystals in the microgravity enviroment of space, therefore, the probability of growing larger, more perfect crystals is greatly increased.

Together with its mutant F16L, T1 lipase travelled to space on the Soyuz TMA-11. The Soyuz FG rocket carrying the Soyuz TMA-11 spacecraft was lifted off from the launching pad at Site 1 at Baikonur Cosmodrome in Kazakhstan on October 10, 2007, at 17:22:14 Moscow summer time. The crew included our first Angkasawan, Dr. Sheikh Muszaphar Shukor Al Masrie. At ISS (International Space Station), the activation process of protein crystallisation was initiated on day three of the mission and the deactivation process was carried out at 4.5 h before undocking on day 11. Simultaneous activation and deactivation processes were conducted on Earth using ground control unit. Dr. Sheikh Muszaphar Shukor Al-Masrie, returned to Earth on October 21, 2007 by boarding Soyuz TMA-10. The first space mission was a total 100% success where the microgravity effect on the crystallisation T1 lipase was evident by the finer atomic details at 1.3 Å compared to its earth counterpart at 1.8 Å. The higher resolution obtained was due to bigger and purer crystals obtained under microgravity. Following this success, more proteins will be sent to space under the collaboration between JAXA (Japan Aerospace Exploration Agency) and ANGKASA. The first flight was launched on July 24, 2009 where we sent five proteins to space. The second flight is due to be launched on February 4, 2010. Crystals from these proteins are expected to grow bigger and nearly perfect in microgravity, making their protein structures easier to be observed, altered and synthesised thus enabling development of designer enzymes for industrial uses.

R. N. Z. R. A. Rahman, T. C. Leow, A. B. Salleh, and M. Basri, 2007. Geobacillus zalihaea T1, a Novel Thermophilic Lipolytic Bacterium Isolated from Palm Oil Mill Effluent in Malaysia. BMC Microbiology, 7, 77.

T. C. Leow, R. N. Z. R. A. Rahman, M. Basri, and A. B. Salleh, 2007. High Temperature Crystallization of Thermostable T1 Lipase. Crystal Growth & Design, 7, 406-410.

H. Matsumura, T. Yamamoto, T. C. Leow, A. B. Salleh, M. Basri, T. Inoue, Y. Kai, R. N. Z. R. A. Rahman, 2008. Novel Cation-π Interaction Revealed by Crystal Structure of Thermoalkalophilic Lipase. PROTEINS: Structure, Function, and Bioinformatics, 70, 2, 592-598.

R. A. Abusham, R. N. Z. R. A. Rahman, A. B. Salleh, M. Basri, 2009. Optimization of Physical Factors affecting the Production of Thermostable Organic Solvent-tolerant Protease from a Newly Isolated Halo Tolerant Bacillus subtilis Strain Rand. Microbial Cell Factories, 8, 20.

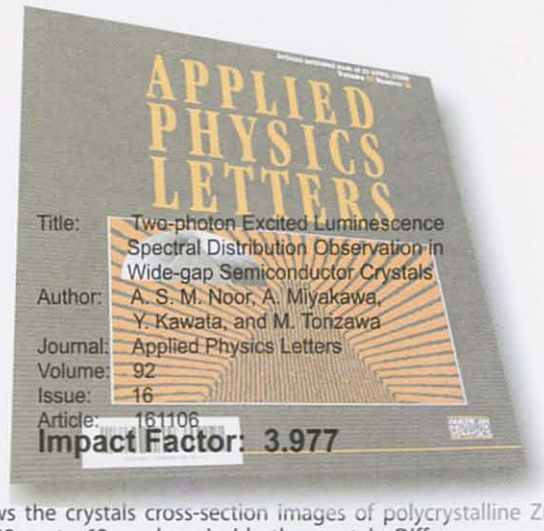
R. N. Z. R. A. Rahman, S.N. Baharum, A. B. Salleh and M. Basri, 2005. High Yield Purification of an Organic Solvent Tolerant Lipase from Pseudomonas sp. strain S5'. Analytical Biochemistry, 341, 267-274.

R. N. Z. R. A. Rahman, S. Fujiwara, M. Takagi, S. Kanaya, and T. Imanaka, 1997. Effect of Heat Treatment on Proper Oligomeric Structure Formation of Thermostable Glutamate Dehydrogenase from a Hyperthermophilic Archaeon. Biochem. Biophys. Res. Commun. 241, 646-652.

Reader Enquiry
Raja Noor Zaliha Raja Abd. Rahman
Department of Microbiology, Faculty of Biotechnology and Biomolecular Sciences, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia
Tel: +603-8946 7592 E-mail: rnzaliha@biotech.upm.edu.my

IF: 3.977

Identifying Defects in Wide-band Gap Semiconductor Crystals



Wide-band gap semiconductor crystals such as ZnSe, GaN, and InGaN found their way in our daily life. Products such as digital versatile disk (DVD) and blue-ray disk player, light emitting diode (LED) on cars, traffic lights and many more profoundly use these crystals since they exhibit a high, powerful light at short and visible spectrum. However, during the fabrication process, defects on these crystals dampen their prolonged use.

Two-photon excitation arise from the simultaneous absorption of two photons in a single quantised event provide a way for investigating these defects. Since the energy of a photon is inversely proportional to its wavelength, in order for two-photon excitation to occur, it requires twice of the wavelength usually needed for single photon excitation. Typical semiconductor crystal consists of conduction band, band gap and valence band as shown in Figure 1. When excitation light incident on the sample, electron at the valence band will absorb the energy and excite to the conduction band. The electron will then return to its previous state releasing its energy in terms of photoluminescence. In single-photon excitation, a photon will excite an electron to the conduction band before releasing its energy as photoluminescence. For two-photon excitation, two photons are required to excite an electron from the valence band.

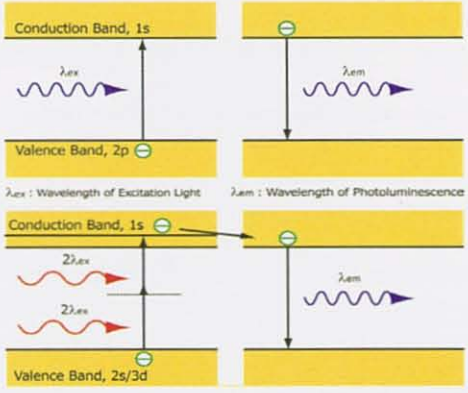


Figure 1: Difference between Single- and Two-photon Excitation

Figure 2 shows the band gap wavelength for a typical semiconductor crystal. Single-photon excitation wavelength is much shorter than the band gap wavelength. Absorption rate is also high for single-photon excitation, making it impossible to obtain photoluminescence deep inside the crystals. Two-photon excitation use wavelength that is much longer than the band gap wavelength. Furthermore, the absorption rate at this wavelength is small and occurs only at the focal volume allowing deep imaging inside the crystals. Thus, it is possible to obtain depth imaging property inside the crystals.

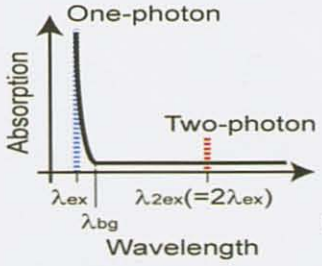


Figure 2: Absorption for Both Single- and Two-photon Excitation

Figure 3 shows the crystals cross-section images of polycrystalline ZnSe obtain from 42μm to 62μm deep inside the crystals. Differences can be seen from the images at difference depth thus allowing types of defects to be analysed inside the crystals. Figure 4 shows an image of 464nm photoluminescence. All 5 points correspond to difference defect detected for the sample. We discovered that the defects are mainly due to impurities during the maturing process and pressing of the crystals.

Here we showed that two-photon excitation microscopy techniques allow deep imaging scanning of crystals, and identification of defects in wide-gap semiconductor crystals ZnSe. Biological application imaging can also take advantage of this technique since it suppresses toxicity, photobleaching and autofluorescence during the process.

