8th INTERNATIONAL CONFERENCE FOR YOUNG CHEMISTS

ICYC 2022
8th INTERNATIONAL CONFERENCE FOR YOUNG CHEMIST

ADVANCEMENTS & INNOVATIONS IN CHEMISTRY BEYOND PRESENT CHALLENGES

VIRTUAL CONFERENCE

18 – 20
OCTOBER 2022

ORGANIZED BY

SCHOOL OF
CHEMICAL SCIENCES

USM
UNIVERSITI SAINS MALAYSIA
APEX

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Mahidol University

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FOREWORDS

DEAN OF THE SCHOOL OF CHEMICAL SCIENCES, UNIVERSITI SAINS MALAYSIA

Assalamualaikum and greetings to all ICYC 2022 participants,

It gives me great pleasure to welcome all of you to the 8th International Conference for Young Chemists (ICYC 2022). Although the 8th ICYC was originally scheduled for September 2021, the Organizing Committee has decided to postpone the event to 18th-20th of October 2022, in light of the pandemic.

Started in 2001, where it was first known as the Regional Conference for Young Chemists, ICYC has since become a platform to gather and disseminate the latest knowledge in the field of chemistry. ICYC is a biennial conference organized by the postgraduate students of the School of Chemical Sciences, Universiti Sains Malaysia with the aim of bringing local and international researchers together to facilitate interaction and networking among researchers, to share and discuss new findings and applications in the field of chemistry. It is our wish that the intellectual discourse will result in future collaborations between universities, research institutions, and industry both locally and internationally.

In line with the theme "Advancements and Innovations in Chemistry Beyond Present Challenges" speakers and participants of ICYC 2022 will share their research and knowledge on the advancements and innovations made regardless of all challenges, to solve problems in order to create a better future for tomorrow and for mankind.

Finally, I would like to thank the organizing committee for their tremendous efforts in organizing the conference. I would also like to take this opportunity to express my gratitude to our co-organizer from Mahidol University, all speakers, participants and sponsors for your full support, cooperation, and contribution to ICYC 2022. I wish you all, a fruitful and successful conference.

Sincerely,

PROF. DR. ROHANA ADNAN
Dean,
School of Chemical Sciences,
Universiti Sains Malaysia

CHAIRPERSON OF ICYC 2022

Assalamualaikum and greetings to all ICYC 2022 participants,

The world of science is an exciting world to explore. It is always amazing to see how much of it, especially chemistry, has evolved throughout the years. Although the COVID-19 virus has struck the world and affected most research studies during a stretch period of two years and ongoing, it is awe-inspiring to see how academics, researchers, and scientists alike have adapted to this pandemic and continue to impact the world of chemistry, for evolution towards a brighter and greener future. It is an honour to be given this opportunity to help provide a platform for the wide spectrum of chemistry research to be discussed and shared with the minds of students, researchers, and academics all over the world.

The slogan, "Advancements and Innovations in Chemistry Beyond Present Challenges" has been chosen to highlight all the impactful research advancements and innovations that has been achieved in the various fields of chemistry despite the ongoing pandemic that has struck the world. Through this year's International Conference for Young Chemists (ICYC 2022), we hope to provide a platform for young students, researchers, and academics to inspire other young minds with the incredible knowledge and findings to be shared.

This year marks the historical 21st year of the legacy of this biennial conference, and I am proud to present the 8th International Conference for Young Chemists (ICYC 2022). I would like to take this opportunity to thank the organizing committees for their tireless hard work, the advisory board for their full support and the staff of USM, especially the School of Chemical Sciences, for being helpful throughout the planning and execution process. In addition, I would also like to thank the co-organizers, sponsors, invited speakers and respected researchers as well as the participants for their contribution and participation to make this year's ICYC 2022 a success. Lastly, on behalf of the organizing committee, I would like to wish the participants to have a rewarding experience whilst attending this conference, and I hope this experience will inspire you to continue to provide an impact towards the field of chemistry.

Sincerely,

SITI NURSHAHIRA MOHD RADZUAN
Chairperson,
ICYC 2022

PLENARY SPEAKER

Prof. Dr. Lee D. Wilson
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Lee D. Wilson is an Indigenous Scholar and Professor at the University of Saskatchewan who specializes in polymer and macromolecular materials chemistry with research directed at understanding their *structure-function* relationships relevant to sorption phenomena in physical to biological processes. Wilson has an established research program with many peer-reviewed publications (>200) with an h-index of 47 and an i10-index of 144 with more than 6800 citations. Invited contributions as a speaker at regional, national, and international meetings include a large number of plenary and keynote presentations. Wilson has supervised numerous HQP, and his research program is supported by Tri-council and other external research support. Wilson's research involves the synthesis, characterization, and studies of the physicochemical properties of biopolymer and macromolecular-based materials in aqueous media and other environments. This research has contributed to developments in environmental remediation technology, construction materials, chemical separations such as biofuels, controlled-release carrier systems, sustainable energy and water capture in HVAC systems, specialized coatings and sensor technology. Wilson's research group is actively involved in studies focused the modification of polysaccharides and biomaterials using sustainable chemistry, along with characterization of their structure and physicochemical properties to address a range of fundamental and applied problems.

Google scholar link:
https://scholar.google.ca/citations?user=N6_fvB4AAAAJ&hl=en

KEYNOTE SPEAKERS

Prof. Dr. Sharifah Muhammad
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Sharifah Mohamad is a Professor in the Department of Chemistry, Faculty of Science, University of Malaya. She is an analytical chemist. Her major research interest are focused on sample preparation techniques for trace analysis of complex samples, such as an environmental and food samples. Her area of expertise includes green analytical chemistry, separation science and design materials for analytical and environmental applications. Her research focuses on the synthesis and design of solid and liquid phases for sample preparation techniques, particularly in organic pollutants separation. Current research interests in utilizing green materials such as cyclodextrin, green solvents (ionic liquids and deep eutectic solvents) and natural materials from kitchen waste for chemical analysis. She has published over 120 peer-reviewed publications and 2 book chapters. She has supervised 24 PhD students, 17 MSc students and one postdoctoral fellow. She is currently supervising 9 PhD students and one MSc student. Currently, she as Deputy Head of University of Malaya Centre for Ionic Liquids (UMCiL) and Deputy Dean (Undergraduate), Faculty of Science.

Google scholar link:
https://scholar.google.com.my/citations?user=zSwHO5oAAAAJ&hl=en

Prof. Dr. He Teng

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Teng He is a Professor at the Dalian Institute of Chemical Physics, Chinese Academy of Sciences (DICP, ACS). He pursued his PhD degree in DICP, ACS from 2006 to 2012 under the supervision of Prof. Ping Chen and Prof. Tao Zhang. Then, He was promoted to be an associate professor and joined Prof. Chen's group in DICP. From 2017 to 2018, he was a visiting scientist at Pacific Northwest National Laboratory (PNNL) in USA, focusing on liquid materials for hydrogen storage. Now he is a full professor in DICP. His research interests cover the synthesis and characterization of novel hydrogen storage materials and catalysts for de/re-hydrogenation, including B-N-based materials, liquid organic hydrogen carriers and metalorganic hydrides. Until now, he has published over 70 peer-reviewed papers in Angew, EES, Adv. Mater and so on.

Google scholar link:
https://scholar.google.com.my/citations?hl=en&user=Y4lTdXEAAAAJ

Prof. Dr. R. Roto
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R. Roto is a Professor of Chemistry in the Department of Chemistry, Gadjah Mada University, Yogyakarta, Indonesia. He was born on November 11, 1967, in Purworejo, Central Java Indonesian. He obtained his PhD in Chemistry from the University of New Brunswick, Canada in 2005 and M. Sc in Applied Chemistry from Keio University, Japan in 1998. He received his B. Sc. in Chemistry from Gadjah Mada University, Indonesia in 1991. He has 17 years of experience in teaching and research. His research interest is mainly in surface electrochemistry, novel analytical method development, and material science. He is currently serving as an assessor at the Royal Society of Chemistry (England) International Committee of Accreditation and Validation since the year 2018. He is also a member of the Royal Society of Chemistry, England and the Indonesian Chemical Society. He was awarded the Best Paper Awards (2020) at Gadjah Mada University and the Board of Governors Merit Award from the University of New Brunswick, Canada (2005).

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https://scholar.google.com.my/citations?hl=en&user=ugRr8oAAAAAJ

INVITED SPEAKERS

Assc. Prof. Dr. Siwaporn Meejoo Smith
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Siwaporn Meejoo Smith is an Associate Professor in the Center of Sustainable Energy and Green Materials in the Department of Chemistry, Mahidol University (Thailand), and a coordinator for the Chemistry of Natural Resources and Waste module. She obtained her B.Sc. in Chemistry from Mahidol University and a PhD degree in Chemistry from the University of Birmingham, United Kingdom. She was awarded the 2015 Wiley-CST Award for Contribution to Green Chemistry, 2015 L'Oréal Thailand For Women in Science Fellowship Award for Materials Science Research, the Thai National Commission for UNESCO, and the 2017 Endeavour Executive Fellowship from the Australian Government. Her current research focuses involve developing of structural sorbents and catalysts derived from waste or biomaterials for environmentally sustainable applications

Google scholar link:
https://scholar.google.com.my/citations?hl=en&user=QVw7mFcAAAAJ

Chm Dr. Lim Jun Wei
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Lim Jun Wei was conferred with a Bachelor of Science (Hons) degree in Chemistry from Universiti Sains Malaysia in the year 2009. He later received his PhD qualification in Environmental Chemistry from the same university in the year 2013. Currently, he is affiliated with the Department of Fundamental and Applied Sciences, Universiti Teknologi PETRONAS, serving as the Senior Lecturer and Cluster Head of Applied Chemistry program. His major research interests are insect-based biological compounds, bioremediation of solid wastes and wastewaters, microalgal biofuels, and green hydrogen. Accordingly, he has published more than 250 research papers inclusive of book chapters of late. In terms of professional associations, he is the member of The Royal Society of Chemistry (MRSC) at international level and Professional Chemist registered with Malaysian Institute of Chemistry at national level. He is also one of the Graduate Technologists under the Malaysia Board of Technologists. Besides, he has joined the Editorial Board Members of Chemical Science and Biomolecular Engineering under Boffin Access and Archives of Biochemical Engineering under Somato Publications. For other editorial experiences, he had served as the Guest Editors for Chemosphere, Biomass and Bioenergy, Energy Nexus, Processes and Energies, while still being the Subject Editor for Processes.

Google scholar link:
https://scholar.google.com.my/citations?user=MrS0AFkAAAAJ&hl=en

Dr. Yvan Six

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Yvan was born in 1970. He graduated from l'X (École Polytechnique, Palaiseau, France) in 1993. In 1997, after the completion of his PhD under the supervision of Prof. Jean-Yves Lallemand at the same institution, he joined the group of Prof. William B. Motherwell at University College London (UK), where he worked on the design of polymer catalysts using the molecular imprinting technology. He returned to France in 1999 to take a second postdoctoral position, with Prof. Samir Z. Zard at the *Institut de Chimie des Substances Naturelles* (ICSN) in Gif-sur-Yvette, where his main project dealt with cascade reactions using the radical chemistry of dithiocarbonates (xanthates). He was hired by the CNRS as a "*Chargé de Recherche*" in 2000. He started developing his research topics at ICSN and moved back to l'X in 2010. His current scientific interests focus on the development of novel methods based on the combined use of polar organometallic reagents and $Ti(OiPr)_4$, the chemistry of cyclopropanes and the synthesis of biologically active molecules. As a research group principal investigator, his research main topics are new transformations based on transmetallation reactions with $Ti(OiPr)_4$, cyclopropanes and cyclobutanes, and natural product synthesis. He also gives full-time supervision for 11 PhD students, 8 post-doctoral research fellows and > 20 project students. He has published 37 publications (around 1050 citations), including two book chapters (h-index = 18).

Google scholar link:
https://scholar.google.com.my/citations?hl=en&user=hmm4TAkAAAAJ

Dr. Hairul Hisham Bin Hamzah

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Hairul Hisham Hamzah received his bachelor and master research degrees in 2006 and 2010, respectively, from the Universiti Putra Malaysia (UPM). In 2013, he then pursued his PhD research at the University of Southampton, UK, under the supervision of Professor Philip N. Bartlett. In May 2017, he moved to the University of Brighton, UK, to take up a position as a postdoctoral research associate in Professor Bhavik Patel's lab at the School of Pharmacy and Biomolecular Sciences. Currently, he has been a senior lecturer at the School of Chemical Sciences, Universiti Sains Malaysia (USM), since January 2018.

Assoc. Prof. Dr. Mohd Hazwan Bin Hussin

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Mohd. Hazwan Hussin is an Associate Professor at School of Chemical Sciences, Universiti Sains Malaysia. He received his B.Sc (Hons.) in Chemistry and M.Sc degrees from Universiti Sains Malaysia, respectively. He was awarded double-PhD degree program with USM and Universite de Lorraine, France. His research area involves lignocellulosic materials, lignin, cellulose and corrosion protections (inhibition and coatings). He was listed as Top 2% Scientists in the world (under the category of 2019 and 2020 citation) by Stanford University. He is also a Research Fellow for CEGEOTECH, UNIMAP and has been appointed as Visiting Professor at the Universite de Lorraine, France. He has published more than 100 papers of his research work in reputable journals and also presented many scientific papers in various conferences, nationally and internationally. He is an Associate Editor for Frontiers in Chemistry - Green and Sustainable Chemistry and Review Editor for Frontiers in Materials - Environmental Degradation of Materials. Dr. Hazwan is also a registered chemist (ChM) with Malaysia Intitute of Chemistry, professional member of Institute of Corrosion (UK) and member of the National Association of Corrosion Engineer, NACE (USA). He is also active in providing testing and consultation to various companies. Dr. Mohd Hazwan is currently served as the Deputy Director for Research Creativity and Management Office (RCMO) USM, Coordinator for USM-UL Centre and Point of Contact for Malaysia-France University Centre (MFUC).

Google scholar link:
https://scholar.google.com.my/citations?user=mxrp-bMAAAAJ

Ts ChM Dr. Wan Mohd Afiq Wan Mohd Khalik

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Ts ChM Dr. Wan Mohd Afiq Wan Mohd Khalik is a senior lecturer in the Analytical Chemistry Program at the Faculty of Science and Marine Environment, Universiti Malaysia Terengganu. He earns his bachelor's degree from Universiti Malaysia Terengganu, Master's and Doctorate degrees from Universiti Kebangsaan Malaysia. He also serves as a research fellow for the Microplastic Research Interest Group (UMT) and the Centre for Water Research and Analysis (UKM). Member of professional bodies: Malaysian Institute of Chemistry, Malaysian Board of Technologists, Malaysian Analytical Sciences Society, Royal Society of Chemistry, and The Chemical Society of Japan. He has experience as an executive editor for the Malaysian Journal of Analytical Sciences (2012-present) and guest editor for the Journal Sustainability Science and Management (UMTAS special issue 2020). His research focuses on developing the microanalytical method for detecting contaminants of emerging concern in environmental water. Work as principal investigator and project member for 11 national and international grants. On record, he has a role as a supervisor for 21 undergraduate and six postgraduate levels. He actively participates in research publications with a recent record of >50 articles and citations >450. Research outcomes also have been recognized through competition awards, including two gold, three silver, and two bronze. He also received the award from Progress in Earth and Planetary Science (most downloaded paper awards 2022) and JGH Open (top cited article 2021).

Google scholar link:
https://scholar.google.com.my/citations?user=Su-IrbYAAAAJ&hl=en

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Prof. Drs. Damris Muhammad obtained Sarjana/Diploma Jambi, Indonesia from Universitas Jambi in 1990 and a master's degree from England Salford University, in 1996. Prof Damris got his Doctorate Degree from Australia Wollongong University, NSW in 2003. His area of research is Analytical and Environmental Chemistry and attended many professional trainings Basic Science Training Bandung, Indonesia University ITB, 1995. Mobile Learning Content Development Saga, Japan Saga University, 2008. Research and Teaching Quality NSW, Australia Sydney University, 2009. He holds various positions as a professor including Vice Dean for Student Affairs Faculty of Education, Univ. Jambi (2010-2014), Dean Faculty of Engineering, Univ. Jambi (2014-2018). Dean Faculty of Sciences and Technology Universitas Jambi (2018-2022). He also attended many international conferences and published many articles.

Google scholar link:

https://scholar.google.com/citations?hl=en&user=-BEBInMAAAAJ

Dr. Rani Maharani

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Indonesia

Rani Maharani is a senior lecturer at the Department of Chemistry, Universitas Padjadjaran, Indonesia where she specialises in Organic Synthesis. She obtained her Bachelor's degree in Chemistry from Universitas Padjadjaran, Indonesia in 2002 and obtained her Master's degree in Natural Product Chemistry from Institut Teknologi Bandung, Indonesia in 2005. In 2009, she furthered her studies and obtained a Doctorate degree (PhD) in Organic Synthesis from La Trobe University, Australia in 2013. She has over 15 years of teaching and research experiences, over 18 publications and 350 citations. She has also been awarded *"Sjamsul Arifin Ahmad Award For Best Young Researcher"* by the Indonesian Society of Natural Product Chemistry in 2015. She has experience in attending over 14 national and international conferences as both presenter and invited speaker, presenting her research centring around organic synthesis.

