

Synthesis

where great innovations come to life

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Meet the Man who Turns Vision into Mission!

Commercial Orchids

Cassava for
Cancer Treatment

Encoding Music for
MIR System

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

Synthesis is the first and only quarterly R&D digest at Universiti Putra Malaysia published in March, June, September and December with the focus on award-winning innovations. 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 study 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 on 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 Research Management Centre. It is available free of charge to the academic community.

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Letters to the Editor

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 Managing Editor, *Synthesis*, Publication Unit, Research Management Centre, 4th Floor, Administration Building, 43400 UPM, Serdang, Selangor, Malaysia or via the Internet to ndeeps@admin.upm.edu.my. The editor reserves the right to edit articles for clarity and space before publication.

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Editorial

Facts and Figures


Facts and Figures are essential in providing a tool to measure the performance of institutions and individuals. In any organisation, the collection of Facts and Figures has formed a sky-high challenge to the responsible entity. For that particular reason, Research Management Centre (RMC) is honoured to be given the baton by the University to face this tough challenge.

The wave of Research University (RU) has continuously penetrated UPM since 2005. Owing to the determination of UPM to submit the application, a giant-wave was formed that changed the landscape of UPM by the announcement of UPM as one of the RU's on 16 November 2006. UPM now has elevated itself to a higher rank in the country and to maintain the status of RU is the next challenge. Believe it or not, we still need to face the upcoming RU Audit which is expected to happen in the year of 2010.

Facts and Figures are part of the auditing exercises by the appointed panel to assess the performance of RU-status universities. In UPM, the Deputy Vice Chancellor (Research and Innovation) is a frequent flyer to all the relevant entities to highlight the importance of gathering Facts and Figures. RMC has initiated the idea of having an internal RU audit which was initially proposed by the DVC himself. So far, he has never missed a trip to all the relevant entities. On the highlight, University's determination on maintaining our RU-status never fades away and significant incentives have been announced to stimulate the 'Excellent Research Culture' in our campus.

Pseudo historically, the academicians are getting familiar with the term "Call for Supporting Documents". The traditional way of distributing letters and asking them to respond seems no longer an effective method in gathering Facts and Figures. Thus, an innovative method is highly needed to resolve this 'epidemic' scenario.

Living in a modern era, the advantage of ICT must be fully utilised to increase the efficiency of managing Facts and Figures in any organisation. UPM has embraced this challenge by supporting the development of UPM Knowledge Management (KM) Portal. The system is capable of capturing and disseminating knowledge and has been perceived as the 'most popular' system in the first-half year of 2007. The UPM KM Portal system has been exploited as the vehicle to transport Facts and Figures in the university. Now, the digital warehouse has been loaded with thousands of documents that are waiting to be mined and digested. Therefore, let us keep updating the system with the current Facts and Figures.

The university is grateful to all academic members for their tremendous support in assisting university in the process of gathering Facts and Figures. Our hope now, it is a 'culture'... 

Mohd Adzir Mahdi



mdadzir@eng.upm.edu.my



Spotlight

The growing importance of research at Universities

Over the past decade most public universities in Malaysia have undergone and continue to undergo considerable change. The major alteration has been that they are gradually becoming more academic as institutions. One result of this reform has been the increase in number of research grants allocated to most universities by the government, and subsequent research outputs (research publications, research products and patents etc), the universities have produced.

The process of academisation has resulted in changes among the faculty at these institutions. In the past, educators had only to possess a Master's degree to be a qualified lecturer. The trend today is to hire more lecturers who have a PhD degree.


The existence of several universities opened new professional opportunities for a growing number of highly qualified and well trained academics who could not find positions within the limited number of universities, did not get tenured or were not interested in a "publish or perish" environment. Whilst the major purpose of educational research may be to improve and inform practice, it carries a subsidiary career-related purpose for the academic community. It is a well-known fact that successful research is important in faculty evaluation, and it is difficult for someone to achieve tenure if he or she does not publish. As part of this changing landscape, all faculty members should engage in research, the university as a whole should be exposed to research and participate in the academic research culture. Research carried out by academics in educational institutions can be shown to have positive effects of many kinds. For the individual member of faculty, the effects of carrying out research may be related to reward structures within the institution. Organisations typically provide two types of rewards: extrinsic, e.g. salary and promotions; and intrinsic, those are associated with the actual process of work. In the case of intrinsic rewards, benefits may be associated with satisfaction arising from: completion, for example of a research project; achievement of a personal goal such as publishing a research paper or experiencing autonomy, and personal growth through work.

In a survey conducted in UK recently, effects of multiple research projects carried out by practitioners in educational institutions were examined. The findings showed that 94 per cent of the respondents to a questionnaire felt that they had learned new skills, which boosted their professional standing. Majority of the respondents reported that research has a powerful positive influence upon the overall ethos of the staff room and the university in general. A large number of the academic staff linked the research to the advancement of their professional careers, through promotion to a more senior post.

Institutions that emphasised research, tended to have larger student enrollments, a geographically more diverse student body, and students had higher degree of knowledge compared with universities who were not active in research.

The more one published, the more likely they were to consider that researchers are more talented, put more effort into their work, work harder and should earn more than non-researchers. Whilst the extrinsic rewards of salary appear to be more highly valued by researchers than non-researchers, all respondents rated the intrinsic rewards relating to professional growth and self-actualisation very highly.

Researchers are thought to be open to innovations, have more professional contacts and to be more self-confident. The interest in research is therefore likely to increase in the following years as academics look for promotion in addition to internal satisfaction derived from the research activity.

Trying to get researchers to support the move towards publishing their scientific work is like trying to get people to behave in a more ecological way. While most people recognise the need to save energy and recycle waste, it takes much more than just awareness to get them to change their habits on a large scale. 

Managing Editor



ndeeps@admin.upm.edu.my

Meet the Man who Turns Vision into Mission!

More and more universities are committed to taking the bilateral relationship with the industries to higher and more comprehensive level. Universiti Putra Malaysia (UPM) too has taken initiative to join the league to boost its professionalism, networking and educational opportunities.



Over the years, UPM has undergone phases of extensive development starting from the transformation of Serdang School of Agriculture in 1931 to Universiti Pertanian Malaysia in 1969 as well as to Universiti Putra Malaysia (1997).

Along the way, UPM has pinned its vision to become a world-class university. This implies that UPM needs to increase its effort to rise to a much higher level; its core business on teaching and learning, research and innovation and professional services. Hence, greater linkages between UPM and industries will be a crucial enabler to this end.


In line with this, the creation of the new portfolio of the Deputy Vice Chancellor (Industry and Community Relations) by the Ministry of Higher Education Malaysia (MoHE) in UPM in late 2007 can be viewed as a remarkable effort of MoHE to strengthen the university-industry linkages.

The university-industry linkages can be considered as a complex and diverse relationship. In UPM, several categories of broad linkage mechanisms have been adopted which comprise as follows:

- Teaching and curriculum development which include joint degree programs, sandwich courses, short, medium and long duration continuing education programs, industrial training and internships for students, staff exchange programs, etc.
- Research and innovation activities that consist of contract, sponsored and collaborative research. Some of these lead to commercialisation of research products and expertise, setting up of incubator and spin-off companies, extending research knowledge and providing business-development assistance to entrepreneurs.
- Formal and informal consultancies.
- Other means which also include joint publications, regular mutual visits, jointly organised meetings, conferences and seminars, joint participation in exhibitions and fairs, industrial supports to individual students or their associations, industrial representations in academic curriculum boards, etc.

