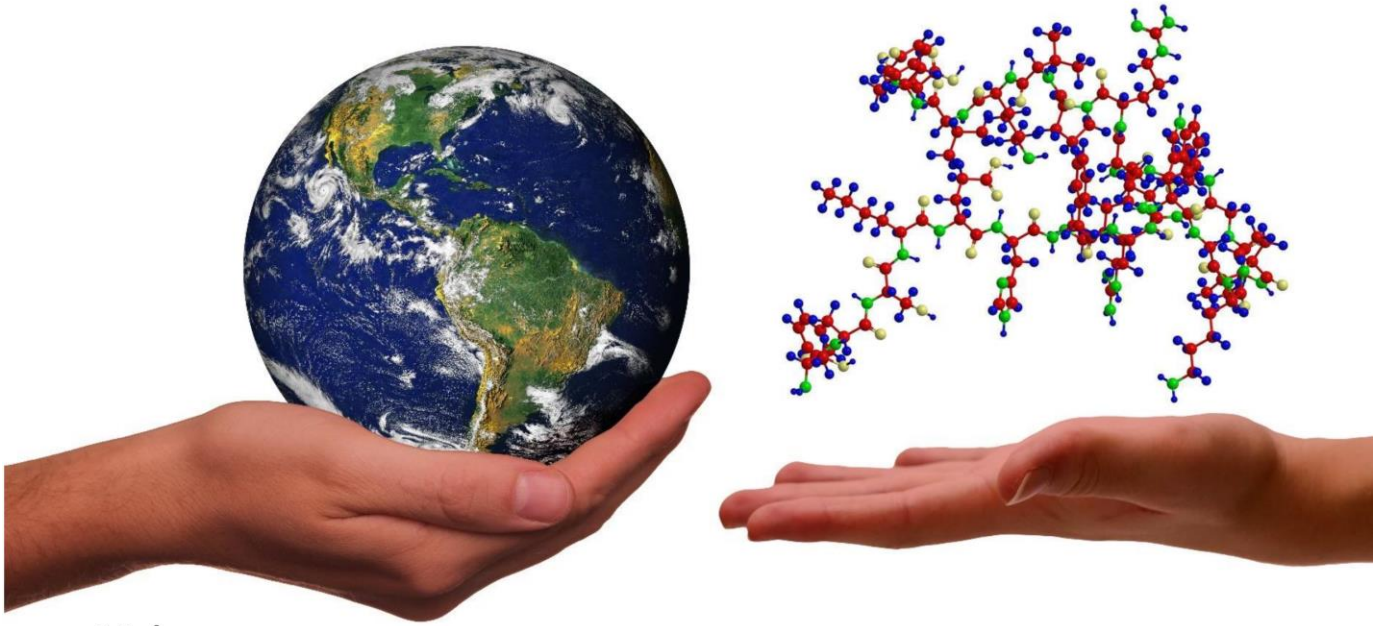
IKM Pahang Branch Online Symposium 2021 :

Chemistry For Sustainable World

16th January 2021

E-Abstract Book



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Welcoming Message

On behalf of the IKMPB Online Symposium organizing committee, I am honored to welcome you to the IKMPB Online Symposium. This is the first ever symposium by IKM Pahang Branch and we have to hold it virtually due to the COVID 19 pandemic. For your information, the IKM Pahang Branch is the newest branch that was established in 2019 under Institut Kimia Malaysia (IKM). 2020 has been a challenging year and I hope 2021 will be better for all of us.

In the roadmap of global development, chemistry can be used to improve the efficiency with which natural resources are used to meet human needs for products and services. For instance, chemical synthesis to produce novel materials for renewable energy. The symposium with the theme "Chemistry for Sustainable World", will stimulate chemists to present innovative research ideas as well as encourage discussion and collaboration across universities and industries. This is parallel to United Nations Sustainable Development Goals and I believe Chemistry plays a vital role in shaping a sustainable world.

The organizing committee received overwhelming response for the participation and carefully reviewed and selected the papers to be presented virtually. The participation consists of chemists around Malaysia and all the accepted papers will be published in Malaysian Journal of Chemistry as Special Issue. Besides, I would like to thank our co-organisers (Universiti Malaysia Pahang & International Islamic University Malaysia) as well as sponsors (Water Analytical instruments, Agilent Technologies & Central Laboratory UMP) for their tremendous support. Not to forget our organizing committee who are so committed to make IKMPB Online Symposium into a great success. Thank you!

The IKMP Online Symposium represents an opportunity to inspire chemists with a perspective of ideas in shaping a sustainable world in chemistry way. We hope all of you find this symposium stimulating, rewarding and meaningful!

Thank you & Terima Kasih!

Best regards,

Assoc. Prof. ChM Dr. Chong Kwok Feng

IKMPB Online Symposium 2021, Chairman

Welcoming Message

On behalf of Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang, I would like to congratulate Institut Kimia Malaysia Pahang Branch (IKMPB) for successfully organizing its first symposium virtually. The global pandemic of COVID19 has pushed us into living under new norm, including organizing intellectual event at online platform. We are honored can be part of this meaningful knowledge sharing event.

As you may notice, we are living in the world that advances at unprecedented rate. More and more technologies are created daily in order to improve human beings lifestyle. In this context, a balance between technology advancement and natural resources preservation is extremely important. It is our responsibility as a professional chemist to catalyze technology creation without compromising the environmental impact. “Chemistry for Sustainable World” is a timely and interesting theme. I see the overwhelming participation from universities around Malaysia is a good sign that our research direction is moving towards sustainable development in science and technology.

Lastly, I wish all of you to enjoy the cutting-edge knowledge sharing in this symposium.

Thank you.

Best regards,

Assoc. Prof. ChM Dr. Mohd Hasbi Ab Rahim

Dean

Faculty of Industrial Sciences and Technology

Universiti Malaysia Pahang

Welcoming Message

Alhamdulillah. All praises to Allah the Almighty. I am delighted to welcome you to our first symposium organized by IKM Pahang Branch in collaboration with IIUM (International Islamic University Malaysia) and UMP (University Malaysia Pahang). It is in the greatest honor to see all of you participating in this virtual IKMPB Online Symposium 2021, gathering all chemists together with chemistry enthusiasts around Malaysia despite the challenging situation we are facing in the midst of COVID-19 pandemic. Thank you very much for your endless support and participation.

Likewise, on behalf of IIUM, I would like to express my heartfelt gratitude to IKMPB for the opportunity given to become a partner for this meaningful event. Equivalent to the IIUM vision to lead the dynamic progressive role in all branches of knowledge and intellectual discourse, this symposium is focusing on chemistry branch of science, with theme "Chemistry for Sustainable World" which aims to provide a platform for the researchers to integrate the research ideas and insights in addition to promote their latest discovery in various chemistry areas.

I believe that the IKMPB Online Symposium 2021 will surely become a massive success and offer a great prospective for the researchers to assimilate the sustainability ideas in chemistry. I would like to sincerely congratulate all the participants, not to forget our sponsors as well as the organizing committees of this symposium for their dedication and commitment. All in all, I hope everyone would take this opportunity to learn and grow. Happy engaging!

Thank you.

Best regards,

Prof. Dr. Shahbudin Saad

Dean

Kulliyyah of Science

International Islamic University Malaysia

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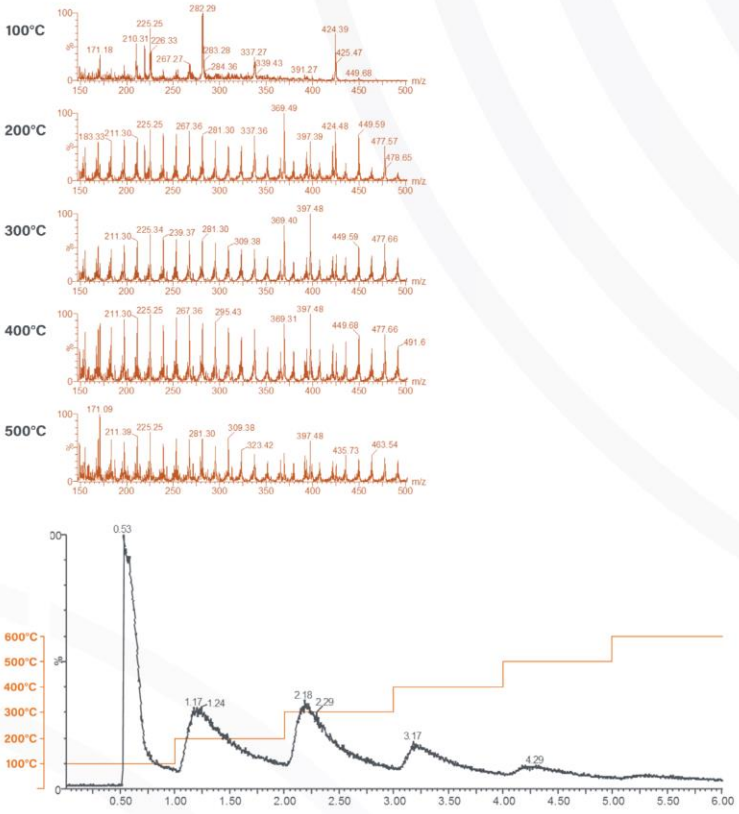

A thermal desorption temperature profile from a lubricant oil sample acquired using a temperature ramp method from 100 °C to 600 °C. Various lubricant oil additives, including Irganox 5057 and Antioxidant L57, were detected at low temperature. Different components of the lubricant oil and other high boiling additives started to desorb at 200 °C and were observed up to 500 °C.