LIST OF SPEAKERS

CODE	PLENARY SPEAKER
PL-1	**Prof. Dr. Lee D. Wilson** *"Preparation and characterization of multifunctional biomaterials for sustainable development "*

CODE	KEYNOTE SPEAKERS
KN-1	**Prof. Dr. He Teng** *"Metalorganic hydrides for hydrogen storage"*
KN-2	**Prof. Dr. Sharifah Mohammad** *"Green approaches in sample preparation techniques"*
KN-3	**Prof. Dr. R. Roto** *"Electrospinning and functionality of polymer to improve sensitivity and selectivity of ammonia sensing by QCM"*

CODE	INVITED SPEAKERS
IV-1	**Assoc. Prof. Dr. Siwaporn Meejoo Smith** *"Advanced oxidation processes catalyzed by layered double hydroxide materials catalysts"*
IV-2	**Chm Dr. Lim Jun Wei** *"Sustainable fuels derived from biomasses"*
IV-3	**Dr. Rani Maharani** *"Total Synthesis of Some Bioactive Cyclopeptides and Cyclodepsipeptides"*
IV-4	**Ts ChM Dr. Wan Mohd Afiq Wan Mohd Khalik** *"Sample preparation strategies for pharmaceutical residue analysis: Progress from conventional to new green analytical method "*
IV-5	**Assoc. Prof. Dr. Mohd Hazwan Bin Hussin** *"Oil palm lignocellulosic biomass-based corrosion inhibitor: potential and opportunities "*
IV-6	**Dr. Hairul Hisham Bin Hamzah** *"3D printed electrodes-based thermoplastic carbon nanomaterials for electroanalytical analyses"*
IV-7	**Prof. Drs. Damris Muhammad** *"The use of a low-cost biochar technology as a strategy to improve the roles of smallholder of oil palm farmers in the reduction of greenhouse gas emissions from agricultural soils, Sumatra, Indonesia "*
IV-8	**Dr. Yvan Six**

	"Aminocyclopropanes as valuable precursors of nitrogen-containing polycyclic systems "

LIST OF PRESENTING PARTICIPANTS

Abstract ID and Code	Name	Title
ICYC 2022-0006 (**ANA-1**)	Ms. Aynul Sakinah Ahmad Fauzi	Fabrication of wo3/rgo-based gas sensor for the detection of ethanol gas at low temperature
ICYC 2022-0009 (**ORG-6**)	Dr. Mohamad Nurul Azmi Mohamad Taib	Design, synthesis and biological evaluation of dispiro pyrrolidine derivatives as inhibitors of Alzheimer's diseases.
ICYC 2022-0010 (**INO-12**)	Ms. Mamoona Jillani	Computational studies on diphenylphosphine ligand for non-linear optional properties
ICYC 2022-0011 (**INO-1**)	Ms. Nur Johari	Intercalation and characterization of zinc oxide with 2-methyl-4-chlorophenoxyactic acid and its effect on seed germination
ICYC 2022-0012 (**PHY-1**)	Ms. Phaik Ching Ang	Synthesis and development of EMT-Type zeolite-mediated silver nanoparticles as antibacterial agents
ICYC 2022-0013 (**IND-2(P)**)	Dr. Kavirajaa Pandian Sambasevam	Valorizing waste crab shells as renewable biomass fillers in polyaniline for ammonia gas detection
ICYC 2022-0014 (**PHY-6**)	Ms. Nur Shazwani Abdul Mubarak	Physical, chemical and optical properties of TiO2 derived from MIL-125-NH2 for the photocatalytic degradation of methylene blue
ICYC 2022-0015 (**ANA-5**)	Mr. Mohammad Albayari	Preparation and application of marine macroalgae sargassum aquifolium as new biosorbent for removal of Uranium(VI) and Thorium(IV) from aqueous solution
ICYC 2022-0016 (**INO-16(P)**)	Mr. Mohammad Irman Khalif Ahmad Aminuddin	Mineral chemistry of atoll garnet: a method to determine rock protolith
ICYC 2022-0017 (**ANA-4**)	Ms. Hanisah Abdul Rahim	Electrochemical synthesis and characterization of copper(II)-Ciprofloxacin/Decanoic acid complex
ICYC 2022-0018 (**ORG-1**)	Mr. Muhammad Solehin Abd Ghani	Isolation, characterization of chemical constituents and hemisynthesis of pentacyclic triterpenoids derivatives from ethyl acetate extract of *diospyros foxworthyi* bakh (Ebanaceae)
ICYC 2022-0019 (**INO-10**)	Ms. Yap Pui Wing	Non-linear disulphide-centered S-shaped oligomers: synthesis and mesomorphic properties

ICYC 2022-0020 (**ORG-5**)	Ms. Wan Nur Huda Hanafi	Isolation and characterization of indole alkaloids from *Kopsia terengganensis* (Apocynaceae)
ICYC 2022-0021 (**INO-9**)	Ms. Thivya Keasavan	Synthesis of waste derived material as catalyst for biodiesel
ICYC 2022-0022 (**INO-3**)	Ms. Maryam Solehah Zulkefli	Activated carbon derived from glycerin pitch for desulfurization of model diesel fuel
ICYC 2022-0023 (**INO-4**)	Dr. Farhatun Najat Maluin	Chitosan-based agronanofungicide formulations as potent antifungal agents for ganoderma disease management of oil palm
ICYC 2022-0024 (**INO-2**)	Mr. Nuraddeen Abdurrahman	A chiral cylinder-like metallomacrocycles bis tri-n-heterocyclic carbene silver(I): synthesis, characterization and anticancer study
ICYC 2022-0025 (**ORG-2**)	Ms. Noor Syarafana Firouz	Pyranocoumarins from the stem bark of *Calophyllum recurvatum* p.f.stevens
ICYC 2022-0026 (**ANA-2**)	Mr. Ganapaty Manickavasagam	Influence of topographical origin on designated physicochemical characteristics and 5-hydroxymethylfurfural content of *Heterotrigona itama* honey from different sites in the northern region of peninsular Malaysia
ICYC 2022-0027 (**INO-7**)	Ms. Normawati Jasni	Photodegradation of oxytetracycline using chitosan modified ZnO QDS under visible light irradiation
ICYC 2022-0029 (**INO-6**)	Mrs. Saima Khan Afridi	Carica papaya leaf mediated green synthesis of ZnO nanoparticles for the photocatalytic degradation of methylene blue
ICYC 2022-0030 (**ANA-10(P)**)	Ms. Nur Hidayah Sazali	Development of liquid phase microextraction using fatty acid-based deep eutectic solvent ferrofluid for determination of polycyclic aromatic hydrocarbon from environmental samples.
ICYC 2022-0031 (**INO-8**)	Ms. Siti Norhazwani Binti Ismail	Synthesis and mesomorphic properties of bent liquid crystals containing triazole core with terminal flexible alkyl chain and laterally ethoxy group
ICYC 2022-0032 (**ORG-7**)	Ms. Nurain Syazwani Zaki	Design, synthesis and characterisation of stilbene-arylcinnamide hybrids
ICYC 2022-0011	Ms. Ummi Liyana	Synthesis, characterization, in-silico and anticancer screening of isatin-3-

(**INO-11**)		thiosemicarbazones with Cu(II) and Zn(II) complexes
ICYC 2022-0034 (**ORG-3**)	Ms. Nurfirzana Liyana Binti Abdul Jaafar	Determination of chemical profile using FTIR spectra and antioxidant properties of green christia vespertillionis varieties
ICYC 2022-0035 (**ORG-8**)	Ms. Anis Najwa Mohd Wahid	Synthesis of cinnamic acid derivatives as potential anti-dengue virus
ICYC 2022-0037 (**ORG-9**)	Ms. Nadia Mohamed Yusoff	Synthesis, characterization, and in-silico studies of cinnamic acid amide against dengue protease
ICYC 2022-0038 (**ORG-10**)	Ms. Nur Rasyidah Ramli	Stability of green synthesis of silver nanoparticles (agnps) using euphorbia milii leaves extract with different solvent polarities
ICYC 2022-0039 (**INO-15(P)**)	Ms. Husna Izzati	Synthesis, Characterization, X-Ray Crystallography and Theoretical Studies of $Os3(Co)11\{PPh_2(1\text{-}C_{10}H_7)\}.H_2O$
ICYC 2022-0040 (**ANA-3**)	Ms. Rr. Widiartyasari Prihatdini	Linear and nonlinear modeling of kinetics and isotherm of malachite green dye adsorption to trimellitic-modified pineapple peel
ICYC 2022-0041 (**INO-13**)	Ms. Aunie Afifah Abdul Mutalib	Efficient photolysis of methyl orange dye by using electrogenerated copper-zinc oxide hybrid
ICYC 2022-0042 (**PHY-5**)	Mr. Nuru-Deen Jaji	Preparation, characterization, thermal degradation kinetics of BPADA-BAPP polyimide and BPADA-BAPP-Ni nanocomposite series
ICYC 2022-0045 (**ANA-7**)	Mrs. Haneen Al Othman	Evaluation of enantioselective comprehensive two-dimensional gas chromatography for the stereoisomeric analysis of chiral monoterpenes in Malaysian citrus spp. Leaf oils
ICYC 2022-0046 (**ANA-6**)	Ms. Norfarizah Hanim Hassan	A comprehensive chemical analysis of Malaysian stingless bee honey: Determination of furanic content, phenolic compounds and enantiomeric distribution of selected terpenes
ICYC 2022-0047 (**ORG-12**)	Ms. Anita Dwi Puspitasari	Mono-chloro chalcone derivatives as breast anticancer agents: synthesis, cytotoxic activity and admet prediction
ICYC 2022-0048 (**ORG-4**)	Ms. Khoirotin Fahmawati	Analysis of secondary metabolites of yellow wood (arcangelisia flava merr.) Extracts as natural dye and its antibacterial activity assay
ICYC 2022-0049 (**ORG-13**)	Ms. Nurul Amira Buslima	Potent antioxidant from ampellocissus cinnamomea tuber extract in preventing carbon tetrachloride-induced hepatic damaged rats

ICYC 2022-0050 (**PHY-2**)	Ms. Nur Aida	Bimetallic gold-silver embedded styrene-methyl methacrylate core-shell nanostructure (SMMA@AuAg) as high-performance thin film surface-enhanced raman spectroscopy (SERS) substrate
ICYC 2022-0052 (**INO-5**)	Dr. Mohd Ridhwan Adam	Application of natural zeolite clinoptilolite for the removal of ammonia in wastewater
ICYC 2022-0053 (**PHY-3**)	Mr. Khai Chen Tan	Metallo-n-heterocycles - a new family of hydrogen storage material
ICYC 2022-0054 (**ORG-11**)	Dr. Abdul Qaiyum Ramle	Supramolecular assembly and spectroscopic characterization of indolenine-barbituric acid zwitterions
ICYC 2022-0055 (**PHY-4**)	Mr. Muhammad Farhan Hanafi	Photocatalytic degradation of phenol using electrogenerated titanium nanoparticles catalyst in the aqueous solution
ICYC 2022-0057 (**BCHEM-1(P)**)	Dr. Siti Nor Atika Baharin	Evaluation of physicochemical properties of coconut water collected between shoreline and outskirt area of Port Dickson, Negeri Sembilan Malaysia
ICYC 2022-0058 (**BCHEM-3(P)**)	Ms. Siti Nursyazwani Maadon	Screening of antioxidant properties in M1V4 mutant line of taro (*colocasia esculenta*) cv. Wangi
ICYC 2022-0059 (**BCHEM-**4(**P))**	Ms. Nor'aishah Hasan	Prelimanary phytochemical screening of medicinal herb, sambau paya (*chloranthus erectus*)
ICYC 2022-0060 (**BCHEM-2(P)**)	Dr. Nurul Hidayah Adenan	Influence of pre-treated local fruit peels in remediating dye pollutant
ICYC 2022-0061 (**BCHEM-5(P)**)	Ms. Suwaibah Mohamed	The antimicrobial activity of natural products (honey, habbatus sauda and coconut water) against selected gram-positive bacteria and gram-negative bacteria.
ICYC 2022-0063 (**PHY-7(P)**)	Ms. Nurul Huda Heri	Enhanced stability of topical cyclosporine-loaded nanoemulsion: optimization, characterization and release kinetics
ICYC 2022-0064 (**ANA-8**)	Dr. Akil Ahmad	Use of chemically treated lemon peel as biosorbent: Preparation, characterization and application

ICYC 2022-0051 (**ORG-14**)	Misbahu Said Ahmad	Green synthesis of 1-indanone chalcones: the review

Programme Summary

Day 1: 18th of October 2022 (Tuesday)

Time	Programme	Platform
0800 - 0825	Login and Registration	ROOM 1
0830 - 0900	Welcome Address & Opening Ceremony	ROOM 1
0905 - 0950	Plenary Lecture	ROOM 1
0955 - 1010	Presentation by CDD Vault	ROOM 1
1015 - 1100	Presentation by Invited Speakers (4 Parallel Modules)	ROOM 1, 2, 3, and 4
1105 - 1255	Oral Presentation (2 Parallel Modules)	ROOM 1 and 2
1300 - 1400	Lunch Break	
1405 - 1450	Keynote Lecture	ROOM 1
1455 - 1645	Oral Presentation (2 Parallel Modules)	ROOM 1 and 2

Day 2: 19th of October 2022 (Wednesday)

Time	Programme	Platform
0830 - 0915	Keynote Lecture	ROOM 1
0920 - 0930	Presentation by Nexus Analytics	ROOM 1
0935 - 1225	Oral Presentation (2 parallel modules)	ROOM 1 and 2
1230 – 1350	Lunch Break	
1355 – 1440	Presentation by Invited Speakers (4 parallel modules)	ROOM 1, 2, 3, and 4
1445 – 1615	Oral Presentation (2 parallel modules)	ROOM 1 and 2

Day 3: 20th of October 2022 (Thursday)

Time	Programme	Platform
0830 - 0840	Presentation by Perkin Elmer	ROOM 1
0845 - 0945	Poster Presentation	ROOM 1
0950 - 1050	Poster Presentation	ROOM 1
1055 – 1140	Keynote Lecture	ROOM 1
1145 – 1230	Closing Ceremony	ROOM 1

Schedule Overview

Date	Time	Program			
18th of October 2022 (Day 1)	0800 - 0825	Virtual Platform Open for Login (ROOM 1)			
	0830 - 0900	Welcome Address and Opening of 8th ICYC (ROOM 1)			
	0905 - 0950	Plenary Lecture: **Prof Dr Lee D Wilson** (ROOM 1)			
	0955 - 1010	Presentation by CDD Vault (ROOM 1)			
	Platform	**ROOM 1**	**ROOM 2**	**ROOM 3**	**ROOM 4**
	1015 - 1100	Invited speaker 1 **Assoc. Prof. Dr Siwaporn Meejoo Smith** (INO)	Invited speaker 2 **Chm Dr Lim Jun Wei** (PHY)	Invited speaker 3 **Dr. Rani Maharani** (ORG)	Invited speaker 4 **Ts ChM Dr. Wan Mohd Afiq Wan Mohd Khalik** (ANA)
	Session	**Oral presentations**			
	Platform	**ROOM 1**	**ROOM 2**		
	1105 - 1255	ORG-1	INO-1		
		ORG-2	INO-2		
		ORG-3	INO-3		
		ORG-4	INO-4		
		ORG-5	INO-5		
	1300 – 1400	Lunch break			
	1405 - 1450	Keynote Lecture 1: **Prof Dr He Teng** (ROOM 1)			
	Session	**Oral presentations**			
	Platform	**ROOM 1**	**ROOM 2**		
	1455 - 1645	ANA-1	PHY-1		
		ANA-2	PHY-2		
		ANA-3	PHY-3		
		ANA-4	PHY-4		
		ANA-5	PHY-5		
19th of October 2022 (Day 2)	0830 - 0915	Keynote Lecture 2: **Prof Dr Sharifah Mohammad** (ROOM 1)			
	0920 - 0930	Presentation by Nexus Analytics (ROOM 1)			
	Session	**Oral presentations**			
	Venue	**ROOM 1**	**ROOM 2**		
	0935 - 1225	ORG-6	INO-6		
		ORG-7	INO-7		
		ORG-8	INO-8		
		ORG-9	INO-9		
		ORG-10	INO-10		
	1230 – 1350	Lunch break			
	Venue	**ROOM 1**	**ROOM 2**	**ROOM 3**	**ROOM 4**
	1355 – 1440	Invited speaker 5 **Assoc. Prof. Dr. Mohd Hazwan Bin Hussin** (IND)	Invited speaker 6 **Dr. Hairul Hisham Bin Hamzah** (ANA)	Invited speaker 7 **Prof. Drs. Damris Muhammad** (ANA)	Invited speaker 8 **Dr Yvan Six** (ORG)
	Session	**Oral presentations**			
	Venue	**ROOM 1**	**ROOM 2**		
	1445 – 1635	ORG-11	ANA-6		
		ORG-12	ANA-7		
		ORG-13	ANA-8		
		ORG-14	INO-11		
		INO-12	PHY-6		
		INO-13	-		

20th of October 2022 (Day 3)	0830 – 0840	Presentation by Perkin Elmer (ROOM 1)
	0845 - 0945	**Poster presentation session (ROOM 1)**
		BCHEM-1(P)
		BCHEM-2(P)
		BCHEM-3(P)
		BCHEM-4(P)
		BCHEM-5(P)
	0950-1050	**Poster presentation session (ROOM 1)**
		ANA-10(P)
		PHY-7(P)
		IND-2(P)
		INO-15(P)
		INO-16(P)
	1055 – 1140	Keynote Lecture 3: **Prof. Dr. R. Roto** (ROOM 1)
	1145 – 1230	Closing ceremony

Note: Oral presenters will be allotted a maximum of 20 min to present including Q&A session.

