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From the Chief Editor

This issue of the Buletin Kimia introduces you to the research activities of the Nanoscience Research Group (NsRG) in 2003 (page 6) and the general objectives of the newly formed Molecular Chemistry and Synthesis Research Group (page 8). The Buletin Kimia will always keep you updated on the research activities of the existing research groups and the formation of new research groups in the School. This issue presents articles which provide a good description of research work encompassing a wide spectrum of topics from natural products to the reutilization of agricultural wastes.

Dr. Wong describes the isolation of various natural products from a shrub commonly found in northern Peninsular Malaysia, *Melastoma malabathricum* L., and the results of their phytochemical and biological examinations (page 22). Pn. Afidah's article (page 9) provides a good example of some practical applications for natural products, in this case mangrove tannin as corrosion inhibitors.

In synthesis work, Dr. Ismail reports a new technique in preparing a thin electrochromatic TiO_2 anatase films by simple sol-gel process (page 20). Dr. Bahruddin and group describes the synthesis of cyclic and acyclic ligands carrying chromogenic groups for complexing various metal ions (page 16).

To commemorate the 100th anniversary of chromatography, Y. Bhg. Dato' Prof. Idiris's article took us back in time to the first lecture delivered by Tswett on 21 March 1903 (page 12). The article also describes Y. Bhg. Dato's initial exposure to chromatography and subsequent research work in USM.

Dr. Yeap reports the study of the molecular structure and conformational analysis of liquid crystals in solution conducted by the Liquid Crystal Group (page 4). The article by Dr. Farook (page 14) describes the preparation of a possible heterogeneous catalyst from rice husk – a good illustration of reutilization of waste materials.

Environmental-related articles include one by Prof. Lim on the focus and achievements of constructed wetland research in the School (page 5) and the other by Dr. Md. Sani on the research work done on persistent organic pollutants (POPs) in terms of the development of analytical methods for POPs and the determination of levels of POPs in inland waters and various marine species collected from the Straits of Malacca (page 24).

The importance of chemical education has not been overlooked. Dr. Norita's article (page 26) describes the development of multimedia pre-lab modules to assist the students in preparing for laboratory classes.

Lastly, we have also included in this issue two articles for general reading: one by Dr. Mohamad Nasir on the opportunity for chemists in petroleum industry (page 10) and the other by Dr. Mohd. Jain on the corrosion of compact disc (page 18).

Looking forward to your contributions and feedback.

Message from the Dean

Assoc. Prof. Jamil Ismail

Welcome to the third issue of Buletin Kimia. This issue brings you updates of the research activities, achievements and events in the School of Chemical Sciences as year 2003 draws to a close.

The School's research has progressed well despite limited funding for the year. Research money totaling RM1.4M has been secured from various sources, including RM77K from the INTEL research grant. This goes to support 51 new postgraduate students making the total enrolment of 143, out of which 28 have graduated as promising young scientists. A total of 45 papers have been published in refereed journals and at least 20 others presented in conferences including 10 at international level. The statistics represent a renewed momentum as we geared our efforts towards formation of research clusters within the School and collaborations with international institutions. It is an encouraging development.

The School has increased its stride to attract good postgraduate students, the number one criterion in achieving high-quality science. New computer facilities for postgraduates have started operation in October 2003. Upgrading the research equipment for better output and reliability of data and increasing the competency of services via in-house training on instrumentation for operators are our priorities because these are crucial segments supporting the research in the school. The school has embarked on accreditation programmes involving major instruments to get certification targeted in one to two years time. In the pipeline is the assignment of laboratory spaces to accommodate cluster research and encourage more interactions among postgraduates, postdoctoral fellows and supervisors. This renovation of infrastructure is vital for research in the years to come.

Research funding is the second criterion. The school is set to be more proactive and aggressive in its effort to increase the proportion of its research money from industries through joint and contract research and from international funding through collaborations with overseas institutions and universities.

Research association is the third criterion. Ideas that take research to the cutting edge or the frontiers of sciences require a working environment where there are colleagues or people who could challenge and stimulate one's mind besides one's own intuition and innovation. This is the reason why it is often a practice for many renowned laboratories in the world to hire experienced postdoctoral fellows or researchers from other renowned institutions or universities.

It is the aim of every issue of Buletin Kimia to present articles covering different fields of sciences and to stimulate interest in science among the general readers. I hope this issue will achieve the aforesaid aim.

Molecular Structure and Conformational Analysis of Liquid Crystals in Solution

Assoc. Prof. Yeap Guan Yeow

Liquid crystals have generally been regarded as the fourth materials which exist in either liquid or solid form. A comparison among the compounds exhibiting liquid crystal properties with those existing in liquid or solid has shown that the differences of these materials lie in the molecular arrangement wherein the positional and orientational orders are two main parameters which change from one phase to another [1].

In view of the importance of studying these different phases ranging from solid, liquid to liquid crystals, the scientists are compelled to continually innovate on the technique suitable for the study of these molecules in various phases at different temperature. IR and NMR are among the fundamental techniques applicable to the study of these compounds of which the molecules in solid, liquid or even the liquid crystals reorientate in different directions.

Like the other well-established liquid crystal laboratory in the world, the Liquid Crystal Research Group in the School of Chemical Sciences, USM has focussed on the study of the molecular structure and conformational analysis of liquid crystals including some palm oil based derivatives.

Apart from IR, the high resolution 1D (e.g. normal ^{1}H, ^{13}C, DEPT) and 2D NMR techniques (homo- and heteronuclear correlation studies e.g. COSY, NOESY, ROESY, ^{1}H-^{13}C HMQC and HMBC) have been used in the investigation of molecular conformation of liquid crystals in solution [2,3].

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Recent investigation by our research group on cholesteryl alkoxybenzoates and cholesteryl alkoxyphenylbenzoates have led to a conclusion that the cholesteryl fragment was kinked at the ester linkage of O=C-O (Fig. 1).

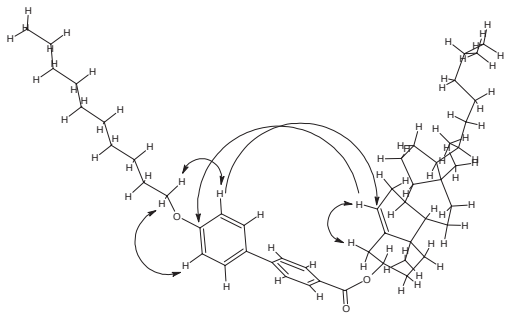

Fig. 1. The molecular structure of cholesteryl decyloxyphenylbenzoate in solution [2].

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Constructed Wetland Research in the School of Chemical Sciences

Prof. Lim Poh Eng

Constructed wetland provides a good example of a wastewater treatment system which utilizes natural processes involving plants, soil and their associated microbial assemblages. It has been proven to be an efficient, low-cost and low-maintenance system suitable for treating wastewater from municipal, agricultural and storm water runoff. The popularity of this system is substantiated by the observation that the number of constructed wetlands has increased to more than 8000 sites across the world. A good review of the system can be found in Lim and Polprasert [1]. In an effort to broaden the application of constructed wetlands, a lot of research interests have now been focused on the potential of the system to treat industrial wastewater containing toxic pollutants such as heavy metals and organic priority compounds. This is the main thrust area for constructed wetland research in the School of Chemical Sciences (SCS).

Research activities on constructed wetland in the SCS are focused on the scientific study of the system. It should be pointed out that most of the current constructed wetland research is basically technology oriented and the system is always treated as a "black box". To ensure that constructed wetlands are operating under natural conditions, the experimental units in USM are placed outdoors and fed with primary-treated domestic wastewater from student hostels in the campus. Over the years, various research projects have been conducted and culminated in a number of publications. These are: (i) Comparative studies of horizontal free-water-surface and subsurface-flow constructed wetlands for the removal of oxygen demand, nitrogen and copper [2], (ii) The respective effects of Zn, Pb and Cd and the combined effect of Zn, Pb, Cd and Cu on the removal of nitrogen and oxygen demand in constructed wetlands [3] (iii) The removal and speciation of Zn, Pb, Cd and Cu along the treatment path in horizontal subsurface-flow constructed wetlands [4] and (iv) Landfill leachate treatment using constructed wetland with gravel-charcoal as media [5]. In terms of capacity building, four postgraduate students had successfully completed their M.Sc. degree based on constructed wetland research. Currently, there are five postgraduate students working on constructed wetland related projects.

Current research activities in SCS on constructed wetland include the following: (i) the study of the fate and transport of organics and dyes along the treatment path, (ii) the study of the role of biofilm on wetland media in the sorption of pollutant and in mitigating the inhibitory effect of toxic substances during the treatment of biodegradable pollutants and (iii) the reutilization of waste materials as wetland media.

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Nanoscience Research Group (NsRG) 2003 Report

Dr. Mohamad Abu Bakar
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The formation of Nanoscience Research Group (NsRG) at the School of Chemical Sciences has been highlighted in the recent issue of our Chemistry Bulletin. The momentum of such an effort has led to an increase in research activities with several new areas of research opportunities identified. This group has also strengthened link previously established and possible new linkages are being established with Indian and Japanese Universities.

Research Activities

Our main strategy is the emphasis on the use of local materials in nanoscience with targeted local applications. This is in line with the national research fundamentals and policies.