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Program

Time	Session
8:30 – 9:00 AM	Registration (online)
9:00 – 9:05 AM	Welcoming Remarks by the Program Chair & Introduction
9:10 – 9:20 AM	Welcoming Message: • Dean - Kulliyyah of Science, IIUM, Kuantan Campus • Dean - Faculty Industrial Sciences and Technology, UMP
9:30 – 10:35 AM	Session I
10:35 – 11:00 AM	Break
11:00 -12:30 PM	Parallel Sessions (II & III)
12:30 – 2:30 PM	Lunch Break
2:30 – 3:45 PM	Parallel Sessions (II & III)
	End

Scan here to join: **Welcoming Session** **Session I** **Session II** **Session IV** **Closing Remark**	
Scan here to join: **Session III** **Session V**	

IKM PAHANG BRANCH Online Symposium 2021

Welcoming Session https://meet.google.com/ebo-dwoo-xcy		
8:30-9:00 AM	Registration (online)	
9:00-9:05 AM	Welcoming Remarks by the Programme Chair & Introduction	
9:10-9:15 AM	Welcoming Message: Dean - Kulliyyah of Science, IIUM, Kuantan Campus	
9:15-9:20 AM	Welcoming Message: Dean - Faculty Industrial Sciences & Technology, UMP	
Session I **https://meet.google.com/ebo-dwoo-xcy**		
Chairperson: Assoc. Prof. ChM Dr. Gaanty Pragas Maniam		
9:30-9:50 AM	Waters Analytical Instruments Sdn. Bhd., Malaysia RADIAN™ ASAP – Discover the Power of Knowing Now	
9:50-10:05 AM	MJC-IKMP-23 Chemical composition of agarwood essential oil (aquilaria malaccensis) upon exposure Towards heat condition	
10:05-10:20 AM	MJC-IKMP-25 Discrimination of Herbal Products from Zingiberaceae Family Using Electric Nose Combined with Chemometric Techniques	
10:20-10:35 AM	MJC-IKMP-4 A preliminary study of potential aquatic Macrophytes in phytoremediation of lead in Muar river	
10:35-11:00 AM	**Break**	
	Session II **https://meet.google.com/ebo-dwoo-xcy**	**Session III** **https://meet.google.com/kmg-kzxm-nyq**
	Chairperson: ChM Dr. Rosliza bint Mohd Salim	**Chairperson: Assoc. Prof. ChM Dr. Hazrulrizawati binti Abd Hamid**
11:00-11:15 AM	MJC-IKMP-6 A review on biosynthesis of nanoparticles for Fabric coatings	MJC-IKMP-19 La(III) Schiff Base complexes: Microwave-assisted synthesis, physicochemical and spectroscopic analysis
11:15-11:30 AM	MJC-IKMP-1 DNA-assisted stabilization of graphene sheets and its application as supercapacitors electrode	MJC-IKMP-21 Transformation Of Kaolin To Kalsilite: Effect Of KOH reaction temperatures concentrations and reaction temperatures
11:30-11:45 AM	MJC-IKMP-11 Structural characterization and visible light induced performance of Fe sensitized TiO_2 nanotube arrays prepared via photoelectrochemical electrodeposition	MJC-IKMP-17 Transesterification of waste cooking oil utilizing Heterogeneous K_2CO_3/Al_2O_3 and KOH/Al_2O_3

11:45-12:00 PM	MJC-IKMP-12 In-vitro evaluation of crosslinked PVA/chitosan-gentamicin sulfate electrospun nanofibers	MJC-IKMP-22 Combining chemometrics, sensory analysis and chromatographic fingerprint of volatile, and phenolic compositions for systematic classification of pineapple (Ananas Comosus L.)
12:00-12:15 PM	MJC-IKMP-3 Chemical properties of cocoa powder-like product from roasted seeds of fermented nephelium lappaceum l. (rambutan) and nephelium mutabile (pulasan) fruits	MJC-IKMP-18 The application of K/Al_2O_3 with ethanolic 2-metylimidazole for the extraction of naphthenic Acid from crude oil
12:15-12:30 PM		MJC-IKMP-5 Facile one-step preparation and characterization of graphene quantum dots suspension via electrochemical exfoliation
12:30-2:30 PM	**Lunch Break**	
	Session IV **https://meet.google.com/ebo-dwoo-xcy**	**Session V** **https://meet.google.com/kmg-kzxm-nyq**
	Chairperson: Prof. ChM Dr. Shafida binti Abdul Hamid	**Chairperson: ChM Dr. Ahmad Zamani Ab Halim**
2:30-2:45 PM	MJC-IKMP-7 Isolation of a morphinan alkaloid and methoxybenzoic acid with investigation on the Antibacterial effect of Alphonsea Cylindrica King leaves	MJC-IKMP-13 Calcium oxide catalyst derived Low Cost Chicken Egg Shell For Transesterification of Waste Cooking Oil To Biodiesel
2:45-3:00 PM	MJC-IKMP-9 Plant extracts: a promising source for the green synthesis of copper nanoparticles towards agriculture and environmental application	MJC-IKMP-14 Synthesis and characterization of amino acid-derived Hydantoins
3:00-3:15 PM	MJC-IKMP-10 Antibacterial and antiplasmodial properties of chemical compounds isolated from bark of Phyllanthus acidus (l.) Skeels	MJC-IKMP-15 Synthesis and characterization of Polyaniline/chitin (squid pens) for removal of Chromium (VI) from aqueous solution
3:15-3:30 PM	MJC-IKMP-16 Development of HPLC method and quantification of Amentoflavone from leaves extracts of three Calophyllum species	MJC-IKMP-26 Synthesis, structural elucidation and mesophase behaviour of hexasubstituted Cyclotriphosphazene molecules with amide linking unit
3:30-3:45 PM	MJC-IKMP-20 Isolation and cloning of sesquiterpene synthases (AmGS3 and AmGS4) and chalcone synthase (AmCHS) from Aquilaria malaccensis responsible for agarwood formation	MJC-IKMP-27 Synthesis, characterization and antimicrobial studies of metal complexes derived from Gentamicin Sulfate
3:45-4:00 PM	**Closing Remark** **https://meet.google.com/ebo-dwoo-xcy**	

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ID: MJC-IKMP-1

DNA-ASSISTED STABILIZATION OF GRAPHENE SHEETS AND ITS APPLICATION AS SUPERCAPACITORS ELECTRODE

Yasin M. Y. Albarqouni[1], Gomaa A. M. Ali[2], Soon Poh Lee[1], Rahim Mohd-Hairul[1], Kwok Feng Chong[1]*

[1] Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, Gambang, 26300 Kuantan, Malaysia
[2] Chemistry Department, Faculty of Science, Al–Azhar University, Assiut, 71524, Egypt

* Corresponding author: ckfeng@ump.edu.my

Abstract

The work reports on the formation of rGO/ssDNA compositeby stabilizing rGO sheets in an aqueous solution containing ssDNA extracted from baker's yeast culture. The as-formed rGO/ssDNA composite is verified using spectroscopic and microscopic techniques, including FTIR, Raman, PL, and FESEM. Physical investigations show the successful stabilization of rGO suspension by ssDNA for more than a month without sheets precipitation. The highly charged backbone of ssDNA comprising phosphate groups, nucleic-bases, and sugar molecules contribute to the rGO stabilization and could be potential electrode material for charge storage supercapacitor. The electrochemical investigations confirm the electrochemical double-layer capacitance behavior of rGO/ssDNA composite in KOH electrolyte, where nearly 2-fold capacitance enhancement is observed compared to pure rGO. The oxygen residues on ssDNA are proven to contribute to the electrochemically active surface area of rGO/ssDNA. By virtue of the proposed material and approach simplicity and environmentally benign, it might become a promising candidate for further processing and practical applications of bio-supercapacitors.