Moreover, the university-industry linkages too have the potential to benefit both parties by ways of mutual dependence and success. Through stronger linkages and collaborations with industries, UPM is apparently gaining tremendous benefits by providing opportunities for industrial training and internships for students to improve their marketability and employability. It also strengthens opportunities for staff and students to familiarise with new knowledge, state-of-the-art technology, management systems and the constraints faced by industries which will be extremely helpful in the development, adaptation, improvement and relevance of curricula for degree programmes.

The industrial collaboration also allows the acquisition or access to hi-tech equipment, increase financial autonomy by attracting additional research and endowment funds from industries as well as from public sources for collaborative research and supplementing income for academic staff from consultancies. Consequently, these linkages also help to enhance the image of both universities and industries as contributors to knowledge and the national economy.

With this new portfolio, the foundation has been laid. Greater concerted effort from all parties involved will enable UPM to broaden and strengthen its linkages with industries, thereby enhancing its teaching and learning processes, achieving excellence in its research and innovation activities, contributing immensely to its extension and continuous education and ultimately promoting its image as the leading Research University in Malaysia as well as a truly world-class university. 

Expert's snapshots

Professor Dr. Tai Shzee Yew is currently the Deputy Vice Chancellor of Industry and Community Relations. He has been actively involved in consultancy works for both Malaysian government and international agencies. His research interest is in policy analysis and modelling of the fisheries sector, as well as valuation of natural resources. Tai has more than 100 papers published in local, regional and international journals, contributed chapters in books and conference proceedings or presented at seminars and conferences. In addition, he has also published 5 books and proceedings. Throughout his career, he has received several awards and recognitions from international and national institutions through his outstanding contributions in teaching and research. Prof. Tai can be reached at +603-89466045 or via email at tncinm@putra.upm.edu.my.

Phenylalanine Ammonia Lyase, a Novel Marker for Colour in Commercial Orchids

The orchid industry is a multibillion dollar business and has become an important contributor to Malaysia's economy. Orchid flowers have a wide variety of colours and some are scented. These attractive flowers form major features at festivals and special occasions. Wide selections of orchid hybrids are available but a few are suitable for commercial production.

The main objective of this study is an attempt to produce new marketable orchids with improved flower colour. Flower colour is an essential consideration for consumer's preference and it is an important factor in determining the market price. One of the problems associated with the colour trait is it varies from plant to plant within a hybrid or species. This will definitely lower the market price.



PLBs and seedlings producing bright coloured petals contain high PAL activity

Commercial orchid seedlings are produced using tissue culture. They are obtained either through clonal propagation or from seeds both of which are derived from protocorm-like bodies or PLBs. Currently, there is no method of predicting the flower colour from the PLBs. The commercial orchid growers have to deal with millions of orchid seedlings at one time. Selecting quality materials at seedling stage is based on whether the plant is physically healthy or not. This, by itself, incurs costs and is labour intensive. In addition, a high percentage of the flowers produced are not true to type and are considered off types or of inferior quality. Developing markers for screening at PLB stage (developmental) to predict plant performance will definitely reduce costs.

These flowers contain high PAL activity



These flowers contain low PAL activity



Example of colour variation that can occur within an orchid hybrid - *Phalaenopsis bellina*

A project was undertaken to study the pathways leading to flower colour which is mainly due to the synthesis of anthocyanin pigments. Studies conducted at UPM have indicated that the phenylalanine ammonia lyase (PAL) activity, one of the enzymes involved in anthocyanin production is directly related to flower colour. The activities of this enzyme were monitored in different plant parts such as the PLBs, the leaves and the flowers of different colour intensities. Several commercial orchid hybrids were tested which included *Phalaenopsis bellina*, *Dendrobium Sonia 17*, *Dendrobium Savin White Vanda Mimi Palmer* and *Phalaenopsis bellina alba*.

The results consistently showed that high PAL activities in PLBs, leaves and flowers are correlated with increased colour intensity. Low PAL activity was detected in white-petalled flowers. Our studies indicated that this enzyme has the potential to be a marker for colour. The marker will be useful in early and large scale screening of PLBs which can produce plants with uniform flower, hence will be more acceptable to both international and domestic market.

The enzyme marker developed is useful for early mass screening of the PLBs which will produce high quality planting materials and value-added traits such as uniformity and intensity in flower colour. **RMC**



- GOLD UPM Invention, Research & Innovation Exhibition (PRPI 2008)
- GOLD Innovation Award, Biotechnology Asia 2006.

Maziah Mahmood and Azzreena Mohamad Azzeme

Reader Enquiry

Department of Biochemistry, Faculty of Biotechnology & Biomolecular Sciences
Universiti Putra Malaysia Serdang, 43400 UPM, Malaysia
Tel: 603-8946 6703 E-mail: maziahm@biotech.upm.edu.my



Harnessing a Natural Cyanide Generating System from Cassava Plant for Cancer Treatment

Cancer ranks second only to cardiovascular disease as a cause of mortality, with an overall 5 year survival rate of less than 50%. Although advances have been made in the treatment of some cancer patients, yet there is no breakthrough in the chemotherapy, particularly in the discovery of penicillin and its revolutionary effect on antibacterial therapy. Most of chemotherapeutic drugs which are characterised by indiscriminate destruction of both normal and tumour cells can be severely toxic to patients and may lead to drug resistance. Therefore, search for better anticancer treatment continues. Hence, there is a growing interest in finding new chemotherapeutic agents for cancer treatment. Part of this search is focused on plant-based compounds especially those glycosides showing active anti-cancer properties.

The research undertaken investigates a potential of harnessing a natural cyanide generating system used by the cassava plant against predators as a viable alternative for cancer treatment. Epidemiological studies had shown a link between low incidences of cancer in communities where cassava intake is the main staple diet in human beings. The prophylactic action of cassava intake and its deleterious effect on human beings are attributed mainly to the expressed toxicity of the aglycone moiety of the cyanogenic glucoside linamarin, when the latter breaks down.

A preliminary investigation of three possible scenarios of *in vitro* exposure of ovarian cancer (Caov-3) and cervical adenocarcinoma (HeLa) derived cell lines to, a) a crude water extract of fresh cassava leaves, representing a dietary exposure to cyanogenic glucoside b) commercial linamarin and c) where a combination of commercial linamarin and crude exogenous linamarase was conducted. The water extract was found to be more efficacious, eliciting an IC_{50} value of $38(\pm 2.32)$ $\mu\text{g/ml}$ and $57(\pm 4.72)$ $\mu\text{g/ml}$ respectively for the ovarian and cervical cell lines, while the commercial linamarin exhibited a poor growth inhibition of $150(\pm 7.56)$ and $210(\pm 11.35)$ $\mu\text{g/ml}$, respectively. The inclusion of linamarase enzyme to the linamarin mixture on one of the cell lines was also studied. The linamarase used was obtained from the same cassava plant and pre-treated



Figure 1: Representation of cassava plant, root and its products

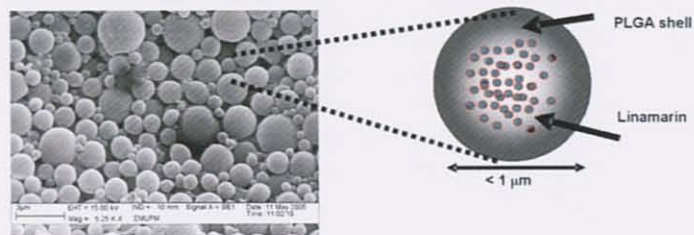



Figure 2: The micro-encapsulated linamarin in PLGA particles

appropriately prior to its use. Results showed a significant improvement in the growth inhibition of cervical cell line to $40(\pm 3.93)$ $\mu\text{g/ml}$ when the linamarase is added to the linamarin mixture. These *in vitro* cytotoxicity assays on human cancer cells and the ability of tested compounds to inhibit the growth or kill these cells in culture are taken as indication of potential value as an anticancer agent *in vivo*.

