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## FOREWORD BY DEAN, FACULTY OF SCIENCE, UNIVERSITI TEKNOLOGI MALAYSIA



#### Assalammualaikum wrm. wbt. and Salam Sejahtera,

Alhamdulillah, our greatest gratitude to Allah All Mighty for His Blessings that the Undergraduate Research Symposium or Simposium Projek Sarjana Muda (PSM), 2015/2016 edition will be conducted. A warm applause and heartiest congratulations to all 4th Year students who will be presenting, to the committee members for successfully organizing this annual event and last but not least to all academic and technical staffs of the Faculty of Science who have tirelessly work to ensure the success of this Simposium, and above all to ensure the students' success through their endless commitment in supervising and providing technical support.

The Simposium PSM is a platform for 4<sup>th</sup> Year students in the Faculty to showcase their research findings, and provides an avenue to enhance their communication skills, both oral and written, while PSM itself has throughout the years proven to be the means by which young scientists are encouraged and nurtured through positive research culture and academic excellence.

It is the Faculty's wish that PSM and the Simposium will continue to flourish and maintain to be one of the Faculty's means of acquiring quality research and publications in years to come. Wassalam wrm wbh and warmest wishes.

Thank you.

**PROFESSOR DR NORSARAHAIDA SAIDINA AMIN** Dean, Faculty of Science

## **FOREWORD BY HEAD OF DEPARTMENT** DEPARTMENT OF CHEMISTRY, FACULTY OF SCIENCE, **UNIVERSITI TEKNOLOGI MALAYSIA**



Salam Sejahtera dan Salam 1 Malaysia,

My heartiest congratulation to our final-year students who will be presenting their research findings during the annual Undergraduate Research Symposium (Simposium Projek Sarjana Muda) organized by the Department of Chemistry for the 2015/2016 session.

The Undergraduate Research Project allows the students to be engaged directly in a guided research and inquiry within the curriculum. Knowledge on chemical concepts acquired during their studies was applied in solving problems based on scientific facts. Through the entire research process, students are trained to gather information, design and conduct the experimental work, perform data analysis and finally documenting and presenting their findings.

The Undergraduate Research Symposium provides an excellent forum for the final-year students to present and defend their findings and disseminates ideas through oral scientific presentation. This year's symposium will see a total of 96 student presentations in the area of Analytical, Computational, Inorganic, Organic and Physical Chemistry during the 3-day symposium. While the students will be evaluated on their presentation and understanding of the research executed, the symposium will provide opportunities for students and staff to gain insights on the research being carried out in the department. I sincerely hope that the event will be learning and knowledgesharing event which can further initiate students into the culture of academic research community and ignite their interest in pursuing postgraduate studies.

Finally, my sincere gratitude to all the academic staff for their dedication and commitment in supervising the students. Sincere appreciation also goes to the supporting staff for their assistance in the technical aspects and warmest congratulation to the committee members who have organized and ensured the smooth running of the symposium

Thank you.

## ASSOCIATE PROFESSOR DR ZAITON ABDUL MAJID

Head of Department Department Of Chemistry, Faculty of Science

#### FOREWORD BY CHAIRPERSON, UNDERGRADUATE RESEARCH COMMITTEE DEPARTMENT OF CHEMISTRY

Assalamualaikum and Salam Sejahtera

On behalf of PSM's Committee members, I am glad to welcome all of you to the Department of Chemistry Undergraduate Research (Projek Sarjana Muda) Symposium 2015/2016.

68 students will present their research findings in this symposium and I would like to congratulate them. I believe all students have demonstrated the intellectual skills and competency with sufficient research exposure throughout year in completion the individual research.



They have faced various changing and unpredictable situations which require high desire and maturity to learn continuously. In the end, all of the research endeavors were rewarded with fruitful findings that will be shared during the research symposium.

This symposium is organized as such to enable students engaging the formal scientific presentation that stimulate the exchange of ideas across the chemistry fields. Students are required to present and discuss the results within the expected level. They will be evaluated based on several criteria and I wish each of them delivering a successful and informative presentation.

On behalf of the committee, I would like to take this opportunity to thank all lecturers and staff who have contributed either directly or indirectly throughout the undergraduate research (projek sarjana muda) program. Last and not least, many thanks to the committee members for the hard work in ensuring the successful in managing this research program.

Finally, I pray to Allah the Almighty to accept our efforts and forgive us for weaknesses and shortcomings. Wassalam.

#### **DR. JOAZAIZULFAZLI JAMALIS**

Chairperson, Undergraduate Research Committee Department of Chemistry, Faculty of Science, UTM.

## SCHEDULE

## :: ANALYTICAL CHEMISTRY ::

	EMISTRY/ Tuesday, 31 May 2016	Place: DK1- C17
Session 1A	CHAIRPERSON – DR. AEMI SYAZWANI ABDUL KEYON ASSISTANT – MARIAM HASAN	
Time	Student	
8.40 – 9.00	MUHAMMAD ARIF AZHAR BIN YUNOS	<b>Supervisor</b> Prof. Dr. Wan Aini Wan Ibrahim
9.00 - 9.20	NURFAZILAH BINTI ZAINAL ABU	Prof. Dr. Abdull Rahim Mohd Yusoff
9.20 - 9.40	MUHAMMAD FAZRUL FAIZ BIN FAUZI	Prof. Dr. Rahmalan Ahmad
9.20 - 9.40	MUHAMMAD FAZKUL FAIZ DIN FAUZI	PTOL DL. Rainnaian Anniau
9.40 - 10.00	NOR AZLINA BINTI AZIZ	PM. Dr. Umi Kalthom Ahmad
10.00-10.20	NAJWA IZZATI BINTI ZAINAL	Prof. Dr. Wan Aini Wan Ibrahim
10.20-10.40	NOOR FATIHAH BINTI MOHD SABRI	Dr. See Hong Heng
BREAK		
	CHAIRPERSON – DR. AEMI SYAZWANI ABDUL KEYON	
Session 1B	ASSISTANT – DINDA AHMAD HAIRUL ROSDI	
Time	Student	Supervisor
11.00-11.20	NURUL HAZNITA BINTI ABDUL HAMID	Dr. Aemi Syazwani Abdul Keyon
11.20-11.40	UMI ZULAIKHA BINTI MOHD AZMI	PM. Dr. Jafariah Jaafar
11.40-12.00	SHARIFAH FARAH HANNA BINTI SYED	Dr. Aemi Syazwani Abdul Keyon
	HARON	
12.00-12.20	NUR FATIHAH BINTI ADAM	Mr. Mohd Daniel Abdullah
12.20-12.40	FLORA ANAK JOSEPH	PM. Dr. Razali Ismail
	BREAK	
	CHAIRPERSON – MR. M	IOHD DANIEL ABDULLAH
Session 1C	ASSISTANT – FARIZA SHAHROM	
Time	Student	Supervisor
2.00 - 2.20	NURUL 'IZZAH BINTI ABDUL KARIM	Dr. Aemi Syazwani Abdul Keyon
2.20 - 2.40	ATHIRAH AISYAH BT MUHAMAD SYUKUR	Prof. Dr. Abdull Rahim Mohd Yusoff
2.40 - 3.00	MURSYIDAH BINTI ABDUL RAHIM	PM. Dr. Razali Ismail
3.00 - 3.20	NURUL FATIN BINTI MOHD SALLEH	Dr. Naji Arafat Mahat
3.20 - 3.40	NOR FATIHA BINTI HISSAM	PM. Dr. Azli Sulaiman
3.40 - 4.00	SITI NORMAZIAH BINTI ZAIDI	PM. Dr. Umi Kalthom Ahmad
4.00 - 4.20	DIAN NUR HAMIZAH BINTI HASSAN	Mr. Hashim Bahrin
BREAK		

## ANALYTICAL CHEMISTRY/ Wednesday 1 June 2016

## Place: DK1- C17

Session 2	CHAIRPERSON – DR. SEE HONG HENG ASSISTANT – AZANI ISHAK	
Time	Student	Supervisor
8.30 - 8.50	NURUL NADHIRAH BINTI ZULKIFLE	Prof. Dr. Wan Aini Wan Ibrahim
8.50 - 9.10	NUR FARIHIN BINTI MUHAMAD	PM. Dr. Jafariah Jaafar
9.10 -9.30	FARHAH BINTI KAMARUDIN	Dr. Hasmerya Maarof
BREAK		
10.15 - 11.15	INVITED LECTURE: CHEMISTRY- OUR LIFE AND FUTURE Dewan Kuliah 2-C17	
END OF SESSION		

## :: INORGANIC AND PHYSICAL CHEMISTRY::

## INORGANIC AND PHYSICAL CHEMISTRY / Tuesday, 31 May 2016

#### Place: DK2-C17

	CHAIRPERSON -DR. FAZIRA	IIYANA ABDUL RAZAK
Session 1A	ASSISTANT – HAMITUL ASMA GHAZALI	
Time	Student	Supervisor
8.40 - 9.00	THARISHINNY A/P RAJA MOGAN	PM Dr. Riadh Sahnoun
9.00 - 9.20	SYAHIRAH BINTI ABDOL RAZAK	Prof. Dr. Abdul Rahim Yacob
9.20 - 9.40	SITI ATHIRAH BINTI AZIZAN	Dr. Siti Aminah Setu
9.40 - 10.00	NURUL NABIHAH BTE MOHAMAD ISHAK	Prof. Dr. Sugeng Triwahyono
10.00-10.20	NADZIDAH BINTI YUSOF	Dr. Che Rozid Mamat
10.20-10.40	MOHD ASYRAF BIN DAHLAN	Dr. Che Rozid Mamat
BREAK		
	CHAIRPERSON – DR. SHEELA CHANDREN	
Session 1B	ASSISTANT – HAZELINDA MASLAN	
Time	Student	Supervisor
11.00-11.20	SITI NURAINNA BINTI WAHID	PM. Dr. Rusmidah Ali
11.20-11.40	NUR ASYIQIN BINTI BUANG	Prof. Dr. Wan Azelee Wan Abu Bakar
11.40-12.00	NOR ANIISAH BINTI HUSIN	PM. Dr. Nor Aziah Buang
12.00-12.20	MOHD NORAZWAN BIN MOHD NOR	Prof. Dr. Mustaffa Shamsuddin
12.20-12.40	AERVINA BINTI MISRON	Dr. Hendrik Oktendy Lintang
	BREAK	
	CHAIRPERSON – DR. SITI AMINAH SETU	
Session 1C	ASSISTANT – NOORLYANA MAZLAN	
Time	Student	Supervisor
2.00 - 2.20	ZULAIKHA ATHIRAH BINTI ALEXZMAN	Prof. Dr. Sugeng Triwahyono
2.20 - 2.40	NURUL A'IN BINTI MOHAMAD WARIS	Dr. Leny Yuliati
2.40 - 3.00	NOOR HIDAYAH FATHIHAH	Prof. Dr. Abdul Rahim Yacob
3.00 - 3.20	NUR SYAFIQAH BINTI FADZIL	PM. Dr. Zainab Ramli
3.20 - 3.40	MUHAMMAD FADHLI BIN KAMARUZAMAN	PM. Dr. Zaiton Abdul Majid
3.40 - 4.00	C WAN NUR IZATI BINTI C WAN AHMAD	PM. Dr. Zainab Ramli
4.00 - 4.20	ANIS SYAZWANIE BINTI JASMANI	Prof. Dr. Madzlan Aziz
BREAK		

## INORGANIC AND PHYSICAL CHEMISTRY / Wednesday 1 June 2016

#### Place: DK2-C17

Session 2A	CHAIRPERSON – DR. SHEELA CHANDREN ASSISTANT – MOHD AZIDY ABDULL AZIZ	
Time	Student	Supervisor
8.30-8.50	NURDIANA BINTI NORDIN	PM. Dr. Nor Aziah Buang
8.50-9.10	NORFAZREEN BINTI SAFFEE	Prof. Dr. Mustaffa Shamsuddin
9.10-9.30	NOOR AINI BINTI RABUYAN	Prof. Dr. Wan Azelee Wan Abu Bakar
9.30-9.50	DEIDREE JANE DOUSI	PM. Dr. Rusmidah Ali
10.15 - 11.15	INVITED LECTURE: CHEMISTRY- OUR LIFE AND FUTURE	
	Dewan Kuliah 2-C17	
BREAK		

Session 2B	CHAIRPERSON –DR. NURSYAFREENA ATTAN ASSISTANT – ABD RAHIM ALI	
Time	Student	Supervisor
11.40 - 12.00	SUFFIAN ASSAURI BIN MOHD ALFADZIRLLAH	Prof. Dr. Madzlan Aziz
12.00 - 12.20	MUHAMMAD AMIEROUL EIRFFAN BIN	Prof. Dr. Hadi Nur
	MOHAMAD	
12.20-12.40	LIM SWEE EAN	PM. Dr. Lee Siew Ling
12.40 - 1.00	FILDZAH BINTI ARIFFIN	Prof. Dr. Sugeng Triwahyono
END OF SESSION		

#### :: ORGANIC CHEMISTRY ::

## ORGANIC CHEMISTRY/ Tuesday, 31 May 2016

#### Place: C18-215

	CHAIRPERSON – DR. SHAJARAHTUNNUR JAMIL		
Session 1A	ASSISTANT – SITI RAFEZAH MAT EMRIN		
Time	Student	Supervisor	
8.40 - 9.00	NUR FARHANAH MOHAMAD NOOR	Prof. Dr. Hasnah Md Sirat	
9.00 - 9.20	JANETTA NAGI ANAK EMPARI	Dr. Norazah Basar	
9.20 - 9.40	NURAQILAH BINTI HISHAMMUDDIN	PM. Dr. Zainoha Zakaria	
9.40 - 10.00	ADRI BIN NORISHAM	Prof. Dr. Hasnah Md Sirat	
10.00 - 10.20	NURSHAHIDA BINTI ROSDI	PM. Dr. Zainoha Zakaria	
10.20 - 10.40	NURUL INSYHIRA BINTI BAHARUDIN	Dr. Roswanira Abd Wahab	
	BREAK		
	CHAIRPERSON – DR. MOHD BAKRI BAKAR		
Session 1B	ASSISTANT- ZAHRATUL' AIN JALIL		
Time	Student	Supervisor	
11.00 - 11.20	NURUL AMIRAH MOHD ABAS	PM. Dr. Farediah Ahmad	
11.20 - 11.40	ILY NURAINI BINTI AZMAN	Dr. Khairil Juhanni Abdul Karim	
11.40 - 12.00	NURUL FATIHAH BINTI AWANG MUDA	Dr. Mohd Bakri Bakar	
12.00 - 12.20	NURUL IZWANIE BINTI ABDULLAH	Dr. Roswanira Abd Wahab	
12.20 - 12.40	NURAIN BINTI ZAINALABIDIN	Dr. Khairil Juhanni Abdul Karim	
12.40 - 1.00	AZIRA FAR'AIN BINTI ANOAR	PM. Dr. Farediah Ahmad	
BREAK			