Research Areas:

Analytical Chemistry (ANA)	Organic Chemistry (ORG)
Industrial Chemistry (IND)	Physical Chemistry (PHY)
Inorganic Chemistry (INO)	Biochemistry (BCHEM)

Detailed Schedule

Day 1: 18th of October 2022 (Tuesday)

Plenary Lecture

Room 1		
Session Chairperson: Prof. Dr. Yeap Guan Yeow		
Time	**Code**	**Title**
0905 - 0950	PL-1	**Preparation and characterization of multifunctional biomaterials for sustainable development** Prof. Dr. Lee D Wilson

Keynote Lecture

Room 1		
Session Chairperson: Dr. Chua Yong Shen		
Time	**Code**	**Title**
1405 – 1450	KN-2	**Metalorganic hydrides for hydrogen storage** Prof. Dr. He Teng

Invited Speakers

Room 1		
Session Chairperson: Assoc Prof. Dr. Noor Haida binti Mohd Kaus		
Time	**Code**	**Title**
1015 - 1100	IV-1	**Advanced oxidation processes catalyzed by layered double hydroxide materials catalysts** Assoc. Prof. Dr. Siwaporn Meejoo Smith
Room 2		
Session Chairperson: Assoc Prof. Dr. Noor Hana Hanif binti Abu Bakar		
Time	**Code**	**Title**
1015 - 1100	IV-2	**Sustainable fuels derived from biomasses** Chm Dr. Lim Jun Wei
Room 3		
Session Chairperson: Assoc Prof. Dr. Oo Chuan Wei		
Time	**Code**	**Title**
1015 - 1100	IV-3	**Total Synthesis of Some Bioactive Cyclopeptides and Cyclodepsipeptides** Dr. Rani Maharani
Room 4		
Session Chairperson: Dr. P. Bothi Raja		
Time	**Code**	**Title**
1015 - 1100	IV-4	**Sample preparation strategies for pharmaceutical residue analysis: Progress from conventional to new green analytical method**

		Ts ChM Dr. Wan Mohd Afiq Wan Mohd Khalik

Oral Presentation

Room 1		
Session Chairperson: Dr. Yeoh Kar Kheng		
Time	**Code**	**Title**
1105 - 1255	ORG-1	**Isolation, characterisation of chemical constituents and hemisynthesis of pentacyclic triterpenoids derivatives from ethyl acetate extract of *Diospyros foxworthyi* bakh. (ebenaceae)** Mr. Muhammad Solehin Abd Ghani
	ORG-2	**Pyranocoumarins from the stem bark of *Calophyllum recurvatum* p.f.stevens** Ms. Noor Syarafana Firouz
	ORG-3	**Determination of chemical profile using ftir spectra and antioxidant properties of green *Christia vespertillionis* varieties** Ms. Nurfirzana Liyana Binti Abdul Jaafar
	ORG-4	**Analysis of secondary metabolites of yellow wood (*Arcangelisia flava merr.*) extracts as natural dye and its antibacterial activity assay** Ms. Khoirotin Fahmawati
	ORG-5	**Isolation and characterisation of indole alkaloids from *Kopsia terengganensis* (apocynaceae)** Ms. Wan Nur Huda Hanafi
Room 1		
Session Chairperson: Dr. Lim Gin Keat		
Time	**Code**	**Title**
1455 - 1645	ANA-1	**Fabrication of wo3/rgo-based gas sensor for the detection of ethanol gas at low temperature** Ms. Aynul Sakinah Ahmad Fauzi
	ANA-2	**Influence of topographical origin on designated physicochemical characteristics and 5-hydroxymethylfurfural content of *Heterotrigona itama* honey from different sites in the northern region of peninsular Malaysia** Mr. Ganapaty Manickavasagam
	ANA-3	**Linear and nonlinear modeling of kinetics and isotherm of malachite green dye adsorption to trimellitic-modified pineapple peel** Ms. Rr. Widiartyasari Prihatdini
	ANA-4	**Electrochemical synthesis and characterization of copper(ii)-ciprofloxacin/decanoic acid complex** Ms. Hanisah Abdul Rahim

	ANA-5	**Preparation and application of marine macroalgae sargassum aquifolium as new biosorbent for removal of uranium(vi) and thorium(iv) from aqueous solution** Mr. Mohammad Albayari

Room 2		
Session Chairperson: Assoc. Prof. Dr. Siwaporn Meejoo Smith		
Time	**Code**	**Title**
1105 - 1255	INO-1	**Intercalation and characterization of zinc oxide with 2-methyl-4-chlorophenoxyacetic acid and its effect on seed germination** Ms. Nur Johari
	INO-2	**A chiral cylinder-like metallomacrocycles bis tri-n-heterocyclic carbene silver(I): synthesis, characterization and anticancer study** Mr. Nuraddeen Abdurrahman
	INO-3	**Activated carbon derived from glycerin pitch for desulfurization of model diesel fuel** Ms. Maryam Solehah Zulkefli
	INO-4	**Chitosan-based agronanofungicide formulations as potent antifungal agents for ganoderma disease management of oil palm** Dr. Farhatun Najat Maluin
	INO-5	**Application of natural zeolite clinoptilolite for the removal of ammonia in wastewater** Dr. Mohd Ridhwan Adam
Room 2		
Session Chairperson: Dr. Ng Si Ling		
Time	**Code**	**Title**
1455 - 1645	PHY-1	**Synthesis and development of emt-type zeolite mediated silver nanoparticles as antibacterial agents** Ms. Phaik Ching Ang
	PHY-2	**Bimetallic gold-silver embedded styrene-methyl methacrylate core-shell nanostructure (smma@auag) as high-performance thin film surface-enhanced raman spectroscopy (sers) substrate** Ms. Nur Aida
	PHY-3	**Metallo-N-Heterocycles – A new family of hydrogen storage material** Mr. Khai Chen Tan
	PHY-4	**Photocatalytic degradation of phenol using electrogenerated titanium nanoparticles catalyst in the aqueous solution** Mr. Muhammad Farhan Hanafi

	PHY-5	**Preparation, characterization, thermal degradation kinetics of bpada-bapp polyimide and bpada-bapp-ni nanocomposite series** Mr. Nuru-Deen Jaji

Day 2: 19th of October 2022 (Wednesday)

Keynote Lecture

Room 1		
Session Chairperson: Assoc Prof. Dr. Melati binti Khairuddean		
Time	**Code**	**Title**
0830 - 0915	KN-1	**Green approaches in sample preparation techniques** Prof Dr Sharifah Mohammad

Invited Speakers

Room 1		
Session Chairperson: Dr. Shangeetha Ganesan		
Time	**Code**	**Title**
1355 – 1440	IV-5	**Oil palm lignocellulosic biomass-based corrosion inhibitor: potential and opportunities** Assoc. Prof. Dr. Mohd Hazwan Bin Hussin
Room 2		
Session Chairperson: Dr. Mardiana binti Saaid		
Time	**Code**	**Title**
1355 – 1440	IV-6	**3D printed electrodes-based thermoplastic carbon nanomaterials for electroanalytical analyses** Dr. Hairul Hisham Bin Hamzah
Room 3		
Session Chairperson: Assoc Prof. Dr. Mohamad Nasir bin Mohamad Ibrahim		
Time	**Code**	**Title**
1355 – 1440	IV-7	**The use of a low-cost biochar technology as a strategy to improve the roles of smallholder of oil palm farmers in the reduction of greenhouse gas emissions from agricultural soils, Sumatra, Indonesia** Prof. Drs. Damris Muhammad
Room 4		
Session Chairperson: Dr. Mohamad Nurul Azmi bin Mohamad Taib		
Time	**Code**	**Title**
1355 – 1440	IV-8	**Aminocyclopropanes as valuable precursors Of nitrogen-containing polycyclic systems**

		Dr Yvan Six

Oral Presentation

Room 1

Session Chairperson: Dr. Mohd Ridhwan bin Adam

Time	Code	Title
0935 - 1225	ORG-6	**Design, synthesis and biological evaluation of dispiro pyrrolidine derivatives as inhibitors of Alzheimer's diseases.** Dr. Mohamad Nurul Azmi Mohamad Taib
	ORG-7	**Design, synthesis and characterisation of stilbene-arylcinnamide hybrids** Ms. Nurain Syazwani Zaki
	ORG-8	**Synthesis of cinnamic acid derivatives as potential anti-dengue virus** Ms. Anis Najwa Mohd Wahid
	ORG-9	**Synthesis, characterization, and in-silico studies of cinnamic acid amide against dengue protease** Ms. Nadia Mohamed Yusoff
	ORG-10	**Stability of green synthesis of silver nanoparticles (agnps) using *Euphorbia milii* leaves extract with different solvent polarities** Ms. Nur Rasyidah Ramli

Room 1

Session Chairperson: Assoc. Prof. Dr. Lee Hooi Ling

Time	Code	Title
1445 – 1615	ORG-11	**Supramolecular assembly and spectroscopic characterization of indolenine-barbituric acid zwitterions** Dr. Abdul Qaiyum Ramle
	ORG-12	**Mono-chloro chalcone derivatives as breast anticancer agents: synthesis, cytotoxic activity and admet prediction** Ms. Anita Dwi Puspitasari
	ORG-13	**Potent antioxidant from ampellocissus cinnamomea tuber extract in preventing carbon tetrachloride-induced hepatic damaged rats** Ms. Nurul Amira Buslima
	ORG-14	**Green synthesis of 1-indanone chalcones: the review** Misbahu Said Ahmad
	INO-12	**Computational studies on diphenylphosphine ligands for nonlinear optical properties** Ms. Mamoona Jillani
	INO-13	**Efficient photolysis of methyl orange dye by using electrogenerated copper-zinc oxide hybrid** Ms. Aunie Afifah Abdul Mutalib

Room 2		
Session Chairperson: Dr. Ahmad Faiz Bin Abdul Latip		
Time	**Code**	**Title**
0935 – 1225	INO-6	**Carica papaya leaf mediated green synthesis of ZnO nanoparticles for the photocatalytic degradation of methylene blue** Mrs. Saima Khan Afridi
	INO-7	**Photodegradation of oxytetracycline using chitosan modified ZnO QDS under visible light irradiation** Ms. Normawati Jasni
	INO-8	**Synthesis and mesomorphic properties of bent liquid crystals containing triazole core with terminal flexible alkyl chain and laterally ethoxy group** Ms. Siti Norhazwani Binti Ismail
	INO-9	**Synthesis of waste derived material as catalyst for biodiesel** Ms. Thivya Keasavan
	INO-10	**Non-linear disulphide-centred s-shaped oligomers: synthesis and mesomorphic properties** Ms. Yap Pui Wing
Room 2		
Session Chairperson: Dr. Mohammad Anwar Mohamed Iqbal		
1445 – 1615	ANA-6	**A comprehensive chemical analysis of malaysian stingless bee honey: determination of furanic content, phenolic compounds and enantiomeric distribution of selected terpenes** Ms. Norfarizah Hanim Hassan
	ANA-7	**Evaluation of enantioselective comprehensive two-dimensional gas chromatography for the stereoisomeric analysis of chiral monoterpenes in malaysian citrus spp. Leaf oils** Mrs. Haneen Al Othman
	ANA-8	**Use of chemically treated lemon peel as biosorbent: Preparation, characterization and application** Dr. Akil Ahmad
	INO-11	**Synthesis, characterization, in-silico and anticancer screening of isatin-3-thiosemicarbazones with Cu(II) and Zn(II) complexes** Ms. Ummi Liyana
	PHY-6	**Physical, chemical and optical properties of TiO_2 derived from MIL-125-NH2 for the photocatalytic degradation of methylene blue** Ms. Nur Shazwani Abdul Mubarak

Day 3: 20th of October 2022 (Thursday)

Keynote Lecture

Room 1		
Session Chairperson: Dr. Oh Wen Da		
Time	**Code**	**Title**
1055 – 1140	Keynote	**Electrospinning and functionality of polymer to improve sensitivity and selectivity of ammonia sensing by QCM** Prof. Dr. R. Roto

Poster Presentation

Room 1		
Session Chairperson: Dr. Abdul Qaiyum bin Ramle		
Time	**Code**	**Title**
0845 - 0945	BCHEM-1(P)	**Evaluation of physicochemical properties of coconut water collected between shoreline and outskirt area of port dickson, negeri sembilan malaysia** Dr. Siti Nor Atika Baharin
	BCHEM-2(P)	**Influence of pre-treated local fruit peels in remediating dye pollutant** Dr. Nurul Hidayah Adenan
	BCHEM-3(P)	**Screening of antioxidant properties in m1v4 mutant line of taro (C*olocasia esculenta*) cv. Wangi** Ms. Siti Nursyazwani Maadon
	BCHEM-4(P)	**Prelimanary phytochemical screening of medicinal herb, sambau paya (chloranthus erectus)** Ms. Nor'aishah Hasan
	BCHEM-5(P)	**Influence of pre-treated local fruit peels in remediating dye pollutant** Ms. Suwaibah Mohamed
Room 1		
Session Chairperson: Dr. Farhatun Najat binti Maluin		
Time	**Code**	**Title**
0950-1055	ANA-10(P)	**Development of liquid phase microextraction using fatty acid-based deep eutectic solvent ferrofluid for determination of polycyclic aromatic hydrocarbon from environmental samples.** Ms. Nur Hidayah Sazali
	PHY-7(P)	**Enhanced stability of topical cyclosporine-loaded nanoemulsion: optimization, characterization and release kinetics** Ms. Nurul Huda Heri
	IND-2(P)	**Valorizing waste crab shells as renewable biomass fillers in polyaniline for ammonia gas detection** Dr. Kavirajaa Pandian Sambasevam

	INO-15(P)	**Synthesis, characterization, x-ray crystallography and theoretical studies of $Os_3(CO)_{11}\{PPh_2(1\text{-}C_{10}H_7)\}$.H2O** Ms. Husna Izzati
	INO-16(P)	**Mineral chemistry of atoll garnet: A method to determine rock protolith** Mr. Muhammad Irman Khalif Ahmad Aminuddin

Plenary Speaker

PLENARY SPEAKER

Prof Dr Lee D Wilson

ADDRESSING WATER SECURITY BY CONTROLLED REMOVAL OF ENVIRONMENTALLY RELEVANT CONTAMINANTS WITH SUSTAINABLE ADSORBENTS

Lee D. Wilson

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Concerns for human and ecosystem health relate to the fate and transport of oxyanion species such as phosphate, nitrate, and sulfate in aquatic environments. Biopolymer flocculants and adsorbents offer a green strategy for the controlled removal of oxyanion species in water and wastewater due to their tunable molecular properties and sustainability [1-2]. For the case of solid-liquid treatment systems, the use of chemical additives and reduction of secondary pollution, as compared with conventional treatment methods. This presentation will provide an overview of our research efforts related to the use of biopolymer platforms for the removal of waterborne contaminants. As well, an overview of the development of biopolymer systems for the controlled removal of environmentally relevant ions (e.g., oxyanions and heavy metals) will be outlined. In particular, case studies of biomaterials with hierarchical structure are described, where synthetic modification (surface functionalization, cross-linking, and composite formation) that display enhanced physicochemical properties related to adsorption and responsiveness to external external stimuli (pH, ionic strength, temperature, chemical species, etc.) are described [3,4]. This research contributes to addressing water security through the development of functional bioadsorbents for addressing Grand Challenges in sustainable water treatment, catalysis, and sensor technology [2,5,6].

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3. Udoetok, I. A.; Wilson, L. D.; Headley, J. V. Self-Assembled and Cross-Linked Animal and Plant-Based Polysaccharides: Chitosan−Cellulose Composites and Their Anion Uptake, ACS Appl. Mater. Interfaces, 2016, 8, 33197–33209.

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Keynote Speaker

KEYNOTE SPEAKER 1

Prof Dr Sharifah Mohammad

GREEN APPROACHES IN SAMPLE PREPARATION TECHNIQUES

Sharifah Mohamad*

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The analytical chemistry community is striving to apply the principles of Green Analytical Chemistry in the analytical chemistry laboratory, which redefines analytical procedures, with a drastically changed philosophy on analytical method development. Among the various steps that constitute the analytical workflow, sample preparation is considered to be the most challenging step of the analytical procedure. While no sample preparation is clearly the most environmentally friendly approach, complete elimination of this step is not always practical. In such cases, the sample preparation techniques with green materials are considered ideal alternatives. In this talk, we focus mainly on various green materials such cyclodextrin, ionic liquid and low-transition-temperature mixtures (LTTMs) solvent for separation studies. In addition, we share our experience with transforming kitchen waste to inexpensive chemicals. We are discovering the hidden potential of the kitchen wastes as useful resources for analytical application, with a concept "*everything is chemicals through the eyes of a chemist*".

Keywords: Sample preparation, green materials, separation

KEYNOTE SPEAKER 2

Prof Dr He Teng

METALORGANIC HYDRIDES FOR HYDROGEN STORAGE

Teng He

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Tremendous research efforts have been given to the development of inorganic hydrides such as alanates, amide-hydride composites, borohydrides, etc. in the past two decades. As compared with the extensively explored inorganic hydrides, less organic hydrides were identified, undervaluing the potential of the large family of organic compounds. The difficulties in manipulating the thermodynamic properties and selectivity in the dehydrogenation of organic hydrides may account for the main reasons. In light of no materials developed to date could fully meet the practical requirements for hydrogen storage in terms of thermodynamic/kinetic properties, reversibility, hydrogen capacity, safety and cost etc., a breakthrough in the development of novel material system is highly needed. The idea we discuss here is the hybridization of inorganic and organic hydrides to form a new family of hydrogen storage material namely metalorganic hydride.

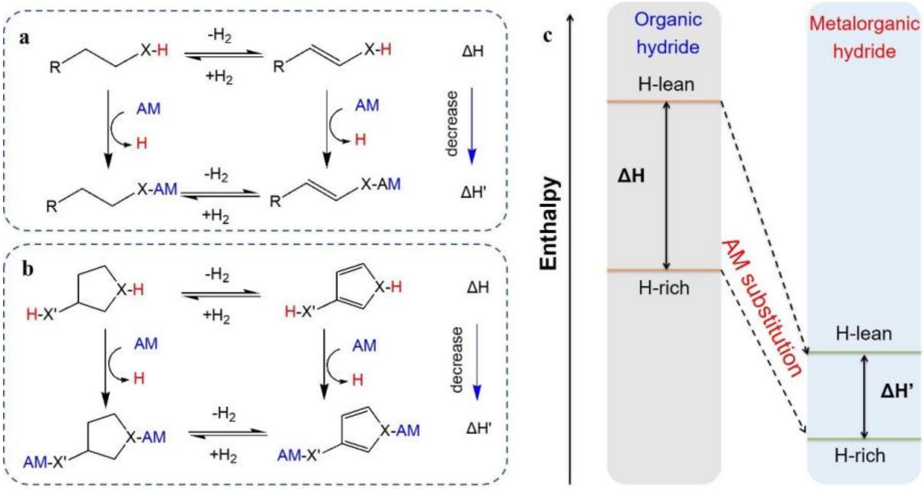

Fig. 1. (a, b) The metallation strategy for synthesizing AM-aliphatic and -cyclic organic hydrides to tune thermodynamic properties, X = N, O, S, P etc.; (c) Scheme of thermodynamic optimization by AM substitution.

Keywords: Hydrogen Storage; Metalorganic Hydrides; Thermodynamic modification

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KEYNOTE SPEAKER 3

Prof. Drs. Roto

ELECTROSPINNING AND FUNCTIONALITY OF POLYMER TO IMPROVE SENSITIVITY AND SELECTIVITY OF AMMONIA SENSING BY QCM

Roto Roto[1,*], Sintia Ainus Sofa[1], Aditya Rianjanu[2], Nur Aisyah Humairah[2], Ahmad Kusumaatmaja[2], and Kuwat Triyana[2]

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The sensitivity and selectivity of a gas sensor by the quartz crystal microbalance (QCM) method are the focuses of analytical methods. Detection of ammonia gas is essential for tracking the amount of ammonia in the air and in the human body to understand the extent of renal disease. We have developed an ammonia detection technique by QCM through sensing surface modification by electrospinning method, the addition of doping, and molecularly imprinted polymer (MIP) technique. Doping with boric acid, tartaric acid, citric acid, and oxalic acid improved the analytical parameters of ammonia. In addition, the molecularly imprinted polymer of the electrospun polyvinyl acetate (PVAc) nanofiber further improved the selectivity. The structural and chemical surface morphology of the nanofiber-based active layers on top of the QCM was confirmed by FTIR spectroscopy, SEM, and AFM. The sensitivity of the PVAc nanofiber-based QCM sensor doped with citric acid was found to be the highest (2.95 Hz/ppm) among others and had a limit of detection (LOD) of down to the sub-ppm level (550 ppb). The produced QCM sensor with boric acid doping had an ammonia sensing sensitivity of 0.079 Hz/ppm. In addition, the QCM sensor obtained by MIP showed a sensitivity of 0.243 Hz/ppm, three times greater than the former. In addition, it gave much better selectivity over other gases or vapors, including similarly structure trimethylamine, methylamine, and household gases. It proves that the QCM electrode modified with PVAc by electrospinning and doped acids combined with the MIP method increased the sensing performance. This improved QCM sensing technique is expected to be an alternative to detecting ammonia in the air.