Development of effective drug carriers with least side effects especially for cancer treatment is considered to be as important as the discovery of new anti-cancer drugs. It would be ideal if the chemotherapeutic drugs could exert their actions only on cancerous cells and leave normal cells less affected or even untouched, and this is the expected advantage of the targeted delivery for anticancer drugs. The administration of appropriate doses at proper intervals is a usual practice to ascertain that the drug concentration is always optimized between its effectiveness and tolerability the drug at modest concentration would have much better effects than a pulsed supply of the drug at a high concentration. Thus, it is of importance that the investigation on a carrier for linamarin is conducted in order to ensure that only the correct amount of linamarin is released in the human system that avoids any side effects. A biodegradable PLGA was chosen as the carrier due to their easy dissolution in the system without exerting any side effects to the body. The *in vitro* drug delivery findings showed a superior improvement in the controlled release and bioavailability of linamarin when encapsulated in PLGA microparticles. 

- **GOLD** Invention and New Product Exposition (INPEX 2006)
- **Bronze** Malaysia Technology Expo (MTE 2006)
- **SILVER** UPM Invention, Research & Innovation Exhibition (PRPI 2005).



Norhafizah Abdullah

Reader Enquiry


Department of Chemical and Environmental Engineering, Faculty of Engineering
Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia
Tel: +603 8946 6295 E-mail: fihaz@eng.upm.edu.my

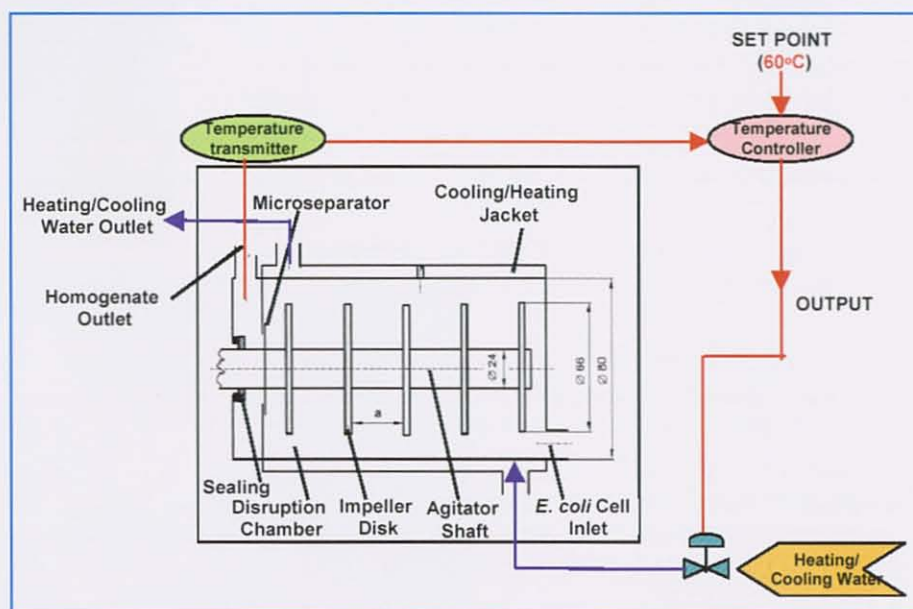


An Efficient Mechanical Cell Disruptor for the Release of Hepatitis B virus capsid from *Escherichia coli*

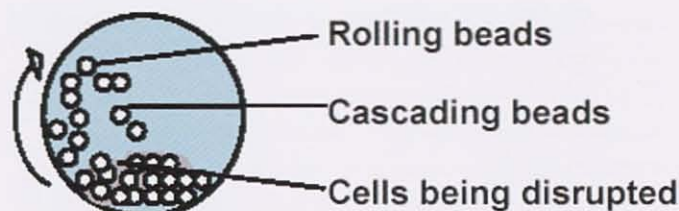
An efficient mechanical cell disruptor consisting of a bead milling chamber and a temperature controlling system has been developed to release heat stable intracellular proteins such as hepatitis B virus capsid (HBcAg) from *Escherichia coli* (*E. coli*).

The co-release of the host proteins together with the target protein poses a major problem in protein recovery processes. For instance, competition between the binding of host cell proteins and target proteins to the adsorbents could interfere the performance of a chromatography process. The temperature of the mechanical cell disruptor can be controlled at a point where the bioactivity of the target protein is preserved but the host proteins are heat precipitated or deactivated. This cell disruptor has better performance compared to the existing cell disruption technique which has been routinely used in small scale laboratories.

The cost to disrupt *E. coli* using this mechanical cell disruptor is about RM 1.92/L, compared to RM 3.70/L in the conventional enzymatic method. The time taken to process 120 ml of 10% biomass concentration is 6 times faster than the enzymatic method. Furthermore, the purity of HBcAg derived from mechanical cell disruptor is significantly higher compared to that of the HBcAg obtained from enzymatic method. This improved cell disruption method will lead to a reduction in HBcAg preparation cost. HBcAg has a potential in the development of various diagnostic reagents, vaccines as well as a valuable tool in gene therapy. 



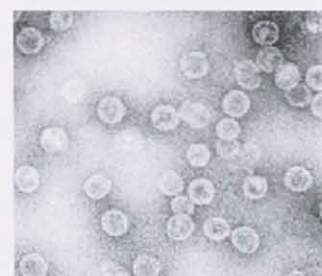
An efficient mechanical cell disruptor consisting of bead milling chamber and temperature controlling system



Cell disruption mechanism inside the bead milling chamber



Recombinant hepatitis B virus capsid expressed intracellularly in *E. coli*



Empty recombinant hepatitis B virus capsid produced in *E. coli*



GOLD World Exhibition of Innovation, Research and New Technologies, Belgium (EUREKA 2006)
GOLD International Invention, Innovation, Industrial Design Technology Exhibition (I-TEX 2006)


Tey Beng Ti, Ho Chin Woi, Michelle Ng Yen Tan, Tan Wen Siang, Ling Tau Chuan and Suryani Kamarudin

Reader Enquiry

Department of Chemical and Environmental Engineering, Faculty of Engineering
Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia
Tel: 603-8946 6289 E-mail: btey@eng.upm.edu.my



The use of nanotechnology in life sciences or the so called nanobiotechnology is already having an impact on various applications, especially in diagnostics and drug delivery. Nanobiotechnology is now becoming an important tool in area of drug discovery which include nanoparticles, nanobiosensors and nanobiochips, to name a few. Nanoscale assays on the other hand can significantly contribute to cost-saving while nanomaterials such as fullerenes, carbon nanotubes, nanobiohybrids and 2D layered materials could be use as potential drugs carrier and vector. Future prospects for the application of nanobiotechnology in medical technology, gene transfer, food technology, health care and for the development of personalised medicine appear to be very promising.