The group started its research on colloidal metal nanoparticles with specific catalytic applications. For the year 2003, we have also started the work on nanocomposites, biomaterials, heterogeneous catalysts and computer modeling. The work on nanocomposites is polymer-based, particularly the locally available natural polymers such as natural rubber (NR), epoxidised natural rubber (ENR), cellulose, chitin and chitosan. Heterogeneous catalysts are silica, titania, ceria and tin oxide-based with tin, nickel and related metals as active surfaces.

The research in the year 2003 has culminated in several local and international publications as well as conference proceedings, oral and poster presentations. Several postgraduate students have successfully completed their Master or Doctorate programme while several other new students have recently joined the group for M.Sc. programme.

Two of our team members, i.e. Dr. Rohana and Dr. Shafida, are currently on research attachment at the Universite Henri Poincare, France. Recently, Prof. Millot from UHP visited our School and discussion on the present and future research collaboration was held. We also have an active link with INTEL (M) Bhd. via Dr. Chee Choong Kooi. Five of our postgraduates have also attended the Seminar on Nanotechnology: Concept and Future Direction held at the University's Institute of Postgraduate Studies on 14 December. The seminar was organized by INFORMM-RCMO-NBD Topdown.

Collaboration and University-Industry Link

Our current active collaboration has provided us with the training of personnel (staff and students) as well as funding for ongoing research and student sponsorship. While this is a continual bilateral cooperation, steps have to be taken to strengthen it. We are planning to prepare several postgraduate students for co-tutelle programme with Universite Henri Poincare, France for the year 2004/2005. Several joint research proposals for the above purpose and grant procurement have also been proposed.

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Resources and Infrastructure

In the year 2002, several USM short-term grants and one FRGS grant were awarded to the group members. In 2003, another FRGS grant and a contract research grant (a grand total of RM 173 060) were secured by the group. These recent grant awards will enable the research group to proceed with their research activities through the year 2004. Proposals are underway to secure more grants in year 2004.

Some of the basic major instrumentations needed by the group are available at USM and "freely" accessible to the group members. These include the XRD, XRF, TEM, FT-IR and FT-NMR. Recently, the School of Biological Sciences has acquired a HR-SEM. We are currently procuring a computer/server for modeling using the grant awarded this year. We are also planning to expand the instrumentation scope for the purpose of this research such as surface area analyzer, diffuse reflectance FTIR and UV-VIS etc as well as upgrading the present instrument capability e.g. solid state NMR. These will be achieved via industrial, national and regional collaboration and grant applications.

List of Publications By NsRG In 2003

M. Adlim and M. Abu Bakar, "Applications of Chitosan on Preparations of Platinum, Palladium, Gold and Silver Colloidal Nanoparticles Catalysts" **In** the *Proceedings of International Seminar On Marine Sciences and Resources*, pp 106-110, Marine Science Research Center, Syiah Kuala University, Banda Aceh, Indonesia, March 12-15, 2003.

J. Ismail, M. Abu Bakar and R. Adnan, "Nanoscience Research Group (NsRG)", Bull. KIMIA.USM, Vol.2, No1, (2003), 20-21.

M. Adlim and M. Abu Bakar, "Size Control and Morphology of Chitosan Stabilised Precious Metal Nanoparticles", MicroSoM, V5-6, 2003, 6-10

M. Adlim, M. Abu Bakar, Kong-Yong Liew and J. Ismail, "Synthesis of Chitosan Stabilised Platinum and Palladium Nanoparticles and Their Catalytic Activity", J. Mol. Cat. A: Chemical. *212 (2004) 141-149*

H.P.Choo, K.Y.Liew, H.Liu, C.E.Seng, W.A.K.Mahmood and M.M.Bettahar, "Activity and Selectivity of Noble Metal Colloids for the Hydrogenation of Polyunsaturated Soybean Oil", J. Mol. Catal. A: Chemical, 191 (2003) 113-121.

M. Adlim, M. Abu Bakar, Kong Yong- Liew and J. Ismail, "The Role of Chitosan and The Reduction Method On Characteristic of Chitosan-Stabilised Gold Nanoparticles", Reactive And Functional Polymers Journal, *Accepted for Publication*. (revised)

J.Ismail, I.A.Rahman, R.Adnan, M. Abu Bakar and M.N.S. Sipaut, "Silica-Organo Composite Nanoparticles", An Invited Presentation to Solicit For INTEL Research Grant, INTEL (M) Sdn Bhd, Bayan Lepas, Penang, 13 June 2003.

Research Grant Secured By NsRG

INTEL Research Grant 2003
Title: "Nanocomposite Silica Particles"
Amount: RM 77 000

Geran Penyelidikan Fundamental (FRGS) – 2003
Title: "The Interfacial Interactions and Effects of Thin Organic Layer On The Metal Oxide Surfaces In Metal Oxide-Polymer Surfaces"
Amount: RM 97 060

Postgraduate

Program	New Enrolment	Graduating
Ph.D	-	1
M.Sc	6	2

Molecular Chemistry and Synthesis Research Group

Prof. Teoh Siang Guan

The Molecular Chemistry and Synthesis Group is a multi-disciplinary and multi-institutional link between Universiti Sains Malaysia (USM), Universiti Malaysia Sarawak (UNIMAS), Universiti Pendidikan Sultan Idris (UPSI), Asian Institute of Medicine, Science and Technology (AIMST) and Universiti Tunku Abdul Rahman (UTAR) at the national level and Raman School of Physics (RSP), Pondicherry University, India at the international level. The group focus is on the synthesis, modification, characterization and development of new products.

General objectives of the group:

1. Understanding of the fundamentals of the dynamics of molecular interactions in monomeric, oligomeric and polymeric materials by spectroscopic means such as FT-IR, FT-Raman and FT-NMR spectroscopy.
2. Designing of non-metal and metal-containing compounds and exploration of their biological activity.
3. Investigating the efficacy drug related compounds.

The research areas of interest of the group members are as follows:

1) Prof. Teoh Siang Guan:

a. Synthesis and Biological Activity of Organotin Complexes

b. X-ray analysis and molecular simulation of supramolecules

c. Synthesis and Characterization of Transition Metal Complexes with Potential Antitumour Activity

2) Assoc. Prof. Mas Rosemal Hakim Mas Haris:

a. Synthesis and characterization new phosphazene-based compounds (monomers,

b. oligomers and polymers for specific applications).

c. Tailored modification of rubber and its derivatives: preparation of (a) water

d. soluble, and (b) flame retardant polymeric materials.

e. Structural characterization and reactivity study of natural products.

3) Dr. Farook Adam:

a. The synthesis and characterization of main group organometallic complexes of the $(X_2NMe_2Si)_3C$- (X = aryl, phenyl) ligands.

b. The inter-and intra-molecular coordination of main group organometallic compounds containing bulky organosilicon ligands.

c. The synthesis and characterization of alkoxy silanes from silica based minerals

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Mangrove tannin – an alternative corrosion inhibitor

Afidah Abdul Rahim

In many industries, the need to use constructional materials safely, but cost-effectively, is a primary consideration. Frequently, physical requirements can be satisfied easily, but corrosion effects seriously complicate the selection of suitable materials. Generally, increased corrosion-resistance can only be obtained at increased cost. However, the actual material-related costs incurred in a project will depend on the corrosivity of the environment concerned, the required design life, the physical requirements of the material, and the readily available stocks. In some cases, appearance may also dictate the use of a more expensive material. The costs and problems associated with corrosion-resistant materials means that, in many cases, the use of corrosion inhibitors is a practical and economic alternative. Industrial use of corrosion inhibitors is, therefore, now broad based and extensive.

To date, we have established the procedure for mangrove tannin extraction, isolated and identified several monomers associated with the tannin[2]. Previously, our studies have shown that mangrove tannins exhibited a considerable anticorrosive property as a rust converter and wash primer[2]. In view of the results obtained, we have proceeded to studying the efficiency of mangrove tannin as corrosion inhibitors by electrochemical methods. Electrochemical tests were carried out in a three-electrode electrochemical cell connected to an EG&G Princeton 273A potentiostat. The task that was undertaken at the Laboratoire De Chimie Du Solide Mineral, Faculte Des Sciences, De L'Universite Henri Poincare Nancy 1, France, revealed that inhibition was achieved at pH < 4.00 and is dependent on concentration. Mangrove tannin also proved to be a potential source of corrosion inhibitor when it produced inhibition performance comparable to that of mimosa and quebracho tannin.

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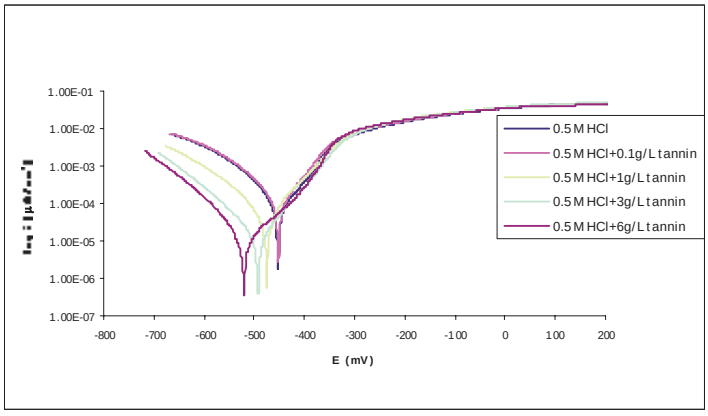

The influence of concentration on the potentiodynamic curves

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Opportunity for Chemists in Petroleum Industry

Dr. Mohamad Nasir Mohamad Ibrahim

The involvement of Malaysia in the upstream petroleum activities had started way back in 1910 when the first oil well was discovered on the top of Canada Hill in Miri, Sarawak. This well was named as Miri Well Number 1 and was discovered by Shell. Four years later, the construction of the country's first refinery plant was completed, also by this Royal Dutch company. Besides Shell, Esso also shared a part of Malaysia's petroleum cake. In short, foreign companies played an important role in contributing towards the growth of our petroleum industry in the early days.