## **ORGANIC CHEMISTRY/ Wednesday 1 June 2016**

## Place: C18-215

	CHAIRPERSON – DR. ROSWANIRA ABDUL WAHAB	
Session 2	ASSISTANT- MUHAMMAD ALI HJ AMIN	
Time	Student	Supervisor
8.30 - 8.50	MOHAMAD AINUDDIN BIN WAHIDIN	Prof. Dr. Wan Azlina Ahmad
8.50 - 9.10	NOR HIDAYAH BINTI ABDULLAH	Dr. Roswanira Abd Wahab
9.10 - 9.30	NUR IZWINDA BINTI A RAHIM	Prof. Dr. Wan Azlina Ahmad
9.30 - 9.50	SITI ADIBAH YUMNI BINTI MD JAILANI	Dr. Roswanira Abd Wahab
BREAK		
10.15 - 11.15	INVITED LECTURE: CHEMISTRY- OUR LIFE AND FUTURE	
	Dewan Kuliah 2-C17	
END OF SESSION		

# ABSTRACT

## CHARACTERIZATION OF BENZENE-1,3,5-TRICARBOXAMIDE ORGANOGEL-GOLD NANOPARTICLES COMPOSITE

#### Aervina Misron, Mustaffa Shamsuddin and

#### Hendrik Oktendy Lintang

Nanoparticles with particle size less than 10 nm have attracted much attention due to their unique properties in the field of optoelectronics, photovoltaics and catalysis. Gold nanoparticles (AuNPs) are well-known for its wide range of applications. However, AuNPs tends to agglomerate to form bigger cluster which limits its potential applications. Recently, organogels have been used for encapsulating nanomaterials with good spatial organisation and stability, leading to the development of optoelectronic devices, catalytic frameworks and new magnetic materials. Meanwhile, benzene-1,3,5tricarboxamide (BTA) has been recognized as a simple and versatile organic motif for the formation of organogel by supramolecular self-assembly. Therefore, this study reports on the preparation of well-ordered AuNPs-organogel by doping Au into the co-assembled BTAs organogel. Firstly, a new organogel with 3-D networks having rectangular arrangement was prepared by mixing the  $BTA_{C12}$ with BTA<sub>C10TEG</sub> with a molar ratio of 1:1. The as-synthesised BTAs organogel was then doped with 1%, 3% and 5% weight percent of 5 nm AuNPs to give AuNPsorganogel composite. The physico-chemical properties of the AuNPs-organogels were characterized by UV-Vis and Fluorescence spectroscopies and TEM analysis. Based on TEM analytical data, the organogel with 1 wt% doped AuNPs give a wellordered and homogenously distributed AuNPs morphology as compared with the 3 wt% and 5 wt% doped AuNPs. On the other hand, the photophysical studies of the AuNPs-organogel revealed that as the concentration of AuNPs increase, there is a batochromic shift of the absorbance in the UV-Vis spectrum and caused quenching in the fluorescence emission intensity and FT-IR transmittance. The photophysical studies suggested that an increase in the loading of AuNPs strongly affected the molecular arrangements of the co-assembled BTAs organogel. In conclusion, homogently distributed, well-ordered arrangement, and shape free agglomeration AuNPs-organogel was successfully synthesized.

## PROPERTIES OF GRAPHENE OXIDE NANOSHEET USING PHOSPHATE AS REDUCING AGENTS IN REDUCTION PROCESS

#### Anis Syazwanie Jasmani and Madzlan Aziz

Graphene sheets are of significance in fundamental and applied science for their exceptional electronic, mechanical, and thermal properties. A simple and efficient method was introduced for the preparation of graphene oxide (GO) from graphite flakes using a simplified Hummer's method. Among the different methods for producing graphene sheets, chemical reduction of GO is favorable due to the fact that it is ease in processing, versatile, and scalable for mass production. This research compares the deoxygenation efficiency of graphene oxide by different reducing agents, dipotassium hydrogen phosphate trihydrate (K<sub>2</sub>HPO<sub>4</sub>.3H<sub>2</sub>O) and potassium hexafluorophosphate (F6KP). The chemically reduced graphene oxide nanosheets (RGO) have been analyzed by Attenuated Total Reflectance Infrared Spectroscopy (ATR-IR), Diffused Reflectance UV-Vis Spectroscopy (DR-UV) and Electrochemical Impedance Spectroscopy (EIS). The ATR-IR indicated that the absorption bands of O-H, C=C, C=O, C-OH and C-O-C of GO spectrum was found to disappear due to the reduction process. In the DR-UV spectrum, the absorption peak of GO was gradually red-shifted from 230 nm to 258 nm and the whole absorption in the spectral region increases with reaction time, suggesting that the electronic conjugation within the graphene sheets is restored. Considering the analysis results, phosphates plays a key role in the efficient removal of the oxygen containing groups in GO, which avoids the use of high toxic and hazardous reducing agents commonly used to obtain RGO in chemical reduction of GO. Both phosphates and prepared graphene are environmentally friendly and inexpensive, which may facilitate the use of graphene-based materials.

## DETERMINATION OF NIFEDIPINE USING VOLTAMMETRIC TECHNIQUE WITH MERCURY MENISCUS AMALGAM ELECTRODE

#### Athirah Aisyah Muhamad Syukur and Abdull Rahim Mohd Yusoff

3,5-Dimethyl-2,6-dimethyl-4-(2-nitrophenyl)-1,4-dihydropyridine-3,5dicarboxylate or known as nifedipine could cause toxic effects like vomiting, dizziness and pounding heartbeats. Besides, it also can affect our environment through wastewater effluent. The study of the electrochemical behavior of nifedipine (NFD) were carried with two different working electrodes; copper electrode and mercury meniscus modified copper amalgam electrode (m-CuSAE) using differential pulse voltammetry (DPV) technique. Due to toxicity of mercury, m-CuSAE was constructed to overcome this problem and as an alternative electrode for hanging mercury drop electrode (HMDE). The optimal conditions for DPV determination for copper electrode and m-CuSAE were in pH 7 and pH 6 respectively of Britton-Robinson Buffer (BRB) in concentration range of 50 µmol/L to 250 µmol/L. NFD was optimized at various parameters such as for the quantitative analysis. Those parameters were accumulation potential, accumulation time, pH of solution, initial potential and calibration of graph for limit of detection (LOD). LOD for copper electrode was 2.2294x10<sup>-5</sup> mol/L while for m-CuSAE was 1.8436x10<sup>-5</sup> mol/l. From the data obtained, it shows that m-CuSAE gave a better results compare to copper electrode with the aid of mercury metallic on it.

## ISOLATION AND IDENTIFICATION OF CHEMICAL COMPOUND OF GARCINIA ATROVIRIDIS.

#### Azira Far'ain Anoar and Farediah Ahmad

Garcinia atroviridis is one of the species of Garcinia that classified under Guttiferae family. It has been studied by the researches through its high medicinal values. *G. atroviridis* also known as "asam gelugor" in Malaysia and it is widely used in food and medication. Extraction of *G. atroviridis* leaves using hexane as solvent yielded a crude extract with dark green colour. The extract was fractionated and purified by using vacuum liquid chromatography (VLC) and gravity column chromatography (CC) techniques. The chemical constituents were elucidated via spectroscopic characterization using infrared (IR) and nuclear magnetic resonance (<sup>1</sup>H NMR and <sup>13</sup>C NMR). Spectroscopic characterisation afforded  $\beta$ -sitosterol. The hexane crude extract was screened for antioxidant activity using diphenylpicrylhydrazyl (DPPH) method. The crude was found inactive against DPPH.

## SYNTHESIS OF MESOPOROUS ZSM-5 USING DIFFERENT SACCHARIDE MESO TEMPLATES AND DIRECTING AGENTS

#### C Wan Nur Izati C Wan Ahmad and Assoc.Prof Dr Zainab Ramli

The mesoporosity of microporous ZSM-5 was synthesised by investigating the effect of different structure directing agents, and mesotemplates. In this study, tetrapropylammonium hydroxide (TPAOH) and tetrabutylammonium hydroxide (TPABr) were used as directing agents that could direct the formation of microporous ZSM-5 structure while saccharides (glucose and sucrose) were chosen as mesotemplates reagents. ZSM-5 zeolite was synthesized by hydrothermal method at 100°C with initial molar composition of Al<sub>2</sub>O<sub>3</sub>: 50SiO<sub>2</sub>:  $8TPA^+$ : 1500H<sub>2</sub>O: 20 saccharides. ZSM-5 was synthesized without using mesotemplate was also synthesized to make comparison with the templated samples. All synthesized samples were characterized by X-Ray Diffraction (XRD), Fourier Transform Infrared (FTIR) and nitrogen adsorption analysis. XRD results showed that only sample prepared by TPAOH as directing agent and sucrose as meso template (ZSM-5-SUC) formed ZSM-5 crystal phase while the rest of the samples showed dominantly amorphous material. Nitrogen adsorption analysis revealed all samples show high surface area (> 500  $m^2/g$ ) with isotherm of the type IV ie mesoporous characteristics. However analysis of the t-plot of all samples indicated that only ZSM-5-SUC sample a mixture of microporous and mesoporous characteristics with the mesoporous pore size distribution centred at 4.7 nm. Study showed that the present OH- for the TPA ion is important in order to direct the formation of ZSM-5 microporous structure while sucrose facilitate the formation of mesoporosity of the ZSM-5 due to its mineralizing property. As compared to TPABr, the use of TPAOH as the directing agent is a good template because OH ion is able to transform Al<sup>3+</sup> into tetrahedral aluminate ion which accounted for the formation of tetrahedral aluminosilicate framework of mesoporous ZSM-5 structure.

## PHOTOCATALYTIC DEGRADATION OF METHYLENE BLUE USING ZINC BASED CATALYST SUPPORTED ON ACTIVATED CARBON FROM RAMBUTAN PEEL

#### Deidree Jane Dousi and Rusmidah Ali

The wastewater which is contaminated dyes such as methylene blue and hazardous organic substances with high amount of aromatic compounds will affect water systems, blocking oxygen dissolution which are essential for aquatic life and can cause harmful effects to human health. Therefore it must be treated. Advanced oxidation processes have been applied to treat the polluted water effectively by reducing or eliminating the contaminant in the water using semiconductor photocatalysts and activated carbon as adsorbent. In this study a single ZnO photocatalyst and coupled ZnO were used together with ZnO/AC which was prepared by physical mixing method with different mass ratios and activation temperatures. Characterizations of the prepared catalysts were performed by FESEM-EDX. Later, the photocatalytic activities of the prepared photocatalysts were tested on the methylene blue solution irradiated under UVlight (6W, 365 nm) and also in the dark. The percentage of degradation was monitored by UV-Visible spectrophotometer. The photodegradation using single ZnO photocatalyst gave 69.39% while adsorption for single ZnO photocatalyst gave 74.42%. The best photocatalysts under irradiation of UV light were ZnO/AC 50:50 (activation temperature of activated carbon: 400°C) with 98.79% degradation, ZnO/AC 70:30 (activation temperature of activated carbon: 500°C) with 99.88% degradation and ZnO/AC 50:50 (activation temperature of activated carbon: 600°C) with 99.95% degradation. Meanwhile for the adsorption reaction, the best photocatalysts were ZnO/AC 50:50 (activation temperature of activated carbon: 400°C) with 99.76% degradation, ZnO/AC 90:10 (activation temperature of activated carbon: 500°C) with percentage degradation of 99.50% and lastly ZnO/AC 90:10 (activation temperature of activated carbon: 600°C) with percentage degradation of 99.72%. Results show that the photocatalytic degradation was dominated by strong adsorption of the rambutan peel activated carbon.

## SYHTHESIS OF BIO-PLASTIC AS SLOW RELEASE FERTILIZER AND BANANA PEEL AS NUTRIENT SOURCE

#### Dian Nur Hamizah Hassan and Hashim Baharin

Slow release fertilizer (SRF) design to release nutrient in the fertilizer to plant continuously at the rate follow the nutrient required by the plant while simultaneously reducing nutrient loss in fertilizer. SRF is a fertilizer that contain plant nutrient in a form which delays its ability by releasing micronutrient slowly into the soil. In this research, bio-plastic were synthesis to study the rate of potassium and phosphorus released in soil by analyze the fertilizer every week for 2 months. Four types of bio-plastic SRF were tested which are 10 %, 30 %, 50 % and 70 % of banana peel as nutrient source. This obtained from different composition of bio-plastic and banana peel added. The effectiveness of four types bio-plastic fertilizer were analyzed and observed and compared every week for 2 months. Amount of potassium and phosphorus released were determined by flame photometer and Hach spectrophotometer respectively. The amount of nutrients released was calculated by week based on the percentage of mass loss obtained. Based on the result, releasing of minerals increase as the composition of banana peel change from 10 % to 70 % as result showed percent of weight loss in week 5 for 10 %, 30 %, 50 % and 70 % are 49.44 %, 52.05%, 59.92%, 65.48% respectively. These phenomena give positive result when tested to the plants also, as the plants growth well. This show that nutrient in bio-plastic well release that benefit to plants.

