BIONANOSEM 2022

3rd Bionanotechnology Research Seminar & Conference 2022

"Prospering Bionanotechnology Research, Innovation & Commercialization"

BioNanoSem
BIONANOTECHNOLOGY RESEARCH

PROGRAMME & ABSTRACT BOOK

Edited by
NIK AHMAD NIZAM NIK MALEK
NOR SURIANI SANI
SITI NUR SAKINAH AHMAD
SABARIAH AJIS

UTM UNIVERSITI TEKNOLOGI MALAYSIA

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KEMENTERIAN SAINS, TEKNOLOGI DAN INOVASI

MALAYSIAN BIOmaterials SOCIETY
Persatuan Biobahan Malaysia

PROGRAMME & ABSTRACT BOOK

3rd BIONANOTECHNOLOGY RESEARCH SEMINAR & CONFERENCE 2022

(BIONANOSEM 2022)

Putrajaya, Malaysia

4th August 2022

https://csnano.utm.my/3rd-bionanosem-2022/

Third Edition 2022

Programme and Abstract Book

BioNanoSem 2022

(Bionanotechnology Research Seminar & Conference)

Editor:

NIK AHMAD NIZAM NIK MALEK

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NIK AHMAD NIZAM NIK MALEK

Centre for Sustainable Nanomaterials

Ibnu Sina Institute for Scientific and industrial Research

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Co-Organizer

National Nanotechnology Centre (NNC), Ministry of Science,

Technology & Innovation (MOSTI) &

Malaysian Biomaterials Society (BMS)

Collaborators

Malaysian Solid-State Science & Technology Society, UTM Chapter (MASS)

Ceramic and Amorphous Group (CerAm), UTHM

Green Chemistry Research Group (GChem), UTM

Advanced Nano Materials Research Group (ANoMA), UMT

Advanced Optical Materials Research Group (AOMRG), UTM

BioM3D Group PPSG (BioM-USM), USM

Advanced Medical and Dental Institute (AMDI„ USM

UTM JAHATAN TEKNOLOGI MALAYSIA

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MALAYSIAN BIOmaterials SOCIETY

CONTENT

Foreword by Program Advisor

Bismillahirahmanirahim.

Alhamdulillah, we express our heartfelt gratitude to Allah SWT for granting us the opportunity to host the 3rd Bionanotechnology Research Seminar and Conference (BIoNanoSem) in 2022. This year's event is being hosted by Centre for Sustainable Nanomaterials (CSNano), Universiti Teknologi Malaysia (UTM) in collaboration with the National Nanotechnology Centre (NNC), Ministry of Science, Technology, and Innovation (MOSTI), and the Malaysian Biomaterial Society (MBS).

BioNanoSem 2022's theme, "Prospering Bionanotechnology Research, Innovation, and Commercialization," is consistent with the goals and scope of UTM Research and Innovation Blueprint 2025. The Office of the Deputy Vice Chancellor Research and Innovation published this Blueprint in 2021 (https://research.utm.my/blueprint/). The primary goal of this Blueprint is to serve as a guide for UTM to strive for excellence in R&D, commercialization, and innovation (R, D, C & I). In addition, UTM is known as a Research University. There are five strategic objectives in this Blueprint which are (i) Strengthening and Enhancing Research Excellence, (ii) Fostering and Catalysing High Return Partnership Engagement, (iii) Advancing from Lab to Market, (iv) Enhancing and Strengthening Research Environment, and (v) Stewarding and Establishing of Trans-Discipline Technology and Networking Platform. The Blueprint's impact will benefit academia, government, industry, the community, and the environment. Bionanotechnology encompasses multidisciplinary fields aligned with nine focus areas identified in this research Blueprint, mainly Smart Manufacturing and Materials, Biomedical and Healthcare Engineering, Natural Product, and Biorefinery and Biotechnology. The nine focus areas are critical at both national and international levels.

In addition, UTM’s research themes are accomplished by the existence of 5 strategic Research Alliances, which are (i) Frontier Materials, (ii) Smart Digital Community, (iii) Innovative Engineering, (iv) Health and Wellness, and (v) Resource Sustainability. In this Research Alliances, members from various faculties come together and engage in cross-

disciplinary research and innovation. The Blueprint is expected to impact future research excellence of UTM, and for the nation.