Keywords: DNA, Graphene, Bio-supercapacitor.

ID: MJC-IKMP-2

MOLECULAR DOCKING ANALYSIS OF DESIGNED LIGANDS ON VP40 OF EBOLA VIRUS

Nur Fadhilah Rahim[1], Mohamad Ariff Mohamad Yussoff[2], Khairul Bariyyah binti Abd Halim[2,3], Azzmer Azzar Abdul Hamid[2,3], Shafida Abd Hamid[1*]

[1]Department of Chemistry, Kulliyyah of Science, International Islamic University Malaysia, 25200 Kuantan, Pahang.
[2]Department of Biotechnology, Kulliyyah of Science, International Islamic University Malaysia, 25200 Kuantan, Pahang.
[3]Research Unit for Bioinformatics and Computational Biology, Kulliyyah of Science, International Islamic University Malaysia, 25200 Kuantan, Pahang.

*Corresponding author: shafida@iium.edu.my

Abstract

Ebola virus consists of different structural proteins, each of which plays its roles in different aspects of viral life cycle. Among them, VP40 plays a number of critical roles in the viral lifecycle such as regulating viral transcription and coordinating virion assembly and budding from infected cells. Due to the fact that VP40 plays a vital role in the Ebola virus life cycle, it is considered as a promising target for the treatment of Ebola virus infection. This study aims to design ligands that have the potential to inhibit the VP40-RNA binding site. A total of seventeen ligands were designed based on the modification Q-88 (ZINC ID: 1342431) scaffold. Q-88 gave the best binding free energy of -97.27 kJ/mol and docking score of -7.1 kcal/mol according to previous literature. The seventeen ligands were then simulated against the RNA binding site using AutoDock Vina. The results showed that all ligands hold high binding affinities with VP40 ranging from -5.5 kcal/mol to -6.9 kcal/mol. Additionally, Q-88 was redocked as reference to determine if the modified ligands can surpass the binding affinity of Q-88 under the same circumstance. This study revealed that the modification of chlorine atoms on the benzene group did not give much effect towards increasing the binding affinity of the complex. Therefore, it is suggested that further chemical modifications can be carried out based on Q-88 scaffold without altering the chlorine atom in the benzene group of the compound.

Keywords: Ebola virus, molecular docking, VP40, Q-88, Q-96

ID: MJC-IKMP-3

CHEMICAL PROPERTIES OF COCOA POWDER-LIKE PRODUCT FROM ROASTED SEEDS OF FERMENTED NEPHELIUM LAPPACEUM L. (RAMBUTAN) AND NEPHELIUM MUTABILE (PULASAN) FRUITS

Hazrulrizawati Abd Hamid[1]*, Izzah Hayati Yahya[1], Aizi Nor Mazila Ramli[1]

[1]Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang Kuantan, Pahang, Malaysia International Islamic University Malaysia.

*Corresponding author: hazrulrizawati@ump.edu.my

Abstract

The present study demonstrated the chemical properties of cocoa powder-like product from roasted seeds of fermented rambutan and pulasan fruits in comparison to commercial cocoa powder. The crude fat content of cocoa powder, 25.70%, was lower than 35.00% of each rambutan and pulasan seed. The major fatty acids in pulasan seed were similar to cocoa fat, which were stearic acid and petroselinic acid. The major cocoa-like flavour components, pyrazine group were found in both rambutan and pulasan seeds. Lower saponin content was obtained in pulasan seed as compared to rambutan seed. Meanwhile, pulasan seed contained higher TPC concentration than rambutan seed. Both fruit seeds were concluded to have high potential to be utilized as cocoa powder in the future.

Keywords: Fermentation; Roasting; Fat properties; Polyphenol; Volatile compounds; Nephelium lappaceum L.; Nephelium mutabile

ID: MJC-IKMP-4

A PRELIMINARY STUDY OF POTENTIAL AQUATIC MACROPHYTES IN PHYTOREMEDIATION OF LEAD IN MUAR RIVER

N. A Jamion [1*], FI Shah Ismail[2], NS Ab Wahid[3], N.S Abu Kassim[4]

[1,2,3,4] School of Chemistry and Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, Negeri Sembilan Branch, Kuala Pilah Campus, 72000 Kuala Pilah, Negeri Sembilan, Malaysia
[1]Research Centre for Sustainability Science & Governance (SGK),
Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia,
43600 UKM Bangi, Selangor, Malaysia
[1]Soil Assessment and Remediation Research Group, Faculty of Applied Sciences,
Universiti Teknologi MARA, 40450 Shah Alam, Malaysia

*Corresponding author: ain7059@uitm.edu.my

Abstract

It has been observed that phytoremediation of wastewater using the aquatic macrophytes system is a predominant method that is economical to construct, requires little maintenance, and can increase the water quality. Our research aims to quantify the potential of water hyacinth (WH) and water lettuce (WL) as a phytoremediation agent to accumulate Lead (Pb) and to determine the water quality of Muar River. Atomic Absorption Spectroscopy (AAS) was used to demonstrate Pb's absorption in the water sample and plant tissue, which is roots. WH and WL uptake rates of Pb were measured in a short-term experiment. The initial concentration of Pb in Muar River was 0.514 mg/L. The maximum efficiency of Pb was observed with WL compared to WH after ten days. The concentration of Pb in Muar River remediated with WH and WL decrease to 0.104 mg/L and 0.063 mg/L, respectively. The bioconcentration factor (BCF) of WL and WH was greater than 1 indicates that both plants were good accumulator plants. The water characteristic was analyzed from six parameters, which were Ammonia Nitrogen (AN), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), pH, and Total Suspended Solid (TSS). Our study demonstrates that water quality was significant improved by phytoremediation by both plants. In conclusion, the study shows that water hyacinth and water lettuce can be used effectively as a phytoremediation tool to absorb Pb and bio-accumulator potential.

Key words: aquatic macrophytes, phytoremediation, water hyacinth, heavy metals, lead

ID: MJC-IKMP-5

FACILE ONE-STEP PREPARATION AND CHARACTERIZATION OF GRAPHENE QUANTUM DOTS SUSPENSION VIA ELECTROCHEMICAL EXFOLIATION

Wan Hazman Danial[1]*, Bashariah Farouzy[1], Mundzir Abdullah[2], Zaiton Abdul Majid[3]

[1]Department of Chemistry, Kulliyyah of Science, International Islamic University Malaysia, 25200 Kuantan, Pahang, Malaysia
[2]Institute of Nano Optoelectronics Research and Technology, Universiti Sains Malaysia 11800 Penang, Malaysia
[3]Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

[*]Corresponding author: whazman@iium.edu.my

Abstract

The study reports on the production graphene quantum dots (GQDs) suspension using simple electrochemical setup which involved electrolyte solution, consisting of citric acid and sodium hydroxide (NaOH) mixture, and pristine graphite rods were used for the electrode without any heating treatment (calcination), thusly avoid any high energy consumption. The balanced reaction mixture of citric acid and NaOH was used to investigate the effects of reaction time and voltage used towards the production of GQDs. UV-Vis spectroscopy analysis revealed significant UV absorption around 240-255 nm which depicted $\pi \rightarrow \pi^*$ transition of aromatic sp^2 C-C bonds while FTIR analysis showed the significant C=C stretching band around 1635 cm^{-1} attributed by the aromatic ring. The exfoliation of the GQDs increased as the concentration of NaOH in electrolyte, time taken and voltage increased. The optimum GQDs suspension can be produced using the balanced ratio of citric acid and NaOH with a voltage of 10 V for 2 hours reaction time. TEM analysis confirmed the presence of the GQDs obtained with average size of ~5nm for the optimum GQDs suspension. The exfoliation of GQDs via the electrochemical technique might pave the way towards upscale and sustainable production of the nanomaterial.

Keywords: Graphene, Graphene quantum dots, suspension, electrochemical, exfoliation

ID: MJC-IKMP-6

A REVIEW ON BIOSYNTHESIS OF NANOPARTICLES FOR FABRIC COATINGS

Hartina Mohd Yusop, Wan Norfazilah Wan Ismail*

Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang,
Lebuhraya Tun Razak, 26300 Gambang, Kuantan, Pahang, Malaysia.