Keywords: QCM, MIP, PVAc, boric acid, ammonia

Invited Speaker

INVITED SPEAKER 1

Assoc. Prof. Dr Siwaporn Meejoo Smith

ADVANCED OXIDATION PROCESSES CATALYZED BY LAYERED DOUBLE HYDROXIDE MATERIALS CATALYSTS

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Polluted wastewater containing organic substances requires a proper management to ensure that the quality of wastewater effluent meets the water quality standards before being discharged to the environment. This work presents a critical review of existing research reports involving the removal of organic pollutants from water, by using layered hydroxide materials. A number of processes, *i.e* adsorption, ion exchange, intercalation reactions, and catalytic oxidation may be simultaneously occurred, being responsible for high removal efficiencies of the organic pollutants from water. It also highlights an up-to-date research study focusing the performance of copper based layered double hydroxide materials in the removal or various organic pollutants. Determination of degradation products and hydroxyl radicals can probe the oxidation of organic pollutants, while structural changes in the layered double hydroxide materials may give an important insight into any intercalation reactions. The performance of layered double hydroxide materials will be discussed, in terms of the relation between their structural and chemical properties, and the feasibility as real-life catalysts for environmental application.

Keywords: Catalysis, Advanced oxidation processes, Layered double hydroxide

Research area (s): *Materials Chemistry, Catalysis, Wastewater remediation*

INVITED SPEAKER 2

Chm Dr Lim Jun Wei

SUSTAINABLE FUELS DERIVED FROM BIOMASSES

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In moving forward to many generations ahead, the consumptions of fossil fuels have been proven infeasible, primarily due to the paucity of natural resources that are non-renewable upon the depletion. For worse, the consumptions of fossil fuels also have engendered myriad environmental menaces that inflict the well-beings of humans and other livings insidiously. Indeed, the main concern associated to the combustion of fossil fuels for energy production is the spew of greenhouse gasses that giving rise to the global warming and climate change calamities. In this regard, the leaders around the world have preached to reduce the greenhouse gasses production, whilst advocating the net zero carbon emission. In achieving this ultimate goal, the sustainable fuels derived from various biomasses have gradually substituted the fossil fuels and will be replaced utterly in 2 decades' time or sooner. These sustainable fuels are widely known as biofuels since the feedstocks are harvested from biomasses. The biofuels are encompassing biodiesel, bioethanol, biogas and biohydrogen or green hydrogen. The first generation of biofuels are mainly derived from food sources that have caused food versus fuel debate. The conundrums are propagating to the second generation of biofuels when the non-food sources are employed to produce fuels. The use of waste cooking oils, for instances, has complicated the chemical conversion processes using catalysts due to the presence of inevitable inhibitors in the oils. Moreover, the conversion of lignocellulosic materials that are abundant in nature entails intensive energy and extensive time before the biofuels are generated. As the land-based biomasses still require further investigations in refining the production processes of biofuels, the cultivation of microalgae particularly in water medium has gained tremendous momentums in recent years. Thereby, crowding out as the third generation of biofuel feedstocks that have been studied in almost every part of the world. The investigations involving microalgal biofuels cover type of species, environmental factors, metabolic activities as well as the downstream processes such as harvesting, dewatering, conversion technologies, etc. The most recent advancement in altering the genes of microalgal cells to strengthen and fasten its growth has led to the fourth generation of biofuels that are derived from the genetically modified microalgae. In fact, the biorefineries are now paving the way not only for the biofuels production, but also other valuable biochemicals in satiating the rising demands, while assuaging the untoward threats to the environments.

INVITED SPEAKER 3

Dr Yvan Six

AMINOCYCLOPROPANES AS VALUABLE PRECURSORS OF NITROGEN-CONTAINING POLYCYCLIC SYSTEMS

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Bicyclic aminocyclopropane compounds constitute a special class of strained molecules which can undergo cyclopropane-ring opening under a variety of conditions [1,2]. During this talk, several examples will be presented, obtained in our group over the last few years [3-6]. The mechanisms of these reactions involve the generation of reactive species, such as iminium, enamine or azomethine ylid derivatives.

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INVITED SPEAKER 4

Dr. Hairul Hisham Bin Hamzah

3D printed electrodes-based thermoplastic carbon nanomaterials for electroanalytical analyses

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3D-printing or additive manufacturing is presently an emerging technology to reshape traditional manufacturing processes. The electrochemistry field can undoubtedly take advantage of this technology to fabricate electrodes to create a new generation of electrodes that could replace conventionally manufactured electrodes. In the electrochemistry research area, studies to date show that there is a demand for electrically 3D printable conductive thermoplastic carbon nanomaterial filaments where these materials can be printed out through an extrusion process based upon the fused deposition modelling (FDM) method. FDM could be used to manufacture novel electrochemical 3D printed electrodes for electrochemical sensor and biosensor applications. This is due to the FDM method being the most affordable 3D printing technique since conductive and non-conductive thermoplastic filaments are commercially available. Hence, based on additive manufacturing, this technology has a significant potential to produce a new generation of electrodes for electroanalytical analyses.

INVITED SPEAKER 5

Assoc. Prof. Dr. Mohd Hazwan Bin Hussin

OIL PALM LIGNOCELLULOSIC BIOMASS-BASED CORROSION INHIBITOR: POTENTIAL AND OPPORTUNITIES

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Malaysia is known to be one of the major producers of palm oil-based products. It was revealed that Malaysia generates more than 50 million tonnes of lignocellulosic biomass waste from oil palm industries without further utilization. Lignin from biomass waste is well known for their antioxidant activities as well as green in nature. Nevertheless, the complex structure of lignin makes it almost impossible for it to be used in any application, hence required some modification to improve the physicochemical properties. The current research shed lights on the utilization lignin from oil palm biomass waste as corrosion inhibitor for metals. The extracted lignins were modified *via* inclusion of organic scavengers as well as fractionation through ultrafiltration methods. The improved properties of lignin by means of their phenolic content, molecular weight, antioxidant and dissolution after the modification were observed. Electrochemical tests revealed that oil palm lignin gave more than 90 % of inhibition efficiencies towards the corrosion of mild steel in acidic solution. Improved properties of lignin give more opportunities for their later applicability in various applications.

Keywords: Oil palm; lignin; corrosion inhibitors.

INVITED SPEAKER 6

Ts ChM Dr. Wan Mohd Afiq Wan Mohd Khalik

SAMPLE PREPARATION STRATEGIES FOR PHARMACEUTICAL RESIDUE ANALYSIS: PROGRESS FROM CONVENTIONAL TO NEW GREEN ANALYTICAL METHOD

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Pharmaceutical active compounds (PhACs) residue has received great attention as potential bioactive chemicals in the environment. These classes of PhACs are considered emerging pollutants because they remain unregulated or biogeochemical cycle not fully understood. Literature studies have demonstrated that despite the relatively low concentrations of pharmaceuticals found in the environment (typically in sub-parts-per-billion levels), the residue is of ecological concern due to their potential long-term adverse effects on humans and non-target organisms. Optimizing the analytical methods, especially the part of sample preparation, is critical for determining their presence and avoiding targeted analytes loss. Major challenges include therapeutic class having a wide range of polarity, derive metabolite and PhACs stability in organic solvents. In early stage method development, conventional sample preparation like solid phase extraction becomes a good selection. No doubt, the proposed method can detect analytes below one ppb. Anyhow, the efficiency of the developed process is subject to solvent dependence. Other demerits include low reusability, lengthy steps, and the need for additional treatment for waste during the post-extraction stage. New proposed analytical methods should offer good merits like low reproducibility, repeatability, or detection limits without sacrificing method performance. We propose two extraction methods during research exploration: thin film microextraction and dispersive liquid phase microextraction. The design of thin film as a mini device offers high detection due to high extractive phase capacity, geometry availability (large surface area) and divergence coating materials. For liquid phase microextraction, an extracting agent is replaced with a green solvent, e.g., deep eutectic, ionic liquid, and supramolecular. For dispersion strategy, solventless step (e.g., effervescent, mechanical stirring, air-assisted) shows method performance in good merits and is suitable for routine analysis. Miniaturise concepts help the researcher design facile methods, especially merging multi-stage steps into single devices. Considering a green profile assessment as a tool for evaluation (e.g., analytical eco-scale, GAPI, AGREE metric), the proposed method offers a higher number of green criteria. Method falls under excellent score and pictogram dominance with the green segment.

Keywords: microanalytical; green solvent; green profile assessment; solventless method

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INVITED SPEAKER 7

Prof. Drs. Damris Muhammad

THE USE OF A LOW-COST BIOCHAR TECHNOLOGY AS A STRATEGY TO IMPROVE THE ROLES OF SMALLHOLDER OF OIL PALM FARMERS IN THE REDUCTION OF GREENHOUSE GAS EMISSIONS FROM AGRICULTURAL SOILS, SUMATRA INDONESIA

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Indonesia is the largest producer of palm oil in the world. Smallholder of oil palm farmers accounts for more than 41% of approximately more than 15 million hectares of the oil palm plantation in Indonesia. Agriculture contributes 25% to the greenhouse gases (CO_2, NH_4 and N_2O) emissions worldwide. However, the roles of the smallholder of oil palm farmers on the GHG emissions reduction remain unclear. Biochar, based on the current research findings, is potentially capable to reduce the GHG emissions from agricultural soils. To reduce these GHG emissions from the soil of small holder oil palm farmers there is an urgent need to integrate a simple technology of producing biochar that the farmers can be used for improvement of soil health and reduction of GHG emission. In this study a low-cost biochar technology (LCBT) was used to produce biochar using palm-shell as feeding materials. This study aimed to reduce the soil CO_2, CH_4 and N_2O gas emissions by amending the biochar to the soils. To achieve the goal three replicates of experimental plots were set up in the field of oil palm plantation in Muaro Jambi Indonesia measuring 50-m x 50-m for a total of 27 subplots measuring 1-m x 1-m. For each subplot biochar was amended to the soils varying of 0, 10 and 20 Mt ha^{-1} and commercial biochar was also used for comparation. Static chambers were installed on the subplot soil surface and after reaching equilibrium, gas "trapped" in the chamber collected on days 0, 5, 10, 20, 40 and 60. A total of 180 gas samples were analysed for the determination of CO_2, CH_4 and N_2O concentrations. Biochar reduced cumulative CO_2 and N_2O emission compared to the control but not for the cumulative CH_4 emission. No significant difference was observed between palm-shell and commercial biochars in the reduction of CO_2, CH_4 and N_2O emissions from the soils. Detail cumulative effects of the biochar amendment to the oil palm soil on the individual gases of CO_2, CH_4 and N_2O emissions and characterisation of the biochar produced with LCBT are discussed.

INVITED SPEAKER 8

Dr. Rani Maharani

Total Synthesis of Some Bioactive Cyclopeptides and Cyclodepsipeptides

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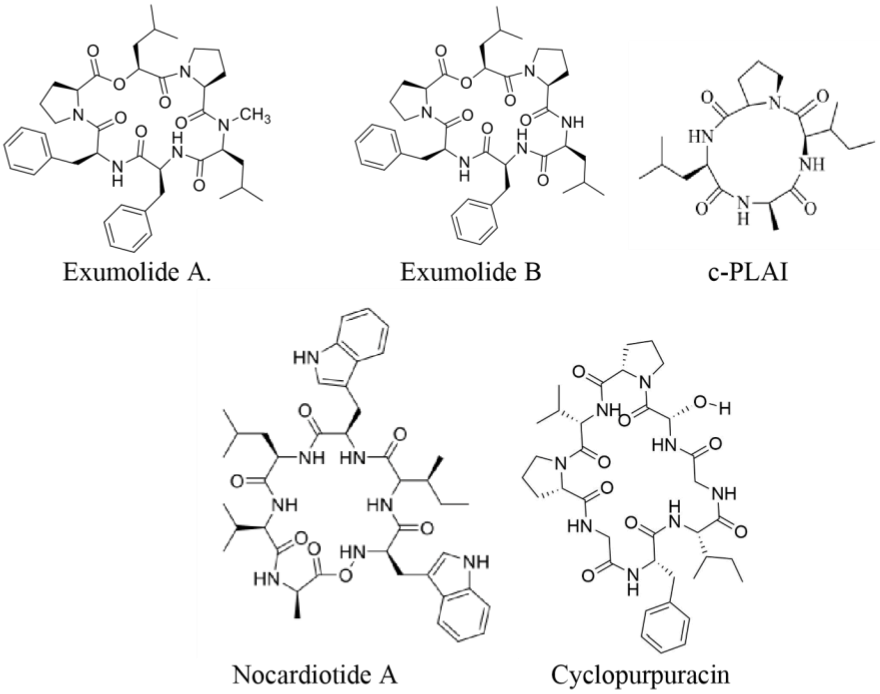
Abstract

Cyclopeptides and cyclodepsipeptides are a class of peptides, which have cyclic structures. The structural difference between cyclopeptides and cyclodepsipeptides is the presence of at least one ester bond replacing an amide bond in the structure of cyclodepsipeptides. These peptides have varied biological properties and their cyclic structures are stable to hydrolytic protease that make them potential as drug. These cyclic peptides were mostly obtained from natural sources. To develop these peptides as new drug candidates, these peptides must be accessible. One of the access to these peptides is through chemical synthesis. Solid-phase peptide synthesis, introduced by Nobel prize winner Robert Bruce Merrifield in 1963, is known to be efficient and faster than the conventional synthesis. This is due to the elimination of the repetitive purification processes in every step of synthesis. This brilliant method has made peptide synthesis more straightforward.

Most of cyclic peptides were prepared through a combination of solid- and solution-phase synthesis, where linear precursor was initially prepared on solid phase and cyclization of the linear precursor was undertaken in solution phase. By using this method, it has made the access to these peptides available. The synthetic pathways to cyclopeptides and cyclodepsipeptides are full of challenges. Herewith, I described our efforts to synthesize two cyclodepsipeptides, exumolides A and B, and three cyclopeptides, c-PLAI, nocardiotide A, and cyclopurpuracin (Figure 1) using a combination of solid- and solution-phase method that were found to be challenging. The selection of cyclization site during retro-analysis is important as it determines the ease of the cyclization. Further, the selection of resin, coupling reagents, and cleaving agents also needs to be considered prior to the synthetic process to lead to the successful synthesis. The synthetic yields of these peptides are varied from 5-73% overall yield. All synthetic products were purified using semi-preparative RP-HPLC and the purified products were characterized by HR-ToF-MS and NMR.



Exumolide A.

Exumolide B

c-PLAI

Nocardiotide A

Cyclopurpuracin

Figure 1 Structures of cyclopeptides and cyclodepsipeptides.

Keywords: Cyclopeptides; cyclodepsipeptides; exumolide A; exumolide B; nocardiotide A; cyclopurpuracin; solid-phase peptide synthesis; peptide cyclization.

Organic Chemistry

DESIGN, SYNTHESIS AND BIOLOGICAL EVALUATION OF DISPIRO PYRROLIDINE DERIVATIVES AS INHIBITORS OF ALZHEIMER'S DISEASES.

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A series of new dispiro pyrrolidines were regioselectively synthesised via [3+2]-cycloaddition reactions of 3,5-bis(arylidene)-1-phenylethyl-4-piperidones with azomethine ylides generated in situ from N-methylglycine and appropriate isatin derivatives. The structures of the synthesised compounds were characterised by NMR, FT-IR and MS. These compounds were assayed *in vitro* for their inhibitory activity against acetylcholinesterase (AChE) and butyrylcholinesterase (BChE), using Ellman's assay. The results demonstrate better inhibitory activity against butyrylcholinesterase as compared to acetylcholinesterase. Compound **7b** exhibits potential as a new BChE inhibitor, with an IC_{50} of 12.78 ± 1.52 μM. A kinetic study suggests **7b** as a mixed-mode inhibitor, where the active molecule can bind to the active or allosteric sites of the enzyme. An *in silico* study was performed using AutoDock Vina to identify the binding mode and conformation of **7b** with the crystal structure of BChE complexed with Thioflavin T (PDB ID: 6ESY). The results indicate better binding properties of **7b** compared with the standard inhibitor Thioflavin T, with calculated binding energies of −11.1 and −8.7 kcal mol-1 for BChE and AChE, respectively

Keywords: Dispiro pyrrolidine, Dispiro heterocycle, 1,3-Dipolar cycloaddition, Cholinesterase.

Research area: *Organic Chemistry*

ISOLATION, CHARACTERISATION OF CHEMICAL CONSTITUENTS AND HEMISYNTHESIS OF PENTACYCLIC TRITERPENOIDS DERIVATIVES FROM ETHYL ACETATE EXTRACT OF *Diospyros foxworthyi* BAKH. (EBENACEAE)

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Diospyros foxworthyi is a tropical plant species of Ebenaceae family. This plant is native to Malaysia. This genus is rich with pentacyclic triterpenoids in the form of lupane-based skeletons, which subsequently intrigue to further its phytochemical findings. The ethyl acetate (EtOAc) extract from the bark of the plant was studied through the isolation, purification and structural elucidation processes resulting in the discovery of a known compound, namely betulin, lupeol and lupenone. Subsequently, the isolated betulin and lupeol were further undergone hemisynthesis by acylation or acetylation reaction which led to the synthesised of twelve interesting betulin and lupeol derivatives. The isolated and synthesised compounds were purified using the chromatographic technique (column chromatography and thin-layer chromatography). The structure of these compounds was elucidated and characterised by using spectroscopic methods consisting of 1D- and 2D-NMR in combination with FT-IR analysis.

Keywords: *Diospyros foxworthyi*, Ebenaceae, natural products, triterpenoid, hemisynthesis

Research area: *Natural Product Chemistry*

ISOLATION AND CHARACTERISATION OF INDOLE ALKALOIDS FROM *Kopsia terengganensis* (APOCYNACEAE)

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The genus *Kopsia* from Apocynaceae family is known for its prolific producing indole alkaloids which posseses many interesting carbon skeleton as well as biological activities. Extraction from the bark of *Kopsia terengganensis* resulted to the isolation of six known compounds from eburnane type; (−)-eburnamine, (+)-isoeburnamine, (−)-eburnaminol, (+)-larutensine, eburnamonine, eburnamenine and one compound from aspidofractinine type; (+)- quebrachamine. These compounds were extracted using acid-base extraction and isolated using various chromatographic techniques (column chromatography, thin layer chromatography and preparative radial chromatography). The structure elucidation and characterisation process of these compounds were conducted by spectroscopic method consist of 1-D NMR, 2-D NMR, FT-IR, UV-Vis and HRMS.

Keywords: Indole alkaloid, *Kopsia terengganensis*, Apocynaceae, acid-base extraction.

Research area: *Natural Product Chemistry*

PYRANOCOUMARINS FROM THE STEM BARK OF *CALOPHYLLUM RECURVATUM* P.F.STEVENS

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Numerous *Calophyllum* sp. have long been valued widely in Asian traditional medicine especially in Malaysia. The modern pharmacological researches on the genus *Calophyllum* has further revealed potentials exhibited by these plants, such as inhibition of HIV, antioxidant, antimalarial, and cytotoxic activity. Species from the genus of *Calophyllum* are abundant in phenolic compounds, particularly xanthones and coumarins. As a result of its potential phytochemicals and pharmacological capabilities, *Calophyllum* has piqued the scientific community's interest. *Calophyllum recurvatum* is a tree endemic to the tropical region of Southeast Asia especially in Malaysia which is locally known as "Bintagor". Phytochemical investigation carried out on this species, *C. recurvatum* has led to the isolation of three known pyranocoumarins; Teysmanone A, Calanone and Soulattrolide. Detailed spectroscopy techniques such as 1D and 2D NMR and MS were used to characterize and elucidate the chemical structures of these compounds. This is the first report on the isolation of pyranocoumarins from *C. recurvatum*.