## HYDROGENOLYSIS OF CELLULOSE INTO ALCOHOL OVER METAL SUPPORTED FIBROUS MESOSTRUCTURE SILICA NANOPARTICLE (FMSN)

#### Fildzah Ariffin and Sugeng Triwahyono

The production of short chain polyols from the hydrogenolysis of cellulose over metal (Ce, Ni or Ru) loaded on Fibrous Mesostructured Silica Nanoparticle (FMSN) catalysts were studied by using autoclave reactor at temperature ranges of 150-220 °C. The FMSN was prepared by microwave assisted hydrothermal method. Then it was modified with amine, followed by addition of Ce, Ni or Ru by incipient wetness impregnation method. The FMSN, Ce/FMSN-NH<sub>2</sub>, Ni/FMSN-NH<sub>2</sub> and Ru/FMSN-NH<sub>2</sub> were characterized with XRD, FESEM, FTIR and nitrogen-physisorption analyzer. The XRD analysis showed that the introduction of metals did not change much the XRD pattern of FMSN. The FESEM and EDX results showed the presence of Ce, Ni and Ru metal on the uniform spherical shape of fibrous silica nanoparticle. The BET surface area of FMSN, Ce/FMSN-NH<sub>2</sub>, Ni/FMSN-NH<sub>2</sub> and Ru/FMSN-NH<sub>2</sub> was 393.81, 371.56, 314.22 and 351.97  $m^2/g$ , respectively. At T=220 °C, P=5 bars, and t= 2 h, the hydrogenolysis of cellulose over Ce/FMSN-NH2 resulted 95 % conversion of cellulose with the product distribution of 3-buten-1-ol (S=63.30%), diisopropyl ether (S=2.86%) and cyclopropane carboxylic acid (S=33.7%). The high activity of Ce/FMSN-NH<sub>2</sub> may be due to the presence of Ce metal catalyst and fibrous silica. While, for Ni/FMSN-NH<sub>2</sub> and Ru/FMSN-NH<sub>2</sub> showed less active than Ce/FMSN-NH<sub>2</sub>.

## DETERMINATION OF HEAVY METALS IN SEDIMENTS AND WATER FROM JOHOR RIVER

#### Flora anak Joseph dan Razali Ismail

Water and sediment from four sampling stations in Sungai Johor were sampled on the month September 2015 and October 2015 and are analysed for 11 metals including arsenic (As), aluminium (Al), cadmium (Cd), copper (Cu), chromium (Cr), iron (Fe), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), and zinc (Zn). Results showed that the mean dissolved metal concentrations (in  $\mu g/L$ ) in Sungai Johor water based on 4 sampling stations (in ascending order) for Cd, Cr, Ni, Mn, As, Hg, Zn, Cu, Pb, Al, and Fe were 0.47, 1.67, 3.80, 4.01, 4.22, 29.03, 42.71, 60.17, 181.68, 292.04, and 1244.65 µg/L, respectively. Mean concentration (in  $\mu g/L$  dry weight) for sediments (in ascending order) for Hg, Cd, As, Ni, Pb, Cu, Cr, Mn, Zn, Al, and Fe were 2.04, 12.76, 67.44, 79.51, 236.75, 270.5, 317.5, 526.5, 1299, 99368, and 124710 µg/L, respectively. A comparison with various water and sediment quality standards showed that the mean metal concentrations in water and sediment of Sungai Johor were low and within the range of natural background except for aluminium, copper, iron, mercury, and lead in water. The main sources of heavy metal contamination in Kota Tinggi were domestic wastewater and agricultural activities.

## SYNTHESIS AND CHARACTERIZATION OF HOMOPOLYMER METHYL METHACRYLATE VIA REVERSIBLE ADDITION FRAGMENTATION-CHAIN TRANSFER (RAFT) POLYMERIZATION

#### Ily Nuraini Azman and Khairil Juhanni Abdul Karim

Homopolymer of poly(methyl methacrylate) was synthesized *via* reversible addition fragmentation-chain transfer (RAFT) polymerization method. Compared to other reversible deactivation radical polymerization (RDRP) methods such as Atom Transfer Radical Polymerization ATRP) and Nitroxide Mediated Polymerization (NMP), this method gives more advantagess as it applies the principle of degenerative chain transfer and the involvement of chain transfer agent. RAFT provides more effective and versatile methods for providing "living" characteristic to radical besides able to control molecular weight of the polymer efficiently. Poly(methyl methacrylate) was prepared using its monomer, methyl methacrylate, 4'4-azobis(4-cyanopentanoic acid) (ACPA) as initiator and 4cyanopentanoic acid dithiobenzoate (CPADB) as chain transfer agent to form The polymerization reaction was carried out at the RAFT macro initiator. temperature of 80°C for 24 hour to achieve high conversion of polymer. The product obtained from the reaction is transparent sticky gel. The structure obtained was analysed by proton nuclear magnetic resonance (1H NMR) and Fourier Transform Infrared (FTIR) spectroscopy methods. The FTIR spectra were recorded in the frequency range from 650 to 4000 cm<sup>-1</sup> at room temperature using Attenuated Total Reflectance (ATR) method.

#### SYNTHESIS OF COUMARINYL – CHALCONES

#### Janetta Nagi Anak Empari and Norazah Basar

Coumarin-based chalcones are organic fluorescent materials that exhibit unique photochemical and photophysical properties which make them useful in variety of applications. In this research, coumarin derivatives were successfully synthesis by using Knoevenagel Condensation Reaction (KCR) with moderate to high yields. The reaction is done by the reaction between various substituted salicylaldehyde derivatives with ethylacetoacetate in basic conditions. Products formed in this study were 3-acetyl-7-methoxycoumarin, 3-acetvl-6bromocoumarin, 3-acetyl-7-hydroxycoumarin, 3-acetyl-8-methoxycoumarin and 3-acetyl-7-diethylaminocoumarin. The study was continued by condensation process coupling of synthesized coumarin as precursors with 2-hydroxy-5nitrobenzaldehyde to formed coumarin-based chromophores containing chalcone moiety. The presence of three-carbon  $\alpha,\beta$ -unsaturated carbonyl system indicated that the coumarinyl chalcone compounds were successfully synthesized. In which, 3-(3-(2-hydroxy-5-nitrophenyl)acryloyl-7-methoxycoumarin and 3-(3-(2hydroxy-5-nitrophenyl) acryloyl-7-hydroxycoumarin successfully were synthesized. Spectroscopic methods which were Nuclear Magnetic Resonance (NMR) and Infrared (IR) used to elucidate the structure of synthesized compounds.

## NEW TUNGSTEN-SULPHATE MODIFIED SILICA-TITANIA AS OXIDATIVE-ACIDIC BIFUNCTIONAL CATALYST FOR DIOL SYNTHESIS

#### Lim Swee Ean and Lee Siew Ling

A bifunctional catalyst with oxidative and acidic sites is highly desired for consecutive transformation of olefins to diols via epoxides as intermediate. In this study, a series of new tungsten-sulphate modified silica-titania bifunctional catalysts were successfully synthesized and characterized. The effect of two parameters, namely tungsten oxide loading and sulphuric acid content was studied. SiO<sub>2</sub>-TiO<sub>2</sub> was prepared via sol-gel method, followed by impregnation with tungsten oxide (WO<sub>3</sub>) and sulphate group (SO<sub>4<sup>2-</sup></sub>). XRD results demonstrated that monoclinic WO<sub>3</sub> appeared in samples of high tungsten loading. A drastic decrease of ~70% in surface area of solid catalyst from 725.8 to 215.3  $m^2/g$  was observed after loading with both WO<sub>3</sub> and SO<sub>4</sub><sup>2-</sup>. Existence of both WO<sub>3</sub> and hydrated tetrahedral Ti in the materials was crucial to generate oxidative sites. Further modification with  $SO_{4^{2}}$  has significantly improved both oxidative ability and acid strength of solid catalyst, producing several folds higher of epoxides and diols. Since Brønsted acid sites are needed for transformation of epoxides to diol, it was believed that the current materials possessed Brønsted acidity. Evidently, the coexistence of  $WO_3$  and  $SO_4^{2-}$  were vital to generate both oxidative and acidic sites in SiO<sub>2</sub>-TiO<sub>2</sub>. The results suggested that 0.5M\_SO<sub>4</sub><sup>2-</sup>/W/SiO<sub>2</sub>-TiO<sub>2</sub> was a promising bifunctional catalyst in diol synthesis which yielded 1217 µmol 1,2epoxyoctane and 246 µmol 1,2-octanediol after 24 h reaction.

## NATURAL DYE PRODUCTION FROM SERRATIA MARCESCENS UTM1 AND CHROMOBACTERIUM VIOLACEUM UTM5 FOR INK APPLICATION

#### Mohamad Ainuddin Wahidin and Wan Azlina Ahmad

Serratia marcescens UTM 1 and chromobacterium violaceium utm5 were known to produce red and violet pigments. These microbial pigments have been used as natural colorant a in various industries due to the toxicological issues of synthetic pigments. This study was carried out to incorporate red and violet pigments as natural colorants into ink for the application on plastic materials. The natural inks were successfully formulated by using polyvinyl butyral,ethyl acetate,methyl ethyl ketone,stearic acid and applied on plastic materials. The natural inks were able to withstand heat up to 60 C and showed no damage on the applications to plastic material during physical contact. The hue and chroma values showed the formulated natural inks falls within the red and violet color. The results showed that the possibility of using microbial pigments as natural colorants for ink formulation and their application on plastic materials.

## BIOSYNTHESIS OF ZINC OXIDE NANOPARTICLES USING FICUS AURICULATA (ELEPHANT EAR FIG) LEAF EXTRACT AND THEIR PHOTOCATALYTIC ACTIVITY

#### Mohd Norazwan Mohd Nor and Mustaffa Shamsuddin

The synthesis of semiconductor metal oxide nanoparticles is an expanding research area due to their applications in photocatalysis. Recently, synthesis of metal oxide nanoparticles assisted by biomolecules have provided alternative to conventional methods due to its simplicity and eco-friendly. In the present study, an environmental friendly, low-cost and simple procedure for the biosynthesis of hexagonal zinc oxide nanoparticles (ZnO-NPs) using aqueous leaf extract of Ficus auriculata as capping agent is described. ZnO-NPs were synthesised via coprecipitation technique by treating zinc nitrate solution with sodium hydroxide in the presence of leaf extract. The structural, morphological and optical properties of the biosynthesised ZnO-NPs have been characterised by using UV-VIS and FTIR spectroscopy, XRD analyses and FESEM-EDX analyses. The formation of ZnO NPs was characterised by the presence of an absorption peak at 353 nm in the UV-vis spectrum. FTIR spectral data showed the presence of functional groups of both leaf extract powder and ZnO NPs indicating the biomolecules have capped on the surface of the nanoparticles. XRD data showed the synthesised ZnO-NPs are wurtzite hexagonal structure with crystallite size of about 13.8 nm. FESEM micrograph image suggested the ZnO-NPs were mostly spherical shape and highly agglomerate. EDX analysis revealed the signals of Zn and O elements in the sample. The synthesised ZnO-NPs was tested for the decolourization of methylene blue under visible and UV irradiation giving an efficiency of 19.8 and 88.2 % respectively. The reactions obeyed a pseudo-first order reaction with rate constant of 0.001 min<sup>-1</sup> and 0.011 min<sup>-1</sup>, respectively.

## SYNTHESIS OF CARBON DOPED TITANIUM DIOXIDE AND ITS PHOTOCATALYTIC STUDIES

#### Muhammad Amieroul Eirffan Mohamad and Hadi Nur

Carbon-doped  $TiO_2$  was successfully prepared from hydrothermal treatment of synthesized amorphous TiO<sub>2</sub> by sol-gel method with glucose as the carbon source. The preparation of carbon-doped happens at temperature of 160 °C. The resulting photocatalyst was characterized by DR-UV, ATR-IR, and PL. The characterization found that the carbon-doped TiO<sub>2</sub> shift its activity towards the visible light region as compared to the undoped counterpart. Carbon-doped TiO<sub>2</sub> shows absorption at region 300-550 nm in DR-UV analysis. From Tauc plot, the band gaps optically obtained was approximately 3.11 eV for the undoped TiO<sub>2</sub> and 2.80 eV for the carbon-doped  $TiO_2$ . ATR-IR shows the presence of C=C band at 1557 cm<sup>-1</sup> in carbon doped TiO<sub>2</sub> as a result aromatization of glucose during the hydrothermal process. Other band found in both photocatalyst includes C=O, OH and Ti-O stretch. PL analysis shows that the carbon doped spectrum quenched when compared to undoped TiO<sub>2</sub> due to low energy needed for emission in carbon doped as the result of lower band gap. PL spectra show the typical two emissions of band gap transition of 422 nm and 468 nm for both undoped TiO<sub>2</sub> and carbondoped TiO<sub>2</sub>. It was found that the carbon-doped TiO<sub>2</sub> exhibits higher photocatalytic activity than the undoped TiO<sub>2</sub> for the degradation methylene blue solution under visible light irradiation ( $\lambda > 420$  nm).

## DETERMINATION OF COPPER(II) ION IN WATER SAMPLES USING AS-SYNTHESISED MAGNETITE-CALCIUM ALGINATE SORBENT WITH FLAME ATOMIC ABSORPTION SPECTROMETRY

#### Muhammad Arif Azhar Yunos and Wan Aini Wan Ibrahim

Conventional technique such as liquid-liquid extraction (LLE) is widely used

in the analysis of Cu(II) ions from water samples. However, LLE is time consuming, tedious, and consume lots of high purity organic solvents. Solid phase extraction (SPE) is an interesting alternative to LLE but it is prone to channelling and is rather expensive. A greener technique such as magnetic solid phase extraction (MSPE) avoids the use of column cartridge and overcome channelling problem. MSPE using magnetite-calcium alginate (Fe3O4-CaAlg) as sorbent is proposed for the extraction of Cu(II) ion from tap and lake water samples and analysis performed using flame atomic absorption spectrometry (FAAS). Characterization of the assynthesised sorbent was performed using Fourier transform infrared spectroscopy and scanning electron microscope. The optimum conditions for Fe3O4-CaAlg MSPE of Cu(II) were achieved at a sample solution of pH 6 with 100 mL sample volume and the existence of interfering ions (Na+, K+, Mg2+,, Cl-) was found not to affect the extraction efficiency of the sorbent for Cu(II) ion. Other MSPE parameters used were 10 min extraction time, 50 mg sorbent, 10 mL of 0.1 M HNO3 as desorption solvent and 5 min desorption time (shaking assisted). The calibration graph was linear from 80-600 ppb with a correlation coefficient (R2) of 0.9983. The LOD (3SD/slope) and LOQ (10SD/slope) of Cu(II) using Fe3O4-CaAlg MSPE with FAAS were in the ppb level. The LOD achieved with the Fe3O4-CaAlg MSPE with FAAS is applicable to the determination of Cu(II) in real water samples (tap water and UTM lake water). Good relative recoveries and precision were achieved with this proposed method. The Fe3O4-CaAlg has great potential as an alternative sorbent for Cu(II) determination from water samples using the greener MSPE method.