*Corresponding author: norfazilah@ump.edu.my

Abstract

Biosynthesis, or also known as green synthesis method, has received enormous attention from the scientific community over the physical and chemical synthesis methods for the production of metal or metal oxide nanoparticles (NPs). The physical and chemical synthesis are typically expensive and generates a large number of hazardous by-products which can cause toxicity to either human or environment. Thus, biosynthesis is an alternative for production of NPs. Biosynthesis involved the use of plant extracts and natural bio-resources such as microorganisms and enzyme. It has been demonstrated that the biosynthesis method is suitable for large-scale production since it is simple, cheap, easy, fast, non-toxic, and environmentally friendly. This review mainly focuses on the use of biosynthesis method to produce metal or metal oxide NPs for fabric coatings. Importantly, the characteristics of the NPs and their applications after fabrication onto the fabrics are also highlighted. The morphology of the NPs is influenced by the types of plant extract, concentration, and the control of metal salt concentration. Meanwhile, the size of NPs is controlled by the temperature and pH of the extract medium. This review also summarizes the advantages, limitations, and future challenges of the biosynthesis towards the production of fabric coatings. There are several advantages in utilizing green substances including moderate operation conditions with a minimal use of toxic chemicals and low energy consumption.

Keywords: Biosynthesis, Green synthesis, Nanoparticles, Fabric coating.

ID: MJC-IKMP-7

ISOLATION OF A MORPHINAN ALKALOID AND METHOXYBENZOIC ACID WITH INVESTIGATION ON THE ANTIBACTERIAL EFFECT OF ALPHONSEA CYLINDRICA KING LEAVES

Kin-Hau Cho [1], Hui-Yin Tan [2], Mohd Azlan Nafiah [3], Siow-Ping Tan [1,*]

[1]Department of Physical Science, Faculty of Applied Sciences, Tunku Abdul Rahman University College, 53300 Kuala Lumpur, MALAYSIA
[2]Faculty of Applied Sciences, Tunku Abdul Rahman University College, 53300 Kuala Lumpur, MALAYSIA
[3]Department of Chemistry, Faculty of Science and Mathematics, Sultan Idris Education University, 35900 Tanjong Malim, Perak, MALAYSIA

*Corresponding author: tansp@tarc.edu.my

Abstract

Alphonsea cylindrica King belongs to the genus Alphonsea Hook. f. & Thomson, which are traditionally used to treat rheumatism, bruises, and edema. Investigations of its antibacterial properties were carried out on hexane and dichloromethane crude extracts using agar diffusion methods and minimum inhibitory concentration against ESKAPE pathogens. Both the extracts showed positive results in inhibiting E. faecium, S. aureus and K. pneumoniae, while dichloromethane extract showed further inhibition against P. aeruginosa. A morphinan alkaloid, O-methylpallidinine (**1**), along with a methoxybenzoic acid, isovanillic acid (**2**) were isolated from the dichloromethane leaf extract of the plant and elucidated via NMR, IR, UV, GC-MS and by comparison with the reported data in previous studies. All these compounds are first time reported from A.cylindrica. Both **1** and **2** showed low activity against S. aureus with an IC_{50} value of 371.82 μg/mL and 385.37 μg/mL respectively. These results can be used as future references for the discovery of morphinans and the potential of Alphonsea cylindrica King as an anti-bacterial source.

Keywords: Alphonsea cylindrica King, Antibacterial activity, O-methylpallidinine, Isovanillic acid

ID: MJC-IKMP-9

PLANT EXTRACTS: A PROMISING SOURCE FOR THE GREEN SYNTHESIS OF COPPER NANOPARTICLES TOWARDS AGRICULTURE AND ENVIRONMENT APPLICATION

Wan Hazman Danial*, Nurul Iman Aminudin*, Hanna Khaleeda Mohd Shukri, Nur Aqilah Sarip

Department of Chemistry, Kulliyyah of Science, International Islamic University Malaysia, 25200 Kuantan, Pahang, Malaysia

*Corresponding author: whazman@iium.edu.my, nuruliman@iium.edu.my

Abstract

Copper nanoparticles has received an immense interest from the scientific community due to its remarkable properties thusly offer various uses in multitude range of applications. Many works have been reported on the nanoparticles production using numerous approaches. Despite various methods can be used for copper nanoparticles preparation, green synthesis outweighs other techniques which is simple, environmentally friendly yet adaptable approach. While some techniques suffer from hazardous environments, complicated procedures and equipment, and time-consuming, the usage of plant extracts is an alternative avenue to produce copper nanoparticles adapting the green synthesis approach. The synthesis mechanism and insight into various plant extracts will be briefly discussed. Albeit there are myriad range of copper nanoparticles applications, this review further focused on the potential of copper nanoparticles in agricultural and environmental application.

Key words: Plant extracts, copper nanoparticles, green synthesis, agriculture,environmental.

ID: MJC-IKMP-10

ANTIBACTERIAL AND ANTIPLASMODIAL PROPERTIES OF CHEMICAL COMPOUNDS ISOLATED FROM BARK OF PHYLLANTHUS ACIDUS (L.) SKEELS

Qian-Yu Lim[1], Siow-Ping Tan[1,*], Hui-Yin Tan[2], Wee-Kent Liew[3], Yee-Ling Lau[3], Mohd Azlan Nafiah[4]

[1]Depertment of Physical Science, Faculty Applied Sciences, Tunku Abdul Rahman University College, 53300 Kuala Lumpur, Malaysia
[2]Department of Bioscience, Applied Sciences, Tunku Abdul Rahman University College, 53300 Kuala Lumpur, Malaysia
[3]Department of Parasitology, Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur, Malaysia
[4]Department of Chemistry, Faculty of Science and Mathematics, Universiti Pendidikan Idris, 35900 Tanjung Malim, Perak, Malaysia

*****Corresponding author: tansp@tarc.edu.my

Abstract

Phyllanthus acidus (L.) Skeels (Phyllanthaceae family) is a plant that is widely distributed in Asian countries, which is traditionally used as a medicinal plant to treat various ailments. Inspired by the uses of the plant, we present the data on the isolation and identification of phyllanthol **(1)** and meso-hydrobenzoin **(2)** from the dichloromethane extract of the bark of P. acidus collected from Kedah. The structures of these compounds were elucidated by extensive spectroscopic analysis. To the best of our knowledge, compound **1** is a known compound and compound **2** is the first report presented on the isolation and structural elucidation as a natural compound. The bark extract and the isolated compounds were evaluated for the antibacterial activity against Escherichia coli, Enterococcus faecium, Pseudomonas aeruginosa, Staphylococcus aureus by disc diffusion assay, minimal inhibitory concentration (MIC), and half-maximal inhibitory concentration (IC_{50}). Compounds **1** and **2** showed significant activity against Escherichia coli (IC_{50} value = 0.42 and 0.47 μg/mL), Enterococcus faecium (IC_{50} value = 0.86 and 0.43 μg/mL), Pseudomonas aeruginosa (IC_{50} value = 0.45 and 0.44 μg/mL), Staphylococcus aureus (IC_{50} value = 12.87 and 0.44 μg/mL), respectively. These compounds also showed significant antiplasmodial activity towards 3D7 strain with IC_{50} value 0.218 μM for compound **1** and 0.228 μM for compound **2** in vitro. All the isolated compounds are not active against MRC-5 cells with an IC_{50} value of more than 60 μg/mL. From the results obtained, P. acidus has been proven as a source of molecules with therapeutic potential.

Keywords: Antibacterial activity, Antiplasmodial activity, phyllanthol, meso-hydrobenzoin, Phyllanthus acidus

ID: MJC-IKMP-11

STRUCTURAL CHARACTERIZATION AND VISIBLE LIGHT-INDUCED PHOTOELECTROCHEMICAL PERFORMANCE OF FE SENSITIZED TIO_2 NANOTUBE ARRAYS PREPARED VIA ELECTRODEPOSITION

Lim Ying Chin[1*], Najaa Mustaffa[1], Asmaa Kadim Ayal[2], Devagi Kanakaraju[3], Lim Ying Pei[4]

[1] Faculty of Applied Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
[2] Department of Chemistry, College of Science for Women, University of Baghdad, Al-Jadriya Campus, Baghdad, Iraq
[3] Faculty Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
[4] Faculty of Chemical Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

*Corresponding author: limyi613@uitm.edu.my

Abstract

Surface modification of TiO_2 nanotube arrays via metal doping is one of the approaches to narrowing the wide bandgap of TiO_2 in order to increase its adsorption to the visible region. The present work focuses on the fabrication of a Fe sensitized TiO_2 nanotube arrays (Fe-TNT) photoanode. Ordered Fe-TNT were successfully synthesized using a facile two-step electrochemical method by varying the deposition voltage (2-4 V). The morphology, structure, composition, and visible light response were characterized by field-emission scanning electron microscopy (FESEM), X-ray diffraction (XRD), energy-dispersive X-ray spectroscopy (EDX), UV-VIS diffusion reflection spectroscopy (DRS) and photoelectrochemical (PEC) test, respectively. The XRD investigations demonstrated that the sensitization of Fe did not destroy the nanotube array structure, and Fe-TNT had an anatase phase composed of cubic-like particles at higher deposition voltage. The UV–vis absorption spectra of the Fe-TNT showed a redshift of photoresponse towards visible light. Such a redshift is characterized by a decrease in bandgap energy and the photo efficiency was enhanced. The optimal photoelectrochemical performance was observed at 2.5 V deposition voltage for 10 minutes and surpassed that of pristine titania nanotube arrays. The present work demonstrates feasible modification of TiO_2 with Fe as a potential photoanode in solar conversion devices.