Keywords: *Calophyllum recurvatum*, coumarins, spectroscopy.

Research area: *Natural Products - Organic Chemistry*

DESIGN, SYNTHESIS AND CHARACTERISATION OF STILBENE-ARYLCINNAMIDE HYBRIDS

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Resveratrol is a stilbene derivative which is known as natural polyphenolic phytoalexin. It is commonly isolated from various plants with a wide range of pharmacological and biological properties. Since the last decade, resveratrol has attracted a great deal of attention as it displayed anticancer, anti-inflammatory, antibacterial, antiviral, neuroprotective, and antioxidant properties. In this study, palladium-catalyzed olefination of aryl halides known as Heck reaction was applied to synthesise seven resveratrol analogues with an amide moiety. The synthesised stilbene undergoes deacetylation, and followed with acylation under basic condition with three cinnamoyl chloride derivatives to give a new series of stilbene-arylcinnamide hybrids. These compounds were characterised using Fourier Transform Infrared (FT-IR), Nuclear Magnetic Resonance (NMR) spectroscopy in combination with High-Resolution Mass Spectrometry (HRMS).

Keywords: Stilbenes; Heck cross-coupling; palladium-catalyzed olefination; stilbene-arylcinnamide hybrids.

Research area: *Organic Chemistry*

DETERMINATION OF CHEMICAL PROFILE USING FTIR SPECTRA AND ANTIOXIDANT PROPERTIES OF GREEN *Christia vespertillionis* Varieties

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C*hristia vespertilionis* (CV) (L. f.) Bakh. f. (Fabaceae), or known as 'Green Butterfly Wing,' is gaining popularity as a valuable, underutilised medicinal plant having antioxidant properties as well as being a new potential source of natural products. The main objectives of this study are to identify the chemical profile of green C*hristia vespertilionis* (GCV) extracted in various polarity of solvents using Fourier transform infrared (FTIR) spectroscopy and to evaluate its antioxidant properties including the measurements of the total phenolic content (TPC), total flavonoid content (TFC), and 2, 2-diphenyl-1-pierylhydrazyl (DPPH) free radical scavenging ability. Extraction of the plant was conducted using polar to non-polar solvents which are water, methanol, ethanol, chloroform and hexane. FTIR spectroscopy analysis of GCV revealed the presence of functional group of -OH, C-H, C=O, C=C, C-O, and N-H that are mainly attributed to phenolics and flavonoids. The bioassays results of the leaf and stem extracts showed a significant quantity of phenolic compounds, ranging from 13.83 to 149.41 mg of GAE / g extract. Moreover, the leaves and stems also showed significant amount of flavonoid compounds, ranging from 10.839 to 30.6179 mg of QE / g extract. The DPPH radical scavenging activity for leaves and stems showed higher in water extract (79.47%) followed by methanol (71.673%), ethyl acetate (55.25%), chloroform (47.028%) and hexane (9.046%) extracts. The outcome of the study will provide the information on the chemical profile and antioxidant properties GCV that can be used for potential applications on diverse medicinal and bioactive components attributes.

Keywords: C*hristia vespertilionis*, Antioxidant, FTIR, Chemical profiling

Research area: *Organic Chemistry*

SYNTHESIS, CHARACTERIZATION, AND IN-SILICO STUDIES OF CINNAMIC ACID AMIDE AGAINST DENGUE PROTEASE

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A natural occurring class compound, cinnamic acid is composed of a benzene ring, an alkene double bond and an acrylic acid functional group. Due to the feasibility of its structure modifications with a variety of compounds, cinnamic acids have been actively explored to improve their biological efficacy. Cinnamic acid derivatives have been reported to exhibit an antimicrobial property. Despite the beneficial properties of cinnamic acid derivatives, the antiviral activity of the amide derivatives especially against the dengue virus is poorly defined. Herein, the cinnamic amide derivatives were synthesized, characterized, and evaluated for their potential as an anti-dengue virus through the *in-silico* analysis of the derivatives against the non-structural protein of viral target, dengue virus type 2 (DENV-2) NS2B/N3. The evaluation was based on binding affinity and interaction with amino acids. Two derivatives (3a and 3f) with the best docking score were reported. Enhanced understanding of the interaction acquired from this analysis provide a useful information on for the prediction of the binding behavior affinity of cinnamic amide derivatives and is ultimately useful in the rational design of drugs to synthesis new compounds with the potential benefits against DENV-2.

Keywords: *In-silico*, Dengue, Cinnamic Amide, NS2B/NS3

STABILITY OF GREEN SYNTHESIS OF SILVER NANOPARTICLES (AgNPs) USING *Euphorbia milii* LEAVES EXTRACT WITH DIFFERENT SOLVENT POLARITIES

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Silver nanoparticle (AgNPs) synthesis can be produced by chemical, physical, and green synthesis methods. In this study, green synthesis of AgNPs was conducted using *Euphorbia milii* leaf extract that acts as the reducing agent. *Euphorbia milii* or also called crown-of-thorn or in Malay *‘Mahkota duri’* was used as the targeted plant in this study due to its rich phytochemical contents. The leaves were extracted into six different solvents (hexane, chloroform, ethyl acetate, acetone, methanol, and distilled water) by increasing polarities to extract different variety of compounds that were applied as reducing agents in the synthesis AgNPs. The crude extract was added to 1 mM AgNO3 solution and kept in the dark at room temperature for 1 day. The process was repeated for all crude extracts with different solvent polarities. The AgNPs solution obtained was analyzed by using UV-Vis spectrophotometer, Fourier transform-infrared spectroscopy (FTIR), and scanning electron microscope (SEM). The stability of the obtained AgNPs was observed and compared between different extracts from different polarities. The wavelength of UV-Vis obtained for the 6 sets was between the range 415-485.5 nm. The appearance of the peak around $\lambda = \sim450$ nm showed the formation of AgNPs based on surface plasmon resonance band. The FTIR spectroscopy of the various extracts/fractions indicated the presence of OH, C-H stretching, C=O stretching, C=C stretching and C-O stretching, respectively compared with the FTIR spectrum for AgNPs for the synthesis and stabilization of the silver nanoparticle. SEM images showed the different sizes of AgNPs for different extracts with range about 67 to 843 nm.

Keywords: *Euphorbia milii*, AgNPs, green synthesis, reducing agent, solvent polarity

Research area: *Organic Chemistry*

MONO-CHLORO CHALCONE DERIVATIVES AS BREAST ANTICANCER AGENTS: SYNTHESIS, CYTOTOXIC ACTIVITY AND ADMET PREDICTION

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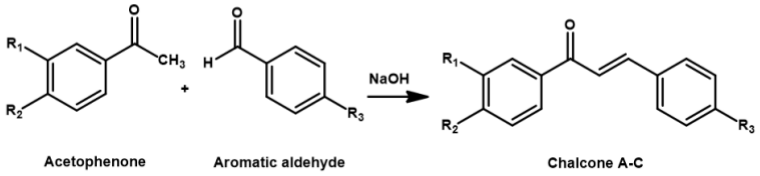
The synthesis of mono-chloro chalcone derivatives (chalcones A-C), cytotoxic assays on breast cancer cells line, and in silico assays have been carried out. Chalcones were synthesized using conventional and ultrasound-assisted methods. Chalcone synthesis was carried out by Claisen-Schmidt condensation with NaOH in methanol at room temperature. Cytotoxic activities on breast cancer cell line MCF7 and T47D were performed using the MTT assay. ADMET prediction was conducted using the pkCSM tool. It was found that the synthesis using ultrasound-assisted resulted in a significant increase in the reaction rate and yield, which was as good as the conventional method (yield > 90%). Furthermore, the spectral characterization of the synthetic compounds was carried out using FTIR, NMR (1H and 13C), and GC-MS. Evaluation cytotoxic activity of breast cancer showed that chalcone C ((E)-3-(4-chlorophenyl)-1-phenylprop-2-en-1-one) had high activity against breast cancer cells MCF7 (16.08 ± 1.93 µg/mL) and T47D (8.04 ± 0.92 µg/mL). These results were supported by *in silico* assay using the pkCSM program, and it can be concluded that mono-chloro chalcone derivatives have good pharmacokinetic properties and cause low toxicity.



A : R_1 = Cl, R_2 = H, R_3 = H
B : R_1 = H, R_2 = Cl, R_3 = H
C : R_1 = H, R_2 = H, R_3 = Cl

Figure 1. The synthetic scheme of chalcone A-C

Keywords: Chalcone, Breast Anticancer, Ultrasound-Assisted, ADMET.

Research area: *Organic Chemistry*

ANALYSIS OF SECONDARY METABOLITES OF YELLOW WOOD (*Arcangelisia flava Merr*.) EXTRACTS AS NATURAL DYE AND ITS ANTIBACTERIAL ACTIVITY ASSAY

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Research on secondary metabolites in the stems of yellow wood (*Arcangelisia flava Merr*.) has been carried out. This study aimed to extract the secondary metabolites of yellow wood stems by batch maceration method using n-hexane, ethyl acetate, and ethanol and identify compounds contained in yellow wood by phytochemical test and LC-HRMS analysis. Furthermore, the potential antibacterial activities of yellow wood extracts were determined against commensal bacteria in humans, i.e., *Staphylococcus aureus* and *Escherichia coli*.

Sequential maceration extraction using ethanol produced a concentrated orange extract with the largest yield than extraction using ethyl acetate and n-hexane. Phytochemical test results indicated that the n-hexane extract contained alkaloids, while the ethyl acetate and ethanol extracts contained alkaloids and phenolic compounds. The LC-HRMS test on the n-hexane extract indicated the presence of nonpolar compounds such as fatty acids, while the ethyl acetate and ethanol extracts contained various nonpolar to polar compounds. The LC-HRMS analysis also showed that the main alkaloid compounds in the yellow wood were berberine and laurolistine. Antibacterial testing on each extract revealed that the n-hexane extract had moderate antibacterial activity against both bacteria, the ethyl acetate extract had strong antibacterial activity against *Staphylococcus aureus* and moderate against *Escherichia coli*, and the ethanol extract had strong antibacterial activity against both bacteria.

Keywords: Yellow wood, berberine, phytochemical, secondary metabolites, antibacterial

Research area: *Organic Chemistry*

POTENT ANTIOXIDANT FROM *AMPELLOCISSUS CINNAMOMEA* TUBER EXTRACT IN PREVENTING CARBON TETRACHLORIDE-INDUCED HEPATIC DAMAGED RATS

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Ampelocissus cinnamomea (Vitaceae) is a vine plant native to Malaysia, Singapore and Indonesia, which traditionally claimed to improve stamina of afterbirth mothers and act as liver tonic. Since the plant derived antioxidants possess strong free radical scavenging abilities which also supposed to be the basis of other bioactivities and health benefits, the tuber of this plant was explored for its potential as a functional food for liver related diseases. The potential antioxidant activity of *Ampelocissus cinnamomea* tuber was explored through sequential solvent extraction and *in vitro* antioxidant assays. Hepatoprotective assay was investigated against carbon tetrachloride (CCl4-) induced hepatic damage in male Spague-Dawley rats at doses of 125, 250, and 500 mg/kg of ethyl acetate extract together with 100 mg/kg silymarin for 7 days. The result showed that the highest antioxidant activity was found in ethy acetate extract. Whilst, hepatoprotective activity of ethyl acetate extract showed significant improvement in terms of a biochemical liver function, antioxidative liver enzymes, and lipid peroxidation activity. The liver organ also showed good recovery in the treated hepatic tissues histologically. In brief, the ethyl acetate extract of *Ampelocissus cinnamomea* tuber possessed prominent hepatoprotective activities which might be due to its *in vitro* antioxidant activity, thus support the use of this plant as a functional food for liver remedy in traditional medicinal system.

Keywords: *Ampelocissus cinnamomea*, antioxidant activity, hepatoprotective activity, carbon tetrachloride.

Research area: *Organic Chemistry*

GREEN SYNTHESIS OF INDANONE BASED CHALCONE: THE REVIEW

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Green synthesis offers various advantages which include the reduction in pollution, wastage of solvents and chemicals, reduction in reaction times, and increase in yield of synthesis. Chalcones are 1,3-diphenyl-2-propene-1-one and belong to a class of flavonoids in which two aromatic rings are linked by a three carbon of α,β-unsaturated carbonyl system. Chalcones and their derivatives are often synthesised using Claisen-Schmidt condensation reactions involving a cross aldol condensation between the appropriate aldehyde or substituted aldehyde and ketone or substituted ketone. Numerous pharmacological activities studies have shown that chalcones and their derivatives possess a wide range of anti-proliferative, antioxidant, anti-inflammatory, and anti-cancer effects. The combination of two or more bioactive scaffolds such as indanone and chalcones has been explored in recent years owing to the need for more pronounced pharmacologically active compounds. Several research works have been conducted on the synthesis of chalcone and chalcone-derivatives. Several novel indanone chalcones have been synthesised and their biological activities such as their use as anticancer antiproliferative agents, and vasorelaxants of aortic rings have been extensively explored. The use of toxic solvents and reagents has a tremendous effect on the environment, this makes it necessary to explore green methods that can be used to limit or eliminate the use of these reagents in organic synthesis. Green methods such as ultrasound, microwave assisted technique, solvent free synthesis, and the use of task specific ionic liquids and deep eutectic solvents as recyclable catalyst have been effectively applied in the synthesis of indanone chalcones. These green methods result in limited solvents use, reduction in synthesis time, environmentally friendly and higher yields of synthesis. This review open doors to more synthetic routes for novel compounds, easier, and green synthesis and focuses on green synthesis of indanone chalcones and their wide range of pharmacological activities.

Keywords: Green synthesis, indanone, chalcone, deep eutectic solvents, microwave assisted synthesis.

Research Area: Organic Synthesis

SUPRAMOLECULAR ASSEMBLY AND SPECTROSCOPIC CHARACTERIZATION OF INDOLENINE-BARBITURIC ACID ZWITTERIONS

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A series of indolenine and barbituric acid (BA) zwitterion scaffolds were synthesized with a maximum yield of 98% via the formation of carbon-to-carbon single bonds. The chemical structures were unambiguously elucidated by various spectroscopic techniques such as ^{1}H, ^{13}C NMR (1D and 2D), FT-IR and high-resolution mass spectrometry (HRMS). Single crystal X-ray crystallography analysis on **4g**, as the **4g.DMF** 1:1 solvate, confirms the presence of well-separated iminium and enolate centres, and also confirms that the BA ring is highly twisted with respect to the indolenine ring due to steric hindrance. The presence of N–H···O$^-$ (enolate) and N–H···O (carbonyl) groups favour one dimensional-suprmolecular assembly in the solid state. The orange and yellow solutions of the zwitterion exhibit an intense molar absorption coefficient, ε ranging between 0.21×10^4 and 2.93×10^4 M^{-1} cm^{-1} in the UV-vis region. Furthermore, the Intramolecular Charge Transfer (ICT) peak of the zwitterion displays a hypsochromic shift in the absorption behavior when the polarity of the solvent increases. Moreover, treatment with a small amount of trifluoroacetic acid (TFA) with the DMF solution of **4g** resulted in the protonation of the enolate of the BA ring. This fundamental work provides valuable structural design and information for the construction of supramolecular chemistry and synthetic dyes based on indolenine substituted BA derivatives.

Keywords: Indolenine, barbituric acid, zwitterion, supramolecular chemistry, ICT.

Research area: *Organic Chemistry*

Physical Chemistry

SYNTHESIS AND DEVELOPMENT OF EMT-TYPE ZEOLITE-MEDIATED SILVER NANOPARTICLES AS ANTIBACTERIAL AGENTS

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The growth of bacterial resistance towards antibiotic causing the need to search a new alternative for antibiotic. By incorporating silver in zeolite, the release behavior of silver can be controlled an enhance its antibacterial efficiency. In this study, EMT-type zeolite silver nanoparticles (AgNPs) are synthesized to investigate its potential as an antibacterial agent. The size and morphology of synthesized EMT-type zeolite AgNPs were further characterized using Ultraviolet-Visible spectroscopy (UV-Vis), Fourier Transform-Infrared Spectroscopy (FT-IR), Transmission Electron Microscopy (TEM) and Scanning Emission Microscopy couple with Energy Dispersive X-Ray Spectroscopy (SEM-EDX). The antibacterial activity of the synthesized EMT-type zeolite AgNPs was investigated against Gram-positive bacteria (*Staphylococcus aureus*), Gram-negative bacteria (*Escherichia coli*) and fungi (yeast) by agar diffusion method.

Keywords: Nanotechnology, EMT-type zeolite, silver nanoparticles, antibacterial agent, bacteria, support material

Research area: *Physical Chemistry*

PHYSICAL, CHEMICAL AND OPTICAL PROPERTIES OF TiO_2 DERIVED FROM MIL-125-NH_2 FOR THE PHOTOCATALYTIC DEGRADATION OF METHYLENE BLUE

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Aminated MIL-125(Ti) (MIL-125-NH_2(Ti)) are among the most attractive metal-organic frameworks (MOFs) in photocatalysis due to large surface areas, good redox activity, strong metal-ligand bonding with a rigid framework, and tunable framework. However, its inherent deficiencies, such as the narrow range of photo-response, and fast recombination of photoinduced carriers, largely limit its application. This study aims to synthesize TiO_2 photocatalyst by thermal decomposition of MIL-125-NH_2. MIL-125-NH_2 was synthesized via a solvothermal method and treated under an argon atmosphere at different calcination temperatures ranging from 300-900°C. Several characterizations were employed to determine the physical, chemical and optical properties of the calcined photocatalysts. Results demonstrate that at high temperatures, the MOF structure collapses and is converted to TiO_2. The X-ray diffraction (XRD) spectroscopy and Fourier transform infrared (FTIR) analysis confirm that the transition of the anatase to the rutile phase at high temperature was successfully achieved at 900°C. This process comprehends the formation of interface defects, followed by the reconstruction of a new crystalline phase and the removal of defects. The orthorhombic square shape of MIL-125-NH_2 becomes well packed to each other at high temperatures, but the square shape was still visible. As the calcination temperature increases, the peak intensity of fluorescence spectra shows an apparent drop suggesting low rates of photogenerated electron-hole recombination and greater photocatalytic activity. The catalytic activity of the photocatalyst was tested in the photocatalytic degradation of methylene blue (MB) dye, and it was proven that the best MB degradation was achieved at 900°C for highly calcined MIL-125-NH_2.

Keywords: Metal-organic framework, MIL-125-NH_2, photocatalysis, thermal decomposition, titanium dioxide.