Realizing the potential petroleum reserve that we have, Petronas, the wholly owned Government Corporation was founded in August 1974 with the responsibility of developing and adding value to the entire oil and gas resources in Malaysia. Since then, Petronas has grown to be an international oil and gas company which engages in a variety of upstream and downstream petroleum activities including exploration and production of oil and gas; oil refining; marketing and distribution of petroleum products; gas transmission pipeline network operations, petrochemical manufacturing and several others. With business interest in more than 30 countries, this Malaysia's national petroleum corporation had announced its profit before tax for the financial year ended on March 31st, 2002 as RM 24.32 billions. This figure was recorded as the second highest earning in the history of the company. This is not unexpected since the demand for hydrocarbon is still high due to its ability to provide a clean and cheap energy compared to others such as coal, nuclear and solar.

Nowadays, petroleum industry plays an important role towards the growth of Malaysia's economy. Besides contributing directly in terms of royalty and sales taxes, petroleum industry provides jobs for thousands of Malaysian. One of the professions that are at high demand in this industry is chemist. As hydrocarbon wells are developed, chemicals are often used throughout the processes ranging from drilling, fracturing, completions, acidizing and work over. In drilling process alone, for example, there are various polymeric thinning agents one could choose from in order to reduce the viscosity of drilling mud so that the amount of energy needed to rotate the drill stem and the drill bit can be reduced. Other than acting as drill string lubrication, drilling mud is needed for controlling subsurface pressures and lifting formation cuttings to surface. Although drilling mud has a humble name, mud engineering is by no means elementary. To explain mud properties, physical chemistry concepts must be employed. Topics such as colloidal suspensions, viscosity, gel formation, emulsion stability and flocculation are the subjects of advanced chemistry classes. While drilling, a mud tends to increase in thickness. This is obviously due to the cuttings that are continuously being entrained. Therefore, formulation of the best drilling fluid system for particular drilling conditions is extremely important and it will bear on the shoulders of both mud engineer and chemist.

Besides due to the increase of solids concentration in the mud, thickening problem in the mud can be caused by contaminants present in the formation. Common

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contaminants encountered in drilling are salt, cement, anhydrite and gypsum. These contaminants will cause clay particles (raw materials for making mud) to flocculate. Flocculation is where the clay platelets link together edge-to-edge and face-to-face to form house of cards-type structures. Besides causing the drilling fluid system thicker, the linked platelets are less effective as fluid loss controller. Engineers must rely on chemists in order to understand the behavior of the clay particles so that the best treatment can be proposed at the end of the day.

Besides active involvement in drilling engineering, chemists are also needed in reservoir engineering. In reservoir engineering, the term 'Primary Recovery' refers to the production of oil from a reservoir without applying external forces to supplement the natural energy of the reservoir. These natural production mechanisms include solution-gas drive, gravity drainage, gas cap expansion, natural water influx and compaction. As the reservoir production continues, well-bore pressures become stabilized and reach equilibrium with a reservoir pressure. The reservoir will be no longer productive under the Primary Recovery process. Studies found that more than 70% hydrocarbon still remain underground after the completion of the Primary Recovery process. Therefore, Secondary Recovery as well as Enhanced Oil Recovery (EOR) projects need to be considered. The Secondary Recovery project includes water-flooding and gas injection whereas the EOR includes steam-flooding, in-situ combustion, carbon dioxide injection, polymer flooding, surfactant flooding and several others. Again, vast varieties of chemicals will be involved in these two projects and the role of chemist is extremely important in order to ensure the projects are successfully executed.

In the School of Chemical Sciences, after the Chemistry in Petroleum research project was started just under three years ago, we can be proud of having our very own mini 'mud lab'. This lab houses two units of model 286 variable-speed electronic rheometers, two units of high pressure and high temperature filter presses, two units of low pressure and low temperature filter presses, one unit roller oven and not to mention other equipments such as mud balance, methylene blue kit, vacuum oven and rotovapor. These equipments allow us to conduct mud testing as per American Petroleum Institute (API) Standard. As in the beginning stage, we will focus our research on formulating drilling fluid system and drilling fluid additive from biomass waste product especially oil palm empty fruit bunches. The establishment of this mini lab should not be viewed as a competitor to the existing lab in other institutions but rather as a complement for them. The unique feature about this lab is that it is operated by a group of chemists and engineers aiming to address both the 'How' and 'Why' types of questions.

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100th Anniversary of Chromatography - From Chlorophyll to Chiral Separations

Dato' Professor Muhammad Idiris Saleh

On 21 March 1903, Tswett presented to the Biological Section of the Warsaw Society of Natural Sciences a lecture entitled "On a new category of adsorption phenomena and their application to biochemical analysis". This is a special date in the history of chromatography[1]. This date is the first public disclosure of the dynamic adsorption analysis, which Tswett soon began to call chromatographic adsorption analysis, marking the birthday of chromatography, literally means *colour writing*. This is seen as the starting point of chromatography, liquid chromatography to be more specific, nowadays the most widely used chromatographic technique. Tswett (or Tsvett) was born in Italy 1872 as the son of a Russian father and an Italian mother. He was educated in Switzerland (Lausanne) and received a Ph.D. in botany at the University of Geneva in 1896. After returning to Russia and some quarrels about his qualification, he became Professor of Botany at the University of Warsaw.

The most important paper reported by Tswett in respect of chromatography[2] was "Adsorption analysis and chromatographic method, applications on the chemistry of chlorophyll". In this paper on "chromatographic analysis", he described the "chromatogram" (the developed zones on the column) and its development by using different eluents. In most of the cases, he stopped when the fastest moving colored zone reached the end of the "chromatographic column". In his work, he detected the different yellow zones (carotinoids) and he always found two green zones of the two chlorophylls a and b.

The great contribution of Tswett was finally completely compiled and he was deservedly crowned The Creator of Chromatography[3] on the 100th anniversary of chromatography. Chromatography became the premier separation technique of the 20th century that changed the whole science in a most revolutionary way. The author believe in the 21st century the chromatographer will continue to push the limit of chromatographic performance parallel with the miniaturization in size. The hyphenated techniques currently developed will attain the ultimate performance of having LC-MS, LC-NMR, LC-IR, LC-spectroelectrochemical etc as a standard analytical instruments in most common chemical laboratories

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The author was first exposed to chromatography in 1976, while pursuing his Ph. D. under the supervision of SJ Lyle in The University of Kent at Canterbury, United Kingdom. The project on "Some Aspects of High Performance Liquid Chromatography on Inorganic Substances" took about 4 years to complete from October 1976 to March 1980[4] . The thesis gives an account of work carried out on matters relevant to the use of HPLC for the separation and determination of inorganic substances. Apart from the development of separation system suitable for inorganic complexes and ionic species, the project gave special emphasis on the development of detector for the determination of redox species as the electrochemical detector was at the initial stage of the

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development and commercialization at that time[5,6].

In the mid 70s, research on the separation by HPLC, either HPLC as a tool for separation, (resemblance to Tswett, LC as a tool to separate chlorophylls) or for the method development, or for the development in the instrumentation itself> was still at the fancy state due to the 'less developed' status in the instrumentation itself. The commercially available components in HPLC instrumentation was rather limited, Waters was at the frontiers then. The same applied to our group. Thus, for my doctoral project, the instrumentation consisted of the homemade HPLC assembled from various parts from the injector, column to detector and recorder.

The work in USM started rather slowly but steadily involving the determination of the content of the cough mixture[7] as the final year project. The work extended to the master's level on the assay of newly developed antimalarial drug, pyronaridine[8]. The research undertaken by a doctoral student on the chromatographic fundamentals, namely, for the development of the general trend on the separation of primary and secondary amines have successfully been proposed[9]. In conjunction with the 100th anniversary of LC, one doctoral student has managed to separate a chiral sulbutamol. This project was rather challenging due to its multidisciplinary nature. With the contribution from colleagues in the Doping Control Center, we manage to develop an efficient clean-up system for the isolation of salbutamol and its metabolites from body fluid[10]. This enables us to determine quantitatively the metabolites in the plasma of volunteers treated with salbutamol[11].

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From Rice Husk To Heterogeneous Catalyst

Dr. Farook Adam

Rice husk is a waste product of the agriculture activity in most countries in Asia and in particular Malaysia. Rice husk has posed a major problem of disposal to the rice milling industry in Malaysia and elsewhere in the world. Efforts have been made in the past 20 years to use rice husk and its ash in various ways [1]. Moreover, efforts have been made in recent times to extract useful products from rice husk. It has been shown by many researchers that rice husk contains 15 – 20% silica (SiO_2), which contributes to its hard and abrasive protective casing covering the rice grain.