Keywords: Electrodeposition, titania nanotubes, photoelectrochemical, iron.

ID: MJC-IKMP-12

IN-VITRO EVALUATION OF CROSSLINKED POLY VINYL ALCOHOL/CHITOSAN – GENTAMICIN SULFATE ELECTROSPUN NANOFIBERS

Nazirah Hamdan, Deny Susanti Darnis, *Wan Khartini Wan Abdul Khodir

Department of Chemistry, Kulliyyah of Science, International Islamic University Malaysia Kuantan Campus, Bandar Indera Mahkota, Kuantan 25200, Pahang, Malaysia.

*Corresponding author: wkhartini@iium.edu.my

Abstract

Polymeric nanofibers with good antimicrobial performance are promising options to thwart wound infection and accelerate wound healing. Although PVA/Chitosan possess many useful properties, but its antibacterial activity is insufficient for effective wound dressing. Therefore, using hydrophilic drug such as Gentamicin Sulfate (GS) that have a broad-spectrum activity against wide range of bacterial infection can enhance the nanofibers performance. In this study, Polyvinyl alcohol (PVA) with chitosan loaded gentamicin sulfate nanofibers were prepared using electrospinning technique and crosslinking with glutaraldehyde for better efficiency of loading and controlled drug released towards the site of interest. Morphological investigation of the nanofibers was carried out using optical microscopy and scanning electron microscopy and it showed smooth and homogeneous nanofibers. FT-IR was used to confirm the nanofibers structure. In situ crosslinking enabled penetration of crosslinking agent into the nanofibers provided and improvement of thermal stability and drug released of the nanofibers. The thermal stability of PVA/Chitosan nanofibers is reduced with the addition of gentamicin sulfate. The kinetic release of gentamicin sulfate followed the Korsmeyer-Peppas model with release exponent, $n < 0.5$. Antibacterial activity of crosslinked nanofibers against Escherichia coli and Staphylococcus aureus showed good inhibition of bacterial growth. Crosslinked PVA/Chitosan loaded gentamicin sulfate nanofibers showed multifunctional characteristics and thus suitable material for controlled drug delivery and tissue engineering application.

Keywords: Polyvinyl alcohol, chitosan, nanofibers, controlled release.

ID: MJC-IKMP-13

CALCIUM OXIDE CATALYST DERIVED LOW COST CHICKEN EGG SHELL FOR TRANSESTERIFICATION OF WASTE COOKING OIL TO BIODIESEL

Noraini Hamzah*, Izyan Yusof, Khairunnisa Khrull Azman, Noor Hasinah Hamizi, Nazrizawati Mohd Tajuddin, Sabiha Hanim Saleh and Mohd Lokman Ibrahim

School of Chemistry and Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, 40450 Shah Alam Selangor

*Corresponding author: pnoraini@uitm.edu.my

Abstract

The decrement in the fossil fuels reserved triggers the need to look for the alternative source of energy. One of the renewable sources of energy that could be considered to substitute traditional fossil fuels is biodiesel. The biodiesel was synthesized from waste cooking oil through transesterification with CaO derived from egg shell as catalyst. The chicken egg shell was treated and proceeded with calcination in a furnace at a temperature of 900°C for 3 hours with flow rate of 10°C/min. The egg shell was completely converted into CaO catalyst, proved by the XRD characterization. BET analysis revealed that the catalyst is mesoporous with surface area of 1.1152 m^2/g with average pore diameter of 78.2 nm. CO_2-TPD analysis revealed that CaO catalyst has strong basic active site with basic amount of 630 μmol/g. SEM images show that the catalyst's morphology is more regular, and the size of particles decreased compared with the chicken egg shell before calcined. Result showed the percentage of FFA less than 1% which is 0.4%. The effect of catalyst loading, methanol/oil ratio, temperature, and time of reaction were investigated by transesterification of waste cooking oil at constant temperature of 65°C for 2 hours of reaction time with stirring rate of 400rpm. The result obtained showed that 2wt.% of catalyst, 15:1 of methanol/oil molar ratio, and reaction at 65°C for 5 hours are the optimum parameters with 80% of biodiesel yield. This study revealed that CaO derived from chicken egg shell has good catalytic activity in transesterification of waste cooking oil into FAME.

Keywords: Biodiesel; Chicken Egg Shell; Transesterification; Waste Cooking Oil

ID: MJC-IKMP-14

SYNTHESIS AND CHARACTERIZATION OF AMINO ACID-DERIVED HYDANTOINS

Ee-Zhen Chin[1], Siow-Ping Tan[1,*], Sook-Yee Liew[2], Thomas Kurz[3]

[1] Department of Physical Science, Faculty of Applied Sciences, Tunku Abdul Rahman University College, 53300 Kuala Lumpur, Malaysia.
[2] Chemistry Division, Centre for Foundation Studies in Science, University of Malaya, 50603 Kuala Lumpur. Malaysia.
[3]Institute of Pharmaceutical and Medicinal Chemistry, Heinrich-Heine Universität Düsseldorf, Universitätsstr. 1, 40225 Düsseldorf, Germany.

*Corresponding author: tansp@tarc.edu.my

Abstract

The Urech hydantoin synthesis is the chemical reaction of amino acids with potassium cyanate and hydrochloric acid allows access to hydantoins and its derivatives. Most of them are biologically active with varieties of structural diversity have made them synthetically attractive. A series of hydantoins are synthesized from various α-amino acids in a reaction with hydrochloric acid and ethanol as the first step, and with potassium cyanate as the second step for the formation of ureido derivatives. Lastly, the cyclization of ureido derivatives yielded the desired hydantoin products. All hydantoins are obtained in a good yield and fully characterized by NMR and IR spectroscopy. This strategy provides a variety of biologically significant hydantoin derivatives.

Keywords: Alanine, glycine, phenylalanine, hydantoins, Urech hydantoin synthesis.

ID: MJC-IKMP-15

SYNTHESIS AND CHARACTERIZATION OF POLYANILINE/CHITIN (SQUID PENS) FOR REMOVAL OF CHROMIUM (VI) FROM AQUEOUS SOLUTION

Kavirajaa Pandian Sambasevam[1]*, Hafiz Istamam[1], Farahin Suhaimi[1], Siti Nor Atika Baharin[1], Nurul Ain Jamion[1,2,3], Muggundha Raaov[4]

[1]School of Chemistry and Environment, Faculty of Applied Sciences, University Teknologi MARA (UiTM), Cawangan Negeri Sembilan, Kampus Kuala Pilah, 72000, Kuala Pilah, Negeri Sembilan Malaysia
[2]Research Centre for Sustainability Science & Governance (SGK), Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia
[3]Soil Assessment and Remediation Research Group, Faculty of Applied Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Malaysia
[4]Department of Chemistry, Faculty of Science, University Malaya, 50603, Kuala Lumpur, Malaysia

*Corresponding author: kavirajaa@live.com

Abstract

The rapid growth of industrial sectors contributes to the increasing amount of heavy metal. It becomes a crucial issue in many developing countries. Among the heavy metals, Chromium (Cr) (VI) has been studied extensively due to its toxic nature in the aqueous solution. Recently, bio/conducting polymer has been reported as a successful material in removing heavy metal from aqueous solution. In this study, chitin was extracted from squid pens and integrated with polyaniline (PANI) via the chemical oxidative method. The integration of chitin with PANI was confirmed by Fourier Transform Infrared (FTIR) spectroscopy, where it indicates the essential peaks of both chitin and PANI present in the PANI/chitin composites. The removal of Cr (VI) was evaluated by Atomic Absorption Spectroscopy (AAS) technique. Several removal optimizations were done such effect of pH, contact time and mass of adsorbent. The results revealed that PANI/chitin could remove highest percentage of Cr (VI) at pH 3, in 12 minutes contact time with 20 mg of the adsorbent for 10 ppm of the initial concentration of Cr (IV) at 298.15 K.

