

# Synthesis

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Magnesium Deficiency is Good for Magnesium Diboride

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Treatment of Oilfield Produced Water for Recycling and Beneficial Reuse

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Great Literary Works of the Malay Language by Raja Ali Haji of Johor-Riau in the 19<sup>th</sup> Century

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Sustainable  
Nanocoatings Surface

COATED

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- New Solar Cell Materials from Ternary Chalcogenide Compounds

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Synthesis is the only quarterly R&D&C bulletin of Universiti Putra Malaysia published in March, June, September and December. It focusses on award-winning innovations and high impact publications. It covers research happenings that emerge from the various faculties and institutes across the university and provides a brief summary of some of the important research findings by UPM. It features special topics that are of national interest in various fields and disciplines.

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

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## Letters to the Editors

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Marine ecosystems are home to various marine lives which include marine animals and plants. As a part of the largest aquatic system, the marine environment is vital for a balanced biodiversity. This leads to the notion of managing the marine ecosystems. Today, marine ecosystems are under threat due to pollution, overfishing and climate change, causing tremendous effects to the roles and functions of ecosystems. A meticulous management of marine ecosystems is regarded to be essential in need of focussing on managing marine lives' resources to ensure future sustainability of the ecosystems.

Hence, UPM initiated the Marine Science Station to help manage and conserve valuable marine ecosystems through research, training and consultation. The station is located at Lot 953 and 960, Jalan Kemang 6, Batu 7 and Lot 2438 at Batu 7 1/2, Teluk Kemang, 71050 SiRusa, Port Dickson, Negeri Sembilan. The mission of the station is to become an interdisciplinary research, teaching, training and consultation service centre in the field of science marine as well as marine and mariculture ecosystem management.

The station provides various infrastructures and facilities to assist in accomplishing the mission. Among the basic infrastructures are an administration building, a building for laboratories, a hatching complex, two semi-detached houses for researchers/guests/staff, a pump house, a campsite, generators, a sedimentation sea water tank, 4 fresh water storage tanks and a *surau*.

There will be various activities conducted at the station such as in the specialisations of (i) Science Marine - oceanography, environmental marine pollution management, marine life sciences at the Strait of Malacca; and (ii) Mariculture – marine technology, aquatic, food biotechnology and marine bioscience; as well as the (iii) development of a national referential museum for fish, aquatic plants, molluscs and crustacea at the Strait of

Malacca. The station will also conduct training activities, short courses and seminars including lectures, provide industrial training placement as well as exposure to practical training in the field and laboratory.

With the constant changing of the marine ecosystems, the Marine Science Station hopes that its mission of managing the marine ecology will not only help preserve and protect living marine resources but also create an understanding regarding the marine environment and awareness for the need to manage the marine ecosystems.

▶ Prof. Dr. Siti Shapor Siraj  
Director (Marine Science Station)

# The Management of Marine Ecosystems



# Sustainable Nanocoatings Surface

With the growing awareness of nanobiocatalysts, a new eco-friendly process is paramount for advances in bioprocess technology. The use of biocatalysts for green organic synthesis, offering clean and mild reaction conditions, provides opportunities to increase productivity, efficiency, purity and quality innovations. Furthermore, this green route may expand and diversify markets for food to agrochemicals. Modern society has become increasingly dependent on fossil resources, especially crude oil that is used not only as fuel but also as a raw material for a variety of chemicals and other commodities. We focussed on the development and application of bio-based processes for effective transformations of non-renewable substrates into useful substances. By selectively combining their molecular constituents (fatty acids, glycerol, amino acids, saccharides etc), a wide variety of specialty and fine chemicals (amides, esters, epoxides, surface-active materials, etc.) can be prepared. Each of these 'platform' chemicals stands at the apex of a cascade of transformations that will produce hundreds of commercially important materials.

Petro-based wax esters, which are derived from the compounds of dicarboxylic acid and alcohol, are one of the most important classes of valuable raw materials. These specially formulated esters are synthesised due to their relatively low cost and good balance of properties using C<sub>6</sub> straight-chain dicarboxylic acid, particularly adipic acid. The excellent properties of adipate ester such as its low toxicity, good thermal stability, low volatility and high biodegradability, make it very useful and significant for industrial and domestic purposes. Short chain adipate esters are most commonly used in manufacturing paint strippers, plasticisers, adhesives and in the coating industry. Medium chain adipate esters are frequently used as emollient esters in cosmetics, agrochemicals and pharmaceuticals. Long chain adipate esters are used as food lubricants for the functions of stability, superior lubricity, corrosion protection and excellent performance at both high and low temperatures.

In an attempt to make the process more environmentally benign, enzymatic synthesis of esters was performed in a solvent-free system. Although organic solvents provide several advantages in enzymatic reactions, their usage in industrial processes is not desirable. They are a source of volatile organic compounds (VOCs) that affect the environment and human health where their usage requires costly post-treatment actions, larger and more expensive reactors and auxiliary equipment. High

## Expert's Snapshots

Prof. Dr. Mohd Basyaruddin Abdul Rahman graduated with a Double Major – BSc degree (Hons.) in Chemistry and Computer Science (Universiti Teknologi Malaysia) and PhD in Catalysis Chemistry (University of Southampton, UK). He began his career as an academician at Universiti Putra Malaysia in 1999 and was promoted to Professorship in less than 10 years. Prof. Dr. Mohd Basyaruddin is a true multidisciplinary scientist; his expertise in Computational Catalysis encompasses broad areas from biocatalysis to structural biology. He was the Head of Department of Chemistry in the Faculty of Science, UPM and currently the Director of Structural and Synthetic Biology Research Centre, Malaysia Genome Institute. For his extraordinary contribution to the scientific and technological development in the country, he received numerous research and personal awards including the National Patent Award, the Outstanding Young Malaysian Award and was selected for the Young Scientists of World Economic Forum. His deep interests include designing novel metalloenzymes and biosolvents for industrial biocatalysis.

selectivity and volumetric productivity, improved substrates and product concentrations as well as fewer purification steps are some advantages of using solvent-free systems.

