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Optically Quenched Wide-gap Semiconductor Crystals Evaluation using Single- and Two-photon Excitation

Andrographolide Derivatives - Suppress the Growth of Cancer Cells

Quicker Peeled Fruits and Vegetables for Everyone!

An Efficient Technology to Control Ammonia Pollution

Nucleotide Probes - For Quicker and Faster Detection of *Candida* Infections

Affinity Precipitation - The Latest Discovery

Applied Magnetics
- Its Rapid Revolution

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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 emerged 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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Exhibitions and Promotional Schedule

2010 EXHIBITION AND PROMOTIONAL ACTIVITIES RESEARCH MANAGEMENT CENTRE (RMC) INNOVATION AND COMMERCIALISATION (ICC)

No.	Activities	Date/Day	Venue
1	ICC Road Shows	January - Mar 2010	UPM Faculties
2	UPM Research Output Promotional Event (1/2010)	28 January 2010 Thursday	Institute of Bioscience
3	Malaysia Technology Expo (MTE)	4 - 6 February 2010 Thursday - Saturday	Putra World Trade Centre (PWTC), Kuala Lumpur
4	UPM Research Output Promotional Event (2/2010)	11 February 2010 Thursday	Faculty of Engineering
6	UPM Research Output Promotional Event (3/2010)	1 April 2010 Thursday	Institute of Advanced Technology
7	International Exhibition of Inventions, New Techniques and Products (GENEVA)	21 - 25 April 2010 Wednesday - Sunday	Geneva, Switzerland
8	Ekspo Hari Harta Intelek Negara (HHIN)	22 - 26 April 2010 Thursday - Sunday	Kuala Lumpur Convention Centre (KLCC), K. Lumpur
9	Malam Gemilang Akademia Putra: Anugerah Penyelidik Cemerlang (APC), Anugerah Pengajaran Putra (APP), Anugerah Perundingan dan Anugerah Khas Perniagaan	6 May 2010 Thursday	Main Hall, UPM
10	International Invention, Innovation and Technology Exhibition (ITEX)	14 - 16 May 2010 Friday - Sunday	Kuala Lumpur Convention Centre (KLCC), K. Lumpur
11	UPM Research Output Promotional Event (4/2010)	27 May 2010 Thursday	Main Hall, UPM
12	Small Medium Industries Exhibition (SMIDEX)	3 - 5 June 2010 Wednesday - Friday	Kuala Lumpur Convention Centre (KLCC), K. Lumpur
13	Invention and New Product Exposition (INPEX)	16 - 18 June 2010 Wednesday - Friday	Pittsburgh, Pennsylvania, USA
14	Malaysia International Halal Showcase (MIHAS)	23 - 27 June 2010 Wednesday - Sunday	MATRADE Exhibition and Convention Centre, Kuala Lumpur
15	UPM Research Output Promotional Event (5/2010)	24 June 2010 Thursday	Main Hall, UPM
16	Pameran Pertanian, Hortikultur dan Agro Pelancongan Malaysia (MAHA)	12 - 23 July 2010 Monday - Saturday	MAEPS, Serdang
17	Malaysia International Food and Beverage Trade Fair (MIFB)	22 - 24 July 2010 Thursday - Saturday	Putra World Trade Centre (PWTC), Kuala Lumpur
18	UPM Invention, Research and Innovation Exhibition (PRPI)	20 - 22 July 2010 Tuesday - Thursday	Main Hall, UPM
19	UPM Research Output Promotional Event (6/2010)	12 August 2010 Thursday	Main Hall, UPM
20	UPM Research Output Promotional Event (7/2010)	26 August 2010 Thursday	Main Hall, UPM
21	UPM Research Output Promotional Event (8/2010)	23 September 2010 Tuesday	Main Hall, UPM
22	The British Invention Show (BIS)	13 - 17 October 2010 Wednesday - Saturday	London, United Kingdom
23	UPM Research Output Promotional Event (9/2010)	28 October 2010 Tuesday	Main Hall, UPM
24	BioMalaysia Exhibition	2 - 4 November 2010 Tuesday - Thursday	Kuala Lumpur Convention Centre (KLCC), K. Lumpur
25	International Exhibition of Ideas, Inventions and Innovations Trade Fair (iENA)	4 - 7 November 2010 Thursday - Sunday	Nuremberg, Germany
26	World Exhibition on Innovation, Research and New Technologies (INNOVA)	18 - 20 November 2010 Thursday - Saturday	Brussels, Belgium
27	UPM Research Output Promotional Event (10/2010)	23 December 2010 Thursday	Main Hall, UPM

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Applied Magnetics – Its Rapid Revolution

A magnet in general is material that produced, or is operated by means of magnetism. The way materials respond at microscopic level to an applied magnetic field is known as magnetism. The magnetic field is invisible but is responsible for the most notable property of magnetism in producing force so that different poles will attract to each other while similar poles will repel each other. The source of magnetism can be found in a permanent magnet and a conductor that is applied by an electric current.

This means that the electrical energy can be converted to the magnetic energy without any medium of transmission. Such relationship makes magnetics capable of producing mechanical energy from an electrical energy such as motors, solenoids and actuators. Vice versa, electrical energy can also be produced from the mechanical energy. The use of electromagnetic principle is more superior compared with other automation principles such as hydraulics since it is cleaner and easier to be controlled for a fast response. The revolution of this field has innovated commercial products such as pumps, compressors, fans, blenders, cutters, drillers, crushers, printers, rollers, etc. Thus, electromagnetics has emerged in a new era where everyone is talking about efficiency and energy consumption plus being environmental friendly and less costly innovations.

We have developed a sensor that can detect linear displacement using an inductive concept. The product is known as the "Linear Displacement Sensor using Meander Coil and Pattern Guide" or LDS. As shown in **Figure 1(a)**, it consists of a sensor head and pattern guide. The sensor head is made of search and excitation coil known as the meander coil. Meanwhile, the pattern guide is made from soft iron (SS400). The advantage of this sensor is that it has a small size and simple structure which makes it easier to miniaturise. Besides, the sensor is very thin and can be embedded into the system. The end products available are printers, paper cutters, etc. **Table 1** shows several points of comparison of this invention compared with other available linear displacement sensors in the market. A market survey had also been done and the results showed that none of the linear displacement sensors available in the market has a very thin sensor as the LDS. **Figure 1(b)** shows the final product of the LDS.

Expert's Snapshots

Dr. Norhisam Misron received his Bachelor, Master and Doctorate in Engineering (Electrical Power Engineering) from the University of Shinshu, Japan in 1998, 2000 and 2003 respectively. Currently he is an Associate Professor of Electrical and Electronics Engineering at Universiti Putra Malaysia where he heads the Power Electronics Machine and Drives research working group. His research interests are in Applied Magnetics, Electrical Machine and Magnetic Sensor. He has conducted various research projects funded by government agencies and industrial agencies. He has also authored more than 80 international journals and proceedings. Currently, he holds 5 international patents which had been granted and has filed 8 local patents.