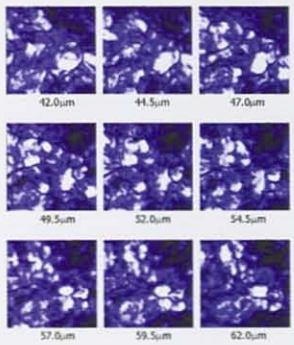


Figure 3: Depth Images of ZnSe Crystals

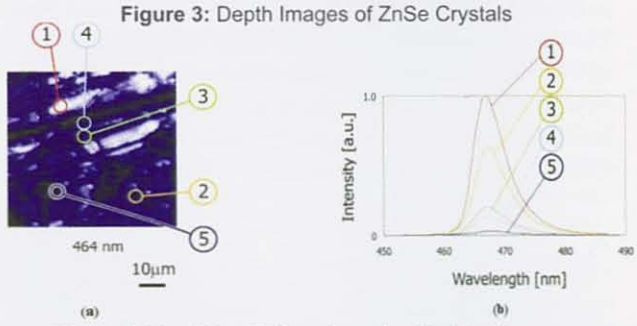


Figure 4: Identifying Defects from the Photoluminescence

A.S.M. Noor, M. Torizawa, A. Miyakawa and Y. Kawata, 2008. Simultaneous Observation of Single- and Two-photon Excitation Photoluminescence on Optically Quenched Wide-gap Semiconductor Crystals. Appl. Phys. Lett., 93, 171107.

A.S. M. Noor, A. Miyakawa, Y. Kawata and M. Torizawa, 2008. Two-photon Excited Luminescence Spectral Distribution Observation in Wide-gap Semiconductor Crystals. Appl. Phys. Lett., 92, 161106.

F. Abdullah, A.S.M. Noor, M.A. Mahdi, H.A.A. Rashid and M.K. Abdullah, 2005. Intracavity Loss Control Effect on Tuning Range of Tunable Dual Erbium-doped Fiber Laser. Laser Phys. Lett., 2, 11, 535.

F. Abdullah, A.S.M. Noor, M.A. Mahdi, M.Z. Jamaludin, K. Dimyati and M.K. Abdullah, 2005. Simulataneous Dual-wavelength Lasing of an Erbium-doped Fibre Laser Over Wide Spectrum Range by Intracavity Loss Optimisation. Optics & Laser Tech., 37, 638.

F.R.M. Adikan, A.S.M. Noor and M.A. Mahdi, 2004. Optimum Pumping Configuration for L-band EDFA Incorporating ASE Pump Source. IEEE Photon. Tech. Lett., 16, 6, 1465.

BRONZE UPM Invention, Research & Innovation Exhibition (PRPI 2005)
BRONZE International Exhibition for Invention, Innovation Technology & Industrial Design (ITEX 2005)

Reader Enquiry
Ahmad Shukri Muhammad Noor
Photonics Laboratory, Wireless and Photonics Networks Research Centre, Department of Computer and Communication System Engineering, Faculty of Engineering, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia
Tel: +603-8946 4468 E-mail: ashukri@eng.upm.edu.my

Understanding Seaweeds for Future Benefits

IF: 11.833

Seaweeds are multicellular marine algae that are widely used as food, sources of minerals such as salts of iodine and potassium, potash, fertiliser, and medicines. Phycocolloids (agar, agarose, carrageenan and alginates) produced by species of red and brown seaweeds are used for cooking, textile sizing, cosmetics, and other purposes. However, seaweed research has not been receiving appropriate attention and funding in the past, studies on the molecular genetics of seaweeds were initiated only in the 1990s.

Seaweed research entered a new phase following the first use of the expressed sequence tag (EST) approach – a relatively inexpensive and quick approach for novel gene discoveries through the sequencing of transcripts randomly chosen from a cDNA library (Figure 1). The availability of seaweed sequences has improved our understanding of codon usage and tandem repeats in seaweed sequences; it also enabled the isolation of transcripts that is difficult to be isolated using other techniques. Although the number of reported seaweed ESTs to date (mainly from the red seaweeds *Porphyra* and *Gracilaria*) accounts for less than 0.2% of all publicly available ESTs, this approach has spurred the development of seaweed research at the molecular level. cDNA macroarray and microarrays (an array of thousands of DNA sequences immobilised on a miniaturised solid substrate or a microscope slide, Figure 2) have been developed for red seaweeds belonging to the genus of *Porphyra*, *Chondrus* and *Gracilaria* for high throughput gene expression analyses and functional annotation of unknown genes, as a spin-off of the EST projects. This is particularly important in seaweed research as many seaweed sequences share little similarity with sequences from other organisms. The limited amount of gene sequences available makes the task of functional elucidation of unknown genes from seaweeds difficult. The EST approach has also laid the foundation for the whole genome sequencing of a few seaweed genetic models. The availability of this sequence information will definitely enhance our understanding of seaweed physiology, biochemistry and molecular biology.

Although the advances in molecular and computational approaches have accelerated the progress of seaweed research, a platform for more-effective communication and information exchange among seaweed research scientists is needed; in particular, collaborative and networking efforts to gather the financial resources and expertise available worldwide to study seaweed genomics. Improved understanding of seaweed physiology, biochemistry and molecular biology should contribute to an improved market value of seaweed produce, and enable the transfer of favourable agronomic traits of seaweeds to economically important crops.

C.-X. Chan, C.-L. Ho and S.-M. Phang, 2006. Trends in Seaweed Research. Trends in Plant Science, 11, 165-166.

S.-S. Teo, C.-L. Ho, S. Teoh, W.-W. Lee, J.-M. Tee, R. A. Rahim and S.-M Phang, 2007. Analyses of Expressed Sequence Tags (ESTs) from an Agarophyte, Gracilaria Changii (Gracilariales, Rhodophyta). European Journal of Phycology, 42, 41-46.

T.K.-M. Wong, C.-L. Ho, W.-W. Lee, R. A. Rahim and S.-M. Phang, 2007. Analyses of Expressed Sequence Tags (ESTs) from Sargassum Binderi (Phaeophyta). Journal of Phycology, 43, 528-534.

C.-L. Ho, Y.-Y. Kwan, M.-C. Choi, S.-S. Tee, W.-H. Ng, K.-A. Lim, Y.-P. Lee, S.-E. Ooi, W.-W. Lee, J.-M. Tee, S.-H. Tan, H. Kulaveerasingam, S. S. R. S. Alwee and M. O. Abdullah, 2007. Analysis and Functional Annotation of Expressed Sequence Tags (ESTs) from Multiple Tissues of Oil Palm (Elaeis guineensis Jacq.). BMC Genomics, 8, 381

C.-L. Ho, S. Teoh, R. A. Rahim and S.-M. Phang, 2009. Transcriptomic Analysis of Gracilaria changii (Rhodophyta) in Response to Low Irradiance. Marine Biotechnology, 11, 513-519.

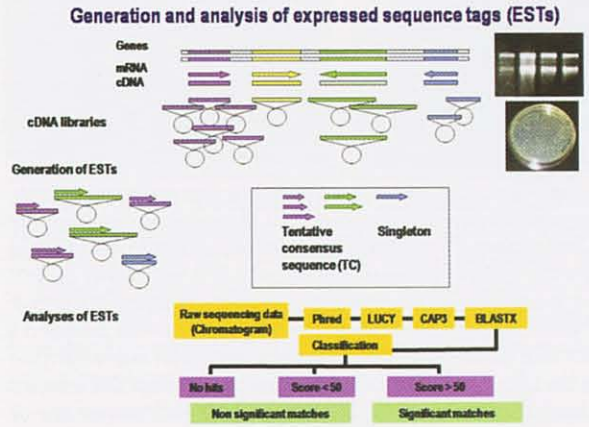


Figure 1: Generation and Analysis of Expressed Sequence Tags (ESTs)

Large-scale single-pass nucleotide sequencing is performed on cDNA clones randomly chosen from cDNA libraries, using universal primer. The raw sequences are subjected to an in-housebioinformatic pipeline of EST analysis and annotation, where the bad quality sequences are removed by Phred, and vector sequences are removed by LUCY; before the redundant sequences are assembled into tentative consensus sequences (TCs) using CAP3.

The tentative unique genes consisting of TCs and singletons are compared to the sequences in the non-redundant protein database using Basic Local Alignment Search Tool (BLAST) and classified according to the scores of their matches. Matches with scores less than 50 and no hits are considered as non-significant; whereas matches with scores more than 50 are considered as significant. The sequences with significant matches are further annotated by referring to Gene Ontology (GO) or Kyoto Encyclopedia of Genes and Genomes (KEGG). mRNA, messenger RNA; cDNA, complementary DNA.