## REMOVAL REMAZOL BLACK B FROM AQUEOUS SOLUTION USING MODIFIED PALM OIL FUEL ASH

#### Muhammad Fadhli Kamaruzaman and Zaiton Abdul Majid

In this study, palm oil fuel ash was activated with acid and used as an adsorbent for the removal of remazol black b from an aqueous. The influence of solution pH, initial dye concentration and contact time were investigated in batch experiments. The adsorption was evaluated using Langmuir and Freundlich isotherms models and found to fit the Langmuir model. The maximum adsorption of remazol black b dye by modified POFA was calculated as 11.24 mg/g. The kinetic study data were well-represented by the pseudo-second-order kinetic model thus indicates that the sorption process is chemisorption process. The adsorbent was characterized using Fourier transform infrared spectroscopy, Brunauer-Emmett-Teller (BET) and X-Ray Diffraction (XRD). Result of this study showed that palm oil fuel ash could be used as a low-cost adsorbent for the adsorption of remazol black b from aqueous solution.

## DETERMINATION OF COPPER, CADMIUM, ZINC AND LEAD IN HAZE USING ATOMIC ABSORPTION SPECTROSCOPY AND DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY

#### Muhammad Fazrul Faiz Fauzi and Rahmalan Ahamad

Air pollution was causes by various sources. For example in nowadays is open combustion, industrial, and mostly is from the vehicle. The air pollutant is due to the content of the suspended particle in the air. This suspended particle is can be inhale because of the size in micron size (PM10 and PM2.5) and contain harmful ion that can cause serious deceases. The concentration of the heavy metal in the air sample was determine using Graphite Furnace Atomic Absorption Spectroscopy (GFAAS) since the detection limit is very low. The sampling was conducted in the Universiti Teknologi Malaysia, UTM in the month of October 2015. At this time, the peninsular of Malaysia having a terrible haze because of the burning in the Sumatra and the Southwest Monsoon that carries the suspended particle. In this study, analysis of selected metal (Cu, Cd, Zn and Pb) was conducted. The air sample filter was treated with acid digestion using nitric acid and hydrogen peroxide prior to determination using GFAAS. From the result obtain, the concentration of the heavy metal can be determine except for zinc because the concentration is to low and cannot be determine using GFAAS analysis. The concentration of copper in the sample is  $393.625 \ \mu g/g$  meanwhile the concentration of lead is  $888.75 \ \mu g/g$ . This two value is higher than the allocated amount of metal need to be consumed by human and can cause harm and bring danger. But for the concentration of cadmium, it only 35.8  $\mu$ g/g and the value is low compare to the two metal mentions earlier.

## FRACTIONATION OF HEAVY METALS IN RVER SEDIMENTS OF SUNGAI JOHOR

#### Mursyidah Abdul Rahim and Razali Ismail

Fractions of heavy metals and their distribution in river sediments from Sungai Johor were investigated. This was done in order to understand their mobility and bioavailability. A sequential extraction technique proposed by the European Community Bureau of Reference (BCR) was applied to assess the presence of Chromium, Nickel and Zinc in the four fractions (acid-soluble, reducible, oxidizable and residual) in four sediment samples. Metal concentrations were assessed using Flame Atomic Absorption Spectroscopy (FAAS). The results were validated by the analysis of spike sample. The results showed good recovery percentage which Cr, Ni and Zn were accounted for 104.8%, 98.8% and 119.0% respectively. Cr resided mainly in residual fraction while Ni in was mainly associated oxidizable fraction. The dominants binding phases for Zn was acid-soluble fraction. Total metal concentration of Cr ranged from 0.28 ± 0.04  $\mu$ g/g to 0.59 ± 0.12  $\mu$ g/g, while for Ni and Zn accounted from  $0.28 \pm 0.01 \ \mu g/g$  to  $0.58 \pm 0.05 \ \mu g/g$  and  $2.30 \pm 0.73 \ \mu g/g$  to  $15.11 \pm 4.33 \ \mu g/g$ respectively. The BCR sequential extraction analyses revealed that the extractable metals in the non-residual fractions exceeded the residual (aqua regia digestion) fraction. The total concentration in the non-residual fractions were not exceed the permissible concentration of heavy metals in sediments provided by the Canadian Sediment Quality Guidelines, although they were mainly found in the nonresidual fractions.

## HYDROCRACKING OF 1,4-DIISOPROPYLBENZENE OVER MOLYBDENUM OXIDE SUPPORTED ON FIBROUS MESOSTRUCTURE SILICA NANOPARTICLE

#### Nadzidah Yusof and Che Rozid Mamat

Hydrocracking is an important catalytic process in petroleum refining industry to convert heavy feedstocks into valuable gasoline and diesel product. This process is typically carried out over acidic catalyst consist of hydrogenatingdehydrogenating component. In this study, fibrous mesostructured silica nanoparticles (FMSN) and MoO<sub>3</sub> loaded onto FMSN  $(MoO_3/FMSN)$  for hydrocracking of 1,4-diisoproylbenzene were prepared via microemulsion system coupled with microwave-assisted hydrothermal and physical mixing method. The catalytic activity was conducted at the temperature range of 423-573 K in a microcatalytic pulse reactor. The X-ray diffraction (XRD) result of FMSN and  $MoO_3/FMSN$  showed the presence of amorphous silica phase and crystalline orthorhombic MoO<sub>3</sub> respectively. The Field Emission Scanning Electron Microscopy (FESEM) and nitrogen physisorption analysis of FMSN showed a spherical morphology dendrimeric silica fiber with a high surface area of 634  $m^2/g$ . The addition of MoO<sub>3</sub> did not much change the support morphology but reduced the surface area to 245  $m^2/g$ . The pyridine adsorbed FTIR study revealed that the FMSN consist of weak Lewis acid, while the presence of MoO<sub>3</sub> enhanced the Lewis acid and developed new Brønsted acid sites. At T=573 K, the conversion of 1,4-diisopropylbenzene over MoO<sub>3</sub>/FMSN 30.6 % higher than the pristine FMSN. The products distribution of 1,4-diiisopropylbenzene cracking over MoO<sub>3</sub>/FMSN determined by gas chromatography-mass spectrometry (GC-MS) analysis were consisted of propane (35.4 %), benzene (2.1 %), cumene (61.7%) and traced amount of lower hydrocarbon (0.8%). The high catalytic activity of MoO<sub>3</sub>/FMSN might be attributed from the presence of moderate Lewis acid sites and Mo, which facilitate the formation and maintenance of active protonic acid sites through a hydrogen spillover mechanism.

## DETERMINATION OF Pb(II) ION FROM WATER SAMPLES USING MAGNETITE-CALCIUM ALGINATE SORBENT WITH FLAME ATOMIC ABSORPTION SPECTROPHOTOMETRY

#### Najwa Izzati Zainal and Wan Aini Wan Ibrahim

Magnetite, Fe<sub>3</sub>O<sub>4</sub> encapsulated with calcium alginate (Fe<sub>3</sub>O<sub>4</sub>-CaAlg) was proposed as a sorbent in magnetic solid phase extraction (MSPE) of Pb(II) ions from water samples. MSPE overcome the limitations of liquid-liquid extraction (LLE) and solid phase extraction (SPE). MSPE use smaller volume fraction of organic solvent for desorption compared to LLE, less tedious than LLE and SPE, and avoids channelling effect as observed in SPE. Pb(II) ions was determined using flame atomic absorption spectroscopy (FAAS) at 283.31 nm. The assynthesised Fe<sub>3</sub>O<sub>4</sub>-CaAlg was characterized using Fourier transform infrared) spectroscopy and scanning electron microscopy. Several MSPE parameters (sample volume, sample solution pH, and effect of selected interfering ions) influencing the extraction efficiency of Pb(II) ions using the Fe<sub>3</sub>O<sub>4</sub>-CaAlg sorbent were studied using 50 mg of Fe<sub>3</sub>O<sub>4</sub>-CaAlg sorbent, 30 min extraction time, 10 mL of 0.1 M nitric acid as desorption solvent and 10 min of desorption time (sonication assisted). It was found that the Fe<sub>3</sub>O<sub>4</sub>-CaAlg MSPE of Pb(II) ions is highly dependent on sample solution pH. Optimum Pb(II) extraction efficiency occurred at pH 6 using 150 mL sample volume and the Fe<sub>3</sub>O<sub>4</sub>-CaAlg MSPE method is not affected by the co-existence of Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>2+</sup> and Cl- ions in solution. The linearity of the  $Fe_3O_4$ -CaAlg MSPE method was in range of 60 – 500 7g/L with coefficient of determination of 0.9790. The limit of detection and limit of quantification were 44.5 7g L<sup>-1</sup> and 76.7 7g L<sup>-1</sup>, respectively. Repeatability (n =3) of the Fe<sub>3</sub>O<sub>4</sub>-CaAlg MSPE method as measured by relative standard deviation was 4.36%. The Fe<sub>3</sub>O–CaAlg MSPE method was applied to two real water samples namely lake and tap water, which was performed under optimum conditions. Lake water recovery (spiked level of 400 7g/L) was 110.38% (RSD 3.04%, n = 3) while the recovery for Pb(II) ion from tap water (spiked at 400 7g/L) was 104.2% (RSD 3.53%, n = 3). Excellent recovery and precision indicates that the proposed Fe<sub>3</sub>O<sub>4</sub>-CaAlg MSPE method is a good alternative candidate for Pb(II) ion analysis from water samples.

## DEMETALLIZATION OF TOXIC AND HEAVY METAL IN RAZOR CLAMS, ENSIS ARCUATUS USING CATALYTIC CHELATION TECHNIQUE

#### Noor Aini Rabuyan and Wan Azelee Wan Abu Bakar

Razor clams, Ensis arguatus is a local seafood and aquatic catches in Malaysia. The toxic and heavy metals content in Ensis arcuatus were recorded below the Malaysian Food Regulation (1985) and EU Food Regulations with the range of initial concentration Pb  $0.053\pm0.030$  to  $0.074\pm0.04$  µg/g, Cd 0.008±0.030 to 0.140±0.240µg/g and Ni 0.003±0.040 to 0.180±0.070µg/g. In this research, the potential chelating agents which is trisodium citrate to remove toxic and heavy metals in Ensis arcuatus was determined using chelation method, while the optimimum conditions used were 600 mg/L, dosage of chelating agents for 1 hours of treatment at temperature 29.5°C. The percentage removal of Pb, Cd and Ni were 21.62% ( $0.06\pm0.03\mu g/g$ ), 31.73% ( $0.005\pm0.00\mu g/g$ ) and 38.07% (0.001±0.02µg/g) respectively by using trisodium citrate. The experimental revealed that with the present of catalyst, the percentage removal of the heavy metals increase as compared with the absence of catalyst. Experimental result showed that with the present of CaO/Al<sub>2</sub>O<sub>3</sub>, the percentage removal were increases It is due to the properties of the CaO that have potential towards the removal of heavy metal. from Ensis arcuatus Meanwhile, XRD analysis depicted the active sites were due to the presence of orthorhombic  $Al_2O_3$ , monoclinic CaA<sub>14</sub>O<sub>7</sub>/CaO.2Al<sub>2</sub>O<sub>3</sub> and cubic Ca<sub>12</sub>Al<sub>14</sub>O<sub>33</sub> species. BET surface area study illustrated the surface area of  $33.22 \text{ m}^2/\text{g}$ . Finally, FTIR analysis concluded that CaO/Al<sub>2</sub>O<sub>3</sub> catalyst at 1000°C treatment showed total removal of metal nitrate species.

## CLASSIFICATION OF HONEY USING FOURIER TRANSFORM INFRARED SPECTROSCOPY AND CHEMOMETRICS

#### Noor Fatihah Mohd Sabri and Mohamed Noor Hasan

The different types of honey depend on the nectar collected from the flower by the bees and regional climatic condition and gave different composition of carbohydrates to one another. Based on the appearance, the different type of honey cannot easily distinguish from one another rather than the different in carbohydrate composition. In this study the different types of honey were discriminated based on the differences in their molecular content and some of honey samples were adulterated to differentiate them from the natural one precisely. The following respective weight ratios: 0.7:1.0, 1.2:1.0 (typical of honey composition), and 2.3:1.0 of solutions containing both D-fructose and D-glucose were prepared for adulterant solutions. Each adulterant solution was added to individual honeys at levels of 7, 14, and 21% w/w. The Fourier Transform Infrared Spectroscopy (FTIR) and attenuated total reflection (ATR) sampling have been used to detect the composition of honey samples and the adulterant solutions. The Chemometric method was used for all the samples by performing pattern recognition procedures and Principal Component analysis (PCA). All samples were scanned using FTIR and the absorbance values were recorded from 650 to 4000 cm<sup>-1</sup>. For each spectra the range of 1000 to 1800 cm<sup>-1</sup> were used as variable with 5cm<sup>-1</sup> interval value of absorbance. The FTIR-ATR combined with chemometrics method is a good method to distinguish original honey from the adulterated honey samples.

## CALCIUM OXIDE DOPED ACTIVATED PALM KERNEL CARBON FOR TRANSESTERIFICATION OF RICE BRAN OIL

#### Noor Hidayah Fathihah Hussian and Abdul Rahim Yacob

Porous carbon materials including traditional activated carbons, carbon nanotubes and nanofibres that have been widely used in a variety of applications. These carbons have been used as catalyst support materials in the fields of energy and environmental chemistry. The support catalyst used in the reaction such as transesterification reaction to form biodiesel or diesel. The transesterification is the displacement of alcohol form an ester. The common alcohol used for the transesterification reaction is methanol. The temperature of the reaction mixture is between the range (60 - 65)°C. The separation of the biodiesel is by using the centrifuge where the middle layer is methyl ester. The biodiesel then characterized by using Fourier Transform Infrared (FTIR/ATR), Gas Chromatography and Nuclear Magnetic Resonance (NMR). While, the prepared activated carbon is analysed by using FTIR and BET surface area. The basicity obtained from the back titration. From the observation, the rice bran oil with higher percentage of calcium oxide (CaO) doped form highest percentage of biodiesel. By using base catalyst, the biodiesel is easier and faster to obtained because need a simple separation step.