All enzymatic reactions are influenced by experimental conditions. Optimisation is an essential tool for improving the system and increasing the efficiency of the process without increasing the cost. Due to the nonlinear behaviour and complicated structures of biochemical processes, it is difficult to predict the effects of independent variables on the reaction yields. The sensitive nature of enzymes may potentially increase the complexity of the models. Response Surface Methodology (RSM) is an efficient statistical tool for optimising multiple variables to predict best performance conditions at the lowest cost and with the fewest experiments. Knowledge-based approaches such as Artificial Neural Network (ANN) are also useful tools for modelling and optimisation because of their adaptability, prediction ability and capability of coping with nonlinearity. We have conducted several optimisation studies in various esterifications using these methods.

The optimum condition found in the batch stirred tank reactor was used in a 4 L continuous reactor by considering the advantages of using continuous bioreactors as opposed to the batch mode which increased the potential for automating the process, reduced labour expenses due to automation, less non-productive time, consistent product quality and decreased toxicity risks to staff. With a substrate flow rate of 5 ml/min, the conversion was nearly constant with an average of 93% throughout the process indicating the steady state operation of the reactor. The operational stability of Novozym 435 during the process was also examined where it retained high catalytic activity even after 28 hours and the percentage conversion decreased gradually from 90% to 70% after 70 hours.

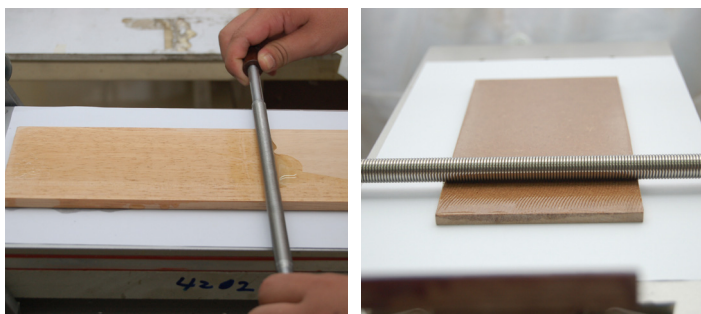
The process of developing waxes to serve as ingredients in coatings for wooden surfaces, with minimal pollutants, non-hazardous compounds and good biodegradability is seeing strong attention. The invention of wax adipate-based esters to replace acrylic-based chemicals in nanocoating formulations for various surfaces has found new potential applications for commercialisation. Our recent study focussed on the adhesion of epoxy acrylate oligomers and adipate ester (dioleoyl adipate

and di-lauryl adipate) monomers. Initially, mixtures of epoxy acrylate and ester produced a whitish coating due to difficulties in achieving stable and fine droplet emulsion of epoxy acrylate through the physical emulsion process.

New formulations were obtained for radiation coatings with colourless mixtures using Brij 30, which had a 9.7 HLB value to solve adhesion problems. The final appearance of the formulation mixture was vital because it affected the coating of the film. Brij 30 is known to have fewer polyoxyethylene chains and an average HLB value if compared to Tweens and Spans. Both factors might affect the solubilisation behaviour of this formulation. The materials of the formulation are required to be judiciously chosen, thus the characteristics of the coatings should be further enhanced.

The adipate ester, on the other hand, was mixed with polymer, surfactant and photoinitiator to undergo radiation-curing or photopolymerisation. The coated film from this formulation gave good performance with gel content exhibiting more than 90% polymerisation. The Koenig pendulum hardness test was found to have a more than 50% hardness after a few cycles of radiation curing and infrared absorption bands correlated to the depletion of the C=C group. Both of these analyses were significant to determine the effect of irradiation passes and important mechanical properties.

Interestingly, the scratch resistance, as a result of the surface coating with a film thickness of 150  $\mu\text{m}$  showed this formulation to be better than commercial or published results of up to 4.5N weight loaded. The presence of dioleil adipate improved properties of clear coatings on wood and glass surfaces. The replacement of acrylate by adipate esters, which are less toxic, was essential to meet a higher degree of safety and environmentally sustainable development.



**Figure 1:** Coatings for wooden surfaces give extra good performance especially for scratch resistance, showing better surface scratch resistance than commercial or published results of up to 4.5N weight loaded

**GOLD** UPM Invention, Research & Innovation Exhibition (PRPI 2009)

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**SILVER** Invention & New Product Exposition (INPEX 2008)

**SILVER** Agency Nuclear Malaysia (2008)

- Patent Special Award (Individual) - Malaysia Intellectual Property Right Day 2009 by MyIPO (2009)
- Champion of Product Innovation - State of Selangor (2007)



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## Reader Enquiry

Mohd. Basyaruddin Abdul Rahman

Department of Chemistry, Faculty of Science,  
Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.  
Tel: +603-8946 6798 E-mail: [basya@science.upm.edu.my](mailto:basya@science.upm.edu.my)



# Molecular Networks Involved in Mouse Cerebral Corticogenesis and Spatio-temporal Regulation of Sox4 and Sox11 Novel Antisense Transcripts

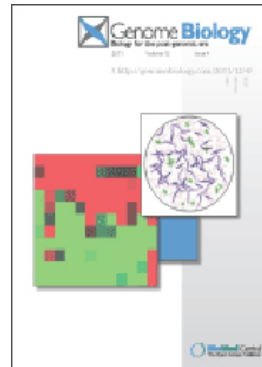
**B**rain development comprises a series of complex events that are carefully governed by the imprinted information stored in our genome known as deoxyribonucleic acid or DNA. This information is stored in a specific format called gene. Genes are read by specialised machineries found in our cell into a comprehensible format known as messenger ribonucleic acids or mRNAs. From each specific mRNA, a final product known as protein is produced. Combinatorial effects of many proteins and their communications with one and another can affect how our cells behave during cell growth, division, and senescence as well as how they respond to the environment. When a protein is present in a level more or less than what is needed, it will distort the regular communication between itself and other proteins in the cell which will cause the cell to behave differently as a compromising measurement or undergo

**Impact Factor: 6.15**

stress. When a pool of cells remains in a compromised or stressful environment for too long, the cells may lead to the development of abnormal characteristics, known as disease.