One of the 2D layered materials that can be used as drugs carrier is zinc-aluminium layered double hydroxides (LDH). LDH has 2D layered structure, held together by the unique expandable bonds between the two layers which can be used as a host for a guest amino acid, glutamate. This novel nanohybrid material was synthesised using direct assembly or co-precipitation method. Different parameters were used and optimised to form amino acid-intercalated pure phase material. Compared to the LDH with nitrate as the counter anion with 0.89 nm interlayer spacing (Fig. 1a), the resulting nanohybrid material has expanded to encapsulate the glutamate anion. The glutamate anion in the resulting bio-inorganic nanohybrid material (BINH) was found to be located in vertical orientation to the inorganic layers (Fig. 1b) with basal spacing of around 1.27 nm and (Fig. 1a). Cytotoxicity tests indicated that Chinese Hamster Ovarian cells were insusceptible to the LDH. Results from this study will be useful in the development of a new delivery system for therapeutic agents comprising amino acids or peptides. 



Professor Zobir's R&D pays off!

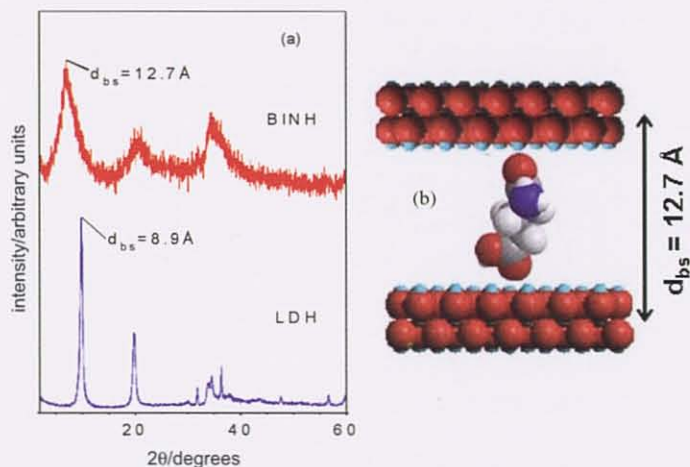


Figure 1: (a) PXRD patterns of LDH and its nanobiohybrid, glutamate intercalated into the LDH interlayer (BINH), and (b) possible spatial orientation of glutamate anion in the LDH interlamellae.

Synthesis of Novel Glutamate-Zinc-Aluminium Layered Double Hydroxide Nanobiocomposites



Mohd Zobir bin Hussein, Mohd Mokrish bin Md Ajat and Khatijah Yusoff

Reader Enquiry

Advanced Materials and Nanotechnology Laboratory, Institute of Advanced Technology (ITMA)
Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia
Tel: +603-8946 6801 E-mail: mzobir@science.upm.edu.my

- SILVER Innovation Award, Biotechnology Asia 2006
- SILVER UPM Invention, Research & Innovation Exhibition (PRPI 2005).





Peter & Jane Mather's Visit to UPM (31 Mar 2008)

1. TREASURE THE MOMENT: (From left) Pertanika Chief Editor Prof. Tan Soon Guan, Prof. Jane Mather, Ms. Erica Kwan, Dr. Peter Mather, Director of RMC Prof. Zulkifli Idrus and Pertanika Executive Editor Dr. Nayan Kanwal.
2. MUR-ROM-BOO: Prof. Abu Bakar Saleh presenting a token of appreciation to Prof. Jane Mather before her departure.



Geneva Palexpo (2-6 April 2008)

1. WE CAME, WE SAW, WE CONQUERED!: The winners of Geneva-Palexpo 2008 flaunting their awards and certificates.
2. STANDING IN THE EYES OF THE WORLD: Part of the UPM delegates lead by Prof. Mohd. Amin Mohd. Soom (second from left) in Switzerland recently.



Researcher Excellence Award (Anugerah Penyelidik Cemerlang) 2008 (9 April 2008)

1. THE CREAM OF THE CROP: (From left) Prof. Norman Mariun, A/P Dr. Mohd. Adzir Mahdi, A/P Dr. Jayakaran Mukundan and A/P Dr. Ishak Aris with their incentive cheques.
2. FLYING COLOURS: The winners of the APC main categories awards having a small chat with the Minister of Higher Education after the prize giving ceremony.
3. UPM GOLDEN WOMEN!: Dr. Lai Oi Ming receiving a cheque replica from the Minister of Higher Education.

Research HAPPENINGS



Intellectual Property Day (23-27 April 2008)

1. **SAVOURING THE SUCCESS!**: Prof. Datuk Nik Mustapha R. Abdullah receiving a certificate and RM30K from Datuk Shahrir Abdul Samad after UPM was announced as the winner for Organisation category.
2. **DAZZLING!**: The winner of Intellectual Property Day 2008 Individual category award, Prof. Raja Noor Zaliha (left) and first runner-up Prof. Suhaila Mohamed.
3. **THINKING AHEAD!**: Prof. Datuk Dr. Nik Mustapha and Prof. Dr. Abu Bakar Salleh are thinking hard how to ensure the UPM's intellectual properties are more secured!



I-TEX 2008 (9-11 May 2008)

1. **SWEET SUCCESS!**: Dr. Lai Oi Ming's "Palm-based Anti Obesity Functional Oil" won a gold medal and INS Special Award "Best Invention in Health Product" at I-TEX 2008.
2. **GLORY GLORY UPM!**: Silver medallist Prof. Fatimah Md. Yusoff (centre) and her co-researchers with their award-winning product.
3. **AWARD WINNING SMILES!**: The winners of I-Tex 2008 proudly displaying their awards.



Down the Memory Lane (Newsmakers around the campus)

1. **FOR THE RECORD!**: The entire team of the Office of the Deputy Vice Chancellor (R&I) with smiles.
2. **THE JEWELS OF UPM!**: (From left) Prof. Dzolkhifli Omar, Prof. Datin Paduka Khatijah Mohd. Yusoff and Prof. Ghizan Saleh.
3. **QUEEN OF SPORTS!**: Dr. Vijayaletchumy set new records in all three events she participated.



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 health threats to the environment as well as human beings.

There are several pollutants that are a threat to the drinking water and they can be classified in six categories. i.e.

- Microorganisms;
- Inorganic chemicals;
- Disinfectants;
- Organic chemicals; and
- Disinfection byproducts;
- Radionuclide's

These form the potential pollutants to human drinking water worldwide. The current guideline provides necessary information on these threats. In this issue of Synthesis, information is provided for the first category that focuses on **Microorganisms**.