## CHARACTERIZATION OF POLYCAPROLACTONE-CARBON NANOTUBE COMPOSITE NANOFIBER

#### Nor Aniisah Husin and Nor Aziah Buang

There has been high demand in the production of nanofiber as they have unique properties for various applications. Polycaprolactone (PCL) is a biocompatible polymer which has been widely used in the electrospinning process to produce nanofiber for biotechnology applications. Study on effect of solvents in the fabrication of nanofiber has been widely explored. Different solvents will give different morphology and properties of the nanofiber. Six different formulated solvents system have been used in this study to produce Polycaprolactone-Carbon Nanotube (PCL-CNT) composite nanofiber. The morphology of the nanofiber has been analysed by using Field Emission Scanning Electron Microscope (FESEM) and was found to be in the range of 100 nm-500 nm. The conductivity test and contact angle test were conducted to determine the conducting properties and surface wettability of PCL-CNT composite nanofiber. The binary solvents formulated as THF: DMF with the ratio of 5:5 produced high conductivity, smooth surface and smaller fiber diameter. The presence of CNT as a filler has increase the conductivity of the PCL-CNT composite nanofiber. The solvents system with ratio of THF: DMF, 3:7 has reduced the hydrophobicity of the nanofiber into 81.20°

## ANALYSIS OF ANIONS IN POST-BLAST SOIL WATER USING ION CHROMATOGRAPHY

#### Nor Azlina Aziz and Umi Kalthom Ahmad

Post blast explosive analysis commonly used to capture the person in charge that involved in the explosion. Since the explosion activities is still increased therefore the new way of analyzing the explosive is needed to reduce the time in linking the residues to its origin. Post-blast soil water sample was used for this study. Analyte of interest for this study comprised total of six inorganic anions (fluoride, chloride, nitrite, nitrate, phosphate and sulphate). Solid phase extraction using C18 catridge was done to remove organic materials from sample before analyzed using ion chromatography. Parameter ratio of conditioning solvent (MeOH: DDW) and sample loading flow rate were optimized for effectiveness of solid phase extraction method. Ion chromatography system utilized mobile phase consisting a mixture of 3.2 mmol/L Na CO with 1.0 mmol/L NaHCO and Metrosep A SUPP 5 column. Inorganic anions successfully separated within 20 minutes with conductivity detection. Linearity of calibration range produced  $r^2$  varied from 0.997 to 0.999. The limit of detection was in the range of  $0.41 \mu g/L$ -1.19  $\mu g/L$  and it is proven to be better compared to the previous work. The precision of the method was determined through relative standard deviation (RSD) for both peak area and retention times of 5mg/L standard solution that was injected three times in a day and in three consecutive days as well (n=3). The relative standard deviation (RSD) for within-day is higher than day-to-day for both retention time and peak area.

# PRECONCENTRATION OF LEAD IN WATER SAMPLES BY CLOUD POINT EXTRACTION PRIOR TO DETERMINATION BY FLAME ATOMIC ABSORPTION SPECTROSCOPY

#### Nor Fatiha Hissam and Azli Sulaiman

Lead is a toxic metal that is hazardous to human health. The route of exposure for lead to enter our body which are through air, water and food. Low concentration of lead is the main problem in detection of trace level in water samples. Several techniques have been developed in order to preconcentrate the low concentration of lead in sample such as solid phase extraction, liquid-liquid extraction and solvent extraction. In this study, cloud point extraction is chosen as one of most reliable method for preconcentration of lead in water samples. Cloud point extraction is preconcentration method using 8-hydroxyquinoline as chelating or complexing agent and Triton X-100 as non-ionic surfactant. The lead ion in the sample can be extracted to non-ionic surfactant at rich phase after formation of a hydrophobic complex with 8-hydroxyquinoline. Five parameters were studied to identify the optimum condition for CPE method namely pH, oxine concentration, Triton X-100 concentration, incubation time and temperature of water bath. The optimum conditions for CPE method are at 0.9% (v/v) of Triton X-100,  $7.0 \times 10^{-3}$  M of oxine, as aliquot solution at pH 9, an equilibration temperature of 90°C and a time of 15 min. The optimized CPE method was then applied to the analysis of water samples and the result showed a preconcentration factor of two times was achieved.

# A SOLVENT FREE SYNTHESIS OF EUGENOL CAPRYLATE BY THERMOMYCES LANUGINOSUS LIPASE REINFORCED NANOBIOCONJUGATES

#### Nor Hidayah Abdullah @ Ibrahim and Roswanira Abdul Wahab

In view the adverse effects associated with the chemical route for manufacturing esters and facile deactivation of free lipases during the course of prolonged reactions, an alternative biotechnological technique by immobilizing lipases onto a solid support has been suggested. In this study, a hybrid matrix of acid functionalized multi-walled carbon nanotubes (f-MWCNTs), chitosan (CS) and graphene oxide (GO) was used as support to covalently immobilize Thermomyces lanuqinosus lipase (TLL). Morphological evaluation of the TLL/CS/MWCNTs/GOs carried out using Field Emission Scanning Electron Microscopy (FESEM), Fourier-Transform Infrared Spectroscopy (FTIR) and thermogravimetric analysis (TGA) indicated that covalent attachment of free TLL to the surface of CS/MWCNTs/GO was successful. Efficacy of the developed TLL/CS/MWCNTs/GO as biocatalysts were evaluated against the free TLL for parameters: incubation time, molar ratio of acid:alcohol, stirring speed and reusability, for the solventless synthesis of eugenol caprylate; a component prevalent in fragrances and flavoring agents. The study found TLL/CS/MWCNTs/GO gave its highest yield of eugenol caprylate (48%) at 4 h at 50 °C, molar ratio acid: alcohol of 1:2 and stirring speed 250 rpm, as compared to the free TLL (36.6%) at 4 h at 50 °C, molar ratio acid: alcohol of 1:3 and stirring speed 200 rpm. Pertinently, the improved activity and stability of the TLL/CS/MWCNTs/GO over the free TLL advocated production of a more efficient and robust biocatalyst, two key aspects important in any industrial settings. In view of minimalizing the negative impact of conventional chemical processes on the environment, the TLL/CS/MWCNTs/GO developed here may prove advantageous in the sustainable production of eugenol caprylate.

# BIOSYNTHESIS OF SILVER NANOPARTICLES USING Melicope ptelefolia LEAF EXTRACT AND ITS CATALYTIC ACTIVITY FOR 4-NITROPHENOL REDUCTION

#### Norfazreen Saffee and Mustaffa Shamsuddin

An environmental friendly biosynthetic approach for the preparation of silver nanoparticles (AgNPs) using the aqueous leaf extract of Meliocope ptelefolia (tenggek burung) as reducing and stabilizing agent is reported. The reduction of Ag<sup>+</sup> ions into elemental Ag nanoparticles was monitored using ultraviolet-visible (UV-Vis) spectroscopy. An intense absorbance band at 445nm in the UV-Vis spectrum clearly revealed the formation of AgNPs. Fourier transform infrared (FTIR) spectroscopic data of the AgNPs and leaf extract suggested that the oxidized form of the surface adsorbed biomolecules present in the leaf extract were presumably the main stabilizing agents in the formation of the stable AgNPs. X-ray diffraction (XRD) studies suggested the crystalline nature of the AgNPs produced. Field emission scanning electron microscopic (FESEM) images revealed that the biosynthesized AgNPs are mostly spherical in shape and are highly agglomerated. Transmission electron microscopy (TEM) images showed the particle size of AgNPs in the range of 11 nm to 23 nm with average size of 17 nm. The present biosynthesis of AgNPs was rapid, cost-effective and environmentally friendly. Furthermore, the biosynthesized AgNPs show good catalytic activity for the reduction of 4-nitrophenol to 4-aminophenol in presence of excess hydrazine.

# SYNTHESIS AND CHARACTERIZATION OF CHITOSAN-GRAFTED-POLY(HYDROXTETHYL METHACRYLATE) VIA REVERSE ADDITION FRAGMENTATION CHAIN TRANSFER (RAFT) POLYMERISATION AND ITS CONTROLLED RELEASED FERTILIZER BEHAVIOUR

### Nurain Zainalabidin and Khairil Juhanni Abdul Karim

A chitosan-grafted-poly(hydroxyethyl methacrylate) was synthesized from the reaction between *N*-phthaloylchitosan and poly(hydroxyethyl methacrylate). Poly(hydroxyethyl methacrylate) was first synthesized via Reversible Addition -Fragmentation Chain Transfer (RAFT) polymerisation technique using 4cyanopentanoic acid dithiobenzoate (CPADB) as RAFT agent, 4,4-azobis(4cyanopentanoic acid) (ACPA) as the intiator and tetrahydrofuran (THF) as the solvent for the reaction. The reaction was carried out under nitrogen atmosphere at temperature oil bath of 80°C, preheated, for 24 hours. Poly(hydroxyethyl methacrylate) is insoluble in water. Chitosan was modified by the reaction with phthalic anhydride to form N-phthaloylchitosan that will reacted with poly(hydroxyethl methacrylate) to form copolymer with a better characteristic. The reaction was conducted using dimethylformamide (DMF) as the solvent containing 5% (w/w) water under nitrogen atmosphere at 120°C oil bath temperature, preheated, for six hours and form pale tanned powder. Fourier Transform Infrared Spectroscopy and <sup>1</sup>H Nuclear Magnetic Resonance were used to characterize all the compound formed. Chitosan-grafted-poly(hydroxyethyl methacrylate) was tested for swelling ability for water retention that resembles character of controlled released fertilizer.

## ISOLATION, CHARACTERIZATION AND MODIFICATION OF ZERUMBONE FROM ZINGIBER ZERUMBET

### Nur Farhanah Mohamad Noor and Hasnah Mohd Sirat

Zingiber zerumbet Smith belongs to Zingiberaceae family. The most important part of this plant is its rhizomes which have been associated with variety of medicinal uses. The rhizomes of Zingiber zerumbet is perennial, thick, scally, aromatic and pale yellow internally Rhizome of the Zingiber Zerumbet Smith plant is used as traditional medicine in relieving stomach ache, as a diuretic, and when macerated in alcohols are regarded as a tonic and depurative. Hydrodistillation of the rhizome of Zingiber zerumbet yield essential oil with five major compounds which are zerumbone, humulene, camphene, carophylene oxide, and 12-oxabicyclo [9,1,0]dedeca-3,7-diene,1,5,5,8-tetramethyl-[1R-(1R,3E,7E,11R)]. The soxhlet extraction method of the rhizomes yielded pale yellow extract crude (8.45g, 1.69 %). Fractionation of the crude yielded zerumbone as white crystal solid (0.191g, 2.26 %). The zerumbone undergo reactions with mCPBA in dichloromethane to give zerumbone epoxide (152 mg, 100%). Both zerumbone and zerumbone epoxide were charactherized using 1H and 13C NMR spectroscropy.

# DETERMINATION OF METABOLITES OF n-HEXANE AND BENZENE IN URINE BY USING GAS CHROMATOGRAPHY-MASS SPECTROMETRY

### Nur Farihin Muhamad and Jafariah Jaafar

2,5-Hexanedione (2,5-HD) and trans, trans-muconic acid (t,t-MA) are useful biomarker of exposure to n-hexane and benzene, respectively. Quantification of 2,5-HD and t,t-MA was carried out by gas chromatography-mass spectrometry (GC-MS) which involved liquid-liquid extraction (LLE) as a sample preparation method for urine sample. The sample urine was obtained from volunteer students working in the Organic Chemistry Laboratory, C10, level 2 in Faculty of Science, UTM, Skudai, Johor who are exposed to n-hexane and benzene. For determination of 2,5-HD, the urine sample was treated with acid hydrolysis and extracted with dichloromethane while for determination of t,t-MA, the urine sample was extracted with diethyl ether. In this study, cyclohexanone and benzoic acid are used as an internal standard for 2,5-HD and t,t-MA. Triplicate extractions were carried out for each urine sample and a 1  $\mu$ L of the solution was injected into the GC-MS using HP-1 capillary column and temperature programmed. An excellent linearity was obtained for 2,5-HD with coefficient of 0.9997. The limit of detection (LOD) and limit of determination, R<sup>2</sup> of quantification (LOQ) were 2.03 mg/L and 6.78 mg/L, respectively. The best recovery of 2,5-HD in urine sample is  $103.22 \% \pm 0.58$  with RSD 0.66%. While, for t,t-MA, the LOD and LOQ were 7.04 mg/L and 23.46 mg/L, respectively with a coefficient of determination, R<sup>2</sup> of 0.9784. The recovery of t,t-MA in urine sample is  $97.32\% \pm 3.00$  with RSD of 5.45%. In this study, both 2,5-HD and t,t-MA are not detected in unspiked urine sample and it can be assumed that the students are not exposed to high concentration of n-hexane and benzene in the laboratory. LLE method combined with GC-MS can be used to determine urinary 2,5-HD and t,t-MA for workers who are occupationally exposed to n-hexane and benzene.