As a result, it is hoped that the 3rd BioNanoSem 2022 will achieve its primary goals of enhancing research, innovation, and commercialization in the bionanotechnology field, as well as successfully align with the UTM's research and innovation Blueprint. The Blueprint's goal is to support research and innovation in multidisciplinary fields because the bionanotechnology itself is a multidisciplinary field. This programme is expected to realise the Bionanotechnology Innovation Initiative, which brings products from research to market.

Thank you to the Centre for Sustainable Nanomaterials (CSNano), Ibnu Sina Institute for Scientific and Industrial Research (ISI-SIR), UTM for working tirelessly to ensure the success of the third BioNanoSem 2022. On behalf of UTM, I would like to thank the co-organizers, particularly NNC MOSTI and MBS, as well as all research groups and institutes involved in this programme. Thank you also to Novatiq Scientific Sdn Bhd, our Platinum sponsor, and Business Events Sarawak (BESARAWAK), our Gold sponsor. Your assistance is greatly appreciated. The participants in this programme, including the plenary, keynote, invited, presenter, video, and poster presenters, as well as all committee members involved in this programme, deserve special recognition. May we all work together to achieve success.

"…..the successful implementation of this program requires total commitment from all levels of committee and participants…"

Yours Sincerely,

PROF DR ROSLI MD ILLIAS
Deputy Vice-Chancellor Research & Innovation,
Universiti Teknologi Malaysia

Foreword by Program Director

Bismillahirahmanirahim.

Alhamdulillah, In the Name of Allah the Almighty. I am very grateful to Allah SWT for giving us the opportunity to conduct again the Bionanotechnology Research Seminar and Conference (BioNanoSem) in 2022. This is BioNanoSem's third event. Bionanotechnology is the fusion of biology, or the study of living things, and nanotechnology. It can also be thought of as a biological application of nanotechnology in areas like antibacterial nanomaterials, nanobiomaterials, nanomedicine, nanoparticles, and nanobiology, among others. The Center for Sustainable Nanomaterials (CSNano), Ibnu Sina Institute for Scientific and Industrial Research (ISI-SIR), Universiti Teknologi Malaysia (UTM) aim to remain focused and highlight research on sustainable nanomaterials, which is at the core of bionanotechnology. Sustainable means that something can be maintained over time with little long-term impact on the environment and that it can support or maintain a process that is closely related to "bio," or living things.

First BioNanoSeM was organised by CSNano in 2020 as a venue for researchers to discuss their progress on each project of the Trans-Disciplinary Research Program (UTM-TDR). The TDR program's title and focus are "Antibacterial Wound Healing Application of Bio-Inspired Green Silver Nanoparticles," and it includes five projects from various disciplines. We performed the BioNanoSem again in 2021 with a larger participant including other research groups from UTM and other institutions due to the success of the event, successfully achieving the event objectives, and numerous benefits that we obtained.

CSNano, UTM organised the 2nd BioNanoSem2021 last year in collaboration with the Ceramic and Amorphous Group (CerAm), UTHM, and the Green Chemistry Research Group (GChem), Faculty of Science, UTM. Because the field of bionanotechnology involves multi- and trans-disciplinary research, the primary goal of BioNanoSem is to learn from various fields and perspectives.

This year, CSNano manage to organize 3rd BioNanoSem 2022 together with National Nanotechnology Centre (NNC), Ministry of Science, Technology, and Innovation Malaysia

(MOSTI) and Malaysian Biomaterials Society (MBS). In addition, several research centres and other research groups were also together as co-organisers of this program :

- Malaysian Solid State Science & Technology Society, UTM Chapter (MASS)
- Ceramic and Amorphous Group (CerAm), Universiti Tun Hussein Onn Malaysia (UTHM)
- Green Chemistry Research Group (GChem), UTM
- Advanced Nano Materials Research Group (ANoMA), Universiti Malaysia Terengganu (UMT)
- Advanced Optical Materials Research Group (AOMRG), UTM
- BioM3D Group PPSG (BioM-USM) Universiti Sains Malaysia (USM)
- Advanced Medical and Dental Institute (AMDI), USM