The silica in rice husk can be obtained by removing the organic components through control burning in muffle furnace in the laboratory. Our recent studies have, however, yielded a more environment friendly technique, whereby the silica from rice husk is obtained by solvent extraction (i.e. without the need for burning) [2]. This chemical procedure has been developed in our laboratory and we are in the process of seeking a patent for the process.

The silica obtained was found to have a high specific surface area of 200 m^2g^{-1}. The purity was determined by x-ray fluorescence and it was shown to be 99.99% pure silica. In contrast, pyrolysis process produces 93-95% silica. This can be further purified to > 99% by treating the silica with mineral acids like HCl, H_2SO_4 and HNO_3. The silica, from pyrolysed rice husk-ash (RHA) has been shown to adsorb fatty acids from palm oil [3]. A model study showed the adsorption of fatty acids could be described by the Langmuir isotherm [4]. We are now studying its possible use as a substitute for bleaching clay in palm oil processing. The research indicates promising results but further study needs to be undertaken [5].

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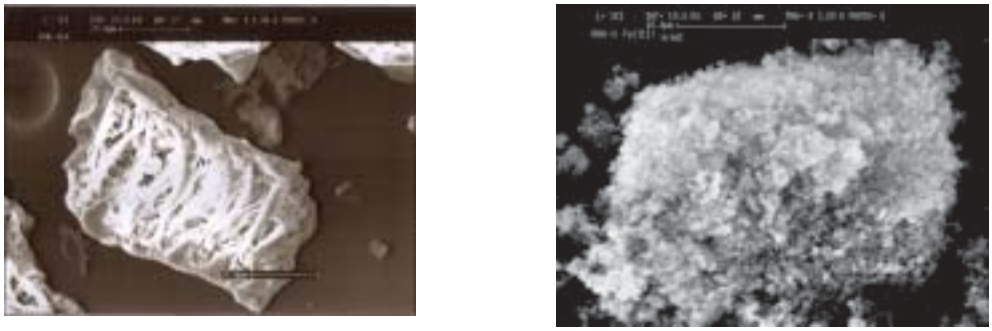
Currently, we are studying the rice husk ash as a possible heterogeneous catalyst. In this study, the RHA has been modified with selected transition metals [6] by co-precipitating the sodium silicate and the metal salt in nitric acid so that the metal can be incorporated into the silica matrix. Tests by SEM and EDX on the solids obtained show that the transition metals are indeed incorporated chemically into the silica matrix. The resulting solid was sometimes amorphous and at other times crystalline depending on "the speed of titration (neutralisation)". We are now in the process of determining the exact method of adding the nitric acid to yield a potential catalyst with a large surface area and amorphous characteristics with consistency and reproducibility. Figure 1 shows the SEM micrographs of RHA and the iron-incorporated catalyst RHA-Fe.

Initial experiments conducted show promise for these new materials as heterogeneous catalyst. The Fe loaded RHA-Fe was used in the Friedel-Craft benzylation of toluene with benzyl chloride [7]. Figure 2 shows the GC spectrum of the reaction products. The peak at 1.09 is toluene, which was present in excess. Benzyl chloride appeared at 2.33, which has been completely converted to products. The *ortho* substituted monobenzyl toluene was expected to be present in a higher proportion due to the presence of 2 *ortho* positions for substitution on the toluene molecule. Based on this assumption [7], the peak at 15.19 was attributed to the *ortho* product while the peak at 14.95 was attributed to the *para* product. The mono substituted product accounted for 93 % while the di-substituted product yield was 4 % (not shown in Fig. 2).

One other reaction in which the RHA-Fe may be useful as a catalyst is in the Micheal reaction



(a) RHA (X 1.00 K) (b) RHA-Fe (X 3.00 K)

Figure 1: SEM images of RHA and RHA-Fe.

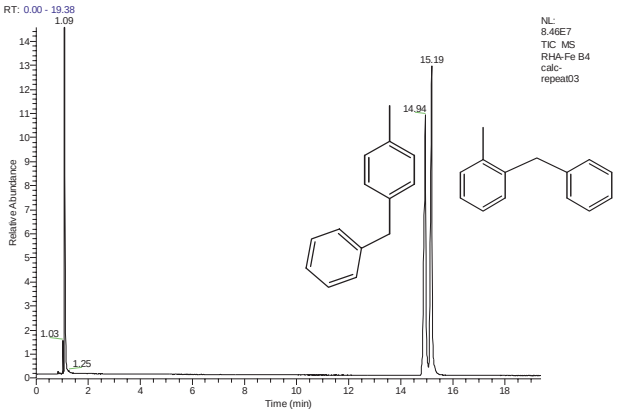


Fig. 2: The GC spectrum after reaction with RHA-FE as catalyst. The *ortho* and *para* substituted product are shown to have formed with the complete transformation of the benzyl chloride.

[8]. We are currently pursuing this in our laboratory. We are also in the process of evaluating the catalytic activity of the other rice husk derived catalyst.

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Chromogenic Reagents: Synthesis and Analytical Applications

Assoc. Prof. Bahruddin Saad*
Abdussalam Salhin and
Dato' Prof. Muhammad Idiris Saleh

Selective neutral ligands such as crown ethers and cryptands are well known for their complexation with various metal ions and many of these cationic complexes are readily extracted into an organic phase. The selectivity principle depends on several factors, such as ligand type and the anion accompanying the metal ion, which sometimes acts as counter ion. For efficient extraction, the addition of bulky or lipophilic anions, many of them are highly colored (such as picrate and bromothymol blue), are mandatory. Liquid-liquid extraction based on ternary complexes formed between ligand, metal and counter ions have been conducted in our laboratory. Selective extraction of lanthanide (III) and mercury (II) have been realized using crowns containing either oxygen, nitrogen or sulfur donor atoms [1-5].

An alternative approach to perform similar task is through the incorporation of high absorbing counter ions itself onto the ligand to form a chromogenic compound. What is most fascinating is the ability of some of these reagents to exhibit a distinct color change upon undergoing interaction with target metal ion. Our on-going research project related to this topic involves studies on the synthesis of several cyclic and acyclic ligands carrying chromogenic groups. Preliminary results obtained showed that the acyclic ligand incorporating picrate anion (Compound **I**) exhibited preferential coordination ability towards metal ions such as Ag^{+}, Co^{2+}, Cu^{2+} and K^{+} over the others studied (Figure 1). Further studies involving the thermal isomerization and photo isomerization of these ligands are in progress.

The possibilities to capitalize on the selective metal ion complexing abilities in tandem with the chromogenic effects are enormous. The fact that the extracted complex is colored suggests that applications can be readily extended for selective photometric determination of metal ions. Liquid-liquid extraction of diverse range of metal ions for each ligand synthesized is being evaluated. The immobilization of these ligands, in particular using sol-gel techniques (in collaboration with Assoc. Prof. Ismail Ab Rahman) for the conservation of precious ligand for repeated use, for fabrication of chemical sensors and solid-phase applications etc. is being actively pursued.

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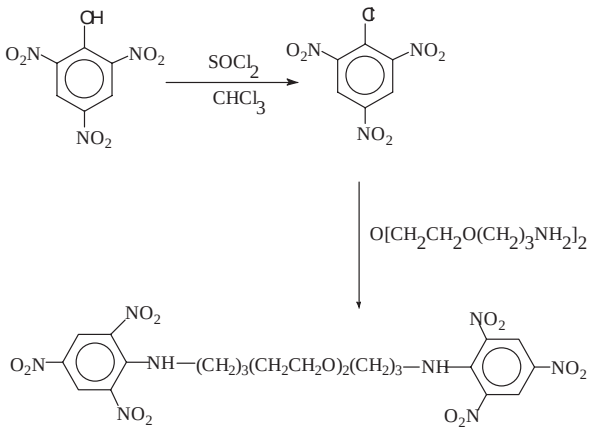
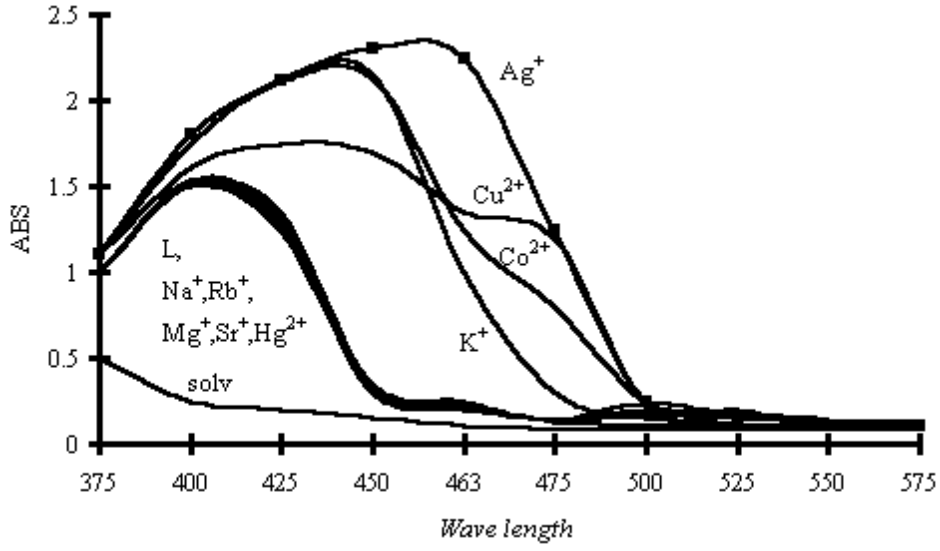


Compound I



Filiform Corrosion of Compact Disc

Assoc. Prof. Mohd. Jain Noordin
Mohd. Kassim

A compact disc, or commonly known by its abbreviation as a 'CD', is a small plastic disc used for the storage of digital information. The compact disc comprises a sandwich of four layers which are a polycarbonate plastic substrate (data layer); a reflective metallic layer of aluminium, gold or silver; a thin, clear protective coating of acrylic plastic; and a graphic disc label. The different layers of a compact disc are shown in Figure 1.