# PREDICTION OF POLLUTATNS USING AERMOD DISPERSION MODEL FOR A 10MW CO-GENERATION COAL – MSW INCINERATION POWER PLANT TANJUNG LANGSAT, JOHOR

### Nur Fatihah Adam and Anthony Nyangson Anak Steven @ Mohd Daniel

Malaysia is one of the countries that generate electricity from many natural resources such as coal and natural gas but these non-renewable resources become depleting from year to year. There is an alternative resource that can be used to generate electricity which is municipal solid waste. It is expected that the number of the incineration in Malaysia will increase due the increasing amount of municipal solid waste and the regulation that related to the air quality become more stringent in the future. In order to meet the current and future air quality regulation, it is essential to evaluate the emission of the pollutants that emitted from the stack of the plant. AERMOD dispersion model was used in this study in order to evaluate the emission of the pollutants from the Tanjung Langsat coalmunicipal solid waste incineration power plant and the suitability of the stack height. From the findings, it shows that, for 200 m stack height, the highest maximum ground level concentration of NOx are 0.1316 µg/Nm<sub>3</sub>, SOx (0.0344  $\mu g/Nm_3$ ), particulate matter (0.0206  $\mu g/Nm_3$ ), dioxin (7.57×10-12  $\mu g/Nm_3$ ), mercury (2.86×10-7 µg/Nm3) and cadmium (4.56×10-5 µg/Nm3). For 120 m stack height, the highest maximum ground level concentration of NOx are (0.2684  $\mu g/Nm_3$ ), SO<sub>x</sub> (0.0700  $\mu g/Nm_3$ ), particulate matter (0.0423  $\mu g/Nm_3$ ), dioxin (7.74×10-12 µg/Nm3), mercury (5.85×10-7 µg/Nm3) and cadmium (9.29×10-5  $\mu g/Nm_3$ ). All the emission of the pollutants from various stack height and with different ratio of combustion were still lower than the current emission limit that stated in the air quality regulation but in the future, this regulation will become more stringent. An improvement should be done in order to make sure that the power plants meet the stringent future environmental law.

### BIOREMEDIATION OF CHROMIUM(VI) TO CHROMIUM(III) USING GEOBACILLUS CALDOXYLOSILYTICUS

### Nur Izwinda A Rahim and Wan Azlina Ahmad

Wastewater discharged from industrial processes contains a lot of hazardous materials, of which Cr(VI) is categorized as carcinogenic and mutagenic and harmful towards human and living things. Thus, industrial wastewater must be treated before discharged to the environment. Previous studies using mesophilic bacteria showed reduction of Cr(VI) to Cr(III) in industrial effluents, but the strain could not survive at higher temperatures. Hence, reduction of Cr(VI) to Cr(III) by using thermophilic bacteria have been studied as this bacteria can withstand higher temperature. This study reports on the reduction of Cr(VI) to Cr(III) by Geobacillus caldoxylosilyticus UTM 6 (GenBank Acession No.KR867680) under optimized conditions. The effect of glucose (0.1%)w/v and 0.2% w/v), sucrose (0.2% w/v) and acetate (0.2% w/v) on growth of G. caldoxylosilyticus was studied. G. caldoxylosilyticus showed highest growth in mixture of NB and glucose at concentration of (0.1% w/v) with OD600 (0.817)compared to NB alone, OD600 (0.798) after 13 h incubation. The maximum growth for G. caldoxylosilyticus in mixture of salt minimal medium and glucose was at 8 h incubation with OD600 of 0.079. G. caldoxylosilyticus shows the ability to utilize NH4+ from basal salts with addition of glucose for metabolism. G. caldoxylosilyticus showed highest reduction capacity of (92.79%) for 10 ppm Cr(VI) in mixture of NB and glucose after 24 h incubation compared to the control. G. caldoxylosilyticus was successfully shown to reduce Cr(VI) and can be used to treat Cr(VI) laden industrial effluent where the temperature may reach up to 60 °C.

## MECHANICAL STRENGTH PROPERTIES OF CHITIN/POLYLACTIC ACID BIOCOMPOSITE FILM

### Nuraqilah Hishammuddin and Zainoha Zakaria

Polylactic acid (PLA) is biodegradable polyester that can be used for many applications such as packaging, medicine and agriculture. However, several disadvantages including brittleness, low toughness, poor water vapour barrier properties and high cost production that limit its application materials. Hence, this study focuses on development of PLA by introducing commercial chitin into PLA with the purpose of obtaining chitin/PLA biocomposite film characteristics. The chitin/ PLA film was prepared at various commercial chitin content (1, 2, 3, and 4 percent of weight) through solution casting method to investigate the effect of commercial chitin content on mechanical strength properties of this biocomposite film. Tensile test and Atomic Force Microscopy (AFM) analysis were carried out to study the properties of chitin/PLA composites. The results showed that the tensile strength and elongation at break of PLA decreased with the addition of chitin. The elastic modulus of the biocomposite films increased upon addition of chitin into PLA. From mechanical properties revealed that chitin and PLA blends are incompatible and supported with the results of Fourier Transform Infrared (FTIR) analysis that showed the absence of specific interaction between chitin and PLA. AFM showed the surface morphology of PLA changed upon addition of chitin and tendency for agglomeration of chitin at high loading indicated the poor filler dispersion in matrix.

## EFFECT OF TEMPLATES VARIATION ON CHEMICAL VAPOUR DEPOSITION GROWN GRAPHENE

### Nurdiana Nordin and Nor Aziah Buang

Achieving graphene with tailored properties is a challenging task and involves many growth parameters. In this research, graphene was successfully grown on aluminium and zinc templates using chemical vapour deposition technique at various temperatures. Methanol is used as carbon precursor and flowed into the system with constant nitrogen gas flow rate. The synthesized graphene resulted in different compositions and densities for both templates where the densest graphene was obtained on zinc template at 400 °C through FESEM characterization. Raman spectroscopy obtained peaks at wavenumber of 1600 cm<sup>-1</sup> and 2800 cm<sup>-1</sup> for G and 2D band respectively, reveal successful deposition of graphene nanomaterials using this method on zinc foil. Medium intensity of D band at wavenumber of 1320 cm<sup>-1</sup>, shows presence of defects on the materials.

## REMOVAL OF BISPHENOL A FROM DRINKING WATER USING POLYSTYRENE ELECTROSPUN MEMBRANE

### Nurfazilah Zainal Abu and Abdull Rahim Mohd Yusoff

Synthesizing nanofibers with accurate size and shape are requirement to achieve excellent water filter media. Currently, endocrine disrupting compounds (EDCs) have raised real concern among safe drinking water and reclaimed wastewater quality issue. Bisphenol-A (BPA) is one of compounds belong to EDCs group and it can cause significant effects towards environment and human health. In this work, the polystyrene (PS) and composite PS electrospun membranes were succesfully synthesized using electrospinning technique. The surface morphology of the membranes were characterized to study their chemical, physical and mechanical properties using Field Emission Scanning Electron Microscope (FESEM), water contact angle, tensile strength measurement and Fourier Transmission Infrared (FTIR). Composite PS electrospun membranes were made up by blending the polymers of Polystyrene, Polyvinylidene fluoride (PVDF) and Polyvinylpyrrolidone (PVP). Three type of membranes were successfully synthesized which were PS (PS 1), PS/PVDF (PS 2) and PS/PVDF/PVP (PS 3). The average membrane size obtained for PS 1, PS 2 and PS 3 were 1258 nm, 1068 nm, and 1366 nm respectively. The efficiency of electrospun membranes were measured by water flux analysis and the removal percentage of BPA. Based on FTIR of PS 3 shows the C=O of PVP presence at 1654 cm-1. Formation of hydrogen bonding occurred between C=O of PVP with OH from BPA has impeded the BPA molecules from entering the permeate phase and increase the removal percentage. However, as the contact angle decrease, the flux rate also decreases from PS 1 to PS 3. The lowest contact angle,  $\theta = 112.8_{\circ}$  of PS 3 due to porous fiber membrane obtained which the liquid (water) easily passed through it during the flux. As a conclusion, all PS electrospun membranes have the potential to remove BPA but varied in their efficiency.

## BIODEGRADABILITY PROPERTIES OF CHITIN/POLYLACTIC ACID COMPOSITE FILMS

### Nurshahida Rosdi and Zainoha Zakaria

In this work, chitin was used as filler in polylactic acid (PLA) through casting method. The morphological, water absorption solution and biodegradability properties of chitin/PLA composite films were investigated using field emission scanning electron microscopy (FESEM), swelling test and soil burial test respectively. FESEM images showed that there are presence of rod-like structures on the surface of PLA/chitin film possibly that of chitin particles. The biodegradability properties of the films increased as the amount of chitin increases. Fourier transform infrared spectroscopy (FTIR) was used to observe the interaction between chitin and PLA. From the spectrum, it indicates that there are no significant changes in the peak position, suggesting that there is no strong chemical interaction taking place between chitin and PLA.

# SYNTHESIS AND CHARACTERIZATION OF RHODAMINE IMMOBILIZED MESOPOROUS SILICA SBA-15 AS METAL IONS CHEMOSENSOR

### Nur Syafiqah Fadzil and Zainab Ramli

Development of chemosensor is essential for detection of ions in the environment qualitatively and quantitatively. This study focuses on the synthesis and characterization of chemosensor based SBA-15 which is rhodamine immobilized SBA-15. SBA-15 is mesoporous silica that having excellent support for constructing fluorescent surface sensor. The mesoporous SBA-15 silica with uniform hexagonal pore was first synthesized followed by surface functionalize by (3-aminopropyl)triethoxysilane (APTES). Before immobilize rhodamine onto the SBA-15, rhodamine hydrazine was prepared by using rhodamine 6G and rhodamine hydrazine and with the help of glutaraldehyde (GLU) as bridging agent, rhodamine was immobilized with SBA-15 silica. SBA-15 silica was successfully synthesized was proven by Small Angle X-ray Scattering (SAXS) analysis that showed a uniform hexagonal pore and it is supported by high surface area which is  $722.58m^2/g$  with pore size of 5.25 nm. The attachment of APTES. GLU, rhodamine hydrazine and rhodamine hydrazine onto SBA-15 were proven by using Fourier Transform Infrared (FTIR) spectroscopy. Fluorescence spectroscopy showed that there is chemosensor properties for rhodamine immobilized SBA-15 by the result of emission wavelength at 540nm which is same with rhodamine hydrazine emission wavelength alone. Thus, from the results it showed that the rhodamine immobilized SBA-15 has potential solid chemosensor for detecting metal ion.

## SYNTHESIS AND CHARACTERIZATION OF MANGANASE OXIDE MODIFIED TITANIUM DIOXIDE FOR THE DEGRADATION OF PALM OIL MILL EFFLUENT

#### Nurul A'in Mohamad waris, Zainab Ramli and Leny Yulianti

In this research the effect of the different amount of MnO loading on commecial TiO<sub>2</sub> (P25) were investigated using two methods of preparation which are co-precipitation and impregnation methods. P25-MnO prepared by impregnation method showed an impressive photocatalytic performance in the degradation of Palm Oil Mill Effluent (POME) which was monitored by UV-Vis spectroscopy, compared to P25-MnO prepared by co-precipitation method. The photocatalytic activity were found maximum for 3 wt.% MnO loading on P25. The XRD of P25-MnO composites showed the presence of anatase and rutile phasees while Fourier transform infrared spectroscopy spectra exihibed Ti-O-Ti bond streching mode of TiO<sub>2</sub> appeared below 800 cm<sup>-1</sup>. Diffuse reflectance ultravioletvisible spectroscopy (DR-UV Vis) of the P25-MnO composit gave maximum absorption spectra at 273 nm while fluorescence spectroscopy shown the emmision band at 421 and 469 nm when excited at 221 nm. The morphology of the best sample, P25-MnO (3wt%) synthesised using impregnation method characterized using Field Emission Scanning Electron Microscope (FESEM) exhibited various size of irregular granulated particles in the nano range size between 40 to 55 nm while energy dispersive X-Ray (EDX) spectroscopy proved the presence of Ti, Mn and O. The highest photocatalytic degrdation activity recorded was 77% performed by P25-MnO (3wt%) catalyst synthesised using impregnation method. Study show that the method of preparation of the MnO loaded P25 has an effect into producing an active catalyst for degradation of POME.

### THE STRUCTURAL AND ELUCIDATION OF PHYTOCHEMICAL OF MURRAYA KOENIGII SPRENG

### Nurul Amirah Mohd Abas and Farediah Ahmad

A structural elucidation of phytochemical study has been carried out to isolate secondary metabolites from the leaves of *Murraya koenigii* Spreng. Maceration process using different polarity of solvents starting from hexane and ethyl acetate to afford the crude extracts. Fractionation and purification on the crude extract were done by vacuum liquid chromatography (VLC) and column chromatography (CC) techniques. The chemical compound obtained were elucidated by infrared (IR) and nuclear magnetic resonance (1H, 13C NMR) spectroscopy. One chemical compound from the hexane crude extract was successfully isolated and identified as mahanimbine. The hexane and the ethyl acetate crude extract of *Murraya koenigii* and mahanimbine was screened for antioxidant activity. It is found that ethyl acetate crude extract was active antioxidant activity. The SC50 values of for DPPH was 0.079 mM while the FRAP value of this compound falls between the range of 0.02 mM to 1.36 mM. The values were comparable with the positive control used in these assays known as butylated hydroxyanisole (BHA).

## SYNTHESIS OF *MESO*-SUBSTITUTED PORPHYRIN VIA GREENER METHOD

### Nurul Fatihah Awang Muda and Mohd Bakri Bakar

Porphyrin is a class of naturally occuring macrocyclic compounds, which play an important role in the metabolism of living organism. From the synthetic point of view, porphyrin can be prepared both in symmetrical and unsymmetrical forms depending on the targeted applications. These study aims is to synthesis the symmetrical meso-substituted porphyrin via different methods. meso-Substituted porphyrin were synthesised by using Adler-Longo, Lindsey and Suzuki coupling reaction methods. In addition, greener method was also investigated to synthesize *meso*-substituted porphyrin. Dipyrromethane was initially used as the primary precursor to obtain 5,15-diphenylporphyrin via condensation reaction with benzaldehyde under Lindsey reaction conditions. 5,15-diphenylporphyrin undergo bromination Afterwards. to access bromoporphyrin as the precursor for further Suzuki coupling reaction to prepare 5,15-di(4-hydroxyphenyl)-10,20-diphenylporhyrin. In the meantime, tetra mesophenyl porphyrin was synthesised via Adler-Longo condensation reaction. Alternatively, greener method was studied by using activated charcoal to synthesis *meso*-substituted porphyrins. All compounds were successfully synthesized in moderate to good yield and characterized by using <sup>1</sup>H-Nuclear Magnetic Resonance (NMR), UV-Visible and Fourier Transform Infrared (FTIR) spectroscopies.