Distorted communications between proteins have been proposed as the cause of various mental health conditions including a varied spectrum of mental disabilities especially in patients diagnosed with autism, schizophrenia, Down's syndrome or Alzheimer's disease. Since mouse and human share about 85% of imprinted information and undergo almost identical brain developmental stages, we, therefore, studied the mouse brain obtained from various developmental stages to resemble the human brain during the first trimester, third trimester, after birth as well as at senescence. In the analysis, we compared and noted all the changes of the amount as well as type of mRNAs found in each stage of the brain development and used them to infer the underlying communicational networks at the protein level.

From our observations, we outlined a benchmark for network comparison between the normal and abnormal brain development conditions. We identified 70 mRNAs/proteins and groups of novel RNAs that did not bear any comprehensible information for the production of any proteins. These mRNAs or novel RNAs were produced in brains of specific developmental stages. Some were



Title : Molecular Networks Involved in Mouse Cerebral Corticogenesis and Spatio-temporal Regulation of Sox4 and Sox11 Novel Antisense Transcripts Revealed by Transcriptome Profiling  
 Author : K. H. Ling, C. A. Hewitt, T. Beissbarth, L. Hyde, K. Banerjee, **P. S. Cheah**, P. Z. Cannon, C. N. Hahn, P. Q. Thomas, G. K. Smyth, S. S. Tan, T. Thomas and H. S. Scott  
 Journal : Genome Biology  
 Volume : 10  
 Issue : 10  
 Page : R104

produced only in the embryonic brain and in the brain of newborns, some were found in the senescence brain and some were in all stages. These findings will improve our understanding on the type of underlying communicational networks during brain development and will serve as a landmark for future evaluation of brains with abnormalities due to unusual developmental pathways.

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Reader Enquiry  
 Cheah Pike See

Department of Human Anatomy, Faculty of Medicine and Health Sciences,  
 Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.

Tel: +603-8947 2355

E-mail: pscheah@medic.upm.edu.my; cheahpikese@yahoo.com

Title : Structural and Superconducting Property Variations with Nominal Mg Non-stoichiometry in  $\text{Mg}_x\text{B}_2$  and Its Enhancement of Upper Critical Field

Author : **S. K. Chen**, A. Serquis, G. Serrano, K. A. Yates, M. G. Blamire, D. Guthrie, J. Cooper, H. Wang, S. Margadonna and J. L. MacManus-Driscoll

Journal : *Advanced Functional Materials*

Volume : 18

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# Magnesium Deficiency is Good for Magnesium Diboride

In nominally pure Magnesium Diboride ( $\text{MgB}_2$ ) samples, there have been surprising discrepancies in the reported values of magnetic field dependence of critical current density,  $J_c$ , upper critical field,  $H_{c2}$  and irreversibility field,  $H_{irr}$  values. The latter two are the lower limits to determine the suitability of a material for application in a particular range of applied magnetic fields before losing their superconducting properties. To kick start the investigation, a series of samples were made by reacting powders in the nominal Mg:B ratio of  $x:2$  ( $x = 0.95 - 1.5$ ). In order to provide a clear picture of the changes in properties as a result of variation in nominal Mg-stoichiometry, a series of complementary physical characterisation measurements were applied.

As shown in **Figure 1**, the  $H_{c2}$  and  $H_{irr}$  values extrapolated at 4.2 K were around 21 T and 12.5 T respectively for the  $x = 1.0$  sample indicating that control of Mg content appeared to be beneficial in the same way as external doping. For the  $x = 1.5$  sample, the corresponding 4.2 K values were lower, at around 17 T and 10 T respectively.

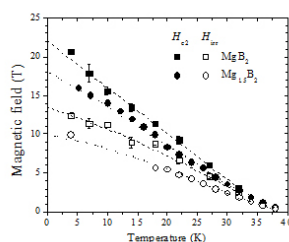
## Impact Factor: 6.78

The  $H(T)$  curves for the  $x = 1.0$  sample were at the very upper-bound of values reported previously for pristine  $\text{MgB}_2$  while those for the  $x = 1.5$  sample were at the very lower bound, which confirmed the strong role of nominal Mg-stoichiometry in controlling  $H_{c2}/H_{irr}$ .

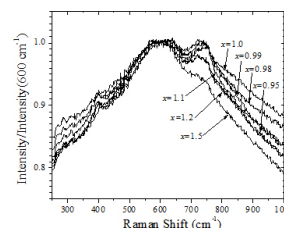
A Raman microscopy measurement was carried out to determine the structural origin of the increased intragranular scattering and enhanced superconducting properties of samples prepared in nominal Mg-deficient environments. **Figure 2** shows the Raman spectra obtained across the sample series with intensities normalised to the intensity of  $600\text{ cm}^{-1}$  peak. The broad, asymmetric peak centred at around  $600\text{ cm}^{-1}$  dominated the Raman spectrum of  $\text{MgB}_2$  and had been ascribed to the  $E_{2g}$  mode. In addition to the peak at  $600\text{ cm}^{-1}$ , two shoulders could clearly be seen at around  $400\text{ cm}^{-1}$  and  $730\text{ cm}^{-1}$ .

To summarise, this study reveals that nominally Mg-deficient samples showed superior  $H_{c2}/H_{irr}(T)$  over samples prepared in a Mg excess environment. As shown by the transport measurements, the enhanced physical

properties coincided with the increased structural disorder because of Mg deficiency as evidenced from the Raman spectroscopy data. With that, extrinsic chemical doping and manipulating Mg stoichiometry are equally crucial for improving the electromagnetic properties of  $\text{MgB}_2$  so as to warrant this material for a wider range of applications.