Compact discs are susceptible to damages on both sides of the disc, which are the play-side and the label-side. Scratches or surface imperfections on the both sides of the disc will deflect the laser beam off or away from the laser receptor. If the scratches penetrate the metallic reflective layer, the laser beam will not be reflected back to the laser receptor and continues straight through the CD. Scratching causes audible problems, permanent skipping or distortion, missing data or unplayable in severe cases.

Another type of damage occurring on compact discs is the corrosion of the reflective aluminum layer. This type of damage only affects the CD-DAs and CD-ROMs, as only these two types of compact disc media have reflective metal layers consisting of aluminium.The defect mode that is observed is patches of missing aluminium metal from the reflective aluminium layer. This is a critical component of the compact disc, as it reflects the laser beam back to the reading assembly. Thus, the missing portion of the reflective aluminium layer would mean failure of the laser beam to be reflected, causing loss of data in that portion of the compact disc. The particular type of corrosion affecting the areas has been identified as filiform corrosion. Filiform corrosion observed on the aluminium layer of a compact disc is shown in Figure 2. Filiform corrosion is also known as underfilm corrosion and vermiform or worm track corrosion, usually initiates at points where the protective film is breached by scratches or other surface defects, in the presence of soluble ionic species, such as chlorides, sulfates, acetate or carbonic acid [1]. EDX analysis on the corroded disc indicated that the filiform corrosion is actively induced by the presence of chloride salt contamination

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on the aluminium surface. The head of the filament contains significant quantities of chloride ions, with little or no free chloride in the long tail [2].

Filiform corrosion has been successfully simulated on the reflective aluminium layer of the compact disc by exposing the surface defect to concentrated hydrochloric acid vapour at 82% relative humidity as shown in Figure 3[3]. The growth of filiform corrosion is dependent on the combined effects of several factors, namely; relative ambient humidity, presence of coating defects, presence of oxygen, aggressiveness of the environment, temperature, nature of the substrate, and pretreatment of the metal surface. The filament head is filled with flowing flocs of opalescent corrosion products which has been identified by means of electron diffraction as mainly $Al(OH)_3$, a whitish gelatinous precipitate (Figure 4)[3].

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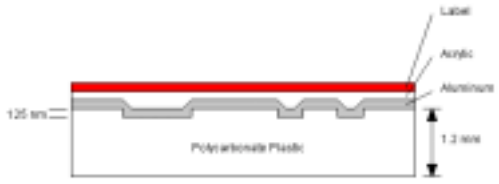

Fig. 1 Cross section of a compact disc

Fig. 2 Filiform corrosion on a corroded compact disc (100X)

Fig. 3 Simulated filiform corrosion on campact

Fig. 4 SEM image of filiform filaments disc (200X)

Electrochromic Thin Films of Titanium Dioxide by Sol-Gel

Assoc. Prof. Ismail Ab Rahman

Recently, a new approach in the preparation of nanocrystalline TiO_2 thin films by sol-gel process through alkoxide routes has been extensively studied.[1-2] These films were normally deposited on ITO glasses, silicon wafer, or glass slide by either dip-coating or spin-coating technique. Alkoxides provide a convenient source of precursors that are soluble in common solvents. Thus, the composition of starting materials and the hydrolysis as well as condensation reactions can be easily controlled in order to yield product with high microstructure homogeneity and new physical properties. Now, this has become a popular method in producing a thin TiO_2 films to study the optical,[3] photocatalytic[4] and electrochromic[5] properties of the films. Only TiO_2 anatase forms showed electrochromism, but this material does not yet exhibit an ideal properties especially in durability and reversibility.

Electrochromism is related to the colour change of a given material under the influence of the external potential. The most commonly used electrochromic materials are WO_3, TiO_2, NiO, MoO_3, IrO_2, CoO_3 and inorganic polymers. Amongst them, WO_3 displays the best electrochromic property due to the nanocrystalline size particles that are able to provide high electronic conductivity. Advancement of knowledge in sol-gel enhances research and development in producing nanocrystalline TiO_2 anatase films with improved electrochromic property. In general, the colour change of TiO_2 is assembled to the WO_3, as a result of electron transfer accompanied by ion insertion or extraction at the counter electrode layer. The reaction can be represented as follows:

$$TiO_2 + xLi^+ + xe^- \leftrightarrow Li_xTiO_2$$

where $0 < x < 1$. TiO_2 is transparent and lithiated TiO_2 is absorbing in the UV range.

In collaboration with AMREC-SIRIM, Kulim Hi-Tech Park, a thin electrochromatic TiO_2 anatase films with a nanosize grain was successfully deposited on an ITO glass substrate with a simple sol-gel route in the presence of a small quantity of acetic acid in a controlled atmosphere room (Fig. 1). The films showed a good transparent and reversible coloration and bleaching process was obtained (Fig. 2). Our results will become a niche area for research and development in nanotechnology.

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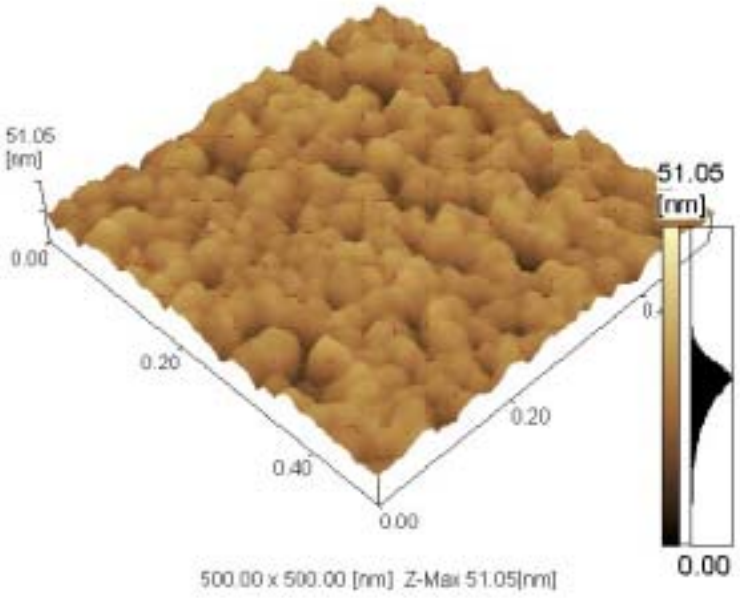
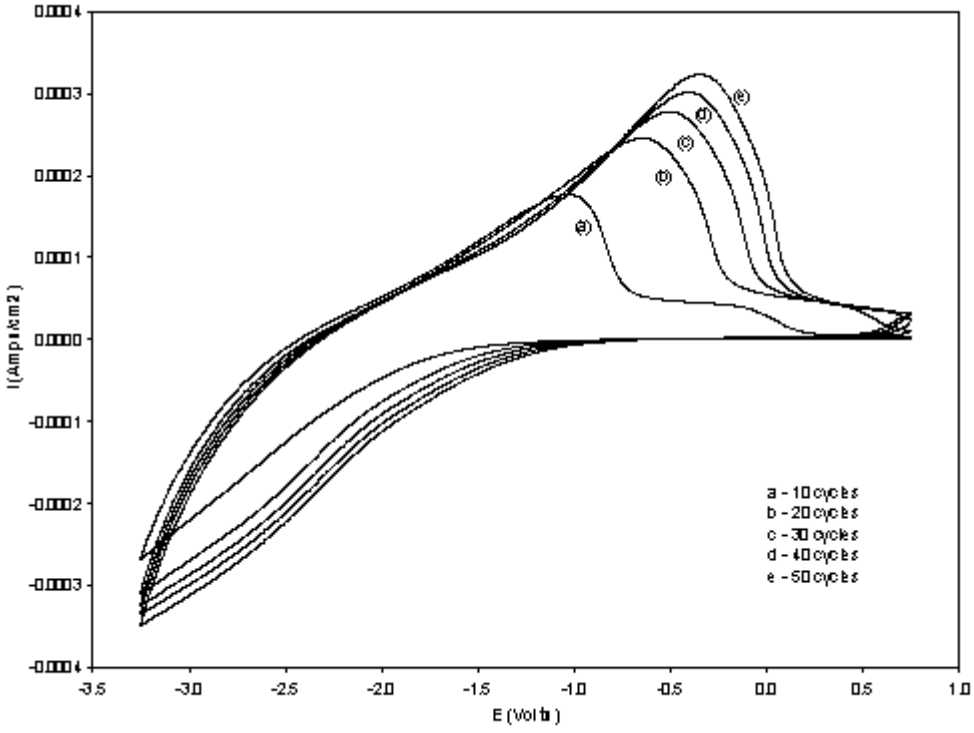


AFM image of TiO_2 thin films on ITO glass deposited by sol gel at 0.5 X 0.5 um scan area.