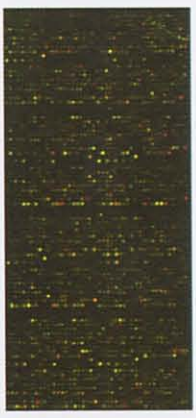
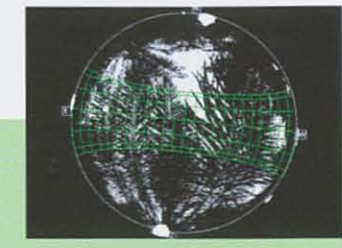


Figure 2: Seaweed cDNA Microarray

A cDNA microarray consists of thousands of DNA sequences (or probes) immobilised by robotic arrayer on a miniaturised solid substrate or a microscope slide for high throughput gene expression analyses and functional annotation of unknown genes. Messenger RNA (mRNA) or complementary DNA (cDNA) from treated and control samples labelled with cyanine fluorescent dyes, Cy5 (red) and Cy3 (green) respectively, are mixed in equal amount and hybridised to the cDNA microarray. The slide is scanned after the removal of non specific binding labels. The relative gene expression can be measured by referring to the signal intensities for each dye for each cDNA probe. The logarithm of the ratio of Cy5 intensity to Cy3 intensity is calculated, positive log(Cy5/Cy3) ratios (red spots) indicate relative excess of transcript in the Cy5-labeled sample, and negative log(Cy5/Cy3) ratios (greed spots) indicate relative excess of transcript in the Cy3-labeled sample. Values near zero indicate equal abundance in the two samples (yellow spots).

BRONZE UPM Invention, Research & Innovation Exhibition (PRPI 2006)
BRONZE (4 awards) UPM Invention, Research & Innovation Exhibition (PRPI 2003)
SILVER (2 awards) UPM Invention, Research & Innovation Exhibition (PRPI 2002)
SILVER Invention/Innovation of Algal Biotechnology at Expo S&T 2002

Reader Enquiry
Ho Chai Ling
Department of Cell and Molecular Biology, Faculty of Biotechnology and Biomolecular Sciences, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia
Tel: +603-8946 7475 E-mail: clho@biotech.upm.edu.my



Camera Vision -

Mechanising Agriculture Sector

It is said that vision is so important that it can account for more than 90% of the total information obtained from all the senses put together. Thus, the first project on camera vision was carried out to differentiate and analyse the colours between the oil palm FFB, with other objects available in the oil palm plantation and identify the maturity of the fruit. The experiment carried out showed that when the camera detected a 'ripe' bunch that matched with the reference red colour intensity in the computer, the LED was turned 'ON'. The signal then turned 'ON' a switch that activated the machine or robot arm to grab and harvest the oil palm FFB.

Another similar project on camera vision system was carried out to grade and sort fresh market *pisang mas* by distinguishing between eight colour ripening index of *pisang mas.* Colour classification represents an important feature evaluation method to automate quality inspection and grading system. The experiments were carried out in the laboratory environment, where the light intensity was controlled. One of the difficulties encountered with robot vision was to control the environment with variations of light intensity from time to time. Two WEBCAM digital cameras were placed onto the robot arm to capture the image of fruits on trees. By 'clicking' on the image displayed on the user interface (UI), the 3-dimensional (3D) distance of the target from the robot arm would be generated a signal to the robot to move to the selected target. The 3D coordinates were applied in mathematical model approach for the movement of robot manipulator simulation.

The unmanned or autonomous tractor has also been developed using camera vision and sensors. In this research, a Kubota L3010 hydrostatic drive tractor was modified to automate the on/off of the engine and manipulate the gear, brake and steering systems. The Kubota L3010 was equipped with cameras, sensors and controllers to acquire information on the surrounding. The range sensor was placed parallel to the front tires to sense any obstacle. The ultrasonic sensor provided angles and distances of the obstacle to the controller which would then generate a set of Boolean logic. Each set of the Boolean logic contained information about the distance and angle of the obstacle for the controller to make a decision in avoiding the obstacle. Webcam32 was used to guide the tractor and capture images of the surroundings.

Colour is the most important indicator for farmers to determine the maturity of oil palm fruit in manual harvesting process. Thus, a research, entitled 'Modeling for Determination of Oil Palm Fruit Maturity and Oil Content', was carried out to study the relationships between oil extraction rate (OER), fruit ripeness and fruit colour. The research described on the use of NIKON Coolpix4500 digital camera to capture the image of the fruit, Extech Lightmeter Data Logger to record light intensity and Soxhlet Extractor to determine the oil content of the fruit. In future, the farmers will only use the camera to capture the image of the fruit in indicating the time of harvest of the matured fruit. The above concept can be applied to other fruit trees to determine fruit maturity.

Another research entitled 'Camera Vision to Determine the Oil Palm Yield' describes the use of Hemispherical Photography Camera to determine the Leaf Area Index (LAI) as the main factor in the growth modeling of crops. Canopy structure is an important study related to radiation, photosynthesis, energy exchange, gas exchange, nutrition analysis, fertiliser treatment, pest management and soil fertility analysis. Leaf Area Index is the main component of canopy structure and used to predict yield of crops. Based on the measurements of the geometry of sky visibility and sky obstruction, hemispherical photographs can be used to calculate solar radiation regimes and plant canopy characteristics.

A research on 'On-line Automated Weedicide Sprayer System' also uses web camera to locate the existence and intensity of weeds in a real time environment in order to spray the weedicide automatically and precisely. At the start of the spraying operation, the web camera initially captures the image of weeds. It is used as reference to compare with the image of weeds captured real-time during the spraying operation. The sprayer valve will open the nozzle for spraying operation when the camera detects the presence of weeds. This successful research reduces wastage and is able to control the environment pollution through selective spraying of chemical.

M.A. Awal, W.I. Wan Ishak, J. Endan and M. Haniff, 2006. Measurements of Leaf Area Index Using Optical Method (LAI-2000) in Oil Palm Plantation: Accuracy and Limitation Assessment. Pertanika J. Tropical Agric. Sci., 29, 1 & 2, 15-24.

W.I. Wan Ishak and M. A. Awal, 2007. Leaf Area Index Model for Oil Palm FFB Yield Prediction. Pertanika J. of Tropical Agric. Sci., 30, 1, 51 -56.7.

W.I. Wan Ishak, 2007. Development of Automation Technology For The Malaysian Agricultural Sector. Journal of The Ingenieur. Board of Engineer Malaysia, 33, 46-54.

M.A. Awal and W.I. Wan Ishak, 2008. Measurement of Oil Palm LAI by Manual and LAI-2000 Method. Asian Journal of Scientific Research 1, 1, 49 – 56.

H. Razali, W.I. Wan Ishak, A. R. Ramli, M. N. Sulaiman, 2008. Modeling of Oil Palm Fruit Maturity for the Development of an Outdoor Vision System. International Journal of Food Engineering, 4, 3, 5.

W.I. Wan Ishak, M.A.Awal and R. Elango, 2008. Development of an Automated Transplanter for the Gantry. Asian Journal of Scientific Research. 1, 4, 451-457, ISSN 1992-1454.

W.I. Wan Ishak, H. Hazlina and M.A. Awal, 2008. Development of Camera-Vision Guided Automatic Sprayer. Pertanika Journal of Sc. & Technology, 16, 2, 97-105.

H. Razali, W.I. Wan Ishak, A. R. Ramli, M. N. Sulaiman and M. H. Harun, 2009. Development of Image Based Modeling for Determination of Oil Content and Days Estimation for Harvesting of Fresh Fruit Bunches. International Journal of Food Engineering, 5, 2, 12.