**Figure 1:** The obtained  $H_{irr}$  and  $H_{c2}$  values versus temperature ratings



**Figure 2:** Raman spectra (normalised value)

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## Reader Enquiry

Chen Soo Kien

Department of Physics, Faculty of Science,  
Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.

Tel: +603-8946 6668

E-mail: skchen@science.upm.edu.my



# Great Literary Works of the Malay Language by Raja Ali Haji of Johor-Riau in the 19<sup>th</sup> Century

The accumulation and transmission of knowledge and wisdom of a community are made possible by the creation of a writing system which is prerequisite to the growth and development of a civilisation. Literary works are considered to be one of the main components of a civilisation.

This study focusses on great literary works in the Malay world, specifically two pioneering works of the Malay language by Raja Ali Haji of Johor-Riau, a giant literary figure in the Malay world in the second half of the 19<sup>th</sup> Century, which are the *Bustan al-Katibin* and the *Kitab Pengetahuan Bahasa*.

In Malaysia, publication of great works were initiated by the Yayasan Karyawan Sdn. Bhd. which was established in 1992 where so far, 16 works have been published as *Siri Karya Agung Melayu* (Series of Great Works of the Malay Language) including the two works by Raja Ali Haji, the *Bustan al-Katibin* written in 1850 and *Kitab Pengetahuan Bahasa* written in 1858 but published in 1927. In the present study, transliteration from Jawi script, annotation and textual analysis were conducted on the two works. These two works, one in the form of a manuscript (*Bustan al-Katibin*) and the other in the form of a lithographic printing (*Kitab Pengetahuan Bahasa*), were selected to be published as Series of Great Works of the Malay Language or *Siri Karya Agung* in the Malay literary world by the virtue of the fact that they were the first two works of the Malay language written by a Malay scholar. Both had also become the first standard textbooks of the Malay language used in the early Malay schools and madrasah(s). *Bustan al-Katibin* is a short description of the Malay language grammar, spelling system and method of letter writing which is used as a guide in learning and in the usage of the Malay language. *Kitab Pengetahuan Bahasa*, on the other hand, is a monolingual dictionary cum encyclopedia of the Malay language used in Johor, Singapore, Riau, Lingga and Pahang. These two works were used in Malay schools and madrasah(s) in Johore, Riau and Singapore as the first standard school textbooks of the Malay language. They became the direct factors in establishing and developing literacy in the Malay community and acted as catalysts to the flowering of the earliest literary tradition in the Malay world in Johor, Singapore and Riau.

Raja Ali Haji himself wrote not less than 12 major works, while his contemporaries and proceeding writers produced about 60 works. Pioneer writers in the early modern Malay literary period such as Syed Sheikh al-Hadi and Sheikh Tahir Jalaluddin were associated with these literary centres.

In short, the two pioneering works of the Malay language by Raja Ali Haji have become an important milestone with regard to the literary development among the Malays which left an inedible mark in its history, and undoubtedly constituted in the precious legacy as great literary works in the Malay civilisation.

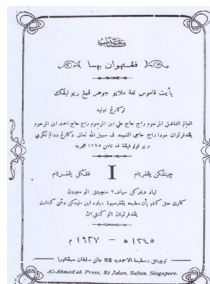


Figure 1: An image of *Kitab Pengetahuan Bahasa*



Figure 2: Images of *Bustan al-Katibin*

- GOLD** UPM Invention, Research & Innovation Exhibition (PRPI 2008)
- SILVER** International Exposition of Research and Inventions of Institutions of Higher Learning (PECIPTA 2009)

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Reader Enquiry  
Hashim Musa

Department of Malay Language, Faculty of Modern Languages and Communication,  
Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.  
Tel: +603-8946 8937 E-mail: hasyim@fbmk.upm.edu.my



# Shortcut and Rapid Protocol of Isolating and Developing DNA Microsatellite Markers for River Catfish

This invention focusses on the process of isolating and developing co-dominant DNA markers of single locus microsatellites for the river catfish (ikan baung), *Mystus nemurus*, by utilising Random Amplified Microsatellites (RAMs). A series of new degenerate anchored primers of di-, tri-, and tetranucleotide repeats have been designed which contained a microsatellite motif at the 3' end and three or more non-repetitive bases at the 5' end of a microsatellite.

The shortcut protocol begins with DNA extraction and PCR amplification by the RAMs primers where genomic DNA was extracted from a single *Mystus nemurus* blood sample. PCR amplification of the extracted DNA was carried out using the designed RAMs primers. Next, fresh PCR amplicons of RAMs primers were cloned into a pCR<sup>®</sup>2.1-TOPO<sup>®</sup> vector using a TOPO TA Cloning Kit (Invitrogen, USA). Positive clones that contained an inserted PCR amplicon were grown in a LB agar plate and selected through blue-white selection strategy. All the identified positive clones were cultured separately in a LB medium (5 mL) containing ampicillin (50 µg/mL) in a 15 mL Falcon tube. Major portions of the cultured clones were stored at -80°C as stock with 15% glycerol content. The remaining culture was centrifuged and the pellet was re-suspended in 100 µL of de-ionised distilled water. The mixture was then subjected to heating and centrifugation. The supernatant contained crude plasmid DNA and was ready for discriminatory screening of positive clones.

Insertion sizes of all the positive clones were subsequently checked by PCR amplification using M13 Forward (-20) and M13 Reverse primer with the crude plasmid DNA prepared in the previous step as a template. The PCR products were electrophoresed on a 2% agarose gel stained with ethidium bromide and visualised under UV light. Positive clones with different amplicon sizes were selected for automated DNA sequencing. In the final stage, the desired clones were regrown from the stock in the LB agar (Pronasida, USA) plates followed by the LB medium (Pronasida, USA). Unique DNA sequences containing microsatellites were submitted online to GenBank (<http://www.ncbi.nlm.nih.gov/>).