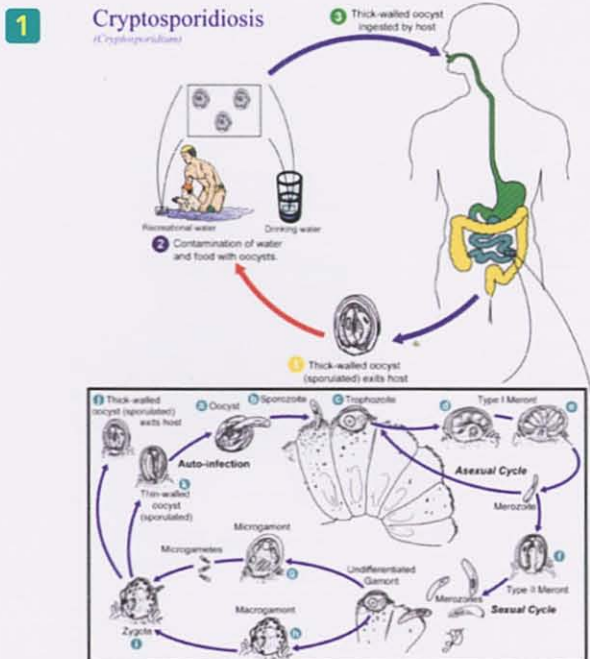
Microorganisms

Contaminant	MCLG ¹ (mg/L)*	MCL ² or TT ³ (mg/L)	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Cryptosporidium	zero	TT	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and fecal animal waste
Giardia lamblia	zero	TT	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste
Heterotrophic plate count	n/a	TT	HPC has no health effects; it is an analytic method used to measure the variety of bacteria that are common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system is.	HPC measures a range of bacteria that are naturally present in the environment
Legionella	zero	TT	Legionnaire's Disease, a type of pneumonia	Found naturally in water; multiplies in heating systems
Total Coliforms (including fecal coliform and Escherichia coli or E. Coli)	zero	5.0%	Not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present ⁵	Coliforms are naturally present in the environment; as well as feces; fecal coliforms and E. coli only come from human and animal fecal waste.
Turbidity	n/a	TT	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff
Viruses (enteric)	zero	TT	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste

Definitions:

¹ Maximum 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; ² Maximum 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; ³ Treatment Technique - A required process intended to reduce the level of a contaminant in drinking water.

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

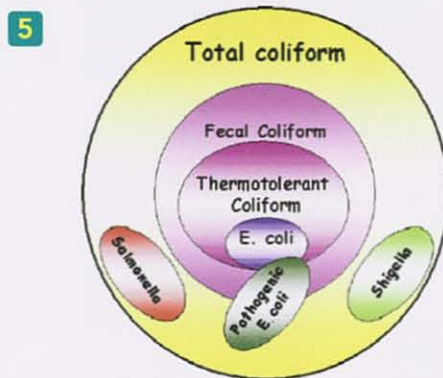
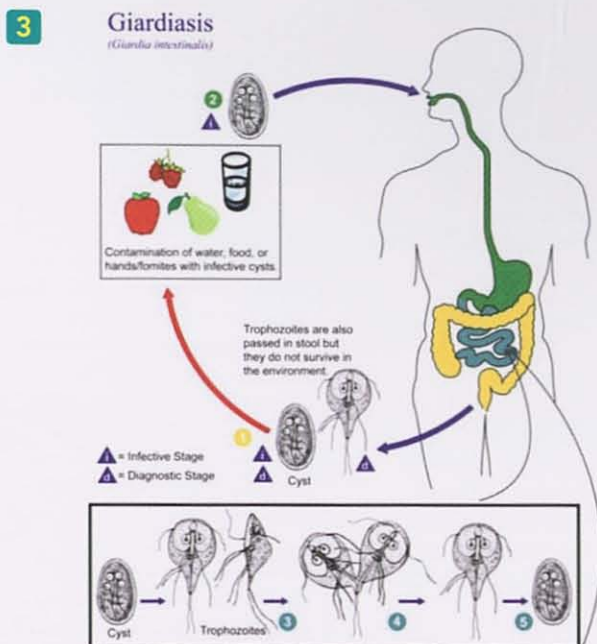


E. Coli is a type of fecal coliform bacteria commonly found in the intestines of animals and humans. The presence of *E. Coli* in water is a strong indication of recent sewage or animal waste contamination in the environment. The sewage may contain many types of disease-causing organisms.

E. Coli can transfer from human and animal wastes via several pathways to the environment. For instances rainfalls, snow melts or other types of precipitation, *E. Coli* may be washed into creeks, rivers, streams, lakes, or ground water. If this contaminated water is used for human consumption without proper treatment, it may cause diseases.

Although most of *E. Coli* strains are harmless and live in the intestines of healthy humans and animals, *E. coli* type of "O157:H7" is one of those hundreds of strains that produces a powerful toxin and can cause severe illness. This infection often causes severe bloody diarrhea and abdominal cramps without any presence of fever in most of the cases. However, it should also be noted that these symptoms are common to a variety of diseases, and may be caused by sources other than contaminated drinking water.

In some age groups, particularly children under the age of 5 or older, the infection can also cause a complication called hemolytic uremic syndrome, in which the red blood cells are destroyed and the kidneys fail. About 2 to 7 % of infections lead to this complication. In the United States, hemolytic uremic syndrome is the principal cause of acute kidney failure in children, and most of the cases of hemolytic uremic syndrome



are caused by *E. coli* type "O157:H7". Hemolytic uremic syndrome is a life-threatening condition usually treated in an intensive care unit. Blood transfusions and kidney dialysis are often required. With intensive care, the death rate for hemolytic uremic syndrome is between 3 to 5 %.

To avoid the diseases and consequent threats from microorganisms such as *E. Coli*, adequate and precise treatments are required. The water can be treated using various methods such as chlorine, ultra-violet light, or ozone, all of which act to kill or inactivate *E. Coli*. **RMC**

....to be continued in Synthesis Issue 22, September 2008

NewsBriefs

RM50K to Promote Environmental Awareness

The international oil and gas giant, ExxonMobil subsidiaries Malaysia contributed RM50,000 to the Nature Education Camp organised by the Faculty of Forestry, Universiti Putra Malaysia (UPM) and the Ministry of Education.

The program which was formerly known as the Natural Science Quiz in the 1980s is meant to educate youth on science education and environmental conservation and protection. The main target group for this program is secondary school students.

The cheque presentation ceremony was held on 29th March 2008 at Ayer Hitam Forest Reserve in Puchong. UPM Deputy Vice Chancellor (Industry and International Relations) Professor Tai Shzee Yew received the cheque on behalf of UPM. Also present at the ceremony was the dean of the faculty, Associate Professor Dr. Awang Nor Abdul Ghani.



A Hello from the Mathers!

Peter and Jane Mather had paid a courtesy visit to UPM recently as part of the efforts to strengthen the links between UPM and the Australian universities. Apart from that, the visit that was allotted on 31st March 2008 was specifically intended to turn *Pertanika* Journal into a more robust scholar publication.

Associate Professor Dr. Peter Mather is a Director of Research at Queensland University of Technology and also an expert in areas like Population Genetics, Applied Genetics of Aquatic Species, and

Conservation Genetics. His professional associations include Genetics Society of Australia, World Aquaculture Society and North American Benthological Society.

Professor Jane Hughes or Jane Mather is a Head, Griffith School of Environment at Griffith University as well as a Research Member of Australian Rivers Institute where she heads the aquatic conservation and biodiversity theme within the institute. Jane also runs the Molecular Ecology laboratory at Griffith University and her interest is using molecular markers to answer ecological and evolutionary questions.