BRONZE *UPM Invention, Research & Innovation Exhibition (PRPI 2009)*
BRONZE *UPM Invention, Research & Innovation Exhibition (PRPI 2008)*
BRONZE *UPM Invention, Research & Innovation Exhibition (PRPI 2007)*
SILVER *UPM Invention, Research & Innovation Exhibition (PRPI 2007)*
BRONZE *UPM Invention, Research & Innovation Exhibition (PRPI 2007)*
BRONZE *UPM Invention, Research & Innovation Exhibition (PRPI 2006)*
SILVER *16th International Invention and Innovation Industrial Design and Technology Exhibition (ITEX 2005)*
SILVER *UPM Invention, Research & Innovation Exhibition (PRPI 2005)*
BRONZE *UPM Invention, Research & Innovation Exhibition (PRPI 2005)*
BRONZE *Institusi Pengajian Tinggi Awam (IPTA) Ekspo Sains, Teknologi dan Inovasi 2004*

Reader Enquiry
Wan Ishak Wan Ismail
Department of Biological and Agricultural Engineering, Faculty of Engineering, Universiti Putra Malaysia, Serdang, Selangor, 43400 UPM, Malaysia
Tel: +603-8946 6408 E-mail: wiwi@eng.upm.edu.my

Facial Expression Modelling

Due to its applicability in various areas such as recognition, robotics and computer animation, facial expression modelling has been the interest of many researches. Creating a realistic facial expression will be quite a challenge as it involves various factors. Perhaps the following Funge's hierarchy of computer graphic modelling might best illustrate the elements needed before a model can be said to be realistic:

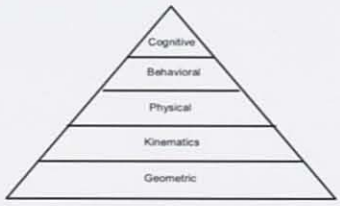


Figure 1: Funge's Hierarchy of Computer Graphic Modelling

The upper layer of the Funge's hierarchy is usually being studied by the social scientist while most of the computer science study will focus on the lower level of the hierarchy. However, it is common for certain project to combine all the elements from the hierarchy. Unfortunately, given the size of the endeavour, much of the research in facial expression is confined to specific layers. Research focus in facial expression is very diverse. Given Funge's hierarchy, it is not surprising that research in the topic of facial expression varied from one group to another. However, in the field of computer science, the research seems to converge on certain specific topics.

Researches in facial expression seem to focus on a few key issues namely tracking, recognition and combination of modelling and animation. Some preprocessing issues such as the conversion from 2D to 3D and distortion correction are also being discussed in facial expression study. Tracking of facial expression can be considered as an important issue in the study because the facial expression property can be extracted via tracking of the face. Various approaches can be used to do tracking. Among others are template matching, model-based, and optical flow. The template matching is the simplest approach where certain pre-selected feature points on the face are tracked and its pattern studied. The model-based approach on the other hand tracks movement by prediction. A generic head model will initially be created; the facial expression movement will then be predicted by deforming the generic head and predicting the next probable location.

Face expression recognition is another area of interest studied by various researchers. Generally the studies attempt to map a particular face deformation with a specific expression such as smile or sad. The muscle attributes of the face have been used as the determinant in classifying the expression into distinct category such as sad or anger. In carrying out the mapping function, computer science researches rely on psychologist's expression description such as Facial Action Coding System (FACS) introduced by Paul Ekman.

The modelling and animation of facial expression is another interesting sub-area that have been given various attentions by researchers, where they can be seen as the visualisation aspects of face expression modelling, with tracking and recognition study act as the input mechanism. The modelling and animation are further divided into several focuses such as muscle-based, parametric and cognitive related modelling. The muscle-based model attempt to model human expression based on the study on human muscle structure. Meanwhile, the cognitive related modelling gives more emphasis on the psychological state of the model during an instance of a time. The cognitive related modelling builds a virtual human than produce expression depending on the cognitive state such as sad, angry or happy.

Figure 2: Usage of Proposed Dual-pivot 3D-based Head Movement Tracking System (DPHT) Approach Enabling the Establishment of Head Position

F. H. Yusoff, R. W. O.K. Rahmat, M. N. Sulaiman, M. H. Shaharom, and H.S. A. Majid, 2009. Temporal Modeling of Head Movement during Facial Expression via Dual Pivot Tracking System – A Case of Disgust', Lecture Notes in Engineering and Computer Science. S.I.Ao, Oscar Castillo, Craig Douglas, David Dagan Feng and Jeong-A Lee (Eds), 1, 927-931.

F. H. Yusoff, R. W. O.K. Rahmat, M. N. Sulaiman, M. H. Shaharom, and H.S. A. Majid, 2009. Temporal Modeling of Head Movement during Facial Expression via Dual Pivot Tracking System – A Case of Disgust', (LNECS). International Multiconference of Engineers and Computer Scientist, (IMECS 2009), 1, 927-931.

S.S. Salleh, R. W. O.K. Rahmat, R. Mahmod and F. Ahmad, 2007. A Novel Approach to Define Parametric Polynomial Function for Lips Motion Estimation. Proceedings of the Int. Conf. on IT in ASIA, CITA07, 10-12 July 2007, Kucing, Sarawak, Malaysia, (ISBN 983-9257-66-8)

F. H. Yusoff, R. W. O.K. Rahmat, M. N. Sulaiman, M. H. Shaharom, H. S. A. Majid, 2007. Dual-Pivot Pose Determination of Human Head Based on Head Movement. Proceeding of the Fourth International Conference on Computer Graphics, Imaging and Visualization, IEEE Bangkok, 13-16 August 2007.

N. Z. Azmi, R. W. O.K. Rahmat and R. Mahmod, 2006. Modeling Expressive Wrinkle on Human Face. Proceedings of the 4th International Conference on Computer Graphics and Interactive Techniques in Australasia and South-East Asia 2006 (GRAPHITE 2006), K.L., 29 November – 2 December 2006.

BRONZE *Malaysia Technology Expo (MTE 2008)*
GOLD *UPM Invention, Research & Innovation Exhibition (PRPI 2007)*

Reader Enquiry
Rahmita Wirza O. K. Rahmat, M. Nasir Sulaiman, Ramlan Mahmod, Fakhrul Yusoff
Department of Multimedia, Faculty of Computer Science and Information Technology, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia
Tel: +603-8946 6595 E-mail: rahmita@fsktm.upm.edu.my

TRIP TO HUTAN PAYA LAUT MATANG

1. **WHAT'S THAT?:** UPM researchers seem to be looking at something.
2. **ENJOYING THE MOMENT:** Prof. Datuk Dr. Nik Mustapha R. Abdullah (UPM VC) and Prof. Dr. Abu Bakar Salleh (R&I DVC) at Hutan Paya Laut Matang trip.
3. **FULL ATTENTION:** The project leader, Assoc. Prof. Dr. Awang Nor Abd. Ghani is briefing his team.
4. **NICE ANGLE:** Assoc. Prof. Dr. Awang Nor Abd. Ghani (2nd from left) and Prof. Dr. Tai Shzee Yew (3rd from right) on a boat ride cruising along Matang mangrove forest.

Porous Bioceramic Composition (27 August 2009)

1. **FULL HOUSE:** Assoc. Prof Dr. Md. Zuki Abu Bakar@Zakaria and Prof. Dr. Abu Bakar Salleh handling the 'Porous Bioceramic Composition' press conference.
2. **A GOOD MODEL FOR UPM RESEARCHERS:** Assoc. Prof. Dr. Md. Zuki in action.
3. **NEW BONES?:** The result of Assoc. Prof. Dr. Md. Zuki's research on 'Porous Bioceramic Composition'.

UPM RESEARCH FINDINGS PROMOTION CEREMONY 2009

UTM-EDUCATIONAL INNOVATION OF MOTORSPORT & AUTOMOTIVE RACE (EIMA RACE 2009)

1. **NO SPEED LIMIT:** A third-year student from the Faculty of Engineering, UPM, Azlan Hapip maneuvering XERON.
2. **HEFTY CHEQUE!:** Azlan Hapip smiling for the camera with the Head of Department of Mechanical and Manufacturing Engineering, UPM, Prof. Ir. Dr. Mohd. Sapuan Salit and other team mates.

TECHNOLOGY ACQUISITION

1. **SHAKE WELL:** Dato' Iskandar Mizal Mahmod shaking hands with Dato' Seri Mohamed Khaled Nordin, the Minister of Higher Education.
2. **Q&A SESSION:** Dato' Iskandar Mizal Mahmod, CEO of Biotech Corp. explaining to the media.