Research area: *Physical Chemistry*

PREPARATION, CHARACTERIZATION, THERMAL DEGRADATION KINETICS OF BPADA-BAPP POLYIMIDE AND BPADA-BAPP-NI NANOCOMPOSITE SERIES

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A series of 4'-(4,4'-Isopropylidenediphenyl-1,1'-diyldioxy) dianiline/ 4,4'-(4,4'-isopropylidenediphenoxy) bis-(phthalic anhydride) BPADA-BAPP polyimide nickel nanocomposites (PINiNCs) were fabricated by a solution mixing method. The chemical structure BPADA-BAPP-PINiNCs series were successfully confirmed by as Proton-Nuclear Magnetic spectroscopy (H-NMR), Fourier Transform Infrared spectroscopy (FT-IR), while morphology has been verified by Scanning Electron microscopy (SEM). The non-isothermal kinetic behavior of the fabricated BPADABAPP-PINiNCs series was studied by thermogravimetric analysis TGA) under a nitrogen atmosphere at heating rates (β) of 5, 10, 15, 20, and 25oC/min. In this study, we attempted to clarify the effects of nickel nano particles (NiNPs) on the nonisothermal degradation kinetics using Flynn–Wall–Ozawa and Kissinger methods. The derived apparent activation energies (*Ea*) fit well with each other (showing the same trend) mean the model is true. The *Ea* showed significant differences at conversion (α) > 0.7, which indicates the role of Ni loading towards degradation behavior. From the calculations, the lifetime prediction at 5% mass loss decreases in the following order: 1% > 5% > 10% which is related to the mobility of BPADA-BAPP PI backbone chain. Hence, the presence of different NiNPs loading reveals their contributions towards thermal degradation and stability.

BIMETALLIC GOLD-SILVER EMBEDDED STYRENE-METHYL METHACRYLATE CORE-SHELL NANOSTRUCTURE (SMMA@AUAG) AS HIGH-PERFORMANCE THIN FILM SURFACE-ENHANCED RAMAN SPECTROSCOPY (SERS) SUBSTRATE

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Raman spectroscopy has outperformed numerous analytical procedures in terms of cost, simplicity, and analysis time. However, it had sensitivity difficulties, where surface enhancement corrected with the advent of material sciences. In this research, we report the easy, simple and cost-effective fabrication of a metallodielectric photonic crystal (MDPC) surface-enhanced Raman spectroscopy (SERS) substrate based on styrene-methyl methacrylate copolymer (SMMA) embedded with gold and silver (Au-Ag) nanoparticles (SMMA@AuAg). Firstly, SMMA copolymer was synthesised via surfactant-free emulsion polymerisation using water as solvent while Au-Ag nanoparticles were produced via one-pot reduction using citrate stabilizer. Compared to monometallic Au and Ag, bimetallic nanoparticles reduce oxidation, less costly, improves stability, and increases SERS signal intensity. SMMA as the 'core' increases particle size tunability, allows for higher light scattering modifiability, and improves heat resistance. The structural characteristics of SMMA copolymers and Au-Ag nanoparticles produced were investigated using Malvern particle size analyser (PSA), scanning electron microscope (SEM), and transmission electron microscope (TEM). SMMA@AuAg thin film was prepared via vertical deposition of SMMA@AuAg core-shell suspension on microscope glass substrate. The SMMA produced had good polydispersity index and high surface area for Au-Ag attachment. The zeta potential changed from -3.78mV to 53.2mV after modification with polyethyleneimine (PEI), implying high degree of stability. The SMMA@AuAg thin film successfully enhanced Raman signal and provided a clear fingerprint of 4-aminothiophenol (4-ATP) at low concentration. With diagnostic devices heading towards portable real-time monitoring, an optically malleable SERS substrate such as the SMMA@AuAg thin film would be most feasible for industrial-sized production with further research.

Keywords: Surface-enhanced Raman spectroscopy, nanoparticles, copolymer

Research area: *Physical Chemistry*

METALLO-N-HETEROCYCLES – A NEW FAMILY OF HYDROGEN STORAGE MATERIAL

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Storing hydrogen efficiently in condensed materials is a key technical challenge. Tremendous efforts have been given to inorganic hydrides containing B–H, Al–H and/or N–H bonds, while organic compounds with a great variety and rich chemistry in manipulating C–H and unsaturated bonds, however, are undervalued mainly because of their unfavourable thermodynamics and selectivity in dehydrogenation. Here, we developed a new family of hydrogen storage material spanning across the domain of inorganic and organic hydrogenous compounds, namely metallo-N-heterocycles, utilizing the electron donating nature of alkali or alkaline earth metals to tune the electron densities of N-heterocyclic molecules to be suitable for hydrogen storage in terms of thermodynamic properties. Theoretical calculations reveal that the enthalpies of dehydrogenation (ΔH_d) of these metallo-N-heterocycles are dependent on the electronegativity of the metals. In line with our calculation results, sodium and lithium analogues of pyrrolides, imidazolides and carbazolides of distinct structures were synthesized and characterized for the first time, where the cation-π interaction was identified. More importantly, a reversible hydrogen absorption and desorption can be achieved over lithium carbazolide which has a hydrogen capacity as high as 6.5 wt% and a suitable enthalpy of dehydrogenation of 34.2 kJ mol^{-1}-H_2 for on-board hydrogen storage.

Keywords: Metallo-N-heterocycle, thermodynamic alteration, reversible hydrogen storage

Research area: *Physical Chemistry*

PHOTOCATALYTIC DEGRADATION OF PHENOL USING ELECTROGENERATED TITANIUM NANOPARTICLES CATALYST IN THE AQUEOUS SOLUTION

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A simple electrochemical method of synthesizing titanium nanoparticles catalyst with assisted combination of *N*,*N*-dimethylformamide (DMF) solution containing tetraethylammonium perchlorate (TEAP) in presence of a naphthalene mediator was conducted in a normal compartment cell fitted with a platinum cathode and titanium anode plate at constant current density of 120 mA cm^{-2} under nitrogen atmosphere at 273 K. The catalysts were characterized using Fourier transform infrared (FTIR), X-ray diffraction (XRD), transmission electron microscopy (TEM), Brunauer-Emmett-Teller (BET), and ultraviolet–visible diffuse reflectance spectroscopy (UV–vis DRS), in order to studies its physico-chemical properties. An excellent photodegradation of phenol in aqueous solution with nearly complete (96.3%) was obtained using 10 mg L^{-1} of phenol concentration with 1.25 g L^{-1} of EGTiO catalyst dosage at pH 5 under light irradiation after 1.5 hours of contact time at room temperature. The photocatalytic behaviour was followed the pseudo first–order kinetic rationalized Langmuir–Hinshelwood model with a good catalyst stability performance. Therefore, toward studies, with a great photoactivity degradation of phenol, promises the catalyst could be used in the wastewater treatment industry and also other applications.

Keywords: Electrochemical method, titanium nanoparticles, phenol, photocatalytic reaction, water treatment, good stability

Research Area: *Physical chemistry*

ENHANCED STABILITY OF TOPICAL CYCLOSPORINE-LOADED NANOEMULSION: OPTIMIZATION, CHARACTERIZATION AND RELEASE KINETICS

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Cyclosporine has been used as an anti-inflammatory agent to treat psoriasis. However, it is associated with poorly water soluble and low bioavailability due to its high lipophilicity property, thus limits cyclosporine application in topical product. Incorporation of cyclosporine into nanoemulsion (NE) system is believed could overcome these issues. The study was aimed to explore the effects of emulsification parameters; shearing intensity, preparation time and temperature on the NE's stability. Further evaluation on its physicochemical properties were performed to optimize the production method. Several batches of NE were homogenized using high-shear homogenizer operated at various emulsifying condition and their physical stability were observed at different temperatures throughout the 6 months of storage period. NE with stable phase were characterized using dynamic light scattering (DLS) and transmission electron microscopy (TEM) and subjected to *in-vitro* release analysis. The optimum conditions in formulating cyclosporine-loaded NE were found to be in range of 11,000 to 13,000 rpm of high shearing intensity, 30 min of shearing time at 40°C of emulsification temperature. The physical observations showed that out of 15 NE prepared, only NE-1 and NE-2 were stable against phase separation after been stored at 4, 25 and 40°C for 6 months. At 4°C, NE-1 exhibited better results than NE-2 with respect to droplet size (225.2nm), zeta potential (-21.8mV) and polydispersity index (0.36), contributing to better stability. Nonetheless, the morphology for both samples presented spherical shape which was in agreement with nanometric size value obtained via DLS. The *in-vitro* release profile of NE-1 demonstrated highest release of cyclosporine from its carrier with 85.22% through cellulose acetate membrane within 5 hours of analysis, that was proven to be well-fitted to the Korsmeyer-Peppas kinetic model (R^2=0.9996). This study revealed the optimal emulsification parameters that could be used to formulate a stable NE containing cyclosporine intended for topical application.

Keywords: Cyclosporine, nanoemulsion, stability, release, drug delivery

Research area: *Physical Chemistry*

Inorganic Chemistry

COMPUTATIONAL STUDIES ON DIPHENYLPHOSPHINE LIGANDS FOR NONLINEAR OPTICAL PROPERTIES

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Diphosphine ligands containing (-HC=N) imine group demonstrating aliphatic and aromatic framework such as ethane and azobenzene exhibit different nonlinear optical (NLO) properties. In this study, two different ligands (A and B) have been synthesized with a percentage yield of 60-70% characterized by spectroscopic analysis. Comparative study of computational analysis using Gaussian software with DFT method and hybrid functional B3LYP together with basis set 6-31G(d,p) has shown good agreement of less than 5% deviation errors. From previous study, derivatives of these compounds have shown good NLO properties contributing by many factors such as conjugation, electron withdrawing groups (EWG), electron donating groups (EDG), metal mass, highest occupied molecular orbital-lowest unoccupied orbital (HOMO LUMO) and band gap. The evaluation shows that both ligands own high NLO properties established on the value of β_{tot} at 1064 nm wavelength. Studies indicate that ligand B showed highest NLO property with the β_{tot} value of 2.0165 esu followed by ligand A 1.9783 esu due to increased conjugation in the system. This is supported by the high dipole moment 5.501404 μ (D) of ligand B. These ligands can be further modified by the addition of the metals to form complexes in order to improve NLO properties.

Keywords: Nonlinear optic property, ruthenium complex, azobenzene, Hartree Fock, Density Functional Theory

Research Area: *Inorganic & Computational Chemistry*

INTERCALATION AND CHARACTERIZATION OF ZINC OXIDE WITH 2-METHYL-4-CHLOROPHENOXYACETIC ACID AND ITS EFFECT ON SEED GERMINATION

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The effective intercalation of zinc layered hydroxide-MCPA (ZMCPA) nanohybrid was achieved by the synthesis of zinc layered hydroxide (ZLH), herbicide, and 2-methyl-4-chlorophenoxyacetic acid (MCPA). At a concentration of 1.0 M, ZMCPA was produced using an ion exchange technique followed by a hydrothermal treatment. The Fourier-transform infrared spectroscopy (FTIR) spectrum demonstrates that strong MCPA bands exist in the ZMCPA spectrum with small wavenumber shifts, implying that intercalation may occur owing to the development of additional bands. The assertion was further supported by Powder X-ray diffraction (PXRD) analysis, which revealed that the zinc oxide fingerprint peaks vanish in the ZMCPA diffractogram. Nevertheless, the basal spacing of 21.6Å, which complemented prior research and indicated the presence of an intercalated metal hydroxide, was certainly present. Using UV-vis Spectroscopy, further characterization was done to assess the efficiency of the nanohybrid herbicide on plants. UV-vis Spectroscopy was first employed to assess the plant's protein content and amino acid composition before and after treatment with ZnO, MCPA, and ZMCPA. The protein level of the plant following treatment with ZnO, MCPA, and ZMCPA was found to be greater than before treatment, indicating that additional time is needed to ensure that the plant fully absorbs the therapy. This study has depicted the potential of ZnO, MCPA, and ZMCPA as more unassailable agrochemical agents since they can control the low dosage of herbicides. This causes less toxic materials to seep into groundwater and threaten aquatic life.

Keywords: Layered double hydroxide, herbicide, MCPA, seed germination.

Research area: *Inorganic Chemistry.*

MINERAL CHEMISTRY OF ATOLL GARNET: A METHOD TO DETERMINE ROCK PROTOLITH

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One subhedral garnet was selected in granite rock obviously has two domains defined by a different composition, which show core and rim portions when analysed using Scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM-EDX). This studied garnet has an atoll type zoning pattern which is identified by core-portion clearly in Ca component and interfiled by biotite and albite. The atoll garnet is 1.4 - 1.5 mm and chemical zoning on the garnet is clearly identified on the Ca, Fe and slightly on Mn and Mg elements with the interior filled by biotite and albite. Biotite in the interior fill is clearly identified particularly by Ca, Mg, K and Si elements while albite in the interior fill is clearly identified by Fe, Al, Na and Si elements. Based on the chemical zonation (rim-core-rim), the garnet core portion has increased in almandine and spessartine, decreased in pyrope and relatively flat in grossular ($Prp_{15-22}Alm_{52-57}Sps_{02-06}Grs_{22-25}$). The rim portion of the garnet shows increasing almandine and spessartine but decreasing grossular and pyrope (Prp_{12-} $22Alm_{52-58}Sps_{03-07}Grs_{22-24}$). It should be verified that the garnet in this granite rock is a product of metamorphism.

Keywords: atoll garnet, granite, rock protolith and metamorphic origin.

Research area: *Inorganic Chemistry*

NON-LINEAR DISULPHIDE-CENTERED S-SHAPED OLIGOMERS: SYNTHESIS AND MESOMORPHIC PROPERTIES

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Several new liquid crystalline oligomers [bis-n-(2-(6-(4-{4-acetylphenylazo}phenoxy)hexyloxy)phenoxy)alkyl]disulphide containing aromatic azo moieties and kinked at two 1,2-disubstituted phenyl rings were synthesized. The unique feature of this series can be attributed to the presence of inner and outer spacers made up by $-(CH_2)_n-$ wherein n=6-9 and $-(CH_2)_6-$, respectively. The structures of the target compounds were elucidated by spectroscopic techniques (UV, IR and NMR) while the mesomorphic properties were determined by differential scanning calorimetry and polarizing optical microscopy. The presence of aromatic azo moieties was confirmed by FT-IR data (diagnostic absorption at 1470 cm^{-1}) and UV-Vis (l_{max}=365 nm). All the compounds are monotropic of which the oligomer with outer space of n=7 shows nematic phase (N) and droplet texture at 79.8 °C. Schlieren texture of nematic phase with four dark brushes is exhibited by the oligomer with outer spacer of n=8 at 68.3 °C. An interesting behaviour that can be generalized through a comparison between these oligomers is that they seem to exhibit an odd-even effect particularly at the I-N transition temperature wherein the oligomers with odd-numbered inner spacers display higher transition temperature in comparison to its members which possess even parity. A salient observation upon ascending this series is that the oligomers show uniform orange colour with increasing melting points.

Keywords: Non-linear, central disulphide, inner and outer spacers, odd-even effect.

Research area: *Inorganic Chemistry*

ACTIVATED CARBON DERIVED FROM GLYCERIN PITCH FOR DESULFURIZATION OF MODEL DIESEL FUEL

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Adsorptive desulfurization is proposed in this work as an alternative technique for removing sulfur from model and real diesel fuel. It has emerged as a potentially economically feasible and effective alternative to meet the strict environmental standards for sulfur levels in diesel. The synthesis of activated carbon was derived from glycerin pitch and acted as an adsorbent. The resulting activated carbon (AC-Fe) was undergone a crucial step, polymerization with sulphuric acid before being thermochemically treated with ferum nitrate ($FeNO_3$) at 700 °C in N_2 atmosphere. The surface properties and functionalities of AC-Fe were revealed by Brunauer-Emmett-Teller (S_{BET}) analysis, field emission scanning electron microscopy (FESEM), energy dispersive X-ray analysis (EDX), thermal gravimetric analysis (TGA) and Fourier transform infrared spectroscopy (FTIR). Further, the adsorption capacity was studied systematically by analysing the effects of calcination temperature, contact time, adsorbent dosage, and temperature. Under optimum conditions, 78.65% of dibenzothiophene (DBT) was removed and this result showed glycerin pitch as potential material for the adsorptive desulfurization process.

Keywords: Desulfurization, activated carbon, DBT, model diesel

Research area: *Inorganic Chemistry*

CHITOSAN-BASED AGRONANOFUNGICIDE FORMULATIONS AS POTENT ANTIFUNGAL AGENTS FOR GANODERMA DISEASE MANAGEMENT OF OIL PALM

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The oil palm, a commodity and an economic crop in Malaysia, is now under threat from a devastating disease caused primarily by the pathogenic fungus *Ganoderma boninense*. This pathogenic fungus causes the most lethal disease, basal stem root (BSR). As a result, Malaysia loses billions of Ringgits each year as a result of this disease. Therefore, extensive research into the prevention and treatment of BSR disease is critical. Nanoscience and nanotechnology have been shown to provide novel and improved agricultural solutions. Three chitosan-based agronanofungicide systems were synthesised in this study for the development of potent antifungal agents: a single-loaded hexaconazole system (chitosan-hexaconazole nanoparticles, CHEN), a single-loaded dazomet system (chitosan-dazomet nanoparticles, CDEN), and a double-loaded hexaconazole and dazomet (chitosan-hexaconazole-dazomet nanoparticle, CHDEN). The fungicide encapsulated in chitosan-based agronanofungicides was evaluated for loading content, encapsulation efficiency, and release profile. The effect of the crosslinking agent, sodium tripolyphosphate (TPP), on the size of each synthesised nanoparticle was investigated, and it was discovered that increasing the TPP concentration resulted in smaller particle size. Furthermore, both in vitro and in vivo studies have shown that the size of the nanoparticles is crucial for controlling and suppressing the BSR disease. The double-loaded CHDEN system was found to have a synergistic effect in combating the disease in both in vitro and in vivo studies, resulting in the highest antifungal potency with half-maximal effective concentration (EC_{50}) at 3.5 ng/mL and disease reduction of 75% when compared to untreated infected seedlings. Furthermore, phytotoxicity, cytotoxicity, and genotoxicity studies revealed the significance of chitosan nanoparticles in which the chitosan acts as a protective wall to shield the toxic effect of fungicide on oil palm seedlings, cells, and DNA. Furthermore, residual analyses of chitosan-based agronanofungicides on oil palm stem tissue, leaf, and palm oil matrices were performed. There was no fungicide residue found in the palm oil matrices, indicating that it is safe for use in oil palm cultivation. The fungicide half-lives ($t_{1/2}$) in the stem tissue and leaf were found to be 383 and 515 days, respectively, indicating higher uptake and retention of chitosan-based agronanofungicide compared to the conventional counterpart. As a result of these findings, the newly developed chitosan-based agronanofungicides demonstrated high antifungal activity, controlled release properties, prolonged circulation time, no phytotoxicity (on oil palm seedling), low cytotoxicity (on 3T3 mouse fibroblast cells and V79-4 hamster lung cells), no genotoxicity (on V79-4 hamster lung cells), and residue-free. In other words, it has great potential as a long-term alternative for developing integrated management strategies for combating fungal pathogens in crops, particularly oil palm.