Both of the guests were greeted by the Director of RMC Professor Zulkifli Idrus, Deputy Director of Publication Division Professor Fakhru'l Razi Ahmadun, Dean of Agriculture Faculty Professor Ghizan Salleh, *Pertanika* Executive Editor Dr. Nayan D. Kanwal, Publication Officer for *Pertanika* Erica Kwan.



APC: Beyond the Glitz and Glamour!

The hard work and loyalty of the UPM researchers were finally paid off after eighteen of them were honoured at Best Researcher Award (APC) 2007.

Held at Equatorial Hotel Bangi on 9 April 2008, the much awaited event was officiated by the Minister of Higher Education, Dato' Seri Mohamed Khaled Nordin. Also present were UPM Chairman Tan Sri Dato' Zainul Ariff Hussain and

Vice-Chancellor Prof. Datuk Dr. Nik Mustapha R. Abdullah.

Six researchers were commemorated with main awards which were Publication Excellence, Commercialisation and Young Researcher while other twelve were presented with Publication and Patent incentives. All winners were judged based on their dedication, determination and commitment toward R&D developments in UPM throughout the year 2007 as well as their performance internationally and locally.

National Intellectual Property Day

Universiti Putra Malaysia (UPM) was announced as the sole Grand Prize winner after winning two main categories at the National Intellectual Property Day 2008 organised by Malaysia Intellectual Property Corporation (MyIPO) and the Ministry of Local Entrepreneurship and Consumer Affairs (KPDNHEP).

UPM singled out as the winner of Organisation and Individual Category awards.

UPM Vice Chancellor Prof. Datuk Dr. Nik Mustapha R. Abdullah received RM 30 000, a trophy and a certificate for Organisation Category from Datuk Shahrir Abdul Samad, Minister of Local Entrepreneurship and Consumer Affairs at a ceremony held in Kuala Lumpur.

There was also a double victory for UPM when two of its researchers, Prof. Dr. Raja Noor Zaliha Raja Abdul Rahman from the Faculty of Biotechnology and Biomolecular Sciences won the main prize for Individual Category and Prof. Dr. Suhaila Mohamed from the Faculty of Food Science and Technology was the first runner-up in the same category.

Raja Noor Zaliha brought home RM 10 000 cash, a trophy and a certificate for her groundbreaking research on "205Y Lipase" while Suhaila won herself RM 5000 cash for "Seasonex".

The annual exposition was held from 24-27 April 2008 at Kuala Lumpur Convention Centre to promote creative and innovative society and also to stimulate development in intellectual property sector.



Maximise Your Target Kill!

Professor Dzolkhifli Omar had conducted an inaugural lecture on The Future of Pesticides Technology in Agriculture: Maximum Target Kill with Minimum Collateral Damage which took place at Dewan Taklimat, UPM Administration Building on 25 April 2008.

The opening remark for the day was delivered by Deputy Vice Chancellor (Academic & International Affairs) Professor Datin Paduka Khatijah Yusoff introducing Professor Dzolkhifli and his portfolio.

During the lecture, he presented his breakthrough research on various aspects involved in pesticides technology like the controlled release formulation of pesticides, microemulsion formulation of pesticides, improving pesticide application techniques as well as pesticide impact assessment.

The hall was jam-packed with enthusiast representatives from the industries, media and academia. Good job Professor Dzolkhifli!



Bring it on UPM!

UPM continued its outstanding achievement again after winning 10 awards at the 19th Invention, Innovation and Technology Exhibition (ITEX) held at Kuala Lumpur Convention Centre from 9th-11th May 2008.

The most anticipated exhibition was officiated by the Deputy of Higher Education Minister, YB Dr. Hou Kok Chung.

I-TEX is an annual event organised by Malaysian Inventions and Design Society (MINDS) since 1989. This year's exhibition featured more than 500 inventions, covering more than 24 industries from Malaysia, Korea, Taiwan, Hong Kong, Iran, Croatia, Australia and Italy.

UPM sent 11 innovative R&D products to compete at the I-TEX's two main categories; Invention Competition and Malaysia Innovative Product Award. (See table below for the winners and their exhibits).



No	Award Category	Recipient	R&D Product	Award Received	Faculty/ Institute
1	Invention Competition	Raja Noor Zaliha Raja Abd. Rahman (Prof. Dr.)	L2 Lipase: A Thermostable Enzyme for Industrial Application	• Gold	Biotechnology & Biomolecular Science
		Lai Oi Ming (A/P. Dr.)	Production of Palm-based Anti Obesity Functional Oil	• Gold • Special Award- INS Award for Best Invention in Health Product	Biotechnology & Biomolecular Science
		Fatimah Md. Yusoff (Prof. Dr.)	Mass Production of Pure and Halal Tropical Microalgae Using Photobioreactors	• Silver	Institute of Bioscience
		Sabira Khatun (A/P Dr.)	Smart Auto Driven Vehicle (SADV)	• Silver	Engineering
		Annie Christianus (Dr.)	A Recirculating System Designed for the Culture of Horseshoe Crab Larvae	• Silver	Agriculture
		Azni Idris (Prof. Dr.)	Aspergillus Flavus Soft Pallet as a New Biocoagulant for Treating Turbidity, Organic Matter, Nutrient and Colour in Water and Wastewater	• Bronze	Engineering
2	Malaysia Innovative Product Award	Norhafizah Abdullah (Dr.)	Supercritical Anti Solvent (SAS) System for Nanoparticles Production	• Bronze	Engineering
		Norman Mariun (Prof. Ir. Dr.)	Ohmic Heater Pasteurizer	N/A	Engineering
		Rosnah Shamsudin (Mrs.)	Machine for Making Jam	N/A	Engineering

TNCPI is Now Officially ISO Certified!

After going through a tenses phase, the staff of the Office of Deputy Vice Chancellor of Research and Innovation (TNCPI) can finally breathe easy when the office was finally certified by International Organisation for Standardisation (ISO) on 9th May 2008.

The unforgettable moment was announced by the Deputy Vice Chancellor of Research and Innovation Prof. Dr. Abu Bakar Salleh shortly after the audit session by the Standard and Industrial Research Institute of Malaysia (SIRIM).



UPM Bags 5 Awards in Switzerland

Universiti Putra Malaysia (UPM) was in the limelight again after winning 1 gold, 3 silver and 1 bronze medals at the 36th International Exhibition of Inventions, New Techniques and Products of Geneva (Geneva-Palexpo) 2008 held at Geneva, Switzerland from 2-6 April 2008.

The university was represented by its six prominent researchers to exhibit their research products. The sole gold medallist for UPM Dr. M. Iqbal Saripan was in double joy after his creation, Wire-Mesh

Collimator for Gamma Camera was also awarded with Geneva

Jury Appreciation.

Professor Elias Saion, Professor Taufiq Yap and Dr. Zanariah won themselves a silver medal each while Associate Professor Ir. Dr. Mohd. Saleh Jaafar took home a bronze medal. The UPM team was lead by Professor Ir. Mohd Amin Mohd Soom.

This year's exhibition managed to attract 720 exhibitors from 45 countries with a thousand completely new inventions dedicated to innovation and to new products.

UPM Track Queen Sets New Records at 33rd KESSUMA!