ResearchHAPPENINGS

UPM RESEARCH FINDINGS PROMOTION CEREMONY 2009

Fungal Infection Detection Kit (14 September 2009)

1. **NEW FINDINGS:** Rapid Detection Kit for Life – Threatening Fungal Infections.
2. **TAKE A LOOK AT THE SLIDE:** Assoc. Prof. Dr. Chong Pei Pei during her 'Fungal Infection Detection Kit' press conference.
3. **EXCELLENT WORK!:** Assoc. Prof. Dr. Chong Pei Pei showing her 'Fungal Infection Detection Kit' to Prof. Dr. Zulkifli Idrus.

1


2


3


1


2


3

MoU SIGNING CEREMONY BETWEEN UPM & PHARMASOL GmbH, GERMANY

1. **BIG SMILES:** The Vice Chancellor of UPM, Prof. Datuk Dr. Nik Mustapha R. Abdullah in a firm handshake with a representative from Pharmasol GmbH, Prof. Dr. Rainer H. Muller.
2. **READ CAREFULLY:** A seal between UPM and Pharmasol GmbH.
3. **I WONDER WHAT IT IS...:** Prof. Dr. Rainer H. Muller seems interested with the gift he has received.


2


1

UPM R&D EXHIBITION (PRPI 2009) 28 July 2009

1. **TOP VIEW:** Booths at PRPI 2009.
2. **HIGH MARKS!:** Judges going to every booth to evaluate the exhibited researches.
3. **LOOKING AT THE SUN:** One of the activities at PRPI 2009.


3

NewsBriefs

A Pioneer Mangrove Forest Research Project in Matang

Assoc. Prof. Dr. Awang Nor Abd. Ghani giving a token of appreciation to a participant's representative.

A group of researchers from Universiti Putra Malaysia (UPM) had conducted a consultation research project of Hutan Paya Laut Matang (HPLM).

The research input would be used by the Perak Forestry Department (JPNP) in preparing a Ten Year Work Plan for the period of 2010 to 2019.

The Dean of Forestry Faculty of UPM, Assoc. Prof. Dr. Awang Nor Abd. Ghani, whom was also the project leader, mentioned that the primary objective of the project is to prepare and revise the Local Volume Table to be used in ascertaining and counting the trees in HPLM.

According to him, the project could identify the mangrove and non-mangrove area and also set a classification of sea swamp forest into production zone, preservation zone, and non-productive zone using the remote sensing and field inventory technology.

"The stakeholder analysis output can be used to study the profile of stakeholders who live around the HPLM area and also gain information on the socio-economy contribution and the dependability of HPLM to the stakeholders, their perception to the management and impact of the effort to their living hoods," he said further.

Assoc. Prof. Dr. Abdullah Mohd, Dr. Kamaruddin Mohd. Noor, Assoc. Prof. Dr. Ahmad Ainuddin Nuruddin, Dr. Kamziah Abd. Kudus and Ismail Adnan Abdul Malik were the participating researchers with diverse background in forest inventory area, GIS, eco and recreational travel planning, stakeholder and community analysis, and forest management and statistic.

The research visit was accompanied by the Deputy Vice Chancellor (Research and Innovation), Prof. Dr. Abu Bakar Salleh and Deputy Vice Chancellor (Industry and Community Relations), Prof. Dr. Tai Shzee Yew.

UPM Wheels to 1st Runner-up in EIMA Race

XERON by UPM.

A team of staff and students, from the Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, UPM had wheeled to second place in UTM-Educational Innovation of Motorsport & Automotive Race '09 (EIMA RACE '09) with its creation called Xeron, a vehicle powered by a 130 cc engine.

The team's leader, Dr Mohd. Khairol Anuar Mohd. Ariffin from the Department of Mechanical and Manufacturing Engineering, mentioned that the race was not a major criteriain order to win the competition. The competition was also judged based on the evaluation of performance, design, brake test, and the safety aspect of the vehicle. Details that produce precise calculation are the main contributor of this victory. The team, which consists of 6 lecturers, 5 technical staff, and 22 students, has done some upgrades to the concept of the previous model which had participated in the same tournament previously," he said.

The team earned a cash prize of RM2000 as the runner up. The competition was held in Dato' Sagor circuit with the theme 'Innovation'. 12 teams from IPTA, IPTS, Polytechnic, IKM, and research institutions from the whole nation participated in the race, which were judged by representatives from Modenas, Sirim, and Yamaha.

New Supercritical Fluid Technology

Exchange of Documents on Technology Acquisition between Dato' Iskandar Mizal Mahmod (CEO of Biotech Corp.) and Prof. Datuk Dr. Nik Mustapha (UPM VC).

Universiti Putra Malaysia (UPM) established a joint venture with Biotechnology Corporation (BiotechCorp) to be a leader in biotechnology industry through Supercritical Fluid Technology as a platform to enhance the natural product industry of Malaysia. Currently, UPM is in the process of constructing a Supercritical Fluid Centre (PSCF) that will play a major role in the local researchers' development and expertise in pure chemical, nutraceuticals and pharmaceutical studies that use CO2 technology.

According to the Chief Executive Officer of BiotechCorp, Dato' Iskandar Mizal Mahmod, cooperation between government and private sectors such as this will open up more chances in increasing the competitiveness between the government, industry, non-governmental organisation, and academic body.

FeyeCon, a Netherland-based company, will be involved as a technology provider to assist BiotechCorp. in increasing Malaysia's ability to produce high quality products. The Supercritical Fluid usage in Malaysia is still at the beginning state, however, it is widely use in the food, nutraceutical, fuel, and pharmaceutical industry in Malaysia.

The potential is huge for Malaysia to become an initiator at the global level in the natural product industry which is currently to worth at RM 280 billion. The size of natural products market, including herbs, in Malaysia is estimated worth at RM 4.6 billion and expected to increase at 8% to 12% annually.

Invention, Research and Innovation Exhibition (PRPI 2009)

Variety of booths at PRPI 2009.

UPM's annual exhibition, the Invention, Research and Innovation Exhibition (PRPI 2009) was held at Sultan Salahuddin Abdul Aziz Shah Arts and Cultural Centre on 28 July 2009.

With the theme "Sustaining High Impact Integrative Research", PRPI was organised by the Office of the Deputy Vice Chancellor (Research & Innovation) to promote new research outcomes and findings that have potential to be commercialised.

The exhibition also serves as the preliminary stage before these new researchers are selected to represent the university at any national and international exhibitions.

Initially, the exhibition was scheduled for three days but was reduced to one due to the order from the Ministry of Higher Education to stop all students' activities because of the H1N1 concern.

However the incident did not dampen anybody's mood when 531 projects participated with 103 projects were selected for the gold medals, 148 won the silver medals and 187 was awarded with bronze.

Even though PRPI were sadly interrupted by the H1N1 issue, the event still managed to meet its objectives and was a great success!

Bone Resurrection using the Shells of Cockles

UPM scientists, standing from left Dr. Bahaa Fakhri Hussein, Assoc. Prof. Dr. Md. Zuki Abu Bakar@Zakaria and Assoc. Prof. Dr. Noordin Mohamed Mustapha.

A group of UPM scientists had succeeded in producing a scaffold that could fix bone defects or could promote bones resurrection using Porous Bioceramic Composition from calcium carbonate contained in the shells of cockles.

The 3-D Porous Bioceramic Scaffold, which uses seashells as the main substance, is the first in Malaysia. Its safety and effectiveness have been tested in the lab using the lab's specimen (rabbit).

The group, consisted of five scientist and led by Assoc. Prof. Dr. Md Zuki Abu Bakar@Zakaria from the Department of Veterinary Preclinical Sciences, Faculty of Veterinary Medicine, UPM, started the study since 2007 in order to replace or to improve animal and human bone defects cause by bone cancer, accident, and also for cosmetic surgery.

"The scaffold needs to be sowed and incubated with osteoblas which can be gathered through bone marrow cells and germinated in tissue culture lab before it is planted in the desired bone," said Dr. Zuki during the press conference in UPM, which were attended by the Deputy Vice Chancellor (Research and Innovation), Prof. Dr. Abu Bakar Salleh and 23 media representatives.