Keywords: Chitosan nanoparticles, nanofungicides, antifungal, phytotoxicity, cytotoxicity, genotoxicity and residual analysis

Research area: *Inorganic Chemistry*

A CHIRAL CYLINDER-LIKE METALLOMACROCYCLES BIS TRI-*N*-HETEROCYCLIC CARBENE SILVER(I): SYNTHESIS, CHARACTERIZATION AND ANTICANCER STUDY

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Abstract

Through self-assembly, the preparation of trinuclear carbene complexes from polycarbene ligands and silver(I) ions has been investigated. Reactions between 1,3,5-tris(bromomethyl)benzene with three equimolar of ***N***-substituted alkyl benzimidazole yielded the formation of numerous aromatic backbone scaffolds tris-benzimidazolium salts, H_3**L** (**1-5**). Further reaction of the salts with Ag_2O resulted in the formation of bis tri-NHC trinuclear silver(I) complexes with the formula of $[Ag_3L_2]\cdot 3PF_6\cdot 3MeCN$ (**6-10**) (where NHC = *N*-heterocyclic carbene). The compounds were fully characterized by ^{1}H and ^{13}C NMR, FTIR, and elemental analyser. Structure elucidation from single-crystal X-ray diffraction data revealed that the complex **9** is a cylindrical-like structure featuring three silver(I) atoms sandwiched between two tricarbene ligands with the aromatic backbone of each ligand is arranged in eclipsed conformation. The anticancer study of the salts and complexes was carried out with Etoposide used as the positive control. Subsequently, only complexes **6-10** were found to have potential as anticancer agents, with **6** and **8** are more active compared to the positive control.

Keywords: *Benzimidazolium salt, tri-NHC, trinuclear silver(I), cylindrical-type, anticancer.*

Research area: *Inorganic Chemistry (Organometallics)*

PHOTODEGRADATION OF OXYTETRACYCLINE USING CHITOSAN MODIFIED ZNO QDS UNDER VISIBLE LIGHT IRRADIATION

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This study reports the synthesise of chitosan-modified ZnO QDs (Chitosan-ZnO QDs) via the microwave method for the photodegradation of oxytetracycline (OTC) under visible light irradiation. The photocatalytic reaction was carried out in a homemade reactor equipped with two fluorescent lamps (48 W). The synthesised photocatalyst was characterised by Fourier transmission infrared (FT-IR), x-ray diffraction (XRD), high-resolution transmission electron microscopy (HRTEM), scanning electron microscope (SEM), UV-vis diffuse reflectance spectra (UV-DRS), photoluminescence (PL) and nitrogen adsorption-desorption (NAD). The (Chitosan-ZnO QDs) has wurzite hexagonal crystalline phase with an average crystallite size of 8.2 nm. The SEM analysis shows the evenly distributed micro-spherical structure. The NAD analysis indicate the Chitosan-ZnO QDs is a mesoporous material with a Brunauer-Emmet-Teller (BET) surface area of 31.88 m^2/g and an average pore size distribution of 11.7 nm. The band gap energy was determined to be 3.29 eV, whereas the PL analysis detected the presence of various types of defects. The defects prolonged the charge carrier separation. The removal of OTC was 95.1% within 40 minutes. The percentage is higher than other ZnO-based catalysts reported in the literature. Scavenging tests indicate that photogenerated holes (h^+) and superoxide radicals () were the primary reactive oxygen species responsible for photodegrading the OTC. The catalyst was stable to be recycled five times.

Keywords: ZnO QDs, chitosan, microwave, photocatalysis, oxytetracycline.

Research area: *Inorganic Chemistry*

CARICA PAPAYA LEAF MEDIATED GREEN SYNTHESIS OF ZnO NANOPARTICLES FOR THE PHOTOCATALYTIC DEGRADATION OF METHYLENE BLUE

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The last decade has witnessed a tremendous shift towards the synthesis and study of nanomaterials and nanoparticles. These nanoparticles possess a wide variety of applications such as in plant nutrients, solar cells, or wastewater treatment. One such metallic nanoparticles are zinc oxide (ZnO). ZnO as a photocatalyst and one of the advanced oxidation technologies is highly useful for the treatment of wastewater with persistent organic pollutants. In this study, ZnO was synthesized using the green synthesis technique. Carica papaya leaf extract was used to synthesize ZnO. The sample was characterized through a variety of analytical methods in order to understand its morphology, size, and structural phase purity. Field emission scanning electron microscopic (FESEM), transmission electron microscopic (TEM), powder X-ray diffraction analysis (PXRD), Fourier transform infrared spectroscopy (FT-IR), and UV–Visible spectroscopy techniques were studied. The FESEM analysis helped in understanding the surface morphology of the synthesized ZnO nanoparticles (NPs). The results demonstrate spherical ZnO NPs with an average lateral size of ~50 nm. TEM analysis confirmed the thin layer formation of NPs in accordance with the particle size dejected through FESEM. PXRD confirmed that ZnO NPs consist of hexagonal wurtzite phases. Observing a strong absorption peak at 362 nm in UV–Vis spectroscopy indicated the formation of ZnO NPs. The observed vibration peaks in the FT-IR analysis at 422 and 557 cm^{-1} indicated the presence of Zn and O atoms in ZnO. Notably, the as-synthesized ZnO NPs were used to degrade the methylene blue (MB) dye under UV light irradiation with 79% degradation efficiency in a 210-minute time interval.

Keywords: Carica papaya leaf, Zinc Oxide, Photocatalyst, Methylene blue.

Research area: *Synthetic Inorganic Chemistry*

APPLICATION OF NATURAL ZEOLITE CLINOPTILOLITE FOR THE REMOVAL OF AMMONIA IN WASTEWATER

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ABSTRACT

This work intends the characterization of the natural zeolite clinoptilolite and its capability in removing the ammonia in wastewater. The natural zeolite clinoptilolite was characterized using transmittance electron microscopy (TEM), X-ray diffraction (XRD), Fourier-transform infrared (FTIR) spectroscopy, X-ray fluorescence (XRF) and zeta potential prior to the adsorption process. The results showed that the natural zeolite clinoptilolite possessed the lamellar and needle-like structure thus giving the highest surface area for effective adsorption. The main constituent of the element consisted of natural zeolite clinoptilolite is known to have a high affinity toward ammonia. Thus, the excellent performance in removing ammonia of up to 82.97% has revealed that the natural zeolite clinoptilolite has a great potential to be developed as a synergized adsorptive ceramic membrane that is combining the adsorption and the filtration of water simultaneously.

Keywords: *Natural zeolite clinoptilolite; ammonia removal; adsorption; wastewater treatment*

SYNTHESIS AND MESOMORPHIC PROPERTIES OF BENT LIQUID CRYSTALS CONTAINING TRIAZOLE CORE WITH TERMINAL FLEXIBLE ALKYL CHAIN AND LATERALLY ETHOXY GROUP

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A triazole-cored liquid crystal is believed to be able to display spontaneous polarization as a result of its bent-shaped conformer. Hence, a new series of bent-shaped liquid crystals containing a triazole ring were synthesized and characterized with spectroscopic methods. The triazole-cored and bent liquid crystals possess the flexible alkyl chain at one terminal while the other side of the core is connected by a laterally ethoxy Schiff base containing a biphenyl CN group. The optical study under the polarizing optical microscope (POM) revealed that the presence of mesophase is dependent on the length (n) of the alkyl chain, $-C_nH_{2n+1}$ while the length (n) also reflects their clearing temperatures (T_c) in which the analogous compounds with higher n numbers possess lower T_c points. The SmA phase was observed for compounds in which the alkyl chain length of n 12. This observation can literally be associated with its adequate bending angle and charge distributions along the two arms.

Keywords: Triazole, bent-shaped, laterally ethoxy

Research area: *Inorganic Chemistry*

SYNTHESIS, CHARACTERIZATION, *IN-SILICO* AND ANTICANCER SCREENING OF ISATIN-3-THIOSEMICARBAZONES WITH Cu(II) AND Zn(II) COMPLEXES

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The use of isatin as a core in a compound provides an interesting view in pharmacological research. A ligand incorporating isatin and 4-methyl-3-thiosemicarbazone was prepared using the reflux conventional method with moderate yield. The prepared ligand and complexes were characterized using various spectroscopic methods (FT-IR, ^{1}H NMR, and UV), elemental analysis, and molar conductivity measurements. The single crystal structure of the ligand exhibited as a monoclinic system in the P2(1)/c space group. Quantum chemical calculations were also performed using the B3LYP method to acquire information on the optimized structures of the molecules and determine the molecular excited state properties of the compounds. The anticancer activity of the compounds was evaluated against Leukaemia K562 cells using an MTT assay. Both ligand and Zn(II) complex possessed good anticancer activity compared with copper(II) complex based on IC_{50} values.

Keywords: Anticancer properties; Density Functional Theory (DFT); Isatin; Thiosemicarbazide

Research area: *Inorganic Chemistry*

SYNTHESIS, CHARACTERIZATION, X-RAY CRYSTALLOGRAPHY AND THEORETICAL STUDIES OF $Os_3(CO)_{11}\{PPh_2(1-C_{10}H_7)\}.H_2O$

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This work presents the spectroscopic analysis, single-crystal X-ray crystallography and theoretical studies of $Os_3(CO)_{11}\{PPh_2(1-C_{10}H_7)\}.H_2O$. The compound crystallizes in the triclinic, *P-1* space group with unit cell parameters a = 12.4377(14), b = 12.4413(13), c = 12.4718(13) ˚A, α = 87.3030(19), β = 63.7889(17) and γ =79.3982(19)°. The asymmetric unit of this structure consists of one-triangulo-triosmium complex molecule and one of a water molecule. The crystal packing of the title compound is stabilized by O–H···O and C–H···O hydrogen bonds as well as C–H···π interactions. The intermolecular interactions were investigated by Hirshfeld surfaces and the associated 2D fingerprint plots. In order to investigate the electronic properties of the compound, the DFT approach using the M06-2X exchange correlation functional with LanL2DZ pseudopotential on Os and 6-31(d,p) Pople basis set for all other atoms have been performed.

Keywords: Triosmium, metal cluster, DFT, Hirshfeld surface.

Research area: *Inorganic Chemistry*

EFFICIENT PHOTOLYSIS OF METHYL ORANGE DYE BY USING ELECTROGENERATED COPPER-ZINC OXIDE HYBRID

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A photoactive Cu-doped ZnO (Cu-ZnO) hybrid was synthesized via a simple electrogeneration procedure. The efficiency of the Cu-ZnO hybrid was then evaluated via discoloration reaction of dye pollutant, methyl orange (MO) under visible light irradiation. As result, complete degradation of MO was accomplished after 6-hour light exposure with the optimum condition of pH 3, 10 mg/L initial dye concentration, and 0.038 g of Cu-ZnO hybrid. Meanwhile, in the presence of pure ZnO catalyst, only 23% MO was managed to be degraded, remarking its low catalytic reactivity compared to the Cu-ZnO. Besides, the reusability test conducted demonstrated excellent reusability of the Cu-ZnO, as the catalyst was able to maintain its degradation efficiency up to 3 cycles. Conclusively, the electrogenerated Cu-ZnO catalyst was highly capable of degrading methyl orange dye pollutant and therefore have a high potential for future wastewater treatment application.

Keywords: Photodegradation, methyl orange, zinc oxide, copper, electrochemical method.

Research area: *Advanced material*

SYNTHESIS OF WASTE DERIVED MATERIAL AS CATALYST FOR BIODIESEL

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In this study, biodiesel was produced from low grade cooking oil by transesterification process utilizing clay catalyst. The physiochemical properties of catalyst and biodiesel were characterized using Fourier transform infrared spectroscopy (FTIR), Thermogravimetric analysis (TGA) and Field emission scanning electron microscopy with Energy Dispersive X-ray spectroscopy (FESEM-EDX). The transesterification process was optimized based on several parameters such as type of catalyst used, calcination temperature of catalyst, dosage of catalyst used, ratio of oil to methanol used, time of transesterification reaction and reaction temperature. The experimental results revealed that the synthesized catalyst efficiently converted free fatty acids (FFA) present to fatty acid methyl esters (FAMEs). The maximum biodiesel yield of 48.80 % was obtained at optimum reaction conditions: catalyst amount 4 wt % of SBE/KOH 500, reaction time 2 h, reaction temperature 55 °C and oil to methanol molar ratio 1:20.

Keywords: Clay, Cooking oil, Biodiesel, Transesterification, Catalyst.

Research area: Inorganic Chemistry

Analytical Chemistry

FABRICATION OF WO_3/RGO-BASED GAS SENSOR FOR THE DETECTION OF ETHANOL GAS AT LOW TEMPERATURE

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The demand for ethanol production is increasing gradually with the growing use of biofuel. However, high exposure to ethanol might cause drowsiness, unconsciousness, and could also affect the liver and nervous system. Thus, high sensitivity ethanol detector is very crucial. Tungsten trioxide (WO3), an n-type semiconductor has become attractive material for gas sensors due to its ability to detect various oxidizing and reducing gas. However, pristine WO3 exhibits low sensitivity towards VOC gases. Moreover, it takes a longer response and recovery time and usually operates at a high temperature, which results in high energy consumption. Reduced graphene oxide (rGO) is added to the WO3 to overcome these drawbacks as its large surface area would improve the sensing ability significantly. In addition, rGO is also known for its ability to reduce the operating temperature of a sensor, thus reducing energy consumption. The objective of this study is to fabricate a WO3/rGO based gas sensor with an ITO glass substrate for better sensitivity toward ethanol. WO3 is prepared via a one-step hydrothermal method while rGO is prepared by a modified Hummer's method. The sensor material is fabricated by deposition of WO3/rGO on ITO glass via screen printing. The nanocomposite materials undergo XRD analysis to validate the interlayer distance of rGO and the crystalline phases of the WO3. The result displays that WO3 has an orthorhombic crystal shape. The GO shows a broad peak at $2\theta = 9.0969°$with the interlayer space of 0.97135 nm. The GO peaks disappear after the hybridization process which confirms that the GO has been reduced to rGO. The hybridization of rGO with WO3 doesn't show a significant change to the crystal structure of the WO3.

Keywords: Tungsten trioxide, reduced graphene oxide, ethanol, gas sensor.

Research area: *Electrochemistry*

PREPARATION AND APPLICATION OF MARINE MACROALGAE SARGASSUM AQUIFOLIUM AS NEW BIOSORBENT FOR REMOVEAL OF URANIUM(VI) AND THORIUM (IV) FROM AQUEOUS SOLUTION

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Natural waste sorbents have been given more attention for heavy metal removal. As a result, *Sargassum Aquifolium* Macroalgae (SAM) powder was used in this study for the sorption of uranium(VI) (U(VI)) and thorium(IV) (Th(IV)) ions from aqueous solution. SAM samples were prepared, treated, and then characterized using various techniques such as Fourier-Transform Infrared (FTIR), X-Ray Diffraction (XRD), Thermal Gravimetric Analysis (TGA), Energy Dispersive X-ray Spectroscopy (EDXS), Scanning Electron Microscope (SEM) and BrunauerEmmett (BET). The sorption of U(VI) and Th(IV) ions on SAM was investigated using the batch technique as a function of initial metal ions concentrations, sorbent mass, pH, contact time, and temperature. The sorption kinetic studies showed that the sorption of U(VI) and Th(IV) ions by SAM sorbents was well-described by the pseudo second order equation. The thermodynamics study revealed the sorption process is an endothermic and spontaneous process. The sorption isotherm data correlated well with the Langmuir sorption model with the maximum sorption capacities of 20.4 mg/g and 24.1 mg/g for U(VI) and Th(IV), respectively. Meanwhile, the desorption studies indicated that the most favorable desorption reagent for both metal cations is 0.1 M HNO3. The sorption of U(VI) and Th(IV) ions from real water samples by SAM was tested.

Keywords: Sargassum Aquifoliu, Macroalgae, Sorption isotherm, Sorption kinetic, Thermodynamic study, Desorption.

Research Area: *Analytical Chemistry*

ELECTROCHEMICAL SYNTHESIS AND CHARACTERIZATION OF COPPER(II)-CIPROFLOXACIN/DECANOIC ACID COMPLEX

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In the present study, an electrochemical technique based on the release of Cu^{2+} ions from a Cu anode in the presence of ciprofloxacin (CP) and decanoic acid (DA) has been performed to synthesize Cu(II)-CP/DA complex. The synthesized Cu(II)-CP/DA complex was characterized using attenuated total reflectance-Fourier transform infrared spectroscopy (ATR-FTIR), proton and carbon-13 nuclear magnetic resonance (^{1}H and ^{13}C NMR). The characterization results proved that Cu(II)-CP/DA complex has been successfully synthesized using electrochemical technique. To study the effect of electrolysis conditions on the Cu particle size and Cu(II)-CP/DA morphology different values of applied voltages (1 V, 5 V and 10 V), supporting electrolyte concentrations (0.01 M, 0.1 M, 0.5 M) and initial pH (2.60, 6.12, 7.02 and 11.46) were investigated using transmission electron microscopy (TEM) and field emission scanning electron microscopy (FESEM). A small-sized Cu nanoparticles (3 ± 2 nm) was formed by using 1 V applied voltage, 0.01 M KNO_3 as supporting electrolyte and initial solution pH of 4.92.

Keywords: Electrochemical synthesis, copper complex, ciprofloxacin, decanoic acid, Nanoparticle

Research area: *Analytical Chemistry*

INFLUENCE OF TOPOGRAPHICAL ORIGIN ON DESIGNATED PHYSICOCHEMICAL CHARACTERISTICS AND 5-HYDROXYMETHYLFURFURAL CONTENT OF *Heterotrigona itama* HONEY FROM DIFFERENT SITES IN THE NORTHERN REGION OF PENINSULAR MALAYSIA

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The popularity of Malaysian stingless bee honey is rising among health-conscious individuals after its res recognition as the first Malaysian superfood by the Malaysian Agricultural Research and Development Institute; thus, several chemical and physical evaluations on Malaysian stingless bee honey are vital to ensure the honey has achieved the limits set by Malaysian Standards. Therefore, in the present study, the physicochemical parameters (moisture content, total dissolved solids, pH, free acidity, electrical conductivity, and ash content) and 5-hydroxymethylfurfural of *Heterotrigona itama* honey from different sites in the northern region of Peninsular Malaysia were investigated. Subsequently, the significant difference between *Heterotrigona itama* honey from different geographical origins was studied using univariate analysis (one-way ANOVA followed by post-hoc Tukey's). On the other hand, the discrimination pattern of 45 honey samples based on their topographical origins was evaluated using cluster analysis (heatmap and dendrogram) and chemometrics analysis (principal component analysis and partial least squares-discriminant analysis). As a result, some samples for specific parameters (for example, 5-hydroxymethylfurfural and ash content) have exceeded the limit set by Malaysian Standards. However, only moisture content and pH off all the 45 samples were within the allowed range. A statistically significant difference ($p < 0.05$) has been observed for all the parameters except ash content in terms of inter-topographical origins. Although, the profiles of *Heterotrigona itama* honey from different origins were close to each other. But most of them were separated according to their topographical origins and were validated using a permutation test.