# SCREENING OF FAECAL COLIFORMS AND HEAVY METALS IN WATER FROM THE *IN-SITU* COMMERCIAL WATER FITRATION DISPENSERS IN TAMAN UNIVERSITI, JOHOR BAHRU

#### Nurul Fatin Mohd Salleh and Naji Arafat Mahat

Since the consumption of such water filtration dispenser is scarcely regulated by the relevant health authorities, the machine is left at the operation site without suitable surveillance and its compliance to scheduled-maintenance remains unclear. Therefore, this cross-sectional study is aimed at investigating the presence of faecal coliforms and selected heavy metals vis. lead, copper, manganese, zinc, and iron in the filtered water samples collected from different *in-situ* commercial water filtration dispensers located within the bustling areas around Universiti Teknologi Malaysia (UTM), Johor Bahru campus. It was found that faecal coliforms were detected in filtered water in 6 (20.00%) of the 30 operational machines, ranging between 1 CFU/100 mL to >50 CFU/100 mL, while in commercially bottle mineral water as well as in tap water samples obtained within Universiti Teknologi Malaysia such contamination was not detected. It was evident that filtered water samples from the in-situ water filtration dispensers (No. 17, 20 and 26) were found to be grossly polluted with faecal coliforms (>50 CFU/100 mL) and unacceptable presence of faecal coliforms in the remaining three samples of filtered waters was also detected. This present research copper was found in filtered water samples obtained from 19 of the insitu water filtration dispensers and its concentrations ranged between 0.001 ppm to 0.021 ppm. Other than that, zinc also detected in 13 samples with range concentrations between 0.001 ppm to 0.111 ppm; lead, manganese and iron were evidently not detectable in any of samples. Considering all the above findings, it appears that contamination of faecal coliforms in filtered water may not be in nature source of water used but comes from the failure of regular maintenance. Further studies exploring the maintenance condition along the study period as well as the handling process deserve consideration.

# QUANTIFICATION OF PARACETAMOL CONTENT IN SOLID PHARMAECEUTICAL FORMULATIONS USING FOURIER-TRANSFORM INFRARED (FTIR) SPECTROSCOPY

#### Nurul Haznita Abdul Hamid and Mohamed Noor Hasan

Paracetamol tablets are well-known drug used mainly for relieve pain that can be obtained easily as it readily available in the local market. However, the composition of the tablet may be altered in terms of both their active and inactive ingredients which can affect our health. Therefore, it is important to ensure that the paracetamol content is compatible with the correct dose intake. In this study, the quantification analysis of paracetamol tablets was determined by using Fourier transform-infrared (FTIR) spectroscopy method. A standard paracetamol obtained to prepare a total of 12 different concentration of paracetamol (in milligrams) as standards. Meanwhile, a total of 15 paracetamol tablet samples purchased from various locations in Johor Bahru were used as test samples. The ground samples were scanned using FTIR spectrometer at region 4000-400 cm<sup>-1</sup>. The absorbance data obtained then used to pattern recognition to classify all samples by using Principal Component Analysis (PCA). The analysis then proceeded with calibration model development chemometrics technique by performing Partial Least Square (PLS) with selecting FTIR region of 1800-1000 cm<sup>-1</sup>. The results showed that by using absorbance of paracetamol tablet have been taken every 10 cm<sup>-1</sup> wavenumber interval as variables and preprocessed to perform multivariate analysis and lastly, quantify the paracetamol content in the test samples.

## SYNTHESIS OF OLEYL OLEATE USING *Rhizomucor miehei* LIPASE CHITOSAN-GRAPHENE OXIDE REINFORCED NANOBIOCONJUGATES

### Nurul Insyhira Baharudin and Roswanira Abdul Wahab

In view of the concomitant shortcomings in the production of oleyl oleate by chemical synthesis viz. problematic separation process, use of toxic chemicals as well as liberation of unwanted by-products, a biotechnological route employing the solventless synthesis of olevl oleate using Rhizomucor miehei lipase (RML) reinforced nanobioconjugates has been proposed. Such method may serve as a potentially excellent alternative to the prevailing environmentally harmful chemical route to produce the ester. This is because the biotechnological approach embodies the sustainability in processing as well as being relatively cost-effective, aspects that concur well with the philosophy of green chemistry. Morphological evaluations of the developed Rhizomucor miehei lipase (RML) immobilized onto activated chitosan/graphene oxide beads (CS/GOs) using Thermal Gravimetric Analysis (TGA), Fourier Transform Infrared Spectroscopy (FTIR) and Field Emission Scanning Electron Microscopy (FESEM), respectively, revealed their unique properties and confirmed successful attachment of the lipase onto the CS/GOs beads. The RML-CS/GOs were evaluated against the free RML for the one-variable-at-a-time (OVAT) esterification of oleyl alcohol and oleic acid for an enhance production of oleyl oleate for important parameters: time, molar ratio of acid/alcohol and stirring speed. The findings revealed that the developed RML-CS/GOs did not improved the catalytic activity over the free RML with the former attaining its highest yield (47.0 %) at 40 °C, 240 minuts, molar ratio of acid/alcohol of 1:3 at 250 rpm. In contrary, the free RML afforded its highest yield (92.0%) under conditions at temperature 40 °C, 150 minutes, molar ratio of acid/alcohol of 1:3 at 300 rpm. In view of such unfavorable findings, future studies into alternative methods to immobilize RML onto the CS/GO that improve reaction yield as well as activity of RML are required.

# GREEN SYNTHESIS OF EUGENYL CAPRYLATE USING Thermomyces lanuginosus lipase REINFORCED NANOBIOCONJUGATES

### Nurul Izwanie Abdullah and Roswanira Abdul Wahab

The prevailing chemical route to producing eugenol caprylate has been associated with shortcomings viz. use of organic solvents, emancipation of harmful unwanted by-products and generation of large quantities of wastes that are detrimental to the environment and human health. In this perspective, development of an alternative environmentally begins technique utilizing covalently adsorbed Thermomyceslanuginosuslipase (TLL) onto CS/MWCNTs/GO beads may prove beneficial. The efficacy of CS/MWCNTs/GO/TLL was compared with free TLL under various parameters of temperature, thermal stability and enzyme loading. The characterization of the CS/MWCNTs/GO/TLL using FTIR, FESEM and TGA showed that the TLL was successfully attached onto the surface of the CS/MWCNTs/GO support. The solventless esterification of caprylic acid and eugenol has utilized the CS/MWCNTs/GO/TLL as biocatalysts. Pertinently, immobilization of TLL onto CS/MWCNTs/GO beads may increase structural support to the enzyme to resist premature denaturation as well as facilitate biocatalysts recovery and reuse. The study revealed that the highest conversion for the CS/MWCNTs/GO/TLL (33%) occurred after 4 h at 50°C, acid to alcohol ratio of 1:2, enzyme loading 1 mg/mL and stirred at 200 rpm, as compared to the free TLL (31%) at 4 h, 50 °C, acid to alcohol ratio of 1:2, enzyme loading 1 mg/mL stirred at 200 rpm. Therefore, the CS/MWCNTs/GO/TLL developed here appears as a promising environmental friendly biocatalyst for the synthesis of eugenol caprylate.

# ON-LINE PRECONCENTRATION BY ELECTROKINETIK SUPERCHARGING FOR SEPARATION OF ENDOCRINE DISRUPTING CHEMICAL AND PHENOLIC POLLUTANTS IN WATER SAMPLES

### Nurul 'Izzah Abdul Karim and Aemi Syazwani Abdul Keyon

On-line preconcentration using electrokinetic supercharging (EKS) was proposed to enhance the sensitivity of capillary electrophoresis (CE) separation for endocrine disrupting chemical (methylparaben (MP)) and phenolic pollutants (2-nitrophenol (NP) and 4-chlorophenol (CP)) in water sample. Important EKS and separation conditions such as the concentration of background electrolyte (BGE), the choice of terminating electrolyte (TE), and the injection time of leading electrolyte (LE), sample and TE were optimized. The optimum EKS-CE conditions were: BGE comprising of 12 mM sodium tetraborate pH 10.1, 100 mM sodium chloride as LE hydrodynamically injected at 50 mbar for 30 s, electrokinetic injection (EKI) of sample at -3 kV for 200 s and 100 mM 2-(cyclohexylamino) ethanesulphonic acid (CHES) as TE hydrodynamically injected at 50 mbar for 40 s. The separation was conducted by utilizing negative polarity mode and ultraviolet (UV) detection at 214 nm. Under these conditions, the sensitivity of analytes was enhanced from 100 to 737-fold as compared to normal capillary zone electrophoresis (CZE) with hydrodynamic injection, giving limit of detection (LOD) ranging between 4.89 to 53.0 µg/L. The LODs were adequate for the analysis of these pollutants in environmental water sample having concentration lower than the maximum admissible concentration limit. The method repeatabilities for intra and inter-day (% relative standard deviation RSD) were in the range of 1.07-11% (migration time) and 8.28-14.0% (peak area).

# AMINE FUNCTIONALIZED FIBROUS MESOSTRUCTURED SILICA NANOPARTICLE FOR EFFICIENT ADSORPTION OF HEAVY METALS

#### Nurul Nabihah Mohamad Ishak and Sugeng Triwahyono

Toxic heavy metals such as Zinc (Zn(II)), Cadmium (Cd(II)), Copper (Cu(II)), Mercury (Hg(II)) and Lead (Pb(II)) have excessively accumulated in biosphere and water, leading to the deterioration of the natural environment and health hazard. Considerable efforts have been made to develop effective treatment techniques for removing of heavy metal ions. Among various treatment techniques, adsorption is believed to be one of the promising techniques due to its simplicity, low cost and potential for overcoming the environmental problems. In this study, Fibrous Mesostructured Silica Nanoparticle (FMSN) was functionalized with amine group ((3-Aminopropyl) triethoxysilane) and used as adsorbent for the removal of heavy metal ions. The physicochemical properties of amine-functionalized Fibrous Mesostructured Silica Nanoparticle (NH-FMSN) were characterized using X-ray powder diffraction (XRD), Nitrogen physisorption, Fourier transform infrared spectroscopy (FTIR) and Field Emission Scanning Microscopy/Energy Dispersive X-ray Analysis (FESEM-EDX). The results showed that introduction of amine on FMSN increased the heavy metals uptake due to the stronger affinity towards the cationic heavy metals. The equilibrium data were evaluated using Langmuir and Freundlich isotherm and fitted well to the Langmuir isotherm model. The maximum adsorption capacity for Zn(II), Cd(II), Cu(II), Hg(II) and Pb(II) are 122.4, 80.8, 217.1, 140.5, and 342.5 mg g<sup>-1</sup>, respectively. Batch adsorption model showed that the kinetics followed both pseudo-first order and pseudo-secondorder indicated that adsorption process is controlled by physisiorption and chemisorption process. The thermodynamic studies indicated that the nature of metal ions adsorption is an exothermic and a non-spontaneous process. This study demonstrated that NH-FMSN is suitable and had a great potential as adsorbent for heavy metals removal.

# APPLICATION OF MULTI-WALLED CARBON NANOTUBE-AGAROSE/CHITOSAN COMPOSITE FILM MICROEXTRACTION-HPLC-UV TO THE DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBON IN AQUEOUS MATRICES

#### Nurul Nadhirah Zulkifle, Wan Aini Wan Ibrahim and Mohd. Marsin Sanagi

A new approach in  $\mu$ -solid phase extraction ( $\mu$ -SPE) combined with high performance liquid chromatography ultraviolet detection (HPLC-UV) for the analysis of polycyclic aromatic hydrocarbon (PAHs) namely anthracene in water samples was developed. The  $\mu$ -SPE method utilized multi-walled carbon nanotubes (MWCNTs) immobilized in agarose-chitosan film to serve as the sorbent. The presence of amino functional group in chitosan offered a good dispersion of MWCNTs in a agarose/chitosan matrix and prevent deactivation of sorbent via agglomeration. Ionic interaction between amino groups of chitosan with MWCNTs produce more stable composite film and prevent leaching of sorbent during application. The film was prepared by mixing MWCNTs, agarose and chitosan, followed by drying in an oven. The prepared film was characterized by Fourier transform infrared spectroscopy. Microextraction of anthracene was performed by inserting a hypodermic needle through circular MWCNTsagarose/chitosan film discs (5 mm diameter) and the assembly was dipped into an agitated sample solution prior to HPLC-UV analysis. Important parameters studied included extraction time, desorption time and amount of adsorbent loading. External standard calibration curves prepared showed good linearity (r  $\geq$ 0.9932) over the concentration range of  $10 - 500 \ \mu g \ L^{-1}$ . The limit of detection and limit of quantification of anthracene were 0.657 and 2.192  $\mu$ g L<sup>-1</sup>, respectively, with satisfactory recoveries in the range of 85.23% to 119.05% and acceptable reproducibility (RSD  $\leq$  10.90%). The proposed method showed good sensitivity and was successfully employed in the analysis of PAHs in lake water samples.

## SYNTHESIS OF OLEYL OLEATE IN A SOLVENT FREE SYSTEM USING Rhizomucor miehei LIPASE REINFORCED NANOBIOCONJUGATES

### Siti Adibah Yumni Md Jailani and Roswanira Abdul Wahab

Oleyl oleate is a substance exhibiting good fat soluble properties and wetting behavior at interfaces as well as being non-toxic. These favorable properties have resulted in methyl oleate being commonplace in formulation of cosmetics, pharmaceutical products and lubricant industries. Nonetheless, the preferred chemical route to produce oleyl oleate uses high temperature that incidentally promote degradation of the esters as well as undesired side reactions. In this perspective, an alternative method using Rhizomucor miehei lipase (RML) immobilized onto activated chitosan-graphene oxide (CS-GO) has been proposed. The catalytic competency of the developed RML-CS-GO was evaluated against the free RML under a varying conditions of temperature, enzyme loading, molar ratio of alcohol to acid as well as thermal stability of the RML-CSGO for the solventless synthesis of oleyl oleate. Field Emission Scanning Microscopy (FESEM), Attenuated Total Reflectance (ATR) Spectroscopy and Thermogravimetric Analysis (TGA) revealed successful attachment of the RML onto the surface of CS-GOs. However, the results showed that lower concentrations of oleyl oleate were observed in reactions of RML-CSGO (47.3% at 40°C, 3mg/ml, molar ratio of (1:3, v/v) oleic acid and oleyl alcohol) compared to the free RML (89.3% at 40°C, 3mg/ml, molar ratio of (1:3, v/v) oleic acid and oleyl alcohol), respectively. Considering the lower yield of the ester attained in the RML-CSGO, revisions in protocols for matrix development and enzyme immobilization employed in this study may prove pertinent for developing catalytically enhanced and functional RML-CSGO.