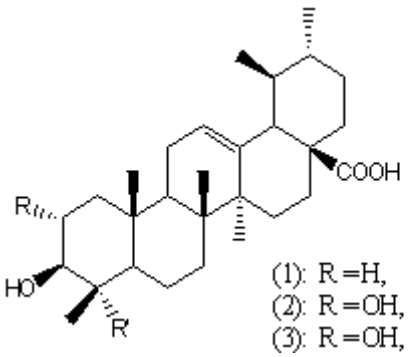
Cyclic voltametry of TiO_2 thin films deposited in 1 M $LiClO_4$/PC electrolyte.

Some Natural Products from *Melastoma malabathricum* L.

Assoc. Prof. Wong Keng Chong

Melastoma malabathricum L.(Melastomaceae), a shrub commonly found in northern Peninsular Malaysia, is used locally as a crude drug for the treatment of cholera, diarrhoea, prolonged fever, dysentery, leucorrhoea, wounds and skin diseases, and for the preparation of gargles.[1,2] The leaves, flowers and fruits are edible. Previous phytochemical investigations of plants growing in India have revealed the presence of eleven free amino acids and two aliphatic compounds (1-octyl docosanoate and 11-methyl-1-tricontanol),[3] fatty acids and sterols,[4] 4'-methylpeonidin-7-*O*-²-D-glucoside, kaempferol, kaempferol-3-*O*-²-D-xyloside and a flavonol diglycoside.[5] Plants encountered in Indonesia have yielded tannins and polyphenols.[6,7] Regarding Malaysian *M. malabathricum*, screening for alkaloids, terpenoids, steroids and saponins has been reported,[8,9] but there has been no detailed phytochemical or biological examination of this plant except for the isolation of malvidin-3,5-diglucoside from the flowers by Lowry many years ago.[10]

In the present study the aqueous methanolic extracts of the fresh leaves and flowers of *Melastoma malabathricum* L. were separately partitioned with solvents and column chromatographed. Three pentacyclic triterpenoids, namely ursolic acid (**1**), 2±-hydroxyursolic acid (**2**) and asiatic acid (**3**) along with ²-sitosterol 3-*O*-²-D-glucopyranoside (**4**), glycerol 1,2-dilinolenyl-3-*O*-²-D-galactopyranoside (**5**) and glycerol 1,2-dilinolenyl-3-*O*-(4,6-di-*O*-isopropylidene)-²-D-galactopyranoside (**6**) were isolated from the leaves. The ethyl acetate-soluble part of the extract of the flowers yielded ellagic acid (**7**) and six flavonoids which were identified as quercetin (**8**), kaempferol (**9**), kaempferol 3-*O*-±-L-rhamnopyranoside (**10**), kaempferol 3-*O*-²-D-glucopyranoside (**11**), kaempferol 3-*O*-²-D-galactopyranoside (**12**) and kaempferol 3-*O*-(2", 6"-di-*O*-*E*-*p*-coumaroyl)-²-D-galactopyranoside (**13**). The last compound is uncommon, being isolated only once before from a plant. These compounds were identified on the basis of chemical and spectral methods such as IR, UV, EI-MS and 1D- and 2D-NMR. . Both the extracts and some of the fractions showed antibacterial activity. Regarding the pure components, asiatic acid from the leaves was active towards *Bacillus subtilis* and *Staphylococcus aureus* while ellagic acid, quercetin and kaempferol isolated from the flowers were the most potent.



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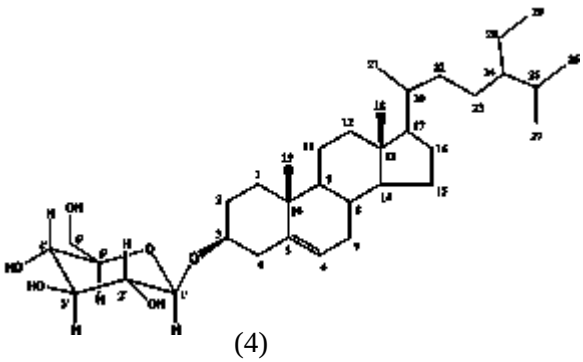
(3): R = OH, R' = CH_2OH



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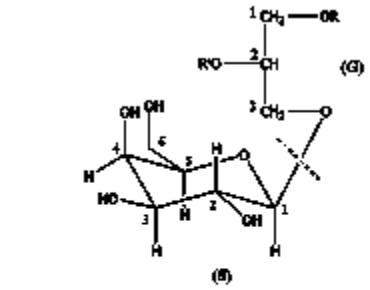

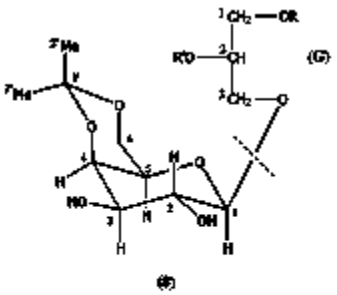

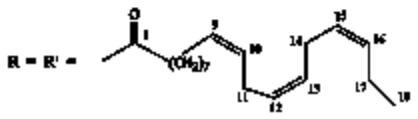

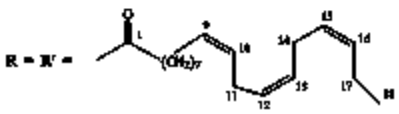

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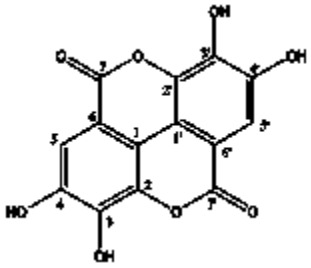
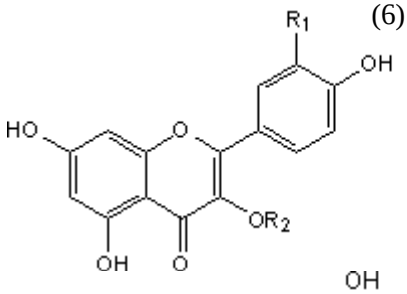
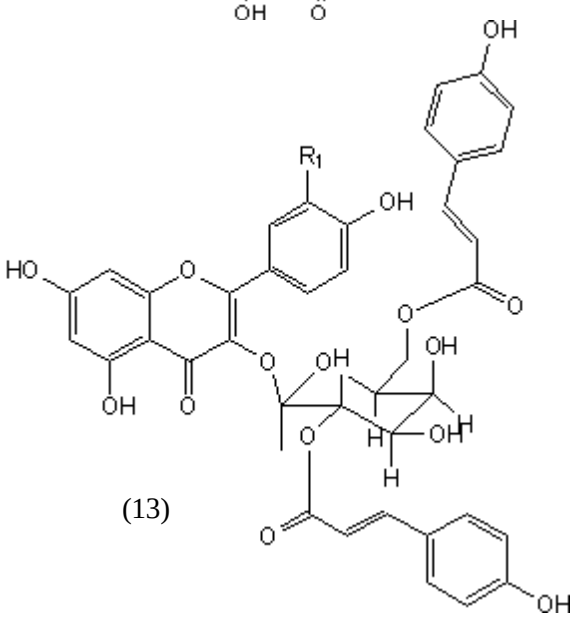




(8) R_1 = OH, R_2 = H
(9) R_1 = H, R_2 = H
(10) R_1 = H, R_2 = Rha
(11) R_1 = H, R_2 = Glc
(12) R_1 = H, R_2 = Gal

(7)



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POPs in Malaysia

Assoc. Prof. Dr. Md. Sani Ibrahim

Persistent organic pollutants or POPs are a group of chemicals, mostly organic compounds that have the following properties;

- highly persistent in the natural environment,
- toxic to environment and human,
- highly bioaccumulative,
- undergoes bioamplification, and
- Capable of long-range transport/migration.

These compounds with the classical example, DDT, are very persistent in nature either in soil, sediment or water. By definition, a POP compound would have a half life of more than 2 months. DDT, for example, has a half life of about 15 years such that even 75 years (5 half-lives) after its application, there would remain about 3 % in the environment. The situation is made worse by the tendency of these POPs to accumulate in the fatty tissues of animals and human such that higher concentrations are found in the older organisms. This is due to the high octanol/water partition coefficients of these chemicals which increase their lipophilicity or affinity to fatty tissue.

Due to the persistent nature of these chemicals, some of these POPs particularly those that have relatively high vapour pressure can be transported across boundaries into remote areas such as the Artic and Antarctic. Lindane and DDT for examples have been found in the Artic and Antarctic environments even though these chemicals had not been used in these areas. Fortunately, most of these POPs are not quite toxic but their accumulative properties pose real threat to human health and ecosystems. The most toxic POP and probably one of the most toxic man-made chemicals are dioxins particularly 2,3,7,8-tetrachlorodibenzodioxin. Dioxins are one of the 12 POPs which are being selected to be eliminated under the Stockholm Convention 2002.

Based on the above definition, several groups of organic compounds have been classified as POPs. These are ;

- Organochlorine Pesticides such as DDT, chlordane, and lindane.
- Polychlorinated Biphenyls (PCBs)
- Polychlorinated Dibenzo-difurans and dibenzo-dioxins (PCDD/PCDF)
- Polynuclear aromatic hydrocarbons (PAHs)
- Phthalates esters (plastisizers)
- Chlorinated phenols.
- Brominated compounds such as polybrominated diphenyl ether (PBDE).
- Emerging POPs such as tetrabutyltin (TBT) and bisphenol-A.