UPM veteran runner in the spotlight after breaking three old records at the 33th Kejuhanan Sukan Staf Antara Universiti-universiti Malaysia (KESSUMA) held at Universiti Malaysia Sarawak (UNIMAS) from 14 - 22 June 2008.

Dr. Vijaya Letchumy set new records for 800-meter, 1500-meter and 3500-meter. She also proudly swept gold medals for all the three events. On top of that, she received gold and bronze medals in 4 x 100-meter and 4 x 400 meter respectively.



Previously, Vijaya was named as the Top 5 Sportswomen during Persatuan Olahraga Master Malaysia (POMM) 2006 where she bagged the title for Long Distance (21km) category. She also walked away as the Sportswomen of the year at Persatuan Olahraga Master Selangor (POMS) 2007.

This year's KESSUMA was officiated earlier by the Minister of Higher Education Dato' Seri Mohamed Khaled Nordin and was partaken by 21 IPTAs nationwide.

QUICK INFO ON PATENTS

What is a Patent?

A patent is an exclusive right given by a Government for an **invention**, which is a **product** or a **process** that provides, in general, a new way of doing something, or offers a new technical solution to a problem. It provides protection for the invention to the **owner** of the patent generally for 20 years.

What kind of Protection does a Patent offer?

Patent protection means that the invention cannot be commercially **made, used, distributed or sold** without the patent owner's **consent**. These **patent rights** are usually enforced in a court, which, in most systems, holds the authority to stop **patent infringement**. Conversely, a court can also declare a patent invalid upon a successful challenge by a third party.

What Rights does a Patent Owner have?

A patent owner has the right to decide who may - or may not - use the patented invention for the period in which the invention is protected. The patent owner **may give permission** to, or **license**, other parties to use the invention on mutually agreed terms. The owner may also **sell** the right to the invention to someone else, who will then become the new owner of the patent. Once a patent expires, the protection ends, and an invention enters the **public domain**, that is, the owner no longer holds exclusive rights to the invention, which becomes available to commercial exploitation by others.

Why are Patents necessary?

Patents provide **incentives** to individuals by offering them **recognition** for their **creativity** and **material reward** for their

marketable inventions. These incentives encourage innovation, which assures that the quality of **human life** is continuously enhanced.

What Role do Patents Play in Everyday Life?

Patented inventions have, in fact, **pervaded every aspect of human life**, from electric lighting (patents held by Edison and Swan) and plastic (patents held by Baekeland), to ballpoint pens (patents held by Biro) and microprocessors (patents held by Intel, for example).

All patent owners are obliged, in return for patent protection, to **publicly disclose information** on their invention in order to **enrich the total body of technical knowledge** in the world. Such an ever-increasing body of public knowledge promotes **further creativity** and **innovation** in others. In this way, patents provide not only protection for the owner but valuable **information** and **inspiration** for **future generations** of researchers and inventors.

Source: www.wipo.int

UPM now has 26 technologies/products that have been patented such as diagnostic kit for virus detection for the use of shrimp industry, fertiliser to enhance rapid shoot and root germination of paddy seed, a robotic system that is capable of handling hazardous chemical processing and experiments at laboratories, a device and method for measurement of tensile strength of materials, especially for indirectly measuring the tensile strength of weak rock and hard soil and many more.

For more information, on UPM patented technologies and products, please visit our website at www.icc.upm.edu.my

Business Plan Presentation to MTDC

In order to encourage commercialisation, Innovation and Commercialisation Centre (ICC) has initiated several steps to achieve our objective of maximising the commercialisation of UPM research products. In-line with that, a business plan presentation session on CDRF Grant Application by Malaysian Technology Development Corporation was held on 24 July 2008 at ICC. The presentation was attended by researchers, industrial partners and officers from MTDC as evaluators. The process which is called Technology Screening will be a quarterly activity arranged by ICC. During the first presentation, several projects / technologies business plans were presented.

Project Name : Coconut Auto Squeezer/Jam Maker/Kuih Bijan Machine
Company : Inovasi Anggerik Sdn. Bhd.
Researcher : Dr. Rosnah Shamsuddin
Project Description :

Kuih Bijan Machine has two main functions, shaping the dough and coating it with sesame seeds. This portable machine is quite small and occupies only a small operating area. The operation of this machine is simple where the dough of Kuih Bijan is fed into the extrusion section and shaped through a die. Then, the dough is cut into small pieces and coated with sesame seeds. This machine is capable to handle approximately 9.8 kg of dough/hour. Auto Squeezer' is an instrument used to grate and squeeze coconut milk from fresh coconut. This equipment is designed specially to help small producers (e.g.; housewives, restaurant owners) in saving their time and cost. The grater has a wall/side hold to enable users to get a suitable opening (1mm to 4mm). This is important in obtaining the best grate in lesser time yet in right quantity. Jam making machine is designed for small scale industries. It operates in a batch process and is divided into 2 main functions, namely, heating and mixing process. The cooking bowl is designed in a medium sized cylindrical shape and equipped with a flexible paddle mixer for a homogeneous mixing.

Business Plan

Amount of Grant : RM500k Return Of Investment : 15% Expected Sale : End of 2008



■ Turn to Page Eighteen

Pertanika

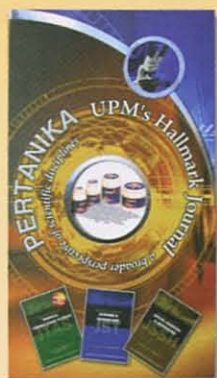
Our goal is to bring high quality research to the widest possible audience

Pertanika is an international peer-reviewed leading journal in Malaysia which began 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**.



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 to 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.*



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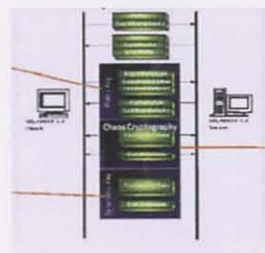
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www.rmc.upm.edu.my/pertanika

Project Name : Chaos Public Key Cryptosystem
Company : Timeline Communication Sdn. Bhd
Researcher : Mr. Muhammad Rezal Dato' Kamel Ariffin
Project Description :

The invention is a cryptographic system using a chaotic approach. The chaotic system is based on "N-body" problem to provide cryptographic security. Existing security measurement which is implemented in most popular browsers is known as Secure Socket Layer (SSL). SSL is a security method "enforced" upon users. SSL gives users asymmetric key using ECC 160-bit with symmetric key by using AES with 128 bits. This invention will help to enhance the system. SELAMAT 3.1 gives the user an asymmetric key using ECDH 256-bit which is equivalent the strength of RSA 3072-bits. SELAMAT 3.1 also enhances the symmetric key by using AES with 256-bits. Furthermore SELAMAT 3.1 induces in between the above chaotic cryptosystem with 256-bit key.