Keywords: heavy metal, polyaniline, squid pens, removal, chitosan, Chromium

ID: MJC-IKMP-16

DEVELOPMENT OF HPLC METHOD AND QUANTIFICATION OF AMENTOFLAVONE FROM LEAVES EXTRACTS OF THREE CALOPHYLLUM SPECIES

Nurul Iman Aminudin[1*], Nadia Aziba Norazhar[1], Farediah Ahmad[2]

[1]Department of Chemistry, Kulliyyah of Science, International Islamic University Malaysia (IIUM), 25200 Kuantan, Pahang, Malaysia
[2]Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia

[*]Corresponding author: nuruliman@iium.edu.my

Abstract

This study described the development and validation of a method that can quantify amentoflavone in the methanol extracts of leaves of three Malaysian Calophyllum species via high performance liquid chromatography (HPLC) technique. Chromatographic analysis was conducted using a reverse phase C_{18} column with water and acetonitrile (55:45) as the mobile phase. The flow rate was 1.0 mL/min and detection by ultraviolet-visible detector at 270 nm. The developed method was validated in terms of linearity, precision and accuracy in accordance to International Conference on Harmonization (ICH) guidelines. The calibration curve showed good linearity ($r^2 > 0.9998$) in a concentration range of 2.5 – 100 μg/mL with low limit of detection and limit of quantification at 1.33 and 4.02 μg/mL, respectively. The percentage of coefficient of variation for intra-day and inter-day precision was less than 2% while percentage of recovery was more than 80% indicating the precision and accuracy of the method. The developed HPLC method was proved as suitable and reliable for its intended application. The amount of amentoflavone quantified from C. incrassatum, C. canum and C. rubiginosum leaves extracts by using the developed method was 9.42, 30.39 and 24.23 μg/mL, respectively.

Keywords: amentoflavone, HPLC, quantification, Calophyllum, extracts

ID: MJC-IKMP-17

TRANSESTERIFICATION OF WASTE COOKING OIL UTILIZING HETEROGENEOUS K_2CO_3 /Al_2O_3 AND KOH/Al_2O_3 CATALYST

Muhammad Amirrul Hakim Lokman Nolhakim[1], Norshahidatul Akmar Mohd Shohaimi[2*], Mohd Lokman Ibrahim[4,5], Wan Nur Aini Wan Mokhtar[5], Ahmad Zamani Ab Halim[6]

[1,2] Faculty of Applied Science, Universiti Teknologi MARA Cawangan Pahang, Kampus Jengka, 26400 Bandar Tun Abdul Razak, Pahang, Malaysia
[3] Centre for Functional Materials and Nanotechnology, Institute of Science, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
[4] School of Chemistry and Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
[5]Department of Chemical Sciences, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia
[6]Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, Kuantan, Pahang, Malaysia

Corresponding author*: akmarshohaimi@uitm.edu.my

Abstract

Biodiesel production from waste oil is preferable nowadays since the amount of fossil fuels for diesel production is decreased year by year. In this study, the transesterification of waste cooking oil was implemented where the simple alkyl esters were made from the chemical reaction of triglycerides and methanol then supported with heterogeneous catalyst to speed up the reactions. Potassium carbonate (K_2CO_3) and potassium hydroxide (KOH) loaded at various catalyst concentration of 10% and 30% on aluminium oxide (Al_2O_3) support was prepared by incipient wetness impregnation (IWI) method. The feedstock used was waste cooking oil (WCO) which collected from household with free fatty acids (FFAs) of 1.05 and moisture content less than 0.015%. The catalyst was extensively investigated using Thermogravimetric analysis (TGA), X-Ray Diffraction Spectroscopy (XRD), Brunauer-Emmett-Teller (BET) and ester content of biodiesel collected was tested using Gas Chromatography-Mass Spectroscopy (GC-MS). The operating conditions for transesterification reaction were set constant with oil to methanol ratio of 1:12, catalyst loading of 5 wt%, and reaction temperature of 65 o C. It was found that 10 wt% K_2CO_3 /Al_2 O_3 was the best catalyst that yielded 9.86g (98.6%) biodiesel with a conversion of 88.81% of ester content that makes the total biodiesel yield of 8.75g (87.57%). Both catalysts found to be stable and suitable for the industrial purposes with less amount of chemical used. The catalyst showed a promising result in converting the triglycerides in waste oil to fatty acids methyl esters (FAME).

Keywords: Biodiesel, transesterification, heterogeneous catalyst, ester content.

ID: MJC-IKMP-18

THE APPLICATION OF K/Al_2O_3 WITH ETHANOLIC 2-METYLIMIDAZOLE FOR THE EXTRACTION OF NAPHTHENIC ACID FROM CRUDE OIL

Noraini Safar Che Harun A[1], Norshahidatul Akmar Mohd Shohaimi B[2*], Ahmad Zamani Ab Halim C[3]

[1] Faculty of Applied Sciences, Universiti Teknologi MARA , 40450 Shah Alam, Selangor,Malaysia A
[2] Faculty of Applied Sciences, Universiti Teknologi MARA Pahang, 24600 Bandar Tun Abdul Razak Jengka,Pahang,Malaysia B
[3] Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, Kuantan, Pahang, Malaysia C

*Corresponding author: akmarshohaimi@uitm.edu.my

Abstract

The world's economy is largely dependent on fossil fuels such as petroleum crude oil. The crude oil processing in the oil refinery can induce serious corrosion problem associated with the presence of Naphthenic acid (NAs) compound thus reduces the quality of the oil. The presence of this acidic compound will lead to an increase in the Total Acid Number (TAN) value and a decreased in the oil price which will affect the oil industry. The purpose of this study is to overcome the corrosion problem by reducing the TAN to less than 1.0 mg KOH/g utilizing ethanolic of 2-methylimidazole with the aid of K/Al_2O_3 catalyst. Petronas Penapisan Melaka crude oil with original TAN of 4.38 mg KOH/g was used as feedstock in this study. The parameters investigated were reaction time, reaction temperature, catalyst loading and catalyst calcination temperature. The alumina supported catalyst was synthesized through Incipient Wetness Impregnation (IWI) methods and characterized using X-ray Diffraction Spectroscopy (XRD) and Scanning Electron Microscopy (SEM). The TAN of crude oil was successfully lowered to 0.93 mg KOH/g by using K/Al_2O_3 catalyst at a calcination temperature of 1000^{o}C. XRD diffractograms of the catalyst at all calcination temperatures of 700, 900 and 1000^{o}C were highly amorphous with a low degree of crystallinity.

Keywords: catalysts, crude oil, naphthenic acid, total acid number.

ID: MJC-IKMP-19

La(III) SCHIFF BASE COMPLEXES: MICROWAVE-ASSISTED SYNTHESIS, PHYSICOCHEMICAL AND SPECTROSCOPIC ANALYSIS

Nur Husnina Nasaruddin[1], Shahrul Nizam Ahmad[1*], Hadariah Bahron[1]

[1] Faculty of Applied Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

*Corresponding author: shahruln@uitm.edu.my

Abstract

Two lanthanum(III) Schiff base complexes, 2,2'-((1E,1'E)-((2,2-dimethylpropane-1,3-diyl)bis(azanylylidene))bis(methanylylidene))diphenollanthanum(III) [**La(AD1H)**] and 6,6'-((1E,1'E)-((2,2-dimethylpropane-1,3-diyl)bis(azanylylidene))bis(methanylylidene))bis(2-methoxyphenol)lanthanum(III) [**La(AD1OMe)**] were successfully synthesized. The complexes were prepared through microwave-assisted synthesis where a minimum amount of solvent was used and a shorter reaction time taken compared to conventional reflux. Both ligands and their lanthanum (III) complexes were characterized through melting point, elemental analysis, FTIR and ^{1}H NMR spectroscopy. The shifting of azomethine (C=N) band to a higher frequency, $\Delta\nu$=17-18 cm^{-1} in IR spectra indicated that the complexation between ligands and metal centres has been established. It was further supported through the shifting of the azomethine proton signal to a higher chemical shift, $\Delta\delta$=0.19-0.21 cm^{-1} in ^{1}H NMR spectra. In addition, the shifting of n–π*(C=N) band in UV-Vis spectra, $\Delta\lambda$= 2–16 nm suggests the involvement of azomethine nitrogen in the complexation.

Keywords: Schiff base, lanthanum, cyclohexanediamine, microwave-assisted synthesis

ID: MJC-IKMP-20

ISOLATION AND CLONING OF SESQUITERPENE SYNTHASES (AmGS3 and AmGS4) CHALCONE SYNTHASE (AmCHS) FROM AQUILARIA MALACCENSIS RESPONSIBLE FOR AGARWOOD FORMATION

Aimi Wahidah Aminan[1], Saiful Nizam Tajuddin[2], Aizi Nor Mazila Ramli[1,2*]

[1]Faculty of Industrial Science & Technology, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Kuantan, Pahang Malaysia
[2]Bio Aromatic Research Centre of Excellent, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Kuantan, Pahang Malaysia

*Corresponding author: aizinor@ump.edu.my

Abstract

Discovery of agarwood marker compounds known as sesquiterpene and phenylethyl chromone is widely studied for years. However, studies of agarwood in genetic level from Aquilaria malaccensis is still very scarce. This study describes the isolation and cloning of sesquiterpene synthase genes (AmGS3 and AmGS4) and chalcone synthase gene (AmCHS) that were identified from A. malaccensis transcriptome data mining. The sizes of AmGS3, AmGS4 and AmCHS were 1162 bp, 1466 bp and 1623 bp in length. The open reading frames (ORFs) of AmGS3, AmGS4 and AmCHS detected were 948 bp, 1047 bp and 1185 bp, with encoding polypeptide length of 348, 315 and 394 amino acids, respectively. The full-length sequences of AmGS3, AmGS4 and AmCHS were successfully isolated from infected stem of A. malaccensis, amplified via polymerase chain reaction, cloned into pGEM-T Easy Vector and transformed into prepared E. coli DH5α competent cells. Sequencing result and BLASTn analysis revealed that ORFs of AmGS3 and AmGS4 were highly homologous to putative delta-guaiene synthase from Aquilaria sinensis with percentage of similarity 98.1% and 98.08%, respectively, while ORF of AmCHS is highly homologous to chalcone synthase from A. sinensis with percentage of similarity of 99.24%. This results therefore demonstrated the successfully isolated sesquiterpene synthases and chalcone synthase genes that may played important roles toward formation of agarwood sesquiterpene and phenylethyl chromone in A. malaccensis.

Keywords: Aquilaria malaccensis, agarwood, sesquiterpene synthase and chalcone synthase.

ID: MJC-IKMP-21

TRANSFORMATION OF KAOLIN TO KALSILITE: EFFECT OF KOH CONCENTRATION AND REACTION TEMPERATURES

Eddy F. Yusslee[1], Nur Hazwani Dahon[2], Mohd Azrul Abd Rajak[3] and Sazmal E. Arshad[4*]

[1,2,3]Preparatory Centre For Science and Technology, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Malaysia
[4]Faculty of Science and Natural Resources, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Malaysia

*Corresponding author: sazmal@ums.edu.my

Abstract

Kalsilite has been synthesis using kaolin as silica and alumina precursors via hydrothermal method with the addition of KOH as potassium source. The effects of KOH concentrations and reaction temperature have been investigated. XRD diffratograms and SEM images indicated the formation of kalsilite after hydrothermal reaction of kaolin at 190°C in 0.75 M KOH solution for 24 hours. Higher KOH molarity increases the crystallinity of the product while zeolite W were formed at lower KOH concentration. On the other hand, 190°C was sufficient to convert kaolin to kalsilite while at lower temperature, zeolite W has been found as the dominant product.

Keywords: Kaolin, hydrothermal, kalsilite

ID: MJC-IKMP-22

COMBINING CHEMOMETRICS, SENSORY ANALYSIS AND CHROMATOGRAPHIC FINGERPRINT OF VOLATILE, AND PHENOLIC COMPOSITIONS FOR SYSTEMATIC CLASSIFICATION OF PINEAPPLE (ANANAS COMOSUS L.)

Syaidatul Faraha Zainuddin[1], Rozita Osman[1]*, Hafizan Juahir[2], Siti Raihan Zakaria[3]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
[2]East Coast Environmental Research Institute, Universiti Sultan Zainal Abidin, 21300 Kampus Gong Badak, Kuala Terengganu, Malaysia
[3]Faculty of Applied Sciences, Universiti Teknologi MARA Pahang, 26400 Jengka, Pahang, Malaysia

* Author for correspondence; rozit471@uitm.edu.my

Abstract

Classification and quality control of fruits in Malaysia is based on the morphological traits manual done by the agricultural officer. As this approach is based on human perception and judgment, it may be biased and inconsistent. The aroma of pineapple is made up of a wide range of volatile and non-volatile compounds depending on the varieties and maturity stages of the fruits and thus, can be valuable factors in classifying the fruits. The chromatographic fingerprints of volatile and phenolic compounds from pineapple pulp were obtained by using Gas Chromatography-Mass Spectrometry Detector (GC-MSD) and 2-Dimensional-Liquid Chromatography – Diode Array Detector (2D-LC-DAD), respectively. The sensory profile of the four pineapple varieties (Morris, Josephine, MD2, and Sarawak) were done using quantitative descriptive analysis (QDA) to evaluate differences among the pineapple samples. QDA analysis showed the fruity aroma of pineapple was insignificant to differentiate between the pineapple varieties with a scale of 4.13±2.07, 5.33±2.58, 3.87±2.07, and 3.00±0.00 for Morris, Josephine, MD2, and Sarawak, respectively showing sensory analysis alone could be biased and unreliable in discriminating pineapple varieties. Chemometric techniques based on unsupervised (principal component analysis (PCA) and hierarchical cluster analysis (HCA)), and supervised (discriminant analysis (DA) and partial least squares discriminant (PLS-DA) analysis using 13 sensory attributes, 10 selected phenolic compounds, and 35 volatile compounds allowed the discrimination of four different pineapple varieties. Application of chemometrics revealed the potential marker compounds for each pineapple variety permitting the unambiguous distinction between Morris, Josephine, MD2, and Sarawak pineapple.

Keywords: Chemometrics, volatile compounds, phenolic compounds, chromatographic fingerprint, pineapple

ID: MJC-IKMP-23

CHEMICAL COMPOSITION OF AGARWOOD ESSENTIAL OIL (AQUILARIA MALACCENSIS) UPON EXPOSURE TOWARDS HEAT CONDITION

Hezelin Elayana Shaian[1*], Che Mohd Aizal Che Mohd[2], Saiful Nizam Tajuddin[2]

[1]Faculty of Industrial Sciences & Technology (FIST), Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang Darul Makmur.
[2]Pusat Kecemerlangan Penyelidikan Bioaromatik (BIOAROMATIK), Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang Darul Makmur.

*Corresponding author: hezelin2017@gmail.com

Abstract

Agarwood (Gaharu) is highly value due to extensive usage in the industries including perfumery, pharmaceutical and traditional medicine. The strong and unique woody aroma of agarwood oil is depending on the abundance of sesquiterpenoid or oxygenated sesquiterpene. Post-treatment of agarwood oil such as exposure towards heat, UV light and oxygen under certain period of time were practiced by the industry to induce the formation of sesquiterpenoid content through oxidation process, thus enhance woody aroma of the oil. In this study, agarwood oil (Aquilaria malaccensis) from Pahang, Malaysia was subjected to exposure of heat at 40 ºC for period of 3, 7, 14, 20 and 30 days. Gas chromatography analyses identified the major compounds in the oils as 9-hydroxyselina-4,11-dien-14-oic acid (6.94-8.06 %), epi-α-cadinol (6.38-7.88 %), selina-3,11-dien-9-al (5.20-6.72 %), β-eudesmol (3.95-5.22 %), 10-epi-γ-eudesmol (3.95-3.87 %), selina-4,11-dien-14-oic acid (4.21-4.85 %), and α-eudesmol (3.25-3.79 %), kusunol (1.77-3.02 %), kessane (2.42-2.90 %), agarospirol (1.37-1.76%) and guaiol (1.29-1.72 %). The classification of compounds of treated oil (Day 3 to Day 30) found that sesquiterpenoid group dominated the agarwood oil by 62.82 to 66.25 % with highest content in the Day 14. However, further investigation on the selected marker compounds shown decreased in sesquiterpenoid content of Day 0 (untreated oil) 70.85 % to 66.25 % in which highest for treated oil in Day 14. Further study with other parameters such as oxygen and UV light is recommended to be done.

Keywords: agarwood, Aquilaria malaccensis, post-treatment, heat, sesquiterpenoid

ID: MJC-IKMP-24

EFFECT OF EXTRACTED MICROCRYSTALLINE CELLULOSE ON PVA / MICROCRYSTALLINE CELLULOSE BIOCOMPOSITE

Nur Aiman Mohamad Senusi[1], Rathesh Kumaran Ulaganathan[1], Norshahidatul Akhmar Mohd Shohaimi[2], Ahmad Zamani Ab Halim[3], Nurasmat Mohd Shukri[4], Mohamad Asyraf Mohd Amin[5], Abrar Ismardi[6], Nor Hakimin Abdullah[1*]

[1]Advance Materials Research Centre (AMRC), Faculty of Bioengineering and Technology, Universiti Malaysia Kelantan, 17600 Jeli, Kelantan, Malaysia
[2]Chemistry Department, Faculty of Applied Science, Universiti Teknologi MARA, 26400 Jengka, Pahang, Malaysia
[3]Faculty of Industrial Sciences & Technology, University Malaysia Pahang, 26300 Gambang, Kuantan, Pahang, Malaysia
[4]School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kubang Kerian, Kelantan, Malaysia
[5]Green Tech Enov, Lorong TJI 34, Taman Jengka Indah, 26400 Bandar Tun Razak, Pahang, Malaysia
[6]Department of Engineering Physics, School of Electrical Engineering, Telkom University, Jalan Telekomunikasi No. 1 Terusan Buah Batu Bandung, West Java, Indonesia

*Corresponding author: norhakimin@umk.edu.my

Abstract

In this study, microcrystalline cellulose (MCC) prepared from oil palm (Elaeis guineesis) trunks (OPT) combination of water treated fiber and alkali bleaching techniques. The prepared MCC with different compositions (0.5wt%, 1.0wt% and 1.5wt%) then was implemented as reinforcement in polyvinyl alcohol (PVA) matrix to form PVA/MCC biocomposite with glycerine as the plasticizer. The morphology of the extracted MCC was visualized using scanning electron microscopy (SEM) and X-ray diffraction (XRD). The effect of the MCC as biofiller in PVA matrices was studied using Universal Testing Machine. SEM result showed the rough surface and minor agglomeration of the MCC while XRD revealed the MCC was amorphous with the crystallinity index of 48.7 %. The tensile strength of PVA/MCC biocomposites discovered the highest stress value obtained at 1.0wt% of MCC and followed by 1.5wt% and 0.5wt% with the value of 11.87, 10.07 and 9.88 MPA, respectively. It is found that the highest elongation break values of the PVA/MCC biocomposites at 54.93 mm (1.0wt% of MCC) and followed by 53.72 mm (0.5wt% of MCC) and 25.51 mm (1.5wt% of MCC).

Keywords: microcrystalline cellulose, biocomposite, oil palm trunk, tensile strength.

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DISCRIMINATION OF HERBAL PRODUCTS FROM ZINGIBERACEAE FAMILY USING ELECTRIC NOSE COMBINED WITH CHEMOMETRIC TECHNIQUES

Pauzi A. N. 1, Muhammad N.[1,2]*, Kamal N[3]

[1] Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia (UTHM), Pagoh Educational Hub, KM 1, Jalan Panchor, 84600 Muar, Johor, Malaysia.
[2] Centre of Research for Sustainable Uses of Natural Resources (CoR-SUNR), Universiti Tun Hussein Malaysia (UTHM), Parit Raja, 86400 Batu Pahat, Johor, Malaysia.
[3]Institute of Systems Biology (INBIOSIS), Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia.

Corresponding author*: norhayatim@uthm.edu.my

Abstract

Many herbs originating from Zingiberaceae family are used widely as raw materials in the herbal products. Some of them have similar colour for their rhizomes and are quite hard to distinguish from each other, so it is possible to misidentified one for the other. Therefore, it is necessary to find a rapid and reliable method for discrimination of Zingiberaceae based products. The present work investigated the possibility of application of electric nose based on fast gas chromatography (fast GC E-nose) coupled with chemometrics techniques for discrimination of herbal products from Zingiberaceae family. Nine powdered samples consist of Alphinia galanga, Alpinia conchigera, Curcuma longa, Curcuma zedoaria, Curcurma xanthorrhiza, Zingiber officinale, Zingiber zerumbet, Kaempferia galangal, and Kaempferia pandurata were analyzed by fast GC E-nose. Principal component analysis (PCA) and discriminant function analysis (DFA) were further applied for visualization of dataset using score plot. Result demonstrate that sample could be discriminated through the combination of data from fast GC E-nose with PCA and DFA, in which DFA gave clearer discrimination crimination of Zingiberaceae based products which could contributed to the quality control of them in the supply chain of herbal industry.

Keywords: Chemometric, electric nose, herbal product, volatile compounds, Zingiberaceae

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SYNTHESIS, STRUCTURAL ELUCIDATION AND MESOPHASE BEHAVIOUR OF HEXASUBSTITUTED CYCLOTRIPHOSPHAZENE MOLECULES WITH AMIDE LINKING UNIT

Zuhair Jamain[1,2*], Melati Khairuddean[2*], Nur Kamarina Kamaruddin[2], Yeoh Zhi Rui[2]

[1]Faculty of Science and Natural Resources, Universiti Malaysia Sabah (UMS), 88400 Kota Kinabalu, Sabah, Malaysia.
[2]School of Chemical Sciences, Universiti Sains Malaysia (USM), 11800 Penang, Malaysia.

*Corresponding author: zuhairjamain@ums.edu.my and melati@usm.my

Abstract

Alkylation of 4-acetamidophenol with various alkyl halides gave alkylated derivatives **1a-d** which were further reduced to form an amines, **2a-d**. A separate reaction of phosphonitrilic chloride trimer and methyl-4-hydroxybenzoate yielded **3**, hexa-(oxy-4-methyl benzoate)cyclotriphosphazene which was then reacted with ethanol and potassium hydroxide to give **4**, hexa-(oxy-4-benzoic acid)cyclotriphosphazene. This hexasubstituted intermediate **4** was reacted with a series of intermediates **2a-d** to yield final compounds **5a-d**, hexasubstituted cyclotriphosphazene with amide linking unit. All the structures of the intermediates and final compounds were characterized using the Fourier Transform Infrared (FTIR) and Nuclear Magnetic Resonance (NMR) spectroscopy. The liquid crystal properties of all the synthesized compounds were determined using Polarized Optical Microscope (POM). POM observation showed that compounds **5a-d** exhibited liquid crystal properties of smectic A and smectic C phases. The clearing temperature of these compounds increased as the aliphatic chain length increased. The additional carbon length will increase the transition temperature of the compounds.

Keywords: Liquid crystal, cyclotriphosphazene, amide, smectic A, smectic C.

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SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL STUDIES OF METAL COMPLEXES DERIVED FROM GENTAMICIN SULFATE

Fiona N.-F How [a]*, Mohammad Faiz Hizzuan Bin Hanapi[a], Dayang Fatin Nadhirah Binti Abang Sapani[a]

[a]Department of Chemistry, Kulliyyah of Science, International Islamic University Malaysia, Jalan Sultan Ahmad Shah, Bandar Indera Mahkota, 25200, Kuantan, Pahang Darul Makmur, Malaysia

Abstract

Gentamicin is a broad-spectrum aminoglycoside antibiotic with reduction in antimicrobial activity due to antimicrobial resistance. Complexation of gentamicin with metal ions is expected to facilitate the antibiotic discovery process and would overcome the antimicrobial resistance. Five metal complexes, Cr(III), Co(II), Ni(II), Cu(II) and Zn(II) complexes from gentamicin sulfate were successfully synthesized and characterized using decomposition point, elemental analyses, IR and UV–Vis spectroscopy. The result showed all complexes have general formula of $[ML_xL_y.aH_2SO_4.bH_2O]$, where M = metal ions (Cr, Co, Ni, Cu or Zn) and $L_x = L_y$ = gentamicin ligand of either L_1 = gentamicin C1 ($C_{21}H_{43}N_5O_7$) or L_2 = gentamicin C2 ($C_{20}H_{41}N_5O_7$) or L_3 = gentamicin C1a ($C_{19}H_{39}N_5O_7$). Characterization showed that there are presence of sulfuric acid molecules and coordinated water molecules in the metal complexes. Qualitative and quantitative antimicrobial assays were done to evaluate the biological activities of the parent compound and its metal complexes.

Keywords: gentamicin; metal complexes; synthesis; antimicrobial activity