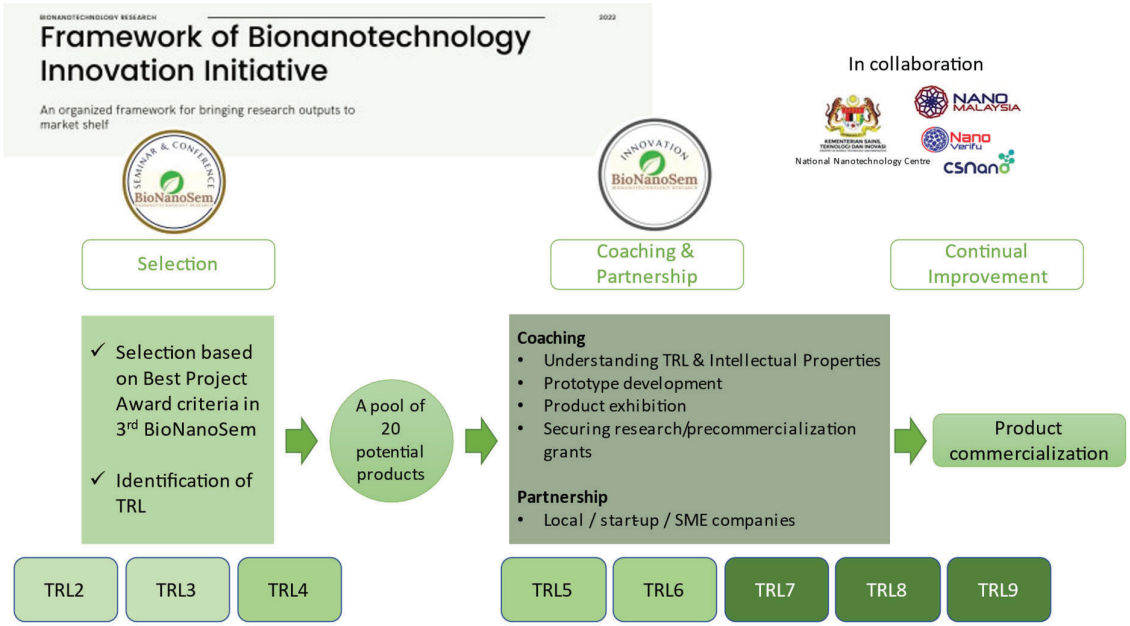
On behalf of the committee members of the 3rd BioNanoSem 2022, I would like to express heartfelt gratitude to all coorganizers and collaborators. The contribution of each committee member is critical to the success of this event. Not to mention our Platinum sponsor, Novatiq Scientific Sdn Bhd, and our Gold sponsor, Business Events Sarawak (BESARAWAK).

The objectives of this programme include :

- To create a platform for researchers and students involved to present and share ideas on topics specifically in bionanotechnology research.
- To expose participants in the field of bionanotechnology focusing on innovation and pre-commercialization of research products.
- Become a platform for research collaboration with research groups within and outside UTM.

At the end of this programme, 20 selected projects will be awarded best project awards, and the researcher will be able to move on to the next stage of product development. It is known as the Bionanotechnology Innovation Initiative. This initiative will begin by determining the Technology Readiness Level (TRL) for each product development. This initiative will train researchers in product development for commercialization and will collaborate with local industries. The product will then achieve higher TRLs, up to TRL8 and TRL9, allowing it to enter the commercialization stage. It is hoped that this initiative will assist our local researchers in commercialising research products, particularly in the field of bionanotechnology. This

initiative is also aligned with the theme of 3rd BioNanoSem 2022 which is "Prospering Bionanotechnology Research, Innovation and Commercialization".



I would like to thank all participants involved as plenary speaker, keynote speaker, invited speaker, video presenter, and poster presenter, as well as sponsors, UTM, MOSTI, collaborators, committee members, and all agencies and companies supporting this programme, on behalf of the committee members of the 3rd BioNanoSem 2022. May this wonderful event achieve its main goal, particularly in the area of Bionanotechnology research.

Yours Sincerely,

ASSOC PROF Ts ChM Dr NIK AHMAD NIZAM NIK MALEK
Director,
3rd Bionanotechnology Research Seminar and Conference (BioNanoSem) 2022,

Director,
Centre for Sustainable Nanomaterials (CSNano),
Ibnu Sina Institute for Scientific and Industrial Research (ISI-