Our involvement in research on POPs started in 1992 when we were requested by Department of Environment, Ministry of Science, Technology and Environment to study the impact of a major oil spill in Strait of Malacca particularly to the Island of Langkawi. Levels of polynuclear aromatic hydrocarbons (PAHs) in sediments were determined to look at the impact of he oil spill. Under the ASEAN-Canada Cooperation on Marine Pollution Monitoring, we monitored the level of PAHs and organochlorine pesticides (OCPs) in sediments collected along the coastal region of West Malaysia. Our research on POPs continued with the study of OCPs and PAHs in waters from several rivers in Northern West Malaysia where we improved our capability to analysed POPs in water using solid phase extraction techniques.

The research on inland water systems continued with extensive study on the Sungai Perak and we are embarking on other river systems in Malaysia. Data on levels of POPs in marine organisms from the Strait of Malacca were hardly available until we undertook a project to study the levels of OCPs in various marine species collected from Strait of Malacca, from bivalves, to schrimp to several types of fishes.

One of our major contribution to the field of POPs research in regional and global stage is our direct involvement in the UNEP/GEF funded project called "Regionally based assessment of Persistent Toxic Substances" to provide data and information

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of the status of POPs particularly the 12 POPs under consideration in the Stockholm convention.

Currently we are looking at the possibility of assessing the health risk due to dietary intake of food contaminated with POPs by monitoring the levels of POPs in food typically consumed by Malaysian. It is an extensive project that we hope to collaborate with the Health Ministry as well as the department of environment. Another on-going project is the monitoring of POPs in Patani Bay, Thailand through a Ph.D. student research project.

Below is the list of our work on POPs research.

- Monitoring of PAHs in Langkawi and Coastal Regions of Malaysia (1992-2002)
- Monitoring of POPs in Malaysian Rivers (1998-2003)
- Organochlorine Pesticides in Marine Organisms From Straits of Malacca (1998-2001)
- POPs in Sungai Perak (1998-2002)
- Regionally Based Assessment of Persistent Toxic Substances in Southeast Asia and South Pacific (2000-2003).
- Assessment of Dioxins releases in Malaysia (2001-present).
- Health Risk Assessment of POPs through Dietary Intake in Malaysia (2002 – present).
- POPs in Patani Bay, Thailand (2001-present).

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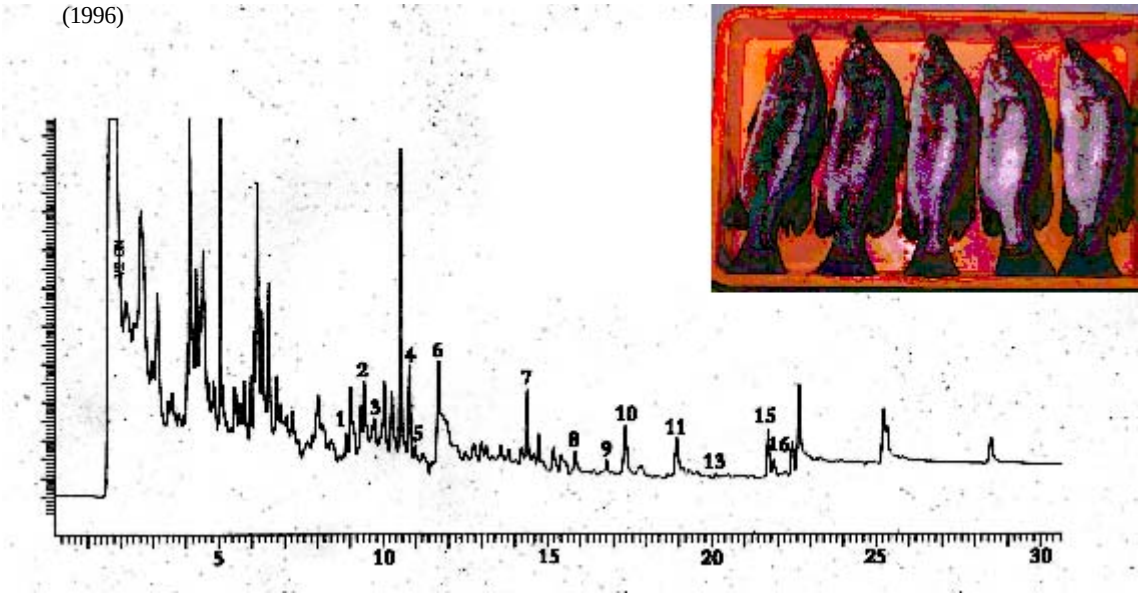
5. Md. Sani Ibrahim and Tan Eng Chiew, "Analysis of Persistent Organic Pollutions in Water by Solid Phase Extraction", paper presented at Simposium Kimia Analisis Malaysia ke-12 (SKAM-12) in Terengganu (1999).

6. Maaruf M. Hossain, Zuber Din and Sani Ibrahim, "Analysis of Organochlorine Pesticide (OCP) in Marine Organisms", paper presented at Simposium Kimia Analisis Malaysia ke-13 (SKAM-13) in Port Dickson, Negeri Sembilan (2000).

7. Tan Eng Chiew and Md. Sani Ibrahim, "Multi-residue Pollutants Analyses of Inland Water Using Solid Phase Extraction", paper presented at Simposium Kimia Analisis Malaysia ke-13 (SKAM-13) in Port Dickson, Negeri Sembilan (2000).

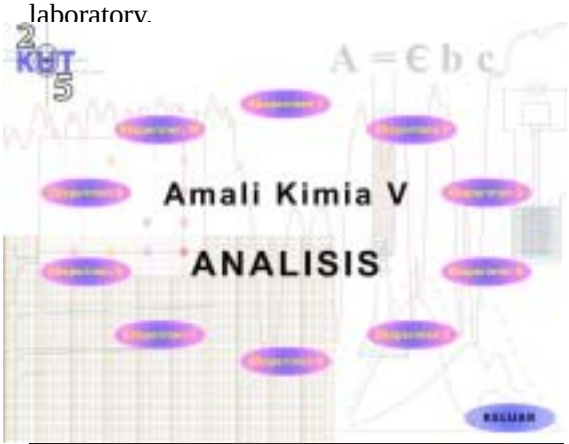
8. G. S. Jacinto, D.W. Connell, Md. Sani Ibrahim, and Lim Kew Leong, "Regionally Based Assessment of Persistent Toxic Substances – Southeast Asia and South Pacific Regional Report", UNEP-Chemical, December 2002.



Using Multimedia Pre-lab Modules to Enrich The Chemistry Laboratory Experience.

Assoc. Prof. Norita Mohamed

Multimedia Chemistry materials have been developed to assist students in chemistry classes and laboratories (1- 4). Some of the advantages of using multimedia materials are increased student interest in the subject material, increased retention of the material and availability of such materials for students to go through at their own pace (5). Logistical problems in laboratory instruction arise from the large number of students involved and the time constraints of the laboratory experience and the resources allotted for laboratory instruction (6). These factors tend to produce a 'cook-book approach' for the laboratory experience where the students cannot afford to make mistakes because of safety and/or logistical reasons related to space, time, chemicals and equipment. The focus of our work is on how interactive multimedia materials can be used to enrich the laboratory experience. Prelab modules developed for KUT 205, the second year analytical chemistry laboratory, are available on the university web server so that students can access these materials from their homes or residence halls at their convenience (7). Development of similar modules for the other analytical chemistry laboratory courses is currently underway. The main aim of these prelab modules is to help students prepare to do the experiments or use instrumentation before they enter the laboratory.



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Down the memory lane ....

The return of a former Dean to School of Chemical Sciences

How is my poster for the Public Lecture?

Interacting with the Laboratory staff

Former Colleagues

Regional Conference for the Young Chemists (RCYC) 2004)

Opening Ceremony

Opening Speech by Dato' Prof. Muhammad Idiris Saleh (Deputy Vice Chancellor, R&D)

Welcoming speech by the Dean (Assoc. Prof. Jamil Ismail)

A section of the crowd for the Keynote Address

One of the main sponsors

Some oversea participants for RCYC2004

School of Chemical Sciences, USM
Highlights of Activities in The Year 2003

Industrial Linkage

The school organized a series of technical lectures presented by invited speakers from Intel Corp. Malaysia as follows:

Date	Topic	Speaker
28.02.03	Application of material characterization in electronic packaging	Dr. Khong Yong Loong, Director, Material Technology Operation
20.06.03	Microprocessor packaging, the key link in the chain	Director, Quality & Reliability Dept.
18.07.03	Polymer material for the semiconductor packaging	Dr. Chee Chong Kooi, Staff Engineer
22.08.03	Chip level interconnection metallurgy for high performance microprocessors	Dr. Sim Kian Sin, Staff Engineer
12.12.03	Characterization technique and defect analysis for electronic packaging	Dr. Beth Yam Wei Yin, Assembly Material & Asia Purchasing
19.12.03	Reliability of semiconductor packaging	Mr. Stephen Lam Ying Pong, Staff Engineer.