"Calcium carbonate is the main element for this scaffold which contains in the shells of cockles and mixes with other elements such as dextrin, dextral, gelatine, and water to form the product in a special mould," he said further.

Dr. Zuki also mentioned that the advantages of the product are low manufacturing cost due to ample supply of seashells in Malaysia and the ability to produce fast bone resurrection.

Quick Fungal Infection Detection Kit

Assoc. Prof. Dr. Chong Pei Pei explaining the function of fungal infection rapid detection kit during a press conference.

A group of UPM researchers had succeeded in producing a quick detection kit for 'candida' fungus infection which could bring death due to late detection. There are eight samples of 'candida' yeast that infect humans and the most severe cases is from the 'albicans' species. All of these species could cause death.

The research group, led by Assoc. Prof. Dr. Chong Pei Pei, 38, from the Department of Biomedical Science, Faculty of Medical and Health Sciences, UPM, managed to produce a quick result in a period of 5 hours compared to conventional chemical diagnosis method which could take a period of 5 days.

According to her, yeast infection in blood and body organs is caused by a yeast called 'candida' that could attack humans' immunisation system.

"The 'candida' yeast exists around humans especially in the intestines, which could infect humans with low antibodies," she said at the press conference of UPM Research Product, organised by the Research Management Centre (RMC) with the cooperation from the Corporate Communication Division. She also said that the detection kit could reduce the patient's death risk because proper medication could be accurately and timely prescribed to the patient.

Dr. Chong started the research in 2007 and was patented in 2007. She also won a bronze medal at the Invention, Research and Innovation Exhibition (PRPI 2009). The detection kit costs around RM20, excluding hospital costs.

Germany Company Helps UPM to Boost Research in Nanotechnology

Memory photo of UPM top management with Prof. Dr. Rainer H. Muller.

Universiti Putra Malaysia is broadening its research in the nanotechnology field at the international level with the help from a nanomedical technology company, Pharmasol GmbH, from Berlin, Germany.

The Vice Chancellor of Universiti Putra Malaysia, Prof Datuk Dr. Nik Mustapha R. Abdullah said that Pharmasol would transfer nanomedical technology information to UPM so that the technology could be expanded here. The collaboration also includes the production of high quality research products, scientific information exchange, publication of articles at high impact journals, assistance to post graduate students, and cooperation in teaching and learning.

Prof. Datuk Dr. Nik Mustapha also mentioned that even though nanotechnology field in UPM is still at the beginning stage, with this dynamic collaboration, UPM could become the pioneer in the technology. "Pharmasol, whom is the expert in the nanomedical technology would be responsible in coordinating a two-way networking to produce research products that could penetrate the local and international market. It would also cooperat in research, innovation and commercialisation of products in nutraceutical, pharmaceutical and cosmoceutical," he said further.

"Pharmasol needs our support because our university has the expertise in bioactive material research from natural resources, especially in nutraceutical, pharmaceutical and cosmoceutical production," he concluded with a smile.

Guidelines for Pollution in Drinking Water

Mohammad Reza Mohammad Shafiee, Mohamad Pauzi Zakaria, Nayan Deep S. Kanwal, Mahyar Sakari, Pourya Shahpoury Bahry and Alireza Riyahi Bakhtiari

Water pollution is one of the major and serious consideration to human. There are several pollutants that pose as a threat to drinking water. They are categorised in six categories as follows:

• Microorganisms; • Disinfectants; • Disinfection Byproducts; • Inorganic Chemicals; • **Organic Chemicals**; and • Radionuclide's

As mentioned above, these are potential pollutants to human drinking water worldwide. This guideline provides a short yet necessary information on these drinking water pollutants. In this volume you will receive information focuses on Organic Chemicals.

Organic Chemicals

Contaminant	1MCLG	2MCL	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Acrylamide	Zero	Very minimum level	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/wastewater treatment
Alachlor	Zero	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops
Atrazine	0.003	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops
Benzene	Zero	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills
Benzo(a)pyrene	Zero	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines
Carbofuran	0.04	0.04	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa
Carbon tetrachloride	Zero	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities
Chlordane	Zero	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide
Chlorobenze	0.1	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories
2,4-D	0.07	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops
Dalapon	0.2	0.2	Minor kidney changes	Runoff from herbicide used on rights of way
1,2-Dibromo-3-chloropropane (DBCP)	Zero	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards
o-Dichlorobenzene	0.6	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories
p-Dichlorobenzene	0.075	0.075	Anemia; liver, kidney or spleen damage; changes in blood	Discharge from industrial chemical factories

Definitions:

1Maximum Contaminant Level Goal (MCLG) - The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals. 2Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.

*Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million.

....to be continued in Synthesis Issue 27, December 2009.

Hydrogen Production from Biomass Gasification - The Secret to a Sustainable and Cleaner Environment

Biomass gasification using organic materials (ideally waste materials which would otherwise go to landfills) is the best way to produce hydrogen from the synthesis gas (syngas) it produces. It can also generate electricity into the local power grid, from which users can create hydrogen in their homes and factories. If our society is to become hydrogen-economy-based, it will have to be done in a sustainable manner without adding to the production of green-house gases, which resulted in global warming.

The concept of mainstream large scale commercial gasification technology is that biomass is converted into a gaseous mixture of hydrogen, carbon monoxide, carbon dioxide and other compounds by applying heat under pressure in the presence of steam and a controlled amount of oxygen (in a unit called a gasifier). In the process, the molecules forming the biomass are broken apart chemically by the heat, steam and oxygen to which they are subjected. This sets into motion chemical reactions that produce a synthesis gas, or "syngas". This gas, although it starts as a mixture of primarily hydrogen, carbon monoxide, and carbon dioxide, it can then be shifted through further reactions to increase the hydrogen gas content. At the same time the operator can reduce the carbon compounds and finally the carbon dioxide can be scrubbed out and captured for long term storage underground to minimise and even reduce global warming. The hydrogen gas is actually produced by steam during the gasification of charred cellulosic material. The yield from steam gasification increases with increasing water to sample ratio.

The production of hydrogen from biomass was described as listed reactions below:

Oxidation reaction:	$C + O_2 \rightarrow CO_2$	(1)
	$C + \frac{1}{2} O_2 \rightarrow CO$	(2)
Boudouard:	$C + CO_2 \rightarrow 2CO$	(3)
Water gas:	$C + H_2O \rightarrow CO + H_2$	(4)
Methanation:	$C + 2H_2 \rightarrow CH_4$	(5)
Water gas shift:	$CO + 2H_2O \rightarrow CO_2 + H_2$	(6)

Hydrogen production systems are based on thermochemical gasification of biomass. They typically consist of the following basic steps; i) pre-treatment, ii) gasification, iii) gas cleaning, and iv) upgrading and separation. The development of the technology is progressing and in essence depends on the successful integration of these steps. Among all technologies, fluidised bed gasifier has been shown to be a versatile technology capable of burning practically any waste combination with high efficiency. The significant advantages of fluidised bed combustors over conventional combustors include their compact furnace, simple design, effective burning of a wide variety of fuels, relatively uniform temperature, and the ability to reduce emissions such as nitrogen oxide and sulphur dioxide gas. In this research, a laboratory scale of fluidised bed is developed to investigate the characteristics of gasification of agricultural wastes available in Malaysia such as rice husk, empty fruit bunch, coconut shell and bagasse.

W.A.K.G. Wan Azlina, R. Moghadam, M. Amran and A. Alias, 2009. Air Gasification of Agricultural Waste in a Fluidized Bed Gasifier: Hydrogen Production Performance. Energies, 2, 258-268.

R. A. Moghadam, W.A.K.G. Wan Azlina, M. Amran and A. Tavassoli, 2009. Hydrogen-rich Gas Production from Rice Husk by Applying Air Gasification in Fluidized Bed Reactor. ISARET 2009, Hotel Residence, Kajang, 28-29 April 2009.

R. A. Moghadam, W.A.K.G. Wan Azlina, M. Amran, and A. Tavassoli, 2008. Hydrogen-rich Gas Production from Agricultural Waste by Applying Air Gasification in Fluidized Bed Reactor. RSCE-SOMCHE 2008, Impiana Hotel, Kuala Lumpur, 2-3 Mac 2008.