Keywords: *Heterotrigona itama* honey, Topographical origin, Physicochemical properties, 5-Hydroxymethylfurfural, Cluster analysis, Chemometrics

Research area: *Analytical chemistry*

DEVELOPMENT OF LIQUID PHASE MICROEXTRACTION USING FATTY ACID-BASED DEEP EUTECTIC SOLVENT FERROFLUID FOR DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBON FROM ENVIRONMENTAL SAMPLES

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With growing interest in developing green extraction methods, deep eutectic solvent (DES) is considered a promising green alternative to the conventional solvent used in most extraction methods. In comparison with other extraction methods, liquid phase microextraction-based DES favourably conforms to the principle of Green Analytical Chemistry (GAC) due to its short sample pretreatment time, low organic solvent usage, and easy automation. Therefore, an environmentally friendly ferrofluid incorporating hydrophobic deep eutectic solvents derived from fatty acids has been developed. The fundamental physiochemical properties of the synthesised deep eutectic solvents ferrofluid were determined using Fourier Transform Infrared Spectroscopy (FTIR), Thermogravimetric Analysis (TGA), Vibrating Sample Magnetometer (VSM), and Scanning Electron Microscopy (SEM), followed by their use as an alternative adsorbent in liquid-phase microextraction to determine polycyclic aromatic hydrocarbons (PAH). The most important extraction parameters were optimised, and the procedure was validated. A Plackett-Burman design was employed to screen the experimental variables that affect the extraction. The selected experimental variables were then optimised using the Box-Behnken design (BBD). The greenness scale of the method was assessed by Analytical Eco-Scale and Analytical GREEness. The developed method was characterised by low limits of detection and quantitation with good precision (RSD). The optimised process successfully delivered a low-cost and environmentally friendly adsorbent, demonstrating a highly promising approach for extracting polycyclic aromatic hydrocarbons from various environmental samples.

Keywords: Fatty acid, PAH, GC-FID, Response surface methodology, greenness.

Research area: *Analytical Chemistry*

LINEAR AND NONLINEAR MODELING OF KINETICS AND ISOTHERM OF MALACHITE GREEN DYE ADSORPTION TO TRIMELLITIC-MODIFIED PINEAPPLE PEEL

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Adsorption is one of the most used and widely known for water and wastewater treatment, especially for toxic dye removal. In this paper, adsorption of malachite green by an adsorbent of utilizing trimellitic -modified pineapple peel studied through adsorption kinetics and adsorption isotherm study. A qualitative desorption study was also done. The adsorbent was prepared with sequential delignification, alkali pretreatments, and proceeding in an esterification reaction with dimethylacetamide, pyridine, and 1,2,4-benzene tricarboxylic (trimellitic) anhydride. The result was an unscented white powder that by characterization shows a characteristic peak of C=O at 1712 cm^{-1} via FT-IR, a removal of amorphous region through processing of the cellulose via XRD, and a significant morphological change via SEM imaging. The adsorption study was measured with spectrophotometry UV-Visible on λ_{max} 617 nm. A linearized and non-linearized methods for best fitting adsorption isotherm models have been studied following a linearized methods for determining adsorption kinetics. A parameter optimization was conducted by statistical and error functions: sum square of errors (SSE), average relative error (ARE), Marquardt’s percent standard deviation (MPSD), a sum of the absolute errors (EABS), coefficient of determination (R^2), and nonlinear reduced chi-square (χ^2), then finally analyzed by the sum of normalized errors (SNE) using MS Excel®. The kinetics model determination was based on best linear correlation through value of R^2. An evaluation of statistical error in conjunction with physical interpretation is much more necessary rather than only one of both. The lowest error function values and best estimation of isotherm parameters were obtained from Sips isotherm using a nonlinear method, with $R^2 = 0.9909$, $q_m = 27.683$ mg g^{-1}, K_S of 0.0016, and value of 1/n of 1.5422. The adsorption was following a pseudo-second order kinetics and showing a maximum desorption in NaCl 0.1 M of 85.3%.

Keywords: Adsorption, cellulose modification, error function, trimellitic anhydride.

Research area: *Analytical Chemistry*

EVALUATION OF ENANTIOSELECTIVE COMPREHENSIVE TWO-DIMENSIONAL GAS CHROMATOGRAPHY FOR THE STEREOISOMERIC ANALYSIS OF CHIRAL MONOTERPENES IN MALAYSIAN *CITRUS* SPP. LEAF OILS

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Citrus spp. essential oils are widely used in the food and pharmaceutical industries owing to their nutritional and therapeutic values. These aromatic leaf oils are known to have characteristic chiral secondary metabolites biosynthesised by plant-mediated stereoselective enzymatic mechanisms. This presentation will highlight our work on the development of a cryogen-free thermal modulation-based enantioselective comprehensive two-dimensional gas chromatography ($_{enant}$GC×GC) approach to perform the stereoisomeric analysis of chiral monoterpenes in Malaysian *Citrus spp*. leaf oils. It incorporates a first-dimension (^{1}D) enantioseparation step that allows the enantiomeric resolution of five chiral monoterpenes, followed by achiral separation in the second-dimension column to provide adequate interference-free enantiomer separation. The modulation ratio was optimised to ensure sufficient modulations across the ^{1}D effluents and reduce indetermined enantiomeric composition. Through this process, we have been able to accurately determine the enantiomeric fractions (EFs) of α-pinene, limonene, citronellal, linalool, and terpinen-4-ol in *Citrus* spp. leaf oils. The prospects of using EFs to differentiate or authenticate C. *hystrix.* (CH), *C. limon*. (CL), *C. pyriformis*. (CP), and *C. microcarpa* leaf oils will be highlighted.

Keywords: *Citrus* spp.; essential oil; chiral monoterpenes; enantioselective comprehensive two-dimensional gas chromatography; solid-state modulation.

Research area: *Analytical Chemistry*

A COMPREHENSIVE CHEMICAL ANALYSIS OF MALAYSIAN STINGLESS BEE HONEY: DETERMINATION OF FURANIC CONTENT, PHENOLIC COMPOUNDS AND ENANTIOMERIC DISTRIBUTION OF SELECTED TERPENES

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Stingless bee (*Trigona sp.*) honey is a highly valued natural product that contains unique and distinctive bioactive compounds with various nutritional and biological importance. However, information on the chemical profiles of stingless bee honey (SBH) remains scarce, particularly on Malaysian SBH. This study aims to provide a comprehensive analysis of the furanic content, phenolic compounds, and the enantiomeric distribution of chiral terpenes in Malaysian SBH. 5-hydroxymethylfurfural (HMF), 5-methyl furfural, and 2-furfural (2F) were simultaneously separated and determined using a validated micellar electrokinetic chromatography–diode array detector (MEKC–DAD) method. HMF was found in most SBH (21.6–545.7 mg kg^{-1}) while 2F was detected in six SBH (2.13–15.53 mg kg^{-1}). High performance liquid chromatography–DAD (HPLC–DAD) method was developed for the simultaneous determination of 14 phenolic compounds in SBH. The enantiomeric fractions of selected volatile terpenes (α-pinene, limonene, linalool, citronellal, terpinen-4-ol and β-citronellol) in SBH were investigated using a combination of enantioselective gas chromatography and enantioselective comprehensive two-dimensional gas chromatography approaches. The prospects of using these data for differentiation and/or authentication of SBH will be presented.

Keywords: Malaysian stingless bee honey, furanic content, phenolic compounds, chiral terpenes, enantioselective gas chromatography.

Research area: *Analytical Chemistry*

Use of chemically treated lemon peel as biosorbent: preparation, characterization and application

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ABSTRACT

Chemically treated lemon peel (LP) was used as an effective adsorbent for the removal of Congo red (CR) from aqueous solution. It was used due to easily available, low-cost and eco-friendly in nature. A number of steps were conducted for the entire research study. Lemon peel was collected and prepared as an effective adsorbent material. Batch experiment was carried out by using the prepared lemon peel adsorbent materials to remove the CR from aqueous solution. The parameters of pH, contact time, initial concentration and dosage of adsorbent were optimized to get the highest removal efficiency of CR. The maximum removal efficiency of lemon peel adsorbent for CR dye was found to be 91% at pH 4. Characterization was carried out to identify the morphology, and chemical compositions. The adsorbent material was characterized by using Scanning Electron Microscopy (SEM) and Fourier Transform Infrared Spectroscopy (FT-IR).

Keywords: Lemon peel; adsorption; Congo red; Remediation; Wastewater

Industrial Chemistry

VALORIZING WASTE CRAB SHELLS AS RENEWABLE BIOMASS FILLERS IN POLYANILINE FOR AMMONIA GAS DETECTION

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Seafood waste possesses an interesting physicochemical characteristic that can be used to produce lucrative end products. In the present study, an attempt was made to valorize waste crab shells as renewable biomass fillers in the synthesis of polyaniline/crab shell (PANI/CS) composites. PANI was synthesized via chemical oxidative method and the waste CSs were added ex-situ into the as-synthesized emulsion of PANI. The physicochemical properties of PANI/CS composites were evaluated by Fourier transform infrared (FTIR), ultraviolet-visible (UV-Vis), X-ray diffraction (XRD) and scanning electron microscope (SEM) techniques. Sensor responses of PANI/CS composites in different concentrations of ammonia (NH_3) gases were reported by using a multimeter with the aid of home-made gas chamber. PANI/CS 20% outperformed among all the prepared PANI/CS composites with a correlation coefficient of $R^2 = 0.9886$. Hence, PANI/CS 20% was selected to undergo sensor performance studies such as selectivity, reusability, and long-term stability. PANI/CS 20% exhibited good selectivity towards NH_3 gas in the presence of others interfering species such as hexane, acetone, diethyl ether and hydrochloric acid fumes and showed stability up to 1 week with 5 cycles of reusability. In conclusion, the study proved that waste biomass of CSs can be effectively incorporated into the PANI matrix and applied as a NH_3 gas sensor with an excellent limit of detection of 9.8 ppm.

Keywords: Biomass, Bioresource, Environment, Gas sensors, PANI, Seashells, Waste management

Research area: *Industrial Chemistry*

Biochemistry

INFLUENCE OF PRE-TREATED LOCAL FRUIT PEELS IN REMEDIATING DYE POLLUTANT

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Improper discharge of pollutants, including dyes, into the environment is a crucial issue in many countries. Multiple methods have been explored to remove dye pollutants, including the use of fruit peels as bio-adsorbent as they are cost-effective and renewable. This study aims to investigate the potential of local fruit peels in removing toxic dyes and determine the sorption of methylene blue using pre-treated fruit peels. In this study, two local fruit peels, i.e., mango and jackfruit, were used as adsorbents for the remediation of toxic dyes. The fruit peels undergone different types of pre-treatments (autoclaving, microwaving, boiling, and soaking in methanol) before use for the remediation of methylene blue (MB). UV-VIS analysis was then used to determine the removal efficiency of MB. Jackfruit treated with methanol (PT4) and mango treated with an autoclave (PT1) showed superior removal with 88.8% and 82.1% decolorization efficiency, respectively, compared to the use of other adsorbents. FTIR analysis confirmed the removal mechanism (biosorption) by examining the interaction of functional groups on fruit peels with dye molecules. This study revealed the capacity of pre-treated local fruit peels for the removal of toxic pollutants. The removal efficiency could be further improved by investigating the optimal conditions (pH, temperature, agitation speed, and initial dye concentrations) of dye removal.

Keywords: biodecolorization, biosorption, dye pollutant, methylene blue.

Research area: *Biochemistry*

A REVIEW ON PHYTOCHEMICAL CONSTITUENTS AND MEDICINAL PROPERTIES OF SAMBAU PAYA (*Chloranthus erectus*)

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The genus Chloranthus (L.) is one of the most important groups of plants belonging to the Chloranthaceae family. Chloranthus erectus is an erect shrub, native to India's Eastern Himalaya, Indo-Burma, and Southeast Asia's tropical and temperate zones. *C. erectus* is a popular folklore medicine used by many indigenous communities to treat localised swelling, joint pain, skin inflammation, fever, and body ache. Traditional knowledge, phytochemistry, and biological activity of *C. erectus* are all included in this review. To gather information on the issue, a search of database sites such as ScienceDirect, Web of Science, PubMed and Web of Science, Google Scholar journal publications was done. According to phytochemical studies, Eudesmanes, Lindenranes, Guaianes Aromadendranes, and other Sesquiterpene polymers are abundant in the plant. Pharmacological activities include anti-inflammatory, antimicrobial activity, antipyretic activity and anti-tumour activity. As a result, this study covers the phytochemical components and their biological assay as well as biological investigations on numerous crude extracts and both in vitro and in vivo fraction, as well as clinical trial data on *C. erectus*. This study includes the structures and pharmacological activity of 34 naturally occurring compounds from *C. erectus*. The review should offer researchers with up-to-date information and encourage more study into *C. erectus* and its pharmacological potential in the development of new therapeutic medicines.

Keywords: Chloranthaceae, Malay herbs, Pharmacological properties, Phytochemical constituents, Sambau Paya

Research area: *Biochemistry*

SCREENING OF ANTIOXIDANT PROPERTIES IN M1V4 MUTANT LINE OF TARO (*Colocasia esculenta*) CV. WANGI

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Colocasia esculenta which also known as Taro that belongs to Araceae family. Taro reported to have antioxidant properties which give many benefits to health. Increasing disease resistance is the sole goal of many Taro mutagenesis experiments, as antioxidants are rarely included. The effect of mutation on Taro's antioxidant level is thus less well understood. The aim of the study is to determine the antioxidant activity, total phenolic and flavonoid content and identify the Rf value in mutated Taro compared to non-mutant Taro using two different solvents 80% methanol and water. So, the finding from the studycan reaffirm its use in conventional diets among people. Treatment 1 (T1) are the taro that placed at ring 2 (nearest to the radiation source), received 0.66 Gy/h chronic gamma irradiation dose. Total phenolic content and total flavonoid content for T1 of water extract were found to be the highest with value of 288.19±31.01 mg GAE/ 100g sample and 1680.75±41.76 mg QE/100g respectively. There was significant difference ($p < 0.05$) in The TPC value and TFC value of T1 water extract. The antioxidant activity of Taro was evaluated using DPPH assay. Taro T7 (lowest dose of gamma irradiation) of methanol extract has the highest antioxidant activity with 88.91±0.06%, which showed significant different ($p < 0.05$) compared to local Taro (control). The range of RF values of the water extract (0.6-0.96)were slightly higher than the range of RF values of the methanol extract (0.62-0.9). In a conclusion, the radiation treatment of T1 which received the highest dose of gamma irradiation have significant effect on total phenolic content, total flavonoid content, and the radical scavenging activities ($p<0.05$).

Keywords: Antioxidant properties, corm, taro, *Colocasia esculenta*, mutant

Research area: *Biochemistry*

EVALUATION OF PHYSICOCHEMICAL PROPERTIES OF COCONUT WATER COLLECTED BETWEEN SHORELINE AND OUTSKIRT AREA OF PORT DICKSON, NEGERI SEMBILAN MALAYSIA

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The present study highlighted physicochemical profiling of coconut water from different planting areas on the shoreline and outskirt of Port Dickson, Negeri Sembilan. Two types of coconuts were studied in each location, which were young coconuts (greenish shell) and mature coconuts (brownish shell). Data was presented as mean±standard deviation using one-way ANOVA. The mean differences for both shoreline and outskirt areas were compared to each other based on their maturity to see the significance of the results. The level of significance applied was $p<0.05$. Five quality properties of coconut water which were pH, volume, total soluble solids, titratable acidity, and water activity were discussed. The quality assessment of all samples revealed that only key quality volumes gave significant differences ($P < 0.05$) in both young CW and mature on the shoreline and outskirts. Inorganic cations and anions determinations were carried out in all samples to further understand the chemical compositions. Atomic Absorption Spectroscopy (AAS) was used to determine inorganic cations (K, Mg, Ca) in all samples, and it revealed that there was no significant level ($P > 0.05$) for young coconut water despite different locations. Nevertheless, significant differences ($P < 0.05$) were observed for mature CW on both shorelines. Selected inorganic anions (chloride, fluoride, phosphate, sulphate and nitrate) were determined by Ion Chromatography and the results exposed that the most prominent inorganic anion present in all samples was chloride ion (200-450 mg/L) and there was no significant difference ($P > 0.05$) found in all respective anions in different locations. The finding reveals that planting area; outskirt or shoreline does only affect the volume of coconut water.

Keywords: Coconut water, physicochemical, nutrient, shoreline, outskirt

Research area: Biochemistry

THE ANTIMICROBIAL ACTIVITY OF NATURAL PRODUCTS (HONEY, HABBATUS SAUDA AND COCONUT WATER) AGAINST SELECTED GRAM-POSITIVE BACTERIA AND GRAM-NEGATIVE BACTERIA.

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Natural products contain compounds that could function as bacterial growth inhibitors. Honey contains hydrogen peroxide, while habbatus sauda contains thymoquinone, and coconut water consists of tannin. These constituents play a crucial function as antibacterial agents. This study aimed to examine the ability of these natural products in suppressing selected gram-positive and gram-negative bacteria known to be hazardous to humans, namely *Staphylococcus epidermidis*, *Pseudomonas aeruginosa*, *Shigella sonnei*, *Staphylococcus aureus*, *Escherichia coli and Bacillus subtilis*. The Kirby-Bauer method was used to evaluate the susceptibilities of the selected bacteria towards the selected compounds. The result showed that honey effectively inhibits *S.epidermidis* as it produced the highest inhibition zone at only 25% (v/v) concentration(0.33 mm diameter). At 100% concentration, honey effectively inhibited other bacteria, *P.aeruginosa*, *S.sonnei*, *S.aureus and B.subtilis* at (0.50 mm diameter) and *E.coli* (0.67mm). Habbatus sauda also showed the highest inhibition zone at a lower concentration of 15% with more than 8.00 mm against *S.aureus*, *S.sonnei*, *S.epidermidis*, *B.subtilis*. No inhibition was detected against *E. coli* and *P. aeruginosa*. Meanwhile, no inhibition zone was detected against tested bacteria in coconut water samples. The data suggested that habbatus sauda acts as the best antibacterial agent against selected bacteria, followed by honey. However, more research is required to provide evidence of the effectiveness of antimicrobial properties in habbatus sauda, honey and coconut water samples and to identify the mechanism of antibacterial properties involved.

Keywords: Antimicrobial, Disc diffusion, Kirby-Bauer methods, Natural products.

Research area: *Biochemistry*