# OPTIMIZATION OF DETERGENT FORMULATION FROM DIFFERENT TYPES OF PLANT-BASED SURFACTANTS USING RESPONSE SURFACE METHODOLOGY

#### Siti Athirah Azizan and Siti Aminah Setu (Sabtu)

The aim of this study was to formulate and optimize the mixing ratio of three different types of plant-based surfactants for liquid detergent. The surfactants used were sodium laureth sulphate (SLES), coconut fatty acid diethanolamide (CDE) and cocamidopropyl betaine (betaine). The physical responses of the detergent formulations were tested based on the following properties: pH, foaming ability, viscosity and washing performance. A statistical analysis method that is Response Surface Methodology was used to generate the formulation compositions. Seventeen combination components were selected according to the criterion. Contour graphics and perturbation graphs were obtained to assess the changed in the response surface in order to understand the effect of the mixture composition to the physical properties studied. The method proved to be efficient to determine the mixing ratio of the three surfactants that gives optimum foaming ability, viscosity and washing performance. The optimum formulation composition was 2.00 % wt of CDE, 8.31 % wt of SLES and 1.00 % wt of betaine that gives 7.16 cm<sup>3</sup> volume of foam, with the viscosity 3.39 mm<sup>2</sup> s<sup>-1</sup> and washing performance up to 98%. Comparison study with existing detergent products in the market showing a comparable washing performance despite there is no additives such as builders has been added to the formulations studied.

## DEGRADATION OF EXPLOSIVE IN SOIL BY USING HIGH PERFORMANCE LIQUID CHROMATOGRAPHY ULTRAVIOLET

#### Siti Normaziah Zaidi and Umi Kalthom Ahmad

The military training activities, disposal of left bomb during WWII era and past explosive manufacture have contaminated soil and posing health problem. The effect of explosive might be left in soil for days, months even for years. Cyclotrimethylenetrinitramine (RDX) and pentaerythritoltetranitrate (PETN) are part of components in explosive that can biotransform with soil to cause soil contamination. In this study, PETN and RDX analytes were extracted from soil samples by ultrasonic extraction. All the soil samples were spiked with 1ml standard mixture with concentration 50:100 ppm of RDX:PETN. Analytes were analyazed using high-performance liquid chromatography ultraviolet detector (HPLC-UV) with phenomenex (C18) column. Acetonitrile-water (65:35) was employed as the mobile phase. The mobile phase was pumped at 1.0mL/min and separation affected using isocratic mode. The detection wavelength for RDX was 235 nm at first 3.2 min and followed by 215 nm at 3.3 min until 8.0 min for PETN. The limit of detection (LOD) for RDX and TNT are 0.04 ppm and 0.08 ppm. The limit of detection (LOD) for RDX and TNT were 0.04 and 0.08  $\mu$ g/mL. The limits of quantitation (LOQ) were 0.15 and 0.26  $\mu$ g/mL with recovery 32% and 8%  $\mu g/mL$  (RDX and PETN).

## PHOTOCATALYTIC DEGRADATION OF PARAQUAT DICHLORIDE USING TITANIUM OXIDE AND ZINCORNIUM OXIDE SUPPORTED ON ACTIVATED CARBON FROM DURIAN SHELL

### Siti Nurainna Wahid and Rusmidah Ali

In the past several years, due to the growth of technology worldwide, industrial has been advance hence the chemical and bacteriological contamination of water streams has become an issue of a worldwide concern. One of the example of herbicides is paraquat dichloride (1,1'-dimethyl-4,4'bipyridinium dichloride). Because of its known toxicity, degradation and removal of paraquat in wastewater have been a matter of utmost importance. In this research, photocatalytic degradation of paraquat dichloride was applied using n type semiconductor such as titanium dioxide and zirconium oxide with activated carbons derived from durian shell. The durian shell activated carbon were prepared through chemical activation (impregnation with sulfuric acid) and semi carbonization at 200 °C for 48 hours before calcine at activation temperatures range 300-600 °C for 45 minutes. The photocatalysts TiO2:ZrO2 (ratio 100:0, 90:10, 70:30, and 50:50) were prepared by calcined at 600 °C for 5 hours. The effects of parameters such as various ratio of TiO2:ZrO2 (100:0, 90:10, 70:30, and 50:50), and activation temperatures (300°C -600°C) for activated carbon on the extent of photodegradation have also been studied. The photocatalytic activity of the prepared photocatalysts was assessed by photodegradation of paraquat dichloride solution using UV-Vis Spectrophotometer measured at maximum absorption wavelength ( $\lambda$ = 258.0 nm) under 365 nm UV light irradiation. The mixed catalysts of TiO2:ZrO2 (50:50) with durian shell activated carbon give the highest percentage of degradation of 94.29%. The prepared catalysts and durian shell activated carbon were characterized using Field Emission Scanning Electron Microscopy-Energy Dispersive.

# MOLECULAR IMPRINTED POLYMER MEMBRANE BY SOL-GEL INDUCED ULTRASONIC METHOD FOR MEFENAMIC ACID ADSORPTION

### Syahirah Abdol Razak and Abdul Rahim Yacob

Molecular Imprinted Polymer (MIP) has always fascinates researchers today. In this study, MIP was prepared for selective adsorption of mefenamic acid by the sol-gel polymerization technique induced by ultra-sonication for maximum binding. Polymerization was conducted by introducing 3-(propylmethacrylate) trimethoxysilane (3-PMTMOS), mefenamic acid (MFA), glacial acetic acid (AcOH) as precursor, template and catalyst respectively. This polymer solution was coated onto the surface of cellulose acetate membrane (CA) by simply immersing into the solution three times. The mefenamic acid was removed from the polymer matrix by washing with glacial acetic acid: methanol with volume ratio of 1:9 with the intention to leave the selective cavity for mefenamic acid. The coated membrane was characterized by Attenuated Total Reflectance Fourier Transform Infrared Spectrometer (ATR-FTIR) within 400-4000cm<sup>-1</sup> range. The adsorption performance of the material was studied and evaluated for three parameters which were pH, contact time and volume of standard used. It was observed that for the optimum adsorption of mefenamic acid with coated MIP-CA membrane the pH is 3.0, contact time is 40 minutes and the volume used is 12 mL. The analysis study on the adsorption efficiency was then conducted by using Ultraviolet-visible spectrophotometer within 260-500nm range respectively.

# APPLICATION OF CHITOSAN-GRAFT-POLY(ITACONIC ACID) DISPERSIVE SOLID PHASE EXTRACTION- ATOMIC ABSORPTION SPECTROSCOPY TO DETERMINATION OF HEAVY METAL IONS

### Sharifah Farah Hanna Syed Haron and Aemi Syazwani Abdul Keyon

This study aimed to investigate the application of chitosan-g-poly(itaconic acid)(CS-g-PIA) adsorbent for the dispersive solid phase extraction (dSPE) of copper (II) ion( $Cu^{2+}$ ) and lead (II) ion ( $Pb^{2+}$ )in water sample. The attachment of chitosan onto itaconic acid was investigated by Fourier Transform Infrared Spectroscopy (FTIR). FTIR showed that CS-g-PIA had C=O stretching at1718 cm<sup>-1</sup> while CS did not have this vibration; therefore confirmed the attachment of chitosan onto itaconic acid. Nitrogen adsorption-desorption analysis result showed that the Brunauer Emmet Teller (BET) surface area of CS-g-IA was 1.3152 m<sup>2</sup>/g. Flame Atomic Absorption Spectroscopy (FAAS) was used to determine the amount of Pb<sup>2+</sup> and Cu<sup>2+</sup> after dSPE. At the beginning of dSPE method, 100 mg of CS-g-PIA sorbent was dispersed into water sample and then agitated by orbital shaker for 30 minutes. After the dispersion of CS-g-PIA sorbent was facilitated, the aqueous sample was decanted and CS-g-PIA sorbent remained for subsequent desorption step. For the desorption process, sulphuric acid (5mL) was added to the adsorbent, whereby the Pb<sup>2+</sup> and Cu<sup>2+</sup> were desorbed into the acid with the aid of ultrasonication. Some extraction parameters were studied, namely pH of the water sample for extraction, mass of adsorbent, duration of extraction, type of desorption solvent and the duration of desorption time. The optimum extraction method parameters wereas follows : water sample pH 6, 100 mg of adsorbent, extraction time of 30 min, sulphuric acid as desorption solvent and desorption time of 7.5 min. The optimized method showed linearity with  $R^2$  of 0.973 and 0.998 for  $Pb^{2+}$  and  $Cu^{2+}$ , respectively. Furthermore, the limit of detection (LOD) was 2.93 mg/L and 0.12 mg/L for Pb<sup>2+</sup> and Cu<sup>2+</sup>, respectively.

# STUDY OF CONFORMATIONAL PREFERENCES ON AMINE CONTAINING CHIRAL DERIVATIZING AGENTS (CDAs)

### Tharishinny Raja Mogan and Riadh Sahnoun

The origin of conformational preference in aminoacetaldehyde (AAA) and methyl 2-aminoacetate (MAA) were theoretically investigated by means of MP2, G2MP2 and G2 calculations. Two stable conformations were found for AAA for which the dihedral angle of N-C -C=O were 14.18° (*syn*) and 147.35° (*anti*) with an energy difference of 0.46 kcal mol<sup>-1</sup> at the MP2 level (0.72 kcal mol<sup>-1</sup> at G2 level). As to MAA, three conformations were found with N-C-C=O dihedral angles of 3.74° (*syn1*), 18.47° (*syn2*) and 105.00° (*gauche*). While *syn1* was found to be the most stable conformation, the energy difference with *syn2* and *gauche* were only 1.60 kcal mol<sup>-1</sup> at the MP2 level (2.04 kcal mol<sup>-1</sup> at G2 level) and 1.86 kcal mol<sup>-1</sup> (3.01 kcal mol<sup>-1</sup> at G2 level), respectively. Upon investigation of the different factors affecting the conformational preference in these two compounds, we confirmed that the stability of the stable conformation is largely attributed to hyperconjugative electron mechanism.

# TWO-STEP STACKING OF CATIONIC ANALYTES BY FIELD ENHANCED SAMPLE INJECTION AND MICELLE TO SOLVENT STACKING IN CAPILLARY ELECTROPHORESIS

#### Umi Zulaikha Mohd Azmi and Jafariah Jaafar

Capillary electrophoresis (CE) with ultraviolet (UV) detection lacks a good concentration sensitivity resulting in a significant obstacle for analysis of part per billion (ppb) levels. Therefore, in this study, a rapid and sensitive capillary zone electrophoresis (CZE) method with field enhanced sample injection and micelle to solvent stacking (FESI-MSS) was developed and validated for the determination of paraquat and bromhexine in river water without sample pre-treatment. The separation was carried out in fused-silica capillary using 100 mM phosphate buffer with 20% acetonitrile at pH 2.5 with an applied voltage of 20 kV. Before sample injection, a micellar solution (10 mM sodium dodecyl sulphate; SDS in 80 mM phosphate buffer at pH 2.5) and an organic solvent rich solution (30% acetonitrile) was hydrodynamically introduced into the capillary. The detection wavelength was 195 nm for paraquat and 210 nm for bromhexine. This on-line pre-concentration method, compared to the conventional capillary zone electrophoresis (CZE) method, resulted in an increased detection response of up to 100-fold in terms of peak height of paraquat compound. The limit of detections (LODs) obtained for the paraquat and bromhexine were 11.76 and 8.05  $\mu$ g/mL, respectively. Adaptability to real sample analysis was evaluated using spiked river water samples.

## IRON AND COBALT LOADED ON FIBROUS MESOSTRUCTURED SILICA NANOPARTICLES FOR CO<sub>2</sub> METHANATION

#### Zulaikha Athirah Alexzman and Sugeng Triwahyono

Nowadays, greenhouse gas emission is one of trending event and carbon dioxide  $(CO_2)$  is one of the most abundant greenhouse gases.  $CO_2$  methanation has the potential to address this problem by introduction of metal loaded fibrous silica nanoparticles (FMSN) as a catalyst which synthesized by microwave assisted hydrothermal method. Iron (Fe/FMSN), cobalt (Co/FMSN) and (FeCo/FMSN) were successfully synthesized by impregnation of metals into FMSN. The catalysts were characterized by FESEM-EDX, XRD, FTIR, BET and CO<sub>2</sub> adsorbed IR analyses. FESEM and EDX result showed the presence of Fe, Co and Fe-Co metal on the uniform spherical shape of fibrous silica nanoparticles. Based on XRD results, it showed that the metal support changed the crystallinity of the FMSN. The addition of metal into the FMSN catalyst increased the concentration and strength of the basic sites on the surface of the catalysts as shown in IR-CO<sub>2</sub>. The BET surface areas of FMSN, Fe/FMSN, Co/FMSN and FeCo/FMSN were 393.81, 216.30, 273.45 and 402.44 m<sup>2</sup>/g. At 500 °C, the methanation of CO<sub>2</sub> showed that FeCo/FMSN presented the highest methanation performances (60%  $CO_2$  conversion and 71%  $CH_4$  selectivity). Fe/FMSN showed the second highest performances with 43% CO<sub>2</sub> conversion and 68% CH<sub>4</sub> selectivity followed by Co/FMSN with 29% CO2 conversion and 47% CH4 selectivity and FMSN with 20% CO<sub>2</sub> conversion and 38% CH<sub>4</sub> selectivity. Optimal dissociative adsorption energy of  $CO_2$  on the metal surface achieved due to constructed surface active sites by combination of Fe and Co. This effect further promotes adsorption and dissociation of H<sub>2</sub> and CO<sub>2</sub>, thus enhancing the activity of the catalyst in  $CO_2$  methanation.

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