Business Plan

Amount of Grant : RM1million Return Of Investment : 132.93% Expected Sale : End of 2008

Project Name : Satiri SuperDwarf
Company : Hextar Landscape Services
Researcher : Assoc. Prof. Dr. Mohd Said Saad, Assoc. Prof. Dr. Abdul Shukor Juraimi
Project Description :

Satiri SuperDwarf is the first local breed turf-grass for green; which is well adapted with local climate, especially in high temperature, high moisture and heavy rainfall. Satiri SuperDwarf is tolerance to shade, extreme sunlight and excessive rainfall. It also can withstand the high traffic (playable in whole year around). On the other hand, short internodes and tiny leaves blades of Satiri SuperDwarf contribute to turf green density; this will suppress the weed growth and yet enhance the smoother green and increase the green speed for the game enjoyment. The advantage of Satiri SuperDwarf compared to other foreign turfgrass is it gives a better choice to green keeper. Well-built Satiri SuperDwarf emphasis confidence to present it to exclusive sport field.



Business Plan

Amount of Grant : RM500,000 Return Of Investment : 66.74% Expected Sale : End of 2008

Project Name : X-Factor for a multimedia engagement behaviour
Company : Digital Durian
Researcher : Dr. Normahdiah Sheik Said
Project Description :

This is a 6-component theory of engagement developed from a series of experiments on children and young teenagers (age 9 to 14) interacting with a number of multimedia applications. The model was developed based on children's reaction to the interface design features of these applications. This model enables us to describe user engagement according to interaction types. The model allows us to distinguish which interactive design features engage children and which do not and the engagement factors that are surrounding it. Engagement is measured using "An Engagement Scale Score" that is specially designed, developed, calibrated and validated. This Modelling Theory of a Multimedia Design Model will enable us know how to design better educational courseware and CDs that is not only engaging but is also sustainable educationally in our attempt to build a long life learning digital citizen.



Business Plan

Amount of Grant : RM400,000 Return Of Investment : RM2 million Expected Sale : End of 2008

Project Name : Turamesin
Company : Prominent Line Sdn. Bhd.
Researcher : Assoc. Prof. Dr. Ratnasamy Muniandy
Project Description :

Turamachine is an asphalt materials analysis machine which simulates the real road building environments, thus give a more accurate report of the asphalt under test. The asphalt materials are compacted using a steel roller just like the heavy-duty steel wheel rollers at the site. The equipment also provides variable slope from 0 to 20% for the purpose of hydroplaning study and skid resistance analysis. The new equipment will be one of its kinds in this area. This new cost effective equipment is capable of measuring several properties such as stability, density and resilient modulus.



Business Plan

Amount of Grant : RM2 million Return Of Investment : 30% Expected Sale : End of 2008

Synthesis BACKISSUES

JUNE 2006 — Issue 13, 2nd Quarter



Editorial: UPM Invention & Research Exhibition 2005
Spotlight: Towards R&D Commercialisation
Research Highlight: Pushing Research to a New Level –
Rationalisation Exercise: Why do we from Research Institutes in the University?

Regulars

- Mesocarp-Specific Promoter for Oil Palm Genetic Modification
- BANG SYSTEM™ – Design and Commissioning of UPM Ballistic Automated Network Gun Systems for Ballistic Studies
- Direct Fermentation of Sago Starch to Various Commercial Products
- SaTri-A Gold

- The Human Security System (S 3000)
- Synthesis and Fabrication of NiZnCu ferrite Cores via Sol-gel Technique
- FluReal H9N2 Check, a Rapid Detection and Sub-typing Kit for Influenza Virus

Research Happenings

- I-TEX 2006
- National Intellectual Property Day (Expo Hari Intelek Negara 2006)
- Geneva-Palexpo 2006

Reportage

- NewsBriefs
- FactFile

SEPTEMBER 2006 — Issue 14, 3rd Quarter



Editorial: UPM continues its pursuit of excellence in education and research
Spotlight: University Rankings
Research Highlight: A New Centre to Promote Technology Transfer and Commercialisation – Innovation and Commercialisation Centre

Regulars

- Detection of Microsatellite Loci in Rhinoceros Beetle *Oryctes Rhinoceros* Using the Randomly Amplified Microsatellites (RAMS) Method
- Carbon Dioxide Enrichment Technique for the Lowland Controlled Environment System
- Mitsozyme™: Natural Enzyme Supplement for Poultry

- LaSt 24: A Novel Nanocomposite -Based Controlled Release Formulation of Latex Stimulant
- MBzyme: Nanobacterial as Catalyst for Green Organic Syntheses
- Cardamonin: a Drug-like Phytochemical with Anti-Inflammatory and Immunomodulatory Properties Research

Research Happenings

- Biotechnology Asia 2006
- Agrobio Exhibition 2006
- IPTA R&D Roadshow 2006
- INPEX International Show 2006

Reportage

- NewsBriefs
- FactFile

DECEMBER 2006 — Issue 15, 4th Quarter



Editorial: Managing Knowledge
Spotlight: Nation Building- the Role of Universities
Research Highlight: A New Centre to Promote Technology Transfer and Commercialisation – Innovation and Commercialisation Centre

Regulars

- King Grass (hybrid *Pennisetum*) Silages- Quality and Digestibility
- Improvement Technology for Cocoa Butter Extraction Using Supercritical Fluid
- Trans- Free- Palm- Based Fluid Shortening
- Bluetooth Smart Remote Control and Sensor System (BLUESS)
- RAWAT: Rainwater Harvester

- The Fabrication and Comparison of NiZn Ferrite Cores via Sol-gel Technique and Solid State Reaction

Research Happenings

- NATPRO 2006
- PRPI 2006

Reportage

- NewsBriefs
- FactFile

MARCH 2007 — Issue 16, 1st Quarter



Editorial: Indicators of Research University Performance
Spotlight: Web Presence & Development
Research Highlight: Towards World-class University- What does it take to be a prestigious research institute?

Regulars

- New Materials for our Industries: PANGIUM EDULE REINW. (Kepayang)- Any Takers for Development of Products?
- NMFerit™: Formulation- Tailoring of the Ni- Mg-Ca-Co-Cu-Zn-Fe Ferrite System to Attain Extremely Low Magnetic-Energy Loss for High-Frequency Application
- The Adoption of Econet: The Internet-Based Malaysian Ecotourism Network and Site Rating Expert System

- RF Coaxial Cavity for Ignition
- Developing Ergonomics Seat for Commercial Vehicle in Malaysia: A Concurrent Approach
- A Family of Parallel Explicit Group Iterative Algorithm on Shared Memory
- Multiprocessors (SMPs) Architecture

Research Happenings

- IENA 2006
- BIS 2006
- MAITREX 2006

Reportage

- NewsBriefs
- FactFile

DECEMBER 2007 — Issue 17-19, 4th Quarter



Editorial: Realisation of Quality Research Management System
Spotlight: Reading a Scientific Paper
Research Highlight: Maximising Research Potential through Quality Academic Publishing- Experts from Six Prominent Global Universities Shares Their Experiences

Regulars

- A Computerised Digital Imaging Technique to Estimate Palm Oil Quality Based on Fruit Colour
- Natural Booster Kit for High Quality Microalgal Production
- A Long-term Triaxial Filtration Test System
- Oil Scan: Remote Oil Spill Detection, Classification and Trajectory

- An Enhanced Mobile IPv6 with Multicast Function and Hierarchical Design
- Why Children and Teenagers are Addicted to Computer Games? NEMD Model- Norma™ Engagement Multimedia Design Model

Research Happenings

- MTE 2007
- BIO International Convention 2007
- ITEX 2007
- INPEX 2007

Reportage

- NewsBriefs
- FactFile

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.k.a. 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



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