This newly developed method is capable of screening large amounts of positive clones without introducing false positive clones. Besides, screening time for positive clones has been reduced dramatically with accuracy reaching 100%. Contrary to other methods, the current method eliminates the use of hazardous reagents such as radioactive isotopes and toxic chemical of fluorescence-

labelled oligonucleotide.



**Figure 1:** A river catfish (ikan baung) or *Mystus nemurus*

**GOLD** British Invention Show (BIS)

**SILVER** UPM Invention, Research & Innovation Exhibition (PRPI 2008)

**SILVER** UPM Invention, Research & Innovation Exhibition (PRPI 2002)

**BRONZE** 3<sup>rd</sup> International Biotechnology Trade Exhibition, Conference & Awards

**BRONZE** Malaysian Technology Expo (MTE)

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## Reader Enquiry

Siti Shapor Siraj

Department of Aquaculture, Faculty of Agriculture,  
Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.  
Tel: +603-8946 4109 E-mail: shapor@putra.upm.edu.my



# UPM'S Award Winning Products and Innovations



Mr. Bakri Bakar explaining his invention – “SRAS-Self Retaining Anal Speculum” to two interested judges.



Assoc. Prof. Dr. Mohd. Yunus Abd. Shukor explaining his invention - “Multiple Xenoassay Kit for detecting Environmental Toxicants” to one of the judges.



Assoc. Prof. Dr. Mohd. Yunus Abd. Shukor (right) and Mr. Bakri Bakar with their inventions and medals.

## UPM Wins A Special Award and Three Gold Medals at BioMalaysia



Prof. Dato' Dr. Yaakob Che Man (middle) receiving a Special Award at the International BioMalaysia Exhibition 2010.

## UPM Wins Two Gold Medals at IENA



Assoc. Prof. Dr. Jayakaran Mukundan and Prof. Ir. Dr. Barkawi Sahari with their medals and certificates.

# R&D&C HAPPENINGS

## UPM Wins 3 Gold and 2 Silver in INNOVA, Belgium



From left: Dr. Siti Salwa Abd Gani, Dr. Rosnah Shamsudin, Prof. Dr. Abdul Halim Shaari, Prof. Dr. Taufiq Yap Yun Hin and Assoc. Prof. Dr. Abdul Rashid Mohamed Shariff.



Prof. Dr. Abdul Halim Shaari with his Special Award from Romania.

## Research Activities on Campus Grounds



A research project by the Faculty of Engineering, UPM and ITA International in placing three wind turbines with different capacities (300W, 1,500W and 3,000W).



Participants concentrating on one of the topics discussed during the International Conference on Food Research held by the Faculty of Food Science and Technology, Universiti Putra Malaysia (UPM).



The collaboration between Universiti Putra Malaysia (UPM) and the University of Natural Resources and Life Sciences, Vienna (BOKU), Austria involving areas on agriculture, forestry, economics and management, food science, environmental studies and biotechnology.

**AGREX'10 TO BOOST AGRICULTURAL PRODUCTIVITY**

The International Conference on Agricultural Extension 2010 (AGREX'10) was held recently at the Palm Garden Hotel, IOI Resort Putrajaya as a platform to raise public awareness on the importance of development activities to promote agriculture. With the theme 'Empowerment of Agri-food Stakeholders in Facing Global Challenges towards Sustainability', this biannual international event is aimed to provide positive impact on the development of the agricultural sector.



Deputy Minister of Higher Education Minister, Dato' Saifuddin Abdullah giving his speech.

The conference was officiated by Deputy Minister of Higher Education, Dato' Saifuddin Abdullah, and attended by 250 participants from within and outside the country.

"In addition to the purpose of gathering experts, academicians, policy makers, researchers and industry members, groups or individuals, AGREX'10 is a platform for participants to share ideas and experiences in developing the agricultural sector to compete in the marketplace," said Dato' Saifuddin.

The conference was organised by the Centre for Extension, Entrepreneurship and Professional Advancement (APEEC), Universiti Putra Malaysia (UPM) in collaboration with the University Agriculture Park and the Faculty of Agriculture. APEEC's Director, Assoc. Prof. Dr. Musa Abu Hassan said he is committed



Dato' Saifuddin Abdullah officiating the conference while Prof. Dr. Tai Shzee Yew, Deputy Vice-Chancellor (Industry and Community Relations) looks on.

to hold such a prestigious conference to strengthen the local agricultural development in the face of global competition. He added that the conference would provide incentives for local farmers to adopt the latest technology in agriculture which will then be followed by the application of modern crops cultivation techniques.



Dato' Saifuddin Abdullah meeting up with some participants of the conference.

**UNIVERSITIES AND THE PRIVATE SECTOR AGREE ON FOOD SECURITY POLICY**

Universities and the private sector including those involved in the food industry need to cooperate with government agencies in order to ensure that a food security policy can be achieved.

The Minister for Science, Technology and Innovation, Datuk Seri Dr. Maximus Ongkili said these parties play an important role to help the government to prepare for the coming local and global food crisis. "The ministry will continue to provide support to accelerate the development of biotechnology and information technology to transform as well as increase the added value of the agriculture sector in the future," he said during the launch of the International Conference on Food Research held by the Faculty of Food Science and Technology, Universiti Putra Malaysia (UPM).

Various approaches are applied in order to develop more research and development centres, innovation centres and tissue banks whereas the biotechnology field is widened in order to transform the



The Vice Chancellor of UPM, Prof. Datuk Dr. Nik Mustapha (middle) presenting a token of appreciation to the Minister for Science, Technology and Innovation, Datuk Seri Dr. Maximus Ongkili.