W.A.K.G. Wan Azlina, M. A. Reza, M.S. M. Amran, O. Rozita, A. Salmiaton and I. Azni, 2008. An Experimental Investigation of Hydrogen Production from Malaysia Agricultural Waste in a Fluidized Bed Gasifier. Sustainable Engineering Technology Conference 2008, Korea, 24-27 August 2008.

W.A.K.G. Wan Azlina, N. A. Ghani, A. B. Alias, M. A. M. Salleh, O. Rozita, A. Salmiaton and I. Azni, 2007. Characterization of Agricultural Waste as Biofuels: Significance and Impact. Procedings of 21st Symposium of Malaysian Chemical Engineers, SOMCHE 2007, Universiti Putra Malaysia, 12-14 December 2007.

SILVER *UPM Invention, Research & Innovation Exhibition (PRPI 2007)*
GOLD *UPM Invention, Research & Innovation Exhibition (PRPI 2007)*

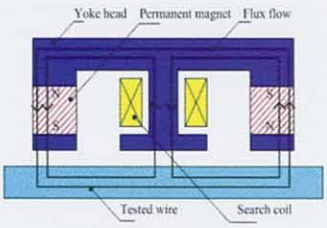
Reader Enquiry
Wan Azlina Wan Abdul Karim Ghani
Department of Chemical & Environmental Engineering, Faculty of Engineering, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia
Tel: +603-8946 6287 E-mail: wanaz@eng.upm.edu.my

Wire Rope Sensor

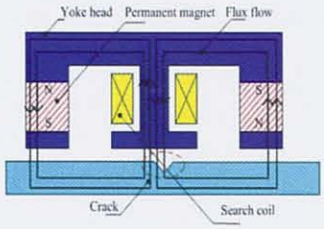
Traditionally, conditions of wire ropes are determined by visual inspection which is not practical, dangerous and can be fatal. Unless the cracks on the wire ropes are huge or severe, it is impossible for users to detect defective wire rope effectively just by visual inspection. Besides, it is also time consuming and impractical for users to detect the large number of wire ropes by visual inspection.

Therefore, a proper sensor that can detect such defects is essential for better inspection to avoid accidents and faulty. In this research, a wire rope sensor is used to detect cracks or defective on a wire rope. The wire rope sensor is developed based on an electromagnetic field common in magnetic circuit theory. It consists of several permanent magnets and search coils. The basic operation principle of the wire rope sensor is based on the rate of change of flux with respect to time.

Figure 1 shows the basic principle of wire rope sensor for single yoke head. In normal condition, the flux distribution causes by the permanent magnet is under equilibrium condition, where no induced voltage will be produced inside the search coils. When a crack is detected in the wire rope, it will produce a change in the magnetic flux, which will produce an induced voltage within the search coil. This is based on Faraday's Law which states that, an induced voltage within inductive coil is directly proportional to the number of inductive coil turns and rate of change of the magnetic flux. In this sensor, the search coil will act as an inductive coil. The induced voltage is signalled to the amplifier circuit. The amplifier circuit amplifies the induced voltage which can be observed from the voltmeter.



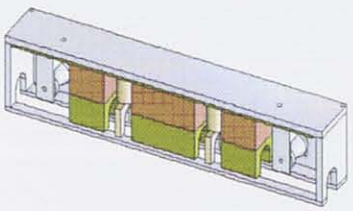
a) Normal



b) Crack

Figure 1: Basic Principle of Wire Rope Sensor for Single Yoke Head

In Figure 2, it shows the wire rope sensor with the double yoke head. This kind of sensor will give induced voltage with more accurate results. Furthermore, it can be used to detect the crack position along the tested wire rope. In this case, a microcontroller is required to process the signal from this sensor.



a) Sectional view

b) Prototype

Figure 2: Wire Rope Sensor with Double Head

One of the advantage of this sensor is its small size. This will make the wire rope sensor become portable and handy. Besides, it is a low cost product with low power consumption since the power source of the microcontroller is only a small battery. This sensor is suitable for several applications such as cable car system, list and elevator, and crane vehicles.

M. Norhisam, N. Wei Shin, H. N. Hasmiza, N. Mariun, Y. Hirama and H. Wakiwaka, 2007. Study on Effects of Magnetic Head Length on Inductive Coil Sensor for Wire Rope Testing. Journal of Industrial Technology, 16, 1.

M. Norhisam, H. N. Hasmiza , H. Ezril, A. Ishak and M. Norman, 2007. Analysis on Head Length Gap of Wire Rope Sensor using Simplified Permeance Method. Proceeding of World Engineering Congress, Penang, 13-18.

SILVER *International Exhibition of Ideas-Inventions-New Products (IENA 2007)*
BRONZE *Malaysian Technology Expo (MTE 2007)*
Patent: *PI 20080292*

Reader Enquiry
Norhisam Misron, Norman Mariun, Ng Wei Shin, Noor Hasmiza Harun
Department of Electrical and Electronic Engineering, Faculty of Engineering, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia
Tel: +603-8946 6299 E-mail: norhisam@eng.upm.edu.my

SRI'S FIVE DISCIPLINES OF INNOVATION (DOI) PROGRAMME

Being innovative in producing technology requires a lot of hard work and discipline besides a dash of creativity and teamwork, of course. This is especially true if it is targeted for the international market.

On that note, Innovation and Commercialisation Centre (ICC), Universiti Putra Malaysia (UPM) had organised a Five Disciplines of Innovation (DOI) Programme conducted by SRI International to assess UPM`s current commercialisation process by reviewing a number of products for commercial viability. The programme, which was held on 21 and 22 July 2009, was officiated by the Deputy Vice Chancellor of Research and Innovation (UPM), Prof. Dr. Abu Bakar Salleh at the Pullman Putrajaya lakeside on the same day.

The goal of this programme is to identify UPM`s patented technologies that could be commercialised internationally. The programme, which was attended by 25 UPM researchers whom have more than one patented technology, had guided them to develop a methodology to evaluate the marketability of their technologies/products.

The Deputy Chairman of SRI International, Steve Clesinski said that UPM and other higher learning institutions in Malaysia have great strength in research and development (R&D) but not in the commercialisation field. From the programme, SRI International will match UPM potential technologies with the ideal international venture capital company in the United States. All the technologies from UPM are reviewed for further assessment and refinement. SRI`s assessment process is thorough, stringent and proven.

SRI International, which is based in California, USA, is an independent, non-profit research institute and conducts client-sponsored research and development for government agencies, commercial businesses, foundations, and other organisations. SRI also brings its innovations to the marketplace by licensing its intellectual property and creating new ventures.

SRI has started more than 20 spin-off companies leveraging the technologies in new commercial applications. This important element of SRI's mission moves new discoveries and innovations from the laboratory into the marketplace.

SRI`s Five Discipline of Innovation Programme consist of:

- Discipline 1: Working on Important vs Interesting Needs
- Discipline 2: Creating Customer Value
- Discipline 3: Developing Innovation Champions
- Discipline 4: Building Innovation Teams
- Discipline 5: Ensuring Organisational Alignment

Pertanika

Pertanika is Indexed in Scopus & EBSCO

Our goal is to bring high quality research to the widest possible audience

Pertanika is an international peer-reviewed leading journal in Malaysia which began its publication in 1978. The journal publishes in three different areas — Journal of Tropical Agricultural Science (JTAS); Journal of Science and Technology (JST); and Journal of Social Sciences and Humanities (JSSH).

JTAS is devoted to the publication of original papers that serves as a forum for practical approaches to improving quality in issues pertaining to tropical agricultural research or related fields of study. It is published twice a year in February and August.

JST caters for science and engineering research or related fields of study. It is published twice a year in January and July.

JSSH deals in research or theories in social sciences and humanities research with a focus on emerging issues pertaining to the social and behavioural sciences as well as the humanities, particularly in the Asia Pacific region. It is published twice a year in March and September.

Why should you publish in Pertanika Journals?

Benefits to Authors

PROFILE: our journals are circulated in large numbers all over Malaysia, and beyond, in Southeast Asia. Recently, we have widened our circulation to other overseas countries as well. We will ensure that your work reaches the widest possible audience in print and online, through our wide publicity campaigns held frequently, and through our constantly developing electronic initiatives through e-Pertanika and Pertanika Online.