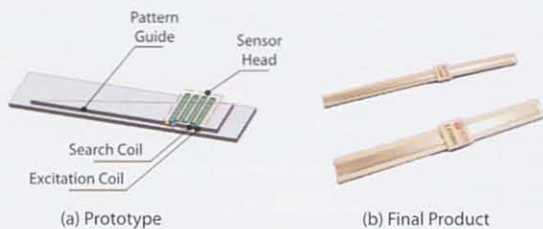


Figure 1: Linear Displacement Sensor

Table 1: Comparison With Other Linear Displacement Sensors

Optical Sensor	Linear Encoder	LDS (UPM)
Detection using light element	Detection on encoded tape	Detection on pattern guide
The beam spot shows the displacement	The encoded tape shows the displacement	The widening of the pattern guide shows the displacement
The beam spot would detect the displacement using a positive sensor detector	The encoded tape would detect the displacement using the hall effect element	The pattern guide would detect the displacement using the meander coil

Another invention which could be highlighted is known as the "Sensor-less Positioning System for the Linear DC Motor". The system could be used in positioning any type of linear DC motor. Typically, a linear DC motor is used to produce short strokes of displacement and normally used in a gripper, pick and place machine, stamping machine, sprayer gun, etc. The traditional method requires a sensor which, unfortunately, doubles the size of the system.





Figure 2: Sensor-less Positioning System for the Linear DC Motor

A modification is made to the motor by connecting a mechanical spring to the moving coil as shown in **Figure 2(a)**. The purpose of this spring is to absorb the forces produced by the motor. Once the forces absorbed by the spring are equal to the forces produced by the motor, the moving coil would stop at certain distances. Due to the harmonic oscillation of the spring, the moving coil oscillates before stopping at equilibrium position. These oscillations create unwanted overshoot and delay the system response. Several approaches have been deployed to control the position of the motor. **Figure 2(b)** shows the final product of the "Sensor-less Positioning for the Linear DC Motor".

In addition, the demand of electricity for outdoor usage is increasing due to the availability of some electrical products for different industries such as agriculture, tourism, construction, landscape decoration, sports, military exercise, etc. All of these require a constant and ample electrical supply. Usage of batteries is impractical due to its power and life cycle limitation, especially for applications that require heavy loads. Therefore, UPM is now seriously engaged in developing a portable generator that could supply more electrical power. Thus, we have developed a permanent magnet mobile generator using a new technique called the double stator topology. The advantage of using this technique is that it produces more electrical power but with a lighter weight compared with the current generator which uses only a single stator. The secret of using the double stator topology is that the outer and inner stator in the double stator would anticipate the leakage flux of the permanent magnet. Hence, this would solve the flux leakage problem that occurs using a single stator generator due to the radial flux direction. Even though the double stator topology is difficult to fabricate due to the existing outer and inner stator, the double stator would become a favourite in the future due to its better efficiency. **Figure 3** shows the final product of the Double Stator Permanent Magnet Generator for oil palm mechanical cutter application.



Figure 3: Double Stator Permanent Magnet Generator for Oil Palm Mechanical Cutter

We have also developed the "Linear Oscillatory Actuator" (LOA) which could be used as an oil palm mechanical cutter. The LOA is the most suitable device for such application since it produces higher force in a single axis direction. The driving force



Figure 4: Linear Oscillatory Actuator (LOA)

produced by the linear actuator would make the cutter vibrates and produces the required cutting force. Another advantage of using the LOA is that it would eliminate the use of gear and bearing which requires regular maintenance. Furthermore, designing an electrical cutter might solve the height problem in conventional oil palm mechanical cutters since only wires are used and it allows for the disappearance of the rotational shaft along the pole. **Figure 4** shows the Linear Oscillatory Actuator (LOA).

The journey in applied magnetic fields is still far and wide open in several industrial and home applications. This is based on the current changes of lifestyle whereby more mechanically-controlled products are replacing the conventional machines. These products have automated precision in control and more convenience plus being environmental friendly with less maintenance.

M. Norhisam, R. N. Firdaus, N. Mariun, I. Aris, H. Wakiwaka and Abdul Razak, J., 2009. Analysis of Thrust Constant, Electrical and Mechanical Time Constant for Slot-less Moving Magnet Linear Oscillatory Actuator. *Journal of the Japan Society of Electromagnetic and Mechanics*, Supplement, 17, S41-S42.

M. Norhisam, F. Azhar, R. N. Firdaus, H. Hashim, M. Nirei, H. Wakiwaka and Abdul Razak, J., 2009. Effect of Spring Constant and Thrust Constant Characteristics to Displacement of Slot Type Moving Magnet of LOA. *Journal of the Japan Society of Electromagnetic and Mechanics*, 17, 3, 437-440.

M. Norhisam, R. N. Firdaus, N. Mariun, I. Aris, H. Wakiwaka and Abdul Razak, J., 2009. Effect of Permeance Model on Thrust Calculation of Slot-less Type Linear Oscillatory Actuator using Permeance Method Analysis. *Journal of Industrial Technology*, 18(1), 15-32.

M. Norhisam, F. Azhar, H. Hashim, M. Nirei, H. Wakiwaka and Abdul Razak, J., 2009. Thrust Calculation of Linear Oscillatory Actuator using Permeance Analysis Method. *Journal of Industrial Technology*, 18, 2, 1-15.

M. Norhisam, A. Norrimah, R. Wagiran, R. M. Sidek, N. Mariun and H. Wakiwaka, 2008. Consideration of Theoretical Equation for Output Voltage of Linear Displacement Sensor using Meander Coil and Pattern Guide. *Sensors and Actuators A*, 147, 470-473.

GOLD UPM Invention, Research & Innovation Exhibition (PRPI 2008)

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

BRONZE (2 medals) Malaysian Technology Expo (MTE 2009)

GOLD AND SPECIAL AWARD The Belgium and International Trade Fair For Technological Innovation (INNOVA 2009)

GOLD AND SPECIAL AWARD British Invention Show (BIS 2009)

PI 20090262: A Cutter

PI 20097008: A Double Stator Electricity Generating Apparatus

PI 20091908: An Electricity Generating Means

PI 20090027: A Moving Magnet of Linear Oscillatory

PI 20097038: A Displacement Sensor

PI 20097039: In-Wheel Permanent Magnet Motor

PI 20084251: Sensor-Less Linear Motor

PI 20080292: Wire Rope Sensor



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Optically Quenched Wide-gap Semiconductor Crystals Evaluation using Single- and Two-photon Excitation

Optical microscopy technique has been the standard tool and method for examining and characterising semiconductor crystals. These crystals such as InGaN, ZnSe and GaN, which are new classes of materials (wide-bandgap, etc.), are becoming more popular and widely used for blue laser and light emitting diode (LED) in Digital Versatile Disk (DVD) and Blue-ray Disk (BD).

Single- and two-photon excitation methods were used to examine the quality of an optically induced defect on InGaN crystal. The defecting process was done using the two-photon excitation and **Figure 1** shows the time and power needed to permanently induce defects on the crystals. From the figure, the highest excitation at 8.70 MW/cm² is the appropriate laser power since it gives the lowest intensity and would continuously drop even after 50s.

Figure 2 shows the images and spectral distributions for both single- and two-photon excitation. Both methods used the same optical configurations, with the exception of excitation laser, which was 405nm laser diodes being used for single-photon excitation while two-photon excitation used femtosecond Ti:sapphire laser (800nm, 80MHz, 100fs). From both images in (a) and (c), the black area (Area 1) is the quenched area while Area 3 represents the normal area. Area 2 is the border between both the defect and normal areas. It is clear that two-photon excitation gives a smoother image compared to single-photon. This is due to the better resolution of two-photon excitation of 71%.

The spectral distributions show that the normal area gives the highest photoluminescence intensity at 481nm for both methods [in (b) and (d)]. This agrees well with the InGaN band gap at 2.58eV. The difference, however, could be seen in the quenched area. No photoluminescence is detected for two-photon excitation but a small photoluminescence is detected for the single-photon excitation. This is due to the selectivity transition of the electron and its related band gap that is completely destroyed whilst the transition level for single-photon excitation is also affected since it is situated near to each other.

Broad photoluminescence is detected at a lower energy level due to the Indium (In) composition and well-width fluctuation based on In mole fraction of 0.14 in the sample. The spectrum of Area 1 and 2 is also affected by the quenching process.

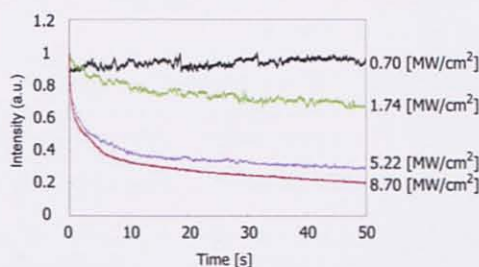
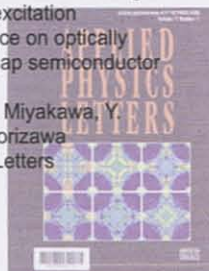


Figure 1: Quenching of InGaN sample for various quenching power with relationship between photoluminescence intensity and exposure time



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

Title : Simultaneous observation of single- and two-photon excitation photoluminescence on optically quenched wide-gap semiconductor crystals
 Author : A. S. M. Noor, A. Miyakawa, Y. Kawata and M. Torizawa
 Journal : Applied Physics Letters
 Volume : 93
 Issue : 17
 Article : 171107
Impact Factor: 3.977



Small side lobes at 440nm are detected in the spectrum of two-photon photoluminescence. Area 1 shows the highest intensity with relative to the band gap intensity. This observation could be described as Piezoelectricity Induced Quantum-confined Stark Effect (PQCSE). The quenching process has little effect on suppressing the PQCSE for Area 1 at 440nm, thus the vibration characteristics are not influenced by optical means.

In this article, the dependency of both excitation methods with its photoluminescence is discussed. The images and its spectral distribution profiles shows the characteristics of the defects induced by two-photon excitation. This would help device engineers to fabricate lasers and LEDs based on these types of crystals.

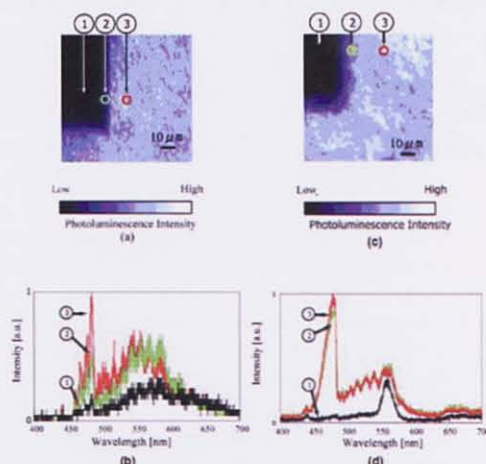


Figure 2: (a) Single-photon photoluminescence image and (b) its respective spectral distribution. (c) Two-photon photoluminescence image and (d) its respective spectral distribution

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

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

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

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

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

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Andrographolide Derivatives - Suppress the Growth of Cancer Cells

Natural products have been the single most leading source in the development of drugs. Information presented on sources of new drugs from 1981 to 2007 indicates that almost half of the drugs approved since 1994 are based on natural products. Over a hundred natural-product-derived compounds are currently undergoing clinical trials and at least a hundred similar projects are in preclinical development where most compounds are derived from leads of plants and microbial sources. Drug discovery from medicinal plants has played an important role in the treatment of cancer. In addition, most new clinical applications of plant secondary metabolites and their derivatives over the last half century have been applied towards combating cancer. For example, topotecan and irinotecan, analogues of camptothecin, a natural product isolated from a Chinese medicinal plant *Camptotheca acuminata*, have made striking improvements in the treatment outcomes of drug-resistant ovarian, cervical, non-small cell lung and colon cancers.

Andrographis paniculata Nees (Acanthaceae) is one of the most important medicinal plants, where it is used in various Asian traditional systems of medicines for gastric disorders, cold, influenza and other infectious diseases. Its common name is 'King of Bitters'. Extracts of the whole plant and the main phyto-constituent andrographolide exhibit several pharmacological activities, including anticancer activity.

Impact Factor: 3.825

Title : Benzylidene Derivatives of Andrographolide Inhibit Growth of Breast and Colon Cancer Cells in Vitro by Inducing G1 Arrest and Apoptosis
 Author : S. R. Jada, C. Mathews, M. S. Saad, A. S. Hamzah, N. H. Lajis, M. F. G. Stevens and J. Stanslas
 Journal : British Journal of Pharmacology
 Volume : 155
 Issue : 5
 Page : 641 - 654
 Impact Factor: 3.825

andrographolide (SRJ09) and 3,19-(3-chloro-4-fluorobenzylidene) andrographolide (SRJ23) as promising anticancer agents. The *in vitro* screen of SRJ09 against 60 human cancer cell lines of the United States National Cancer Institute (NCI) revealed its selectivity towards colon, central nervous system, renal, breast cancers and melanoma. SRJ23 had the most extreme difference in activity profile compared to others whereby it was most active against prostate cancer and least active against renal cancer. In an attempt to elucidate the mechanisms of cytotoxic activity of SRJ09 and SRJ23, we had found that SRJ09 blocked the cell cycle progression at G0-G1 phase through suppression of enzyme cyclin-dependent kinase (CDK)-4. SRJ23-treated HCT-116 colon cancer cells exhibited G1 phase arrest and induction of apoptosis.

Studies in our laboratory focus on anticancer drug discovery, mostly inspired by an interest in novel structures, which are usually derived from nature. Our work demonstrated antitumour activity of andrographolide against human breast cancer in an animal model for the very first time. Many studies have shown that andrographolide is a potent inducer of apoptosis (a form of programmed cell death) in various cancer cell lines, substantiating its potential in cancer therapy.

In order to improve the anticancer potency and cancer-type selectivity of andrographolide, we synthesised a series of andrographolide analogues and subjected them to *in vitro* anticancer screening. From the results obtained, we had identified 3,19-(2-bromobenzylidene)

In summary, andrographolide derivatives are potential anticancer candidates that are believed to possess the characteristics of inducing apoptosis selectively in cancer cells. Presently, studies are in progress to further characterise the molecular events leading to cancer cell cycle arrest and apoptosis by SRJ09 and SRJ23. In addition, we are also exploring the possibilities of chemically modifying SRJ09 for enhancement of the biological activity profile to discover prospective clinical candidates.

S. D. Manikam and J. Stanslas, 2009. Andrographolide inhibits Growth of Acute Promyelocytic Leukaemia Cells by Inducing Retinoic Acid Receptor-independent Cell Differentiation and Apoptosis. *Journal of Pharmacy and Pharmacology*, 51, 69-78.

S. R. Jada, G. S. Subur, C. Mathews, A. S. Hamzah, N. H. Lajis, M. S. Saad, M. F. Stevens and J. Stanslas, 2007. Semisynthesis and In Vitro Anticancer Activities of Andrographolide Analogues. *Phytochemistry*, 68, 904-912.

S. R. Jada, A. S. Hamzah, N. H. Lajis, M. S. Saad, M. F. Stevens and J. Stanslas, 2006. Semisynthesis and Cytotoxic Activities of Andrographolide Analogues. *Journal of Enzyme Inhibition and Medicinal Chemistry*, 21,2, 145-155.

G. Bagalkotkar, S. R. Sagineedu, M. S. Saad and J. Stanslas, 2006. Phytochemicals from *Phyllanthus niruri* and Their Pharmacological Properties: A Review. *Journal of Pharmacy and Pharmacology*, 58,12, 1559-1570.

J. Stanslas, D. J. Hagan, M. J. Ellis, C. Turner, J. Carmichael, W. Ward, T. R. Hammonds and M. F. G. Stevens, 2000. Antitumor Polycyclic Acridines. 7. Synthesis and Biological Properties of DNA-affinic Tetra- and Penta-cyclic Acridines. *Journal of Medicinal Chemistry*, 43, 1563-1572.

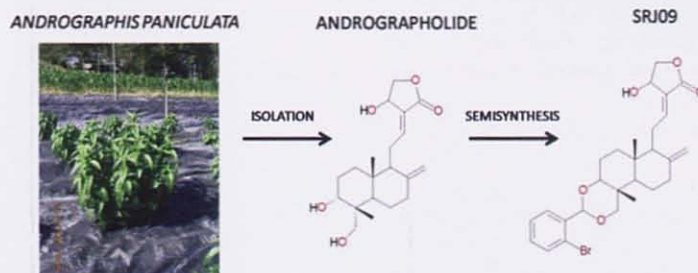


Figure 1: Process in the Making of SRJ09

- GOLD** UPM Invention, Research & Innovation Exhibition (PRPI 2009)
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- BRONZE** UPM Invention, Research & Innovation Exhibition (PRPI 2004)



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2



1



3

CANCER AWARENESS CARNIVAL (3K)

1. The Vice Chancellor of UPM finds something interesting at the Cancer Awareness Carnival.
2. Prof. Datuk Dr. Nik Mustapha R. Abdullah officiating the 3K as the Deputy Director of IBS, Prof. Dr. Abdul Rahman Omar looks on (left).
3. Assoc. Prof. Dr. Latiffah A. Latiff (wearing purple headdress) demonstrating breast check-up procedures.

2010 UPM RESEARCH FINDINGS PROMOTIONAL EVENT



1



2



3

Pineapple Multi-peeler Plus

1. Dr. Rosnah explaining her product to the press.
2. A few demonstrations from Dr. Rosnah.
3. Dr. Rosnah posing with her teammates.



1



2



3

Thymoquinone Rich Fraction (TQRF)

1. The Thymoquinone Rich Fraction (TQRF).
2. Prof. Dr. Maznah Ismail explaining about the TQRF to members of the media.
3. Prof. Dr. Maznah with her invention, the TQRF, produced by the Institute of Bioscience, UPM.

R&D&C HAPPENINGS



MALYSIAN UNIVERSITY ROBOT COMPETITION (MURoC) 2010

1. Some of the UPM participants at MURoC were highly motivated to give their very best.
2. Some of the students setting up their equipment.



MALYSIAN TECHNOLOGY EXPO 2010

1. UPM team at the MTE 2010
2. The judging process during the MTE 2010.
3. The UPM Secretariat booth at the MTE 2010.



A WORKING VISIT BY THE MINISTER OF AGRICULTURE & AGRO-BASED INDUSTRY, Y. B. DATUK SERI NOH OMAR, TO UPM

1. Some of the research products were displayed during the working visit by Y.B. Datuk Seri Noh Omar, the Minister of Agriculture and Agro-based Industry.
2. Researchers from UPM briefing the visitors.
3. Y.B. Datuk Seri Noh Omar listening attentively.



NewsBriefs

UPM Champions in 2 Top Categories at MURoC 2010



Winners, comprising students and lecturers, from the Faculty of Engineering, with their prizes during the Malaysian University Robot Competition (MURoC).

Universiti Putra Malaysia (UPM) walked away as champions in two out of three categories in the Malaysian University Robot Competition (MURoC) 2010. The three categories were Paintball Robot, Rope Climbing Robot and Fire Fighting. UPM proudly seized the Paintball Robot and Rope Climbing Robot categories. Winner of each category brought home a cash prize of RM 1,500 and winning trophy.

The first ever event held in the country was hosted by Universiti Malaysia Perlis (UniMAP) with 170 students, representing 21 teams. Seven public institutions including polytechnics, took part in the competition.

According to the Head of the Paintball Robot team, Mohd. Safuan Mohd. Somari, 25 and a final year student of the Bachelor of Electric and Electronic Engineering Programme, the team was made up of robot enthusiasts and spent countless hours on assembling the robot. "The groundwork took approximately one month, which included conducting a study on the true game of paintball," he added.

Furthermore, he informed the media that the team had participated in numerous competitions and won the Best Design Robot Robocon 2009 and bagged the 2nd runner up title in Robogamez 2009.

Meanwhile, the Head of the Rope Climbing Robot team, Mohd. Afiq Abdul Ghafar, 20, said that his team also took one month getting the robot to function. "Although we have set a target that it would exceed a velocity of less than 10 seconds, we are still satisfied with the 14-second race," he added.

Made up of eight engineering students, the team viewed their success as an inspiration for future competitions. In addition, UPM also became the 2nd runner up for the Fire Fighting category, Best Design category (Paintball and Rope Climbing) and Special Award for Industry as well.

The UPM robotic team supervisors were Wan Zuha Wan Hasan and Assoc. Prof. Dr. Mohammad Hamiruce Marhaban from the Department of Electric and Electronic Engineering, Faculty of Engineering, UPM.



Prof. Dr. Azhar Md. Zain (left), launching the website on cancer prevention while Assoc. Prof. Dr. Minalini Kandiah (right) looks on.

"It is our great hope that the information available on the website would reduce the percentage of cancer patients in Malaysia, most of whom suffer from breast, colorectal, lung, cervix and nasopharynx cancer," said Prof. Dr. Azhar in his officiating speech. In addition, the Head of Researchers in Promoting Health at the Workplace to Prevent Cancer, Assoc. Prof. Dr. Minalini Kandiah said that 21,773 cancer cases had been registered under the National Cancer Registry, which identified 9,974 cases involving men and 11,799 cases involving women.

"In Malaysia, the study shows that the key factor contributing to cancer is the lifestyle which contributes to obesity, minimal physical activity, smoking, alcohol consumption and the absence of fruits and vegetables in the daily diet," she said. "Prior to the launch, we conducted a study on 360 UPM staff. The results are very encouraging especially when found that most respondents have started to change their lifestyles," she added.

NutriHealth, nestles at <http://www.nutrihealth-upm.com> and is designed by UPM, and is currently published in Bahasa Melayu and would soon be in English to cater for international visitors.

Contributions of UPM towards Environmental Sustainability



The Vice Chancellor of UPM, Prof. Datuk Dr. Nik Mustapha Raja Abdullah (left), in a light moment with Prof. Jao Jia Horng (right) after officiating the National Seminar on Current Issues and Challenges in Environmental Quality Management in Malaysia.

UPM is supportive of the effort to sustain the environment as it naturally falls under everyone's responsibility, as told by the Vice Chancellor of Universiti Putra Malaysia (UPM), Prof. Datuk Dr. Nik Mustapha R. Abdullah.

In response to the effort, UPM had established a Centre of Excellence for Environmental Forensics, which is in line with the government's aim to highlight issues on environmental conservation. "The goals of the centre would support UPM's mission, vision and goals in its aspiration to become a university of international repute," he said during the National Seminar on Current Issues and Challenges in Environmental Quality Management in Malaysia held in UPM recently. He added that the seminar would provide a platform for those who practice environmental quality management hence enable them to interact with others on future environmental issues.

In addition, the Dean of the Faculty of Environmental Studies (FPAS), Assoc. Prof. Dr. Ramdzani Abdullah said that hosting the seminar was deemed appropriate when taking into consideration the fact that FPAS had established a Centre of Excellence for Environmental Forensics. "The seminar would aid the effort to strengthen the research institution network and provide an avenue for these researchers to interact," he said further.

The two-day seminar presented 55 papers, namely on Water Ecosystems, Waste Management, Environmental Forensics, Environmental Health, Impact Assessment, Environmental Economics and Environmental Education.

UPM Launches a Website for Cancer Awareness

Universiti Putra Malaysia (UPM) launched a health information website to increase awareness on cancer and other chronic diseases as well as the potential preventive measures through healthy diets and lifestyles. The website, launched by Prof. Dr. Azhar Md. Zain, the Dean of the Faculty of Medicine and Health Sciences, had five main functions which served as guidelines in the prevention of cancer and other chronic diseases such as heart disease, diabetes mellitus and high blood pressure.

He told the media that the website was rather unique due to its interactive features that enabled visitors to correspond with a selected panel of experts who would help them unravel any enquiries, particularly on researches that had been carried out. "With a healthy lifestyle as the top priority, UPM decided to utilise the practicality of a website to disseminate any information on cancer, which have proved to be efficient," he added further.

Goat's Milk to Spider Silk



Dr. Konstantinos (Costa) Karatzas presenting his breakthrough in a public lecture in UPM.

Universiti Putra Malaysia (UPM) hosted a scientist, Dr. Konstantinos (Costa) Karatzas, from the Research Institute of McGill University Health Centre, Montreal, Canada, to share his breakthrough on spider silk made from goat's milk.

His discovery of the spider silk is hoped to make a large contribution to the field of medicine in areas such as organic surgery microsuture and in the development of artificial ligaments for human. Apart from medical convenience and textile manufacturing, the fibre could also be used in engineering devices and racquet strings.

"The strength of the spider dragline silk protein, being weaved into a diameter of a pencil point, would be able to sustain the endurance of a flying Boeing-747 due to its high kinetic absorption. "It is not impossible to foresee the application of this spider silk-fabric in the manufacturing of bullet-proof jackets," he said in a public lecture held at the Briefing Hall, Administration Building, UPM.

The spider silk has been dubbed as "bio steel" due to its 7-fold strength and unique attributes such as toughness, high endurance and flexibility. Dr. Konstantinos managed to get the silk from mammalia cells in NEXIA's patented breed of fast-growing, early-lactating goats. Spider genes were injected into the goat's sperm that resulted in a biosteel-molecule-contained blood. After a period of a few years, the polymer strands would have to be extracted from the milk and woven into thread.

He also dismissed the presumption that this was goat gene alteration and counteracted with an analogy – "A child's medical treatment is more worthy than a goat." Dr. Konstantinos also had to deal with several issues raised such as the possibility to splice the silk into rubber trees or palm trees instead of goats.

A Breakthrough In Alzheimer and Cardiovascular Disease Prevention



Prof. Dr. Maznah Ismail with her associate researcher, Norsharina Ismail, holding the TQRF.

A group of Universiti Putra Malaysia (UPM) researchers successfully created a product called Thymoquinone Rich Fraction (TQRF), an agent to aid the treatment of Alzheimer and cardiovascular disease.

The head researcher, Prof. Dr. Maznah Ismail said the product was extracted from *Nigella sativa* seeds containing Thymoquinone (TQ) that has a very high anti-oxidant activity thus the capacity to maintain optimum health. "Cardiovascular diseases are the most common cause of death worldwide and have been associated with Alzheimer's disease," she said during a press conference, organised by the University Research Management Centre and Corporate Communication Division, to introduce UPM's new products. "The TQRF project was initiated in 2005 and completed in 2008. The TQRF is extracted from *Nigella Sativa* seeds using an efficient and clean platform technology – the Supercritical Fluid Extraction System (SFE)," she said. She was assisted by two co-researchers, Ghanya Al-Naqeeb and Norsharina Ismail, from the Institute of Bioscience, UPM.

Prof. Dr. Maznah, who is also the Head of Molecular Biomedicine Laboratory, Institute of Bioscience, said the reason for choosing *Nigella sativa* seeds, especially from Yemen, Iran and Sudan, was because they produced 40% more TQ oil than the seeds from India and Sri Lanka.

UPM to Increase Cancer Knowledge among Public



The President of MAKNA, Dato' Farid Arifin (left), accompanied by the Vice Chancellor of UPM, visiting the exhibition.

Two entities from Universiti Putra Malaysia (UPM) joined hands in their bid to educate the public regarding cancer by hosting the Cancer Awareness Carnival (3K) and launching two books on cancer knowledge. Organised by the UPM Cancer Research Laboratory – MAKNA from the Institute of Bioscience (IBS) and the Cancer Research Laboratory from the Institute of Social Studies (IPSAS), the carnival was packed with forum activities, health check-ups and cancer preliminaries.

The Vice Chancellor of UPM, Prof. Datuk Dr. Nik Mustapha R. Abdullah, said the social responsibility programme was aimed at providing early exposure on cancer prevention which normally began from one's lifestyle. "This carnival also promotes UPM's new discovery through the IBS Centre of Excellence and Faculty of Medicine and Health Sciences," he said during the officiating ceremony of 3K and book launch of Cancer Educational Research held here recently.

The Director of IPSAS, Prof. Dr. Md. Salleh Hj. Hassan said the books, entitled *Pemakanan untuk Pesakit Kanser Payudara* and *Pengambilan Tenaga untuk Pesakit Kanser Payudara*, cover aspects on energy consumption, body weight, fat intake, social activities, intake of fruits and greens, diet supplements intake and alcohol consumption. The books were published by three UPM researchers; Dr. Zalina Abu Zaid, Assoc. Prof. Dr. Zailiah Mohd. Sharif and Assoc. Prof. Dr. Minalini Kandiah, experts on nutrition and diet.

The recently launched books are among the eight publications funded by Boeing Corporation and are available at the Cancer Resource and Educational Centre (CaRE), Faculty of Medicine and Health Sciences, UPM. The aptly themed carnival, *Kanser Boleh Dicegah Juga*, was held for two days from 4th – 5th February 2010 in conjunction with the World Cancer Day celebrated on the 4th of February every year.

3 in 1 Pineapple-Multi-Peeler

A group of Universiti Putra Malaysia (UPM) researchers successfully invented a 3 in 1 pineapple machine, which was also known as the "Pineapple-Multi-Peeler", that is capable of processing sliced and cubic-shaped pineapples. Head researcher, Dr. Rosnah Shamsudin, mentioned that the time and energy-saving machine was invented based on three main functions – peeling the skins, cutting the pineapple into slices and shaping the slices into cubes.



Dr. Rosnah Shamsudin with her "3 in 1 Pineapple Machine".

"The machine is suitable for use by home-makers and factory-based pineapple entrepreneurs," she said during a press conference of UPM's research products organised by the Research Management Centre and Corporate Communication Division. She was assisted by Siti Zaharah Mustapha from the Faculty of Engineering. The research was initiated in 2008 and completed in 2009. It had also been patented in Malaysia (13th of November, 2009).

Dr. Rosnah Shamsudin noted that prior to starting on the invention, she gained advice from the Malaysian Pineapple Industry Board (MPIB) on ways to improve current pineapple peeling machines. She added that during those times, most of the canned pineapples and *kuih-muih* entrepreneurs were still using the manual method of pineapple processing. She also mentioned that the 3 in 1 pineapple machine is easy to operate, time saving, hygienic and had a low maintenance cost compared to other machines. The 3 in 1 pineapple machine is created for small and medium size pineapple enterprises, pineapple sellers and factories involved in the production of canned pineapples, pineapple tarts, jams and juices.

The Deputy Vice Chancellor (Research and Innovation), Prof. Dato' Dr. Abu Bakar Salleh stated that even though the machine is still in the pre-commercialisation stage, UPM welcomes any party that has interest to commercialise it. "If the machine is commercialised, I have faith that it would provide a huge boost to the national pineapple industry and save the cost of manpower for the peeling process," he added.

She added that the products currently available in the market that were being prepared using other technologies were not capable of trapping the TQ. In addition, the Deputy Vice Chancellor (Research and Innovation), Prof. Dato' Dr. Abu Bakar Salleh, said the product has great potential to attract pharmaceutical companies. "The technology is still at a pre-commercialisation stage and needs a clinical trial on humans before it can be fully commercialised," he added.

Patented in 2008, the product has received numerous accolades at the International Exhibition of Ideas Inventions New Products (IENA) 2009 in Nuremberg, German, two silver medals at the Malaysian Technology Expo (MTE) 2008 and 2009 and another three medals at the Invention, Research & Innovation Exhibition (PRPI), UPM.

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 problems to human. There are several pollutants which pose as threats to drinking water. They are categorised in six categories as follows:

- Microorganisms; • Disinfectants; • Disinfection Byproducts; • Inorganic Chemicals; • **Organic Chemicals**; and • Radionuclides

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

Organic Chemicals

Contaminant	1MCLG	2MCL	Potential Health Effects from Ingestion of Water	Sources of Contaminants in Drinking Water
Ethylbenzene	0.7	0.7	Liver or kidneys problems	Discharge from petroleum refineries
Ethylene dibromide	Zero	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries
Glyphosate	0.7	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use
Heptachlor	Zero	0.0004	Liver damage; increased risk of cancer	Residue of banned termiticide
Heptachlor epoxide	Zero	0.0002	Liver damage; increased risk of cancer	Breakdown of heptachlor
Hexachlorobenzene	Zero	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories
Hexachloro cyclopentadiene	0.05	0.05	Kidney or stomach problems	Discharge from chemical factories
Lindane	0.0002	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, gardens
Methoxychlor	0.04	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, livestock
Oxamyl (Vydate)	0.2	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes
Polychlorinated biphenyls (PCBs)	Zero	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals
Pentachlorophenol	Zero	0.001	Liver or kidney problems; increased cancer risk	Discharge from wood preserving factories
Picloram	0.5	0.5	Liver problems	Herbicide runoff
Simazine	0.004	0.004	Problems with blood	Herbicide runoff

Definitions:

1. Maximum Contaminant Level Goal (MCLG) - The level of a contaminant in drinking water below in 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.

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

....to be continued in Synthesis Issue 29, June 2010.

Candida species are yeast-like fungi that are opportunistic pathogens of humans. Incidence of infections caused by these fungi, termed candidiasis, has been rising tremendously due to the increasing population of immunocompromised and immunosuppressed patients. These infections could be life-threatening in cancer patients, post-surgery and burns patients, also the elderly and premature newborns. Patients with central venous catheters are especially at risk from exogenously introduced systemic candidiasis and candidemia (*Candida* in the blood).

The most predominant species that causes candidiasis is *Candida albicans* or *C. albicans*. However, there has been a global shift in the relative prevalence of species occurring in the last decade. Other predominant species causing candidiasis include *C. parapsilosis*, *C. tropicalis*, *C. glabrata*, *C. rugosa*, *C. krusei*, *C. dubliniensis* and *C. kefyr*. Treatment for candidiasis with conventional antifungal azole drugs such as fluconazole, itraconazole, and clotrimazole is sometimes ineffective as certain species of *Candida* are resistant to these drugs. Therefore it is crucial to identify the particular species of *Candida* infecting a patient so that the appropriate drug could be prescribed.

Current methods of diagnosis for fungal infections involve microbiological culture of the clinical sample (blood, cerebrospinal fluid or other specimens) either manually or in the BACTEC System from BD Diagnostics. This is sometimes followed by biochemical tests to identify the particular fungal species, which could take from 3 to 7 days. The drawbacks from these current methods are time-consuming, lack of sensitivity and high false-negative rates. *Candida* cells might only be briefly present in the blood when an internal organ is infected therefore a blood culture result is not always reliable. Consequently, very often the definitive diagnosis is only obtained during post-mortem.

With the aim of overcoming these problems, a more specific and sensitive method based on the detection of the fungal *Candida* DNA was developed in the present research. Sequence-specific oligonucleotide probes and primers were designed to target the variable region of ribosomal DNA of 8 most common *Candida* species. The specificity of these primers and probes were tested against the DNA from various *Candida* species and several yeasts and bacteria. These primers could be used in nested PCR format or DNA array PCR-reverse hybridisation format.

The sensitivities of the nested PCR and DNA array methods using the species-specific primers and probes were 1 cell/ml, and 10 cells/ml of serum respectively. For the DNA array method, the probes were pre-fixed on a nylon membrane. DNA extracted from clinical samples using commercial DNA extraction kits was subjected to polymerase chain reaction (PCR) and biotin-labelling protocol using universal fungal primers. The biotin-labelled PCR products were then allowed to hybridise to the membrane-bound specific probes. Following some biochemical reaction steps, a blue-purple colour would develop on the strip to indicate that the sample was positive for infection caused by that particular *Candida* species. Conversely, if no blue-purple colour was developed, this indicated that the sample was negative for *Candida* infection. The DNA array reverse dot-blot method takes only 5.5 hours while the nested PCR method takes 6.5 hours from the sample processing, DNA extraction right through to PCR and detection.

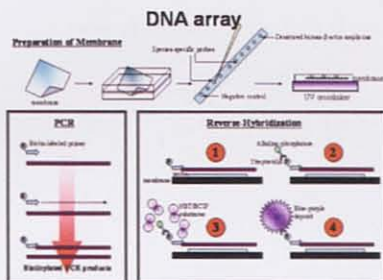


Figure 1: PCR-reverse hybridisation method using the *Candida* species-specific probes prefixed in a nucleotide DNA array format



Figure 2: Specificity test result for the *Candida rugosa* species-specific probe showing only the *C. rugosa* probe gave a colour change from colourless to blue-purple after the membrane was subjected to hybridization with DNA extracted from *C. rugosa* species

Nucleotide Probes

– For Quicker and Faster Detection of *Candida* Infections

In comparison to other studies conducted in Western countries, which have also developed PCR-based techniques for detecting *Candida* infections or for distinguishing the *Candida* species, the current research has certain advantages as to the number of species of *Candida* detected, the unique sequences of the nucleotide probes which have been applied for patent, the high sensitivity and also the affordable costs (USD \$1 per test for nested PCR and US\$ 4 per test for DNA array). Some of the other studies employ expensive equipment such as Real-time PCR and flowcytometer whereas the present method does not require any substantial initial capital as start-up. In the future, it is hoped that technologies incorporating these nucleotide probes can be applied routinely in clinical diagnostics to complement the current microbiological culture methods in order to aid the medical doctors towards a more accurate diagnosis of patients with suspected fungal infections.



Figure 3: Sensitivity test of DNA array method demonstrated that the detection limit for *C. albicans* cells in serum samples using the DNA array method was 10 cells/ml of serum

Malaysian Patent: Nucleotide Probes for Identification and Detection of *Candida* Species (PI 20070524)

- BRONZE** UPM Invention, Research & Innovation Exhibition (PRPI 2009)
- SILVER** International Exposition of Research & Inventions of Institutions of Higher Learning (PECIPTA 2009)
- BRONZE** UPM Invention, Research & Innovation Exhibition (PRPI 2007)
- BRONZE** UPM Invention & Research Exhibition (2003)
- BRONZE** UPM Invention & Research Exhibition (2002)



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Affinity Precipitation - The Latest Discovery

The recovery and purification of the widely used enzyme, trypsin, from any source is of significant industrial interest. The most selective commercial purification method for proteins is affinity chromatography. However, due to its high capital and operating costs, the use of this method in commercial applications is limited to the purification of very high-value products. Chemical engineers at Universiti Putra Malaysia have developed a technique called Affinity Precipitation that incorporates the specificity of affinity chromatography into precipitation. The specificity comes from the first stage of the precipitation mechanism in which modified ligands are added to a protein solution and bounded to the targeted protein. This study indicates that affinity precipitation is a powerful technique that uses waste-free technology. The technique is also more economical than affinity chromatography because of its scaleable capital and lower operation and maintenance costs. Both the capital and operating costs of the affinity precipitation system could be lowered because fewer operations are needed, the simplicity of its operation and its ability to operate in continuous mode.

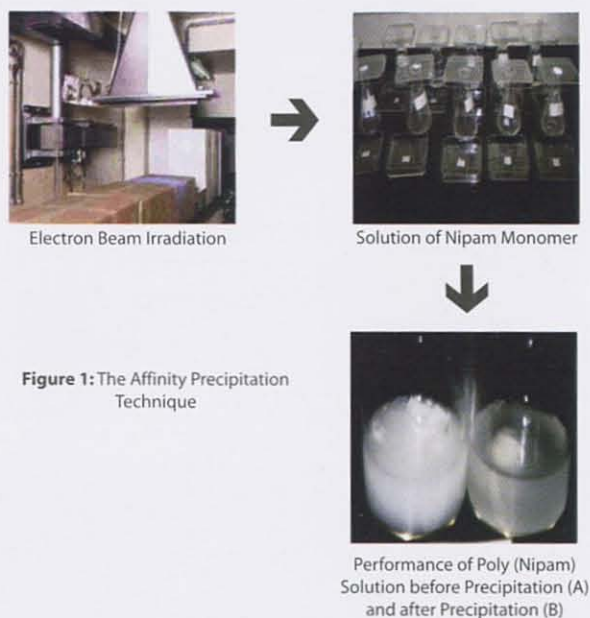


Figure 1: The Affinity Precipitation Technique

By referring to **Figure 1**, the electron beam irradiation method was selected due to its waste-free technology which was less polluting. By using this technique, the efficiency of the precipitation (for the recovery of trypsin) was remarkable, i.e. up to 96%, of which the highest recovery was 86% in a single serial throughput.



GOLD International Exhibition of Inventions, New Techniques and Product (GENEVA 2009)

Hence, this technique could help tremendously to improve the business, safety and environmental performances as explained below:

No.	Industrial Performances
1.	The recovery and purification of trypsin from any source is of industrial interest because the enzyme is widely used for medical purposes, clarification of juice and meat tenderisation.
2.	In terms of costing comparison, the affinity precipitation technique is more economically favourable than affinity chromatography for industrial enzyme purification. It is simple and has a single unit operation. Compared to affinity chromatography, it operates in a packed column which leads to common problems such as blind/dry/flooding, etc. Furthermore, the later technique has very limited purification and complicated design. As a result, it is only being used in laboratories. On the other hand, the former is scaleable and additional units could be added in, if required, to achieve the production's target and specification. In addition, the capital, operation and maintenance costs are predicted to be lower than affinity chromatography.
3.	The application of a synthesised poly (Nipam) using the electron beam irradiation technique for the affinity precipitation of enzymes is an alternative to conventional method, i.e. to synthesise the conjugated polymer using chemical processes. It is waste-free technology and less polluting.
4.	It is a reversible thermo-precipitation conjugated polymer; i.e. firstly, the conjugated polymer is dissolved in the mixture after it has captured the selected enzyme through affinity chromatography. Then, the soluble polymer is re-precipitated by the increasing temperature of the mixture, i.e. it is done during the process of separating the enzyme in the mixture. Finally, the conjugated polymer could be dried and re-used. The process has high potential to be commercialised since the industry is looking for a process which is high in productivity as well as purity. The technology being used is also simple in terms of operation, has low operation and maintenance costs, is environmental friendly and has economical competitiveness compared to the conventional technique.

Its aqueous media has also numerous unique characteristics as well (listed below):

1. It is soluble in water at a lower temperature and yet it becomes insoluble at a higher temperature. As such, it could be re-used and re-cycled many times;
2. It contains reactive groups for ligands and coupling;
3. It does not interact strongly with ligands or impurities;
4. It has sharp and well-characterised transition;
5. It has very narrow molecular mass distribution;
6. It forms precipitates; and
7. It is easily resolubilised.

As a conclusion, affinity precipitation is an outstanding discovery and could be applied in pharmaceutical industries, e.g. the making of capsules made from carrageen and in the production of antibiotics.

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Coenzyme Q10 - A Food Supplement for the Coming Century

Universiti Putra Malaysia (UPM), in joint collaboration with Black Gold Petroleum Sdn. Bhd., is working towards the production of Coenzyme Q10 with improved bioavailability for food supplement made of tobacco leaves.

Coenzyme Q10 (CoQ10) is a vitamin-like nutrient that plays a vital role in cellular energy production. It serves a foundational role in the production of adenosine triphosphate (ATP), which is the cell's primary energy source and drives a number of biological processes including muscle contraction and the production of protein. It is also known as ubiquinone due to its chemical structure of a quinone and it is ubiquitously distributed in nature. The USP refers to CoQ10 as Ubidecarenone.

The production of CoQ10 is dependent on an adequate supply of numerous precursors and cofactors, and a deficiency of one or more of these essential components can adversely affect the production of adequate amounts of CoQ10. The human body produces less CoQ10 as the body ages, and low CoQ10 levels have been associated with chronic diseases like heart disease, cancer, diabetes, Parkinson's disease, and muscular dystrophies. There is a large body of data on the beneficial effects of CoQ10 supplementation in various disease states including cardiovascular diseases and there is substantial evidence for the therapeutic role of CoQ10 supplementation with regard to heart failure.

Only the trans-isomer of CoQ10 is pharmacologically active. There are various process routes for producing CoQ10 such as fermentation and chemical synthesis. The fermentation process for CoQ10 often produces Q7, Q8, Q9 and Q11 as impurities. Most of the chemical synthesis processes produce both isoforms of CoQ10. The cis-isomer needs to be removed before clinical use and is a costly process. The global market for CoQ10 was valued at \$835m in 2008, compared to \$380m in 2003 and there is evidence of sales surges of up to 200 per cent per annum in some countries. With an objective of upscaling the efficient and cost-effective production of highly pure trans-CoQ10 from solanesol (originally isolated from tobacco and which is economical), the project has successfully led to the establishment of the pilot plant with the support of technology from PharmaEssentia Corp., Taiwan. Through the semi-synthesis technology and strict manufacturing guidelines and protocols, the trans-CoQ10 is produced at pre-commercialisation scale, the highest purity CoQ10 available in the world market.

Although many CoQ10 preparations are available in the market, some preparations are less bio-available than others. CoQ10 is not readily absorbed by the body due to a multitude of factors such as purity and poor formulation, which may result in inadequate bioavailability. In order to improve the dissolution profile of CoQ10, a solubilised and stable formulation of CoQ10 (softgel form) has been developed which showed excellent solubility and superior bioavailability as compared to many other CoQ10 formulations. Overall, the special CoQ10 formulation shows four times higher plasma concentration compared to that of ordinary CoQ10 products and 1.3 times higher than current leading brands. Commercialisation of the developed CoQ10 softgel is in progress.

Prof. Datuk Dr. Nik Mustapha R. Abdullah, the Vice Chancellor of UPM, accompanied by Prof. Dato' Dr. Mohamed Shariff Mohamed Din, the Director of ICC and the inventor, Assoc. Prof. Dr. Lai Oi Ming from the Faculty of Biotechnology and Biomolecular Sciences, visited the pilot plant, targeted to produce coenzyme Q10 from tobacco leaves, located at Taman Universiti Indah, Seri Kembangan, Selangor. The Ministry of Science, Technology and Innovation (MOSTI) had allocated RM 5,256,230.00. for the pilot plant under the Technofund grant scheme. Dato' Embi Yusoff, the Director of Black Gold Petroleum Sdn. Bhd. welcomed the delegates from UPM and showed the progress of the project.



Production plant



Coenzyme Q10 powder produced and purified in the plant

Reader Enquiry
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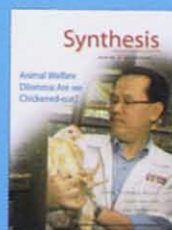
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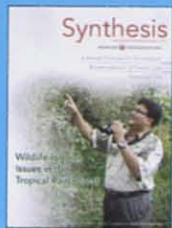
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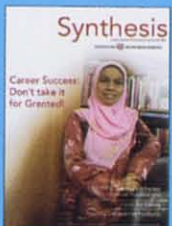
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