Meanwhile, the Vice Chancellor of UPM, Prof. Tan Sri Datuk Dr. Nik Mustapha R. Abdullah noted that the conference aims to provide a platform for idea sharing among researchers and food experts to produce highly durable food. "As a Research University, this conference will provide a new network of researchers and agencies to invent technologies that can be utilised by the community," he said.

agriculture sector in addition to ensuring the country's food supply is guaranteed. "We need to strengthen the technology in the agricultural industry to consolidate the position of the food industry with the aim of increasing food resources," he said.



The Minister for Science, Technology and Innovation, Datuk Seri Dr. Maximus Ongkili together with the Vice Chancellor of UPM meeting the conference participants.

**UPM HOSTS SEMINAR AND WORKSHOP TO OVERCOME INFECTIOUS DISEASES**

The Department of Medical Microbiology and Parasitology, Faculty of Medicine and Health Sciences (FPSK) Universiti Putra Malaysia (UPM) organised a seminar and workshop to discuss various aspects of tropical diseases. The seminar and workshop with its theme, "Global Issues and Directions of Tropical Diseases" discussed numerous aspects regarding tropical diseases including dengue by focussing on its current developments, immediate preventive measures and infections caused by viruses and bacteria.



A speaker answering questions during the National Infectious Diseases Seminar and Workshop 2010.

One of the organisers and a physician microbiologist of UPM, Dr. Leslie Than Lay Thiam said that participants have the opportunity to increase their understanding and expertise in theory before they put them into practice. "Most of the non-academic participants are individuals who work in laboratories and are responsible in identifying patients who might be suffering from infections," he noted during the seminar and workshop.

There were about 100 participants comprised of students, lecturers, hospital staff and civilians who participated in the seminar and workshop that lasted for three days. The workshop was held at the Main Lecture Hall of FPSK.



The Deputy Secretary (Science Services) of the Ministry of Science, Technology and Innovation (MOSTI), Datin Paduka Prof. Dr. Khatijah Mohd Yusoff (4<sup>th</sup> from left) attends the opening ceremony of the seminar and workshop organised by FPSK.

## UPM-ITA INKS MoU ON WIND TURBINE RESEARCH

The Faculty of Engineering, Universiti Putra Malaysia (UPM) and ITA International will conduct a research project on the equipment for wind and solar hybrid turbine system to collect and analyse data in order to test power generation efficiency. ITA will place three wind turbines with the capacity of 300W, 1500W and 3000W, alongside 12 solar panels at a selected area in UPM.



A firm handshake to seal the MoU with Prof. Ir. Dr. Mohd. Saleh Jaafar, the Dean of the Faculty of Engineering (extreme left) overseeing the MoU.

The Minister of Energy, Water and Communications Technology, Dato' Sri Peter Chin Fah Kui noted that green technology plays an important role for the country's development and to drive the economy through an implementation of green economy in the energy, manufacturing, service and transportation sector. "Institutions of Higher Learning (IHL) should strengthen the platform for green technology so that the research outcome will foster rapid development of green technology industries. The Ministry encourages collaboration among private and public institutions of higher learning

to conduct this technology. The alliance between UPM and ITA is in accordance with the basic theme of green technology," he said during the signing of MoU between UPM and ITA International.

Meanwhile, the Deputy Vice Chancellor (Research and Innovation), UPM, Prof. Dato' Dr. Abu Bakar Salleh said the project will be implemented at the new Graduate School of Management Complex and will study the optimum effect on the resulting power generation as well as utility cost savings. "The system is expected to be a source of reference for green technology by students and researchers within and outside the state," he said. ITA International is a local company that has a strategic relationship with Solytech Corporation, Taiwan in green technology, solar service, wind turbine and LED lights.



The Minister of Energy, Water and Communications Technology, Dato' Sri Peter Chin Fah Kui (left) with the Deputy Vice Chancellor (Research and Innovation), Prof. Dato' Dr. Abu Bakar Salleh (right).

## UPM-BOKU SEALS RESEARCH COLLABORATION ON NATURAL RESOURCES AND LIFE SCIENCES

Universiti Putra Malaysia (UPM) and the University of Natural Resources and Life Sciences, Vienna (BOKU), Austria collaborated in the field of research focussing on natural resources and life sciences.

The collaboration between the two universities involved areas such as agriculture, forestry, economics and management, food science, environmental studies and biotechnology. The collaborative partnership also included the exchange of graduate students (PhD and Master's degree) as well as members of the faculties and research specialists.

BOKU believed that the existing relations between the two universities



Prof. Tan Sri Datuk Dr. Nik Mustapha R. Abdullah, the Vice Chancellor of UPM (left) signs the MoU with Prof. Dr. Dietmar Haltrich (right) as witnessed by the President of Austria, Dr. Heinz Fischer (centre).



The Vice Chancellor of UPM, Prof. Tan Sri Datuk Dr. Nik Mustapha R. Abdullah (right) presents a token of appreciation to the President of Austria, Dr. Heinz Fischer (left).

taught in English and are available for international students.

The inked MoU between Malaysia and Austria was witnessed by the President of Austria, Dr. Heinz Fischer who was on a three-day official visit to Malaysia.

## AN MoU TO STUDY THE EFFICIENCY OF PV SYSTEMS IN GENERATING ELECTRICITY

The Faculty of Engineering, Universiti Putra Malaysia (UPM) and Sichuan Zhonghan Solar Power (SZSP) inked a research collaboration to measure the performance of three types of photovoltaic (PV) systems and to review the suitability of the systems to generate electrical energy optimally according to the weather conditions in the country.

The PV systems supplied by SZSP, a China-based company, include a concentrated PV unit, two PV units with a reflector and one flat panel PV unit using solar cells that convert solar energy into



A handshake between the Deputy Vice Chancellor (Research and Innovation), Prof. Dato' Dr. Abu Bakar Salleh and Assistant General Manager of SZSP, Hong Jiang Shu to seal the MoU, as witnessed by the Chairman of UPM Board of Directors, Prof. Emeritus Tan Sri Dato' Dr. Syed Jalaluddin Syed Salim and the Dean of Faculty of Engineering, Prof. Ir. Dr. Saleh Jaafar.



A discussion on a green and renewable energy.

electrical energy.

The Head of Department of Electrical and Electronic Engineering, Dr. Hizam Hashim said that the PV systems will be placed in a suitable location and the electricity generated will be applied to buildings in the area. "We will measure the PV systems

for three months in terms of efficiency and optimised power generation according to the weather conditions in Malaysia," he added during the signing of the memorandum of understanding (MoU) between UPM and SZSP.

The MoU was signed by Deputy Vice Chancellor (Research and Innovation), Prof. Dato' Dr. Abu Bakar Salleh and SZSP's Assistant General Manager, Hong Jiang Shu. The signing ceremony was witnessed by the Chairman of UPM Board of Directors, Prof. Emeritus Tan Sri Dato' Dr. Syed Jalaluddin Syed Salim. Prof. Dato' Dr. Abu Bakar Salleh commented that the MoU is part of UPM's serious effort to practice green renewable energy in order to reduce the amount of carbon pollution.



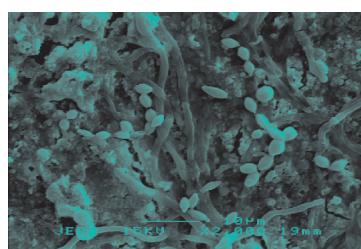
# Treatment of Oilfield Produced Water for Recycling and Beneficial Reuse

The significance of oil and natural gas in modern civilisation is well known. Nevertheless, like most production activities, oil and gas production processes generate large volumes of liquid waste. Oil and gas field wastewater or produced water is the largest waste stream generated in oil and gas industries. Globally produced water production is estimated at around 250 million barrels per day. It is a mixture of different organic and inorganic compounds. The major organic matters in produced water are: dissolved and dispersed oil compounds, dissolved formation minerals, production chemical compounds and production solids as well as salt concentration of produced water which varies over a wide range (1–300,000 mg/L). Due to the increasing volume of waste all over the world in the current decade, the outcome and effect of discharging produced water on the environment has lately become a significant issue of environmental concern. In addition, fresh water scarcity and sustainable water supply are serious problems all over the world because of population growth and expansion of industrial activities. These problems are major concerns in arid areas. Therefore, there is a growing impetus for sanitary and industrial wastewater recycling and reuse. Produced water is a potential resource for recovery, reuse and recycling.

In this research, treatment of produced water with a combined biological and membrane system was studied (MBR). Usual microorganisms cannot survive in hypersaline conditions of the produced water, hence local halophilic microorganisms were isolated and seeded in the MBR. Ultrafilter membranes were used for retention of microorganisms in the biological unit and reverse osmosis (RO) membranes were used for desalination of the MBR permeate (MBR/RO). The efficiency of the MBR at different operating conditions such as the organic loading as well as salinity and hydraulic residence time were investigated.

It was found that the isolated halophilic microorganisms played an important role in the biodegradation of the pollutants at different salinities and that membrane separation was required for ensuring a stable permeate quality. The salinity was able to affect the biodegradation rate of hydrocarbons in the bioreactor, but variations of effluent characteristics were not significant. The treated water from the MBR was found to be suitable for reinjection to oil wells to enhance oil recovery and the MSBR/RO effluent quality is acceptable for irrigation, livestock watering, cooling water systems, boiler feed

water and different industrial applications. It is thus feasible to treat the produced water using the MBR and MBR/RO system where the product quality meets the requirements for discharge and reuse. Although the produced water is a complex mixture of different contaminations, the results showed that by using suitable and effective technologies, it can be treated for various reclamation and reuse options.



**Figure 1:** SEM image of a consortium of halophilic microorganisms used for treatment of produced water

- GOLD** *British Invention Show (BIS 2009)*
- SILVER** *20<sup>th</sup> International Invention, Innovation and Technology Exhibition, Kuala Lumpur, Malaysia, (ITEX 2009)*
- SILVER** *UPM Invention, Research & Innovation Exhibition (PRPI 2007)*
- PATENT** *A Process for Treating Wastewater. Patent Pending Number, PCT/MY2008/000070 (2008)*

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## Reader Enquiry

Fakhru'l-Razi Ahmadun

Institute of Advanced Technology (ITMA),  
Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.  
Tel: +603-8946 7531/6304 E-mail: fakhru@eng.upm.edu.my



# Formulation of Tropical Lignocellulose *Kenaf* Fibre Compound for Malaysian Cars

The research effort initiative of having lighter car body components has started since the beginning of the car industry. The End of Life of Vehicles (ELV) stated that by 2015, vehicles must be made of 95% recyclable materials in which 85% can be recovered through reuse or mechanical recycling and 10% through energy recovery or thermal recycling.

The use of biodegradable and environmental-friendly plant-based lignocellulosic fibres as fillers or reinforcement agents in engineering polymers is a natural choice to make them 'greener'. The availability of inexpensive natural fibres in every part of the world has, in part, fuelled their usage in the past few years. These fibres are nonabrasive to processing equipment and carbon neutral when burned besides being able to be incinerated and cost less. The hollow tubular structure of the natural fibres also reduces their bulk density and makes them lightweight.

Reinforcing plastic with natural fibres is already a well-established approach to obtain special composites with useful properties. One of the celebrated constituents of natural fibres which reinforced plastic composites in Malaysia is the *kenaf* fibre. The research of *kenaf* plastic composite is growing tremendously along with the plastic industry's high demand for it to produce petroleum-based materials. *Kenaf* long fibre plastic composite can be used for a wide variety of applications if the properties are found to be comparable to existing synthesis composites. Since *kenaf* is always available in long fibre form, the mechanical properties found can be of use in many industrial applications such as insulator seals. Besides that, *kenaf* fibre can also be processed into short fibres and used as biocomposite pellets in mould processing of automotive components.

In UPM, researchers of the Laboratory of Biocomposite Technology made an attempt to produce a biocomposite formulation compound for Malaysian car parts especially for door components. For instance, door trims, door handles and door switches. In addition, another inner automotive component that applied the biocomposite pellet formulation was the back panel and rear view mirror frame. The research activities involved were first, the processing of *kenaf* fibre, and then mixing a right formulation of biocomposite pellet and finally manufacturing using injection moulding and a thermoforming machine. Experimental results showed great improvement in the flexural test and impact test with an average of 10.2% and 15.4% respectively compared to pure plastic resin. Moreover, plastic manufacturers

commented that those parts have less manufacturing defects and *kenaf* composite showed a reduction in density and a subsequently lighter overall weight.



**Figure 1:** Examples of car door handles from *kenaf* fibre

**GOLD** British Innovation & Technology Show (2009)

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

**BRONZE** International Invention, Innovation and Technology Exhibition (ITEX 2007)

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Reader Enquiry  
Khalina Abdan

Department of Biological and Agriculture Engineering, Faculty of Engineering,  
Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.  
Tel: +603-8946 6420 E-mail: khalina@eng.upm.edu.my



# UPM-MTDC SYMBIOSIS™ Aims to Produce 20 UPM Technology Entrepreneurs

The Innovation and Commercialisation Centre (ICC), UPM in a joint collaboration with the Malaysian Technology Development Corporation (MTDC) organised a UPM-MTDC Symbiosis™ programme to produce 20 entrepreneurs who will be commercialising 10 research products of UPM. The programme will develop 10 new technology and innovation based companies to achieve the commercialisation of UPM's research products.

The programme which received mandate and support funds from the Malaysian Ministry of Higher Education, aims to instil entrepreneurial skills among graduates who are interested in commercialisation activities besides guiding them of the ways to market the products. The UPM-MTDC Symbiosis™ programme, an initiative of MTDC and ICC, intends to produce independent, competitive and knowledgeable human capital especially for UPM graduates. MTDC's Director of Incubation and Nurturing, Mr. Muhd Shaman Bakar hopes that the success of this programme will be a benchmark for other universities to increase their R & D commercialisation activities in Malaysia.

The programme was participated by 24 participants who had overcome the earlier phase and underwent the induction course on the 21 until 24 November 2010 in Hotel Equatorial, Bangi. The participants were then introduced to the concepts and practices in commercialisation processes, as well as

attended the entrepreneurship course and team building programme to enhance their motivation and team work spirit before they encounter with the real business world.

The Deputy Director (Commercialisation) of ICC, Dr. Seri Intan Mokhtar, who was Head Facilitator for the induction course, emphasised that a deep understanding from the participants regarding the technologies which are to be commercialised is utmost important and cooperation between the participants and technology inventors should be further enhanced.

Two researchers of UPM, Prof. Dr. Maznah Ismail and Prof. Dr. Suhaila Mohamad spent time with the participants during the team building programme conducted at the Endau Rompin National Park for 3 days starting from 24 until 27 November 2010. The Vice Chancellor of UPM, Prof. Tan Sri Dr. Nik Mustapha R. Abdullah attended the closing ceremony of the training session on 24 December 2010 at the same venue before the participants were given a time frame to prepare business plans to commercialise selected technologies.

20 best participants who fulfill the determined criteria will be given the opportunity to start their own companies and businesses in one of the incubation technology centres under MTDC. These future entrepreneurs will continue to receive assistance, funds and guidance to ensure the success of the commercialisation processes. MTDC plans to launch the programme officially in the middle of February 2011.



Director of Malaysian Technology Development Corporation's (MTDC) Incubation and Nurturing Division, Mr. Muhd Shaman Bakar delivering his speech during the induction course opening ceremony.



Participants having a group discussion.

## Reader Enquiry

Asrizam Esam

Commercialisation Division, Innovation and Commercialisation Centre,  
Deputy Vice Chancellor (Research and Innovation), Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.  
Tel: +603-8947 1294 E-mail: [asrizam@icc.upm.edu.my](mailto:asrizam@icc.upm.edu.my)

# Pertanika

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JTAS is devoted to the publication of original papers and serves as a forum to discuss practical approaches to improve 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.

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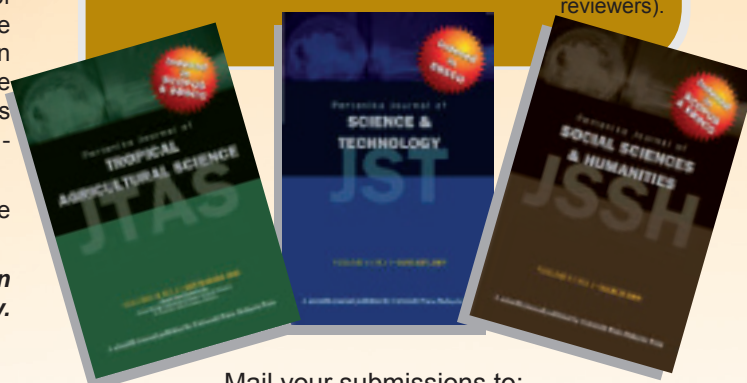
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Universiti Putra Malaysia,  
43400 UPM, Serdang, Selangor, Malaysia.

Tel: +603-8947 1622  
[ndeeps@admin.upm.edu.my](mailto:ndeeps@admin.upm.edu.my)  
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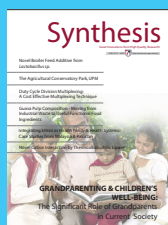
#### R&D&C Happenings

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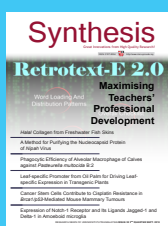
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