QUALITY: Our double-blind peer refereeing procedures are fair and open, and we aim to help authors develop and improve their work. Pertanika JTAS is now over 30 years old; this accumulated knowledge has resulted in Pertanika JTAS being indexed by Scopus (Elsevier).

AUTHOR SERVICES: we provide a rapid response service to all our authors, with dedicated support staff for each journal, and a point of contact throughout the refereeing and production processes. Our aim is to ensure that the production process is as smooth as possible, is borne out by the high number of authors who publish with us again and again.

LAG TIME & REJECTION RATE: the elapsed time from submission to publication for the articles in Pertanika averages 6-8 months. A decision of acceptance of a manuscript is reached in 1 to 3 months (average 7 weeks).

Our journals have a 30% rejection rate of its submitted manuscripts, many of the papers fail on account of their substandard presentation and language (frustrating the peer reviewers).

Call for Papers

Pertanika invites you to explore frontiers from all fields of science and technology to social sciences and humanities. You may contribute your scientific work for publishing in UPM's hallmark journals either as a ***regular article***, ***short communications***, or a ***review article*** in our forthcoming issues. Papers submitted to this journal must contain original results and must not be submitted elsewhere while being evaluated for the Pertanika Journals.

Submissions in English should be accompanied by an abstract not exceeding 300 words. Your manuscript should be no more than 6,000 words or 10-12 printed pages, including notes and abstract. Submissions should conform to the Pertanika style, which is available at www.rmc.upm.edu.my/pertanika or by mail or email upon request.

Papers should be double-spaced 12 point type (Times New Roman fonts preferred). The first page should include the title of the article but no author information. Page 2 should repeat the title of the article together with the names and contact information of the corresponding author as well as all the other authors. Page 3 should contain the abstract only. Page 4 and subsequent pages should have the text - Acknowledgments - References - Tables - Legends to figures – Figures, etc.

Questions regarding submissions should only be directed to the Executive Editor, Pertanika Journals.

Remember, ***Pertanika is the resource to support you in strengthening research and research management capacity.***

An Award Winning International-Malaysian Journal

FEB. 2008

Mail your submissions to:

The Executive Editor,
Pertanika Journals,
Publication Division,
Research Management Centre (RMC),
Tower II, UPM-MTDC Technology Centre,
Universiti Putra Malaysia,
43400 UPM, Serdang, Selangor, Malaysia.

Tel: +603-8947 1622
ndeeps@admin.upm.edu.my
www.rmc.upm.edu.my/pertanika

Synthesis BACKISSUES

MARCH 2008 — Issue 20, 1st Quarter

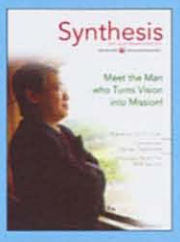
Editorial: UPM Honours its Researchers
Spotlight: What is a Citation Index?
Research Highlight: Shaping the First Class Professional

Regulars
- Periphyton-Bacterial Complex: A Novel System for Improving Water Quality and Shrimp Postlarvae Survival without Water Exchange
- DNA Vaccine for Enterovirus 71
- Converging Thermal Wave Probe a.ka. CTWaveProbe™
- A Novel Hybrid Spacecraft Attitude Control System
- Surface Plasmon Resonance Biosensor Chip for the Detection of GMOs
- New Prospective Polyurethane/ Clay Nanocomposite for Fire Retardant to Complying Sustainable Development

Research Happenings
- NATPRO 2008
- MTE 2008

Reportage
- NewsBriefs
- FactFile

JUNE 2008 — Issue 21, 2nd Quarter



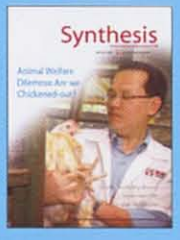
Editorial: Facts and Figures...
Spotlight: The Growing Importance of Research at Universities
Research Highlight: Meet the Man who Turns Vision into Mission!

Regulars
- Phenylalaline Ammonia Lyase, a Novel Marker for Colour in Commercial Orchids
- Harnessing a Natural Cyanide Generating System from Cassava Plant for Cancer Treatment
- An Efficient Mechanical Cell Disruptor for the Release of Hepatitis B Virus Capsid from Escherichia Coli
- Synthesis of Novel Glutamate-Zinc-Aluminium - Layered Double Hydroxide Nanobiocomposites
- Content-based Music Retrieval with N-Grams and a Music-friendly Interface

Research Happenings
- Geneva Palexpo 2008
- APC 2008
- Intellectual Property Day 2008
- I-TEX 2008

Reportage
- NewsBriefs

SEPTEMBER 2008 — Issue 22, 3rd Quarter



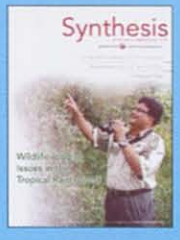
Editorial: R&D through Exhibitions!
Spotlight: Plagiarism = Kidnap
Research Highlight: Animal Welfare Dilemma: Are We Chickened-out?

Regulars
- ZeoPKC: An Additive to Control Ammonia Production in Poultry Houses
- Horseshoe Crab, a Fossil Invertebrate Cultured for the Future
- Intranasal Live-Vaccine - Alternative Concept for Control of Haemorrhagic Septicaernia in Cattle and Buffaloes
- New Distribution Records of Sergestid Shrimp, Acetes intermedius (Decapoda: Sergestidae) from Peninsular Malaysia with Notes on its Population Characteristics
- Environmental Significance of Natural Sources of Trifluoroacetic Acid (TFA)

Research Happenings
- PRPI 2008
- UPM-Elsevier Publishing Seminar 2008
- National Academic Award
- MIFB 2008
- INPEX 2008

Reportage
- NewsBriefs

DECEMBER 2008 — Issue 23, 4th Quarter



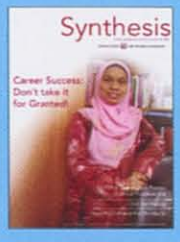
Editorial: Future Direction of Research University-Breaking the Barriers
Spotlight: Towards Internationalisation of Journals
Research Highlight: Wildlife-logging Issues in the Tropical Rain Forest

Regulars
- RNPeptiZyme: A Novel Protease for Biocatalysis in Organic Solvents
- Bioremediation of Textile Dye Polluted Water Using Xenoclean-Azo®
- Compost Tea: A Disease Management Tool for Organic Vegetable Production
- Anti-hypertension and Anti-atherogenic Herbal Tea and Functional Ingredients from Oil Palm Leaves
- The Horseshoe Crab and their Use in Human Cardiac Disorders

Research Happenings
- Down Memory Lane

Reportage
- NewsBriefs

MARCH 2009 — Issue 24, 1st Quarter



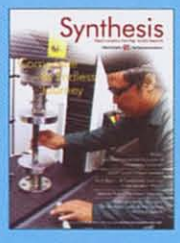
Editorial: UPM: a World Leader in New Tropical Agriculture
Spotlight: What are Peer-reviewed or Refereed Journals
Research Highlight: Career Success: Don't Take It for Granted!

Regulars
- The Effect of Magnesium Vacancies on the Intraband Scattering in MgB2 as Determined by Point Contact Andreev Reflection
- GIS for Paddy: Precision Farming
- RETECS MAPS: Real Tome Electrical Conductivity of Soil Mapping System®
- Parallel 2PB Software for Solving Larger Non Stiff ODEs
- Development of Healthy Oil and Fat Products
- Wire Mesh Collimator for Gamma Camera

Research Happenings
- Pertanika goes International

Reportage
- NewsBriefs

JUNE 2009 — Issue 25, 2nd Quarter



Editorial: Ethical Publications vs KPI...
Facts & Figures: Publication
Research Highlight: Composite - Its Endless Journey

Regulars
- PBDEs - An Environmental Pollutant of Increasing Concern
- SOAP Smart Home Systems
- *Kuih Bijan* - A Traditional Delicacy in the Modern World
- Mobile IPv6 - The Latest Network
- Understanding Microglia: The Immune Cells of the Central Nervous Systems

Research Happenings
- National Intellectual Property Day 2009
- Geneva 2009
- World *Halal* Research Summit 2009
- ITEX 2009

Reportage
- NewsBriefs

Research Management Centre
UNIVERSITI PUTRA MALAYSIA