Invited speakers

The following are the invited speakers who presented their seminars in the School:

Date	Topic	Name of speaker
24.01.03	Safety and exposure of chemicals in USM	Assoc. Prof. Dr. Md. Sani Ibrahim, School of Chemical Sciences
18.06.03	Applications on atomic absorption spectroscopy and Analytik Jena range of product	Mr. Bancha Veokeki, Regional Manager Far East, Maluri Equipment (M) Sdn Bhd
26.06.03	E-Research	Research Officer, Centre of Knowledge, Communication & Tech., USM
25.07.03	Principle and practice of constructed wetland for water pollution control in the Tropics - a case study in Thailand	Prof. Changkak Polprasert, Dean, School of Environ. Resource & Develop. Asian Inst. Of Tech., Thailand
31.07.03	Modeling of the biological system	Dr. Janez Malurti, National Inst. Of Chem. Solvania
12.12.03	The Chemists Act & the chemistry profession	Prof. Dr C. C. Ho, IKM President

School of Chemical Sciences Alumni

Some activities for fostering close relationship between chemistry graduate and undergraduate students were organized by School Alumni Committee members. A number of seminars presented by Alumni members during 2003 are listed as follows:

Date	Topic	Speaker
28.06.03	Chemistry in archeology	Dr. Stephen Chia Ming Soon, Archeology Dept.
03.10.03	DNA-Crime and chemistry	N. Hithaya Jevan, Jabatan Kimia, Petaling Jaya
07.11.03	The importance of chemistry in research, industrial sector & education	Tay Ming Guan, Faculty of Resource Sci. & Tech. UMS
13.12.03	Career opportunity with PDRM	Supt. Leow Kam Soon, Head of Chem., Makmal Forensik, PDRM

Postgraduate Seminar

These activities were organized to provide a platform for the postgraduate students to interact among themselves through presentation of their recent research findings. There were 24 students who presented their seminars in the year 2003.

Instrumentation Seminar

Pekim Elmer Sdn Bhd gave a one-day seminar on July 10, 2003. The speakers were Dr Edward Then and Dr Redzuan Said.

Advance Workshop on Estimation of Measurement Uncertainty in Chemical Analysis – Case Studies.

The workshop was held on July 30, 2003 at Capthorne Orchid Hotel Penang. The event was jointly organized by the School of Chemical Sciences and IKM Northern Branch.

Academic Visitors

Throughout the year 2003, the School of Chemical Sciences was visited by a number of international, regional and local academic visitors. Some of them gave seminars to the academic staff of the School as listed in the invited speakers above. The visitors were:

Assoc. Prof. Susan Hamilton, Director of Studies, University Qeensland, on February 25, 2003.

Dr Lim Teik Thye and his group from the School of Civil and Environmental Engineering, Nayang Institute Technological University, Singapore, on June 4, 20003.

Dr. Timothy G. Saponas, Intel Worldwide Higher Education Programme Manager, Intel Corp., on July 23, 2003.

Dr. Janez Malurti, National Institute Of Chemistry, Solvania, on July 31, 2003.

Prof. Changkak Polprasert, Dean, School of Environment, Resources & Development, Asian Institute Of Technology, Thailand, on July 25, 2003.

Prof. He Boalin, South Central University for Ethnics Communication, College of Chemistry and Life Science, China, on August 6, 2003.

Prof. Dr C. C. Ho. IKM President, on December 12, 2003.

Prof. Remmy Mickel, Research Director, CNRS UMP, Nancy France, and Prof. Millot Claude, Head of Phy. Chem. Dept. University Henri Poicarè, Nancy, France, on December 16, 2003.

Award

In an Expo on Science & Technology held in Kuala Lumpur on 7-9 August 2003, Assoc. Prof. Dr Ismail Ab Rahman, Assoc. Prof. Dr Bahruddin Saad and his research group won a silver medal for the development of product "ALUPUS". This research was headed by Assoc. Prof. Abdullah Mahmood, School of Housing, Building and Planning, USM.

Research Grant Awarded in 2003

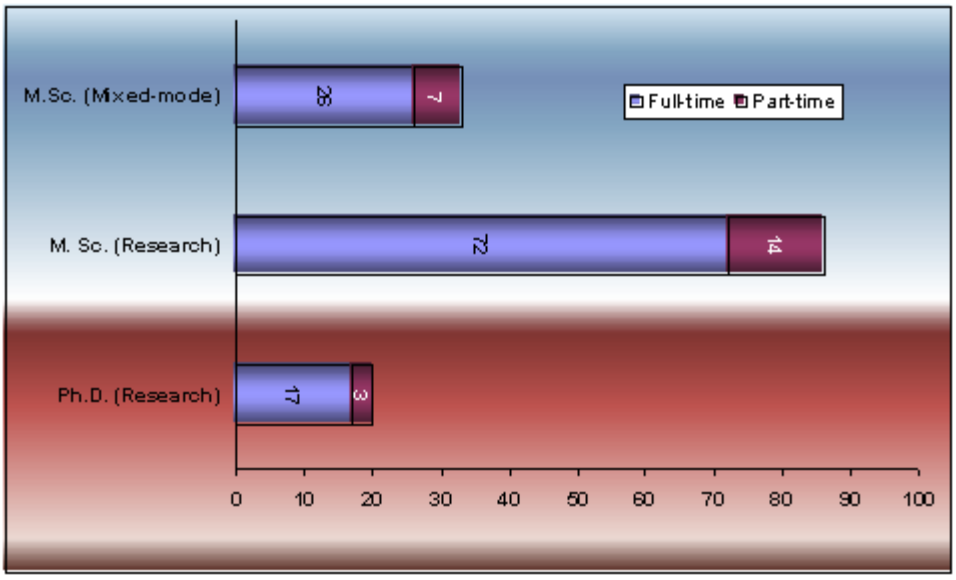
Type of Grants	Nos	Amount	Sources
IRPA Grants	4	RM 806,400.00	MOSTE
FRGS Grants	4	RM 372,962.00	Ministry of Education
Short Term Grants	6	RM 139,710.00	USM
External Grants	1	RM 77,000.00	INTEL
Total	15	RM 1,396,072.00	

POST-GRADUATE STUDENTS IN 2003
SCHOOL OF CHEMICAL SCIENCES
UNIVERSITI SAINS MALAYSIA

1. Total number of Students : 139
   Foreign Students : 20
   Malaysian Students : 119

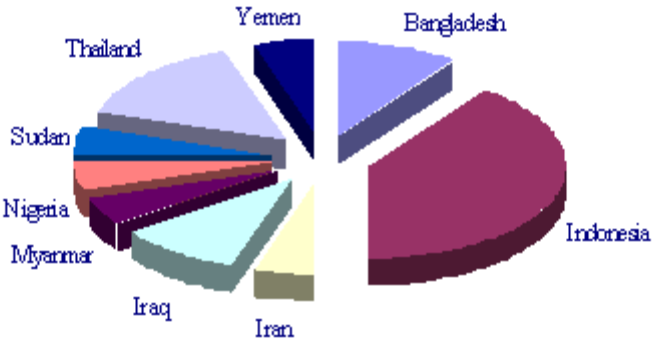
2. Master of Science in Mix-mode Program : 33
   Full time students : 26
   Part time students : 7

3. Research thesis Program : 106
   Doctor of Philosophy : 20
   Full time students : 17
   Part time students : 3
   Master of Science : 86
   Full time students : 72
   Part time students : 14



DISTRIBUTION OF FOREIGN STUDENTS BY COUNTRIES

Bangladesh : 2
Indonesia : 8
Iran : 1
Iraq : 2
Myanmar : 1
Nigeria : 1
Sudan : 1
Thailand : 3
Yemen : 1



Analytical Services: Ultra-trace to Trace Metals Analyses

The Analytical Services Unit (MUPA) offers comprehensive inorganic analytical testing and research utilizing expertise from the School of Chemical Sciences. We provide analyses across a broad range of matrices including drinking water, wastewater, groundwater, sediments, soils, animal tissue, food samples, metal alloys etc. We have an impressive range of modern analytical instruments which can be used to support our analyses and investigations. This includes:

- Atomic Absorption Spectrophotometers
  - Perkin-Elmer AAnalyst 100 with deuterium background correction
  - Perkin-Elmer HGA 850 Graphite Furnace
  - Perkin-Elmer AAnalyst 200
  - Perkin-Elmer FIAS 100 Flow Injection System (As, Hg, Se, Bi, Sb, Te analyses)

- Inductively Coupled Plasma Mass Spectrometer
  - Perkin-Elmer ELAN 6000

- Microwave digestion unit
  - CEM MARS5 Microwave digestion system

The analytical charges are:

FAAS/ FIAS RM 100 per metal (liquid samples)
RM 120 per metal (solid samples)

GFAAS RM 125 per metal (liquid samples)
RM 150 per metal (solid samples)

ICPMS RM 1000 per sample

For analytical services and consultation, please contact Assoc. Prof. Norita Mohamed at Phone: 604-6533686; Fax: 604-6574854, email: mnorita@usm.my or Assoc. Prof. Bahruddin Saad, Director MUPA at Phone: 604-6533888 ext. 4027, email: bahrud@usm.my.

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Universiti Sains Malaysia

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Instructions for Contributors

1) Length of Article – Article should not exceed 1000 words or two pages.

2) Format

a) Title should be centred in 18 point fonts, bold and in lower case letters with initial capital for every word.
b) Name(s) of author(s) should be centred in 14 point fonts and bold.
c) Text should be in Times New Roman at 12 point fonts.
d) Reference citation either by the number system or by authors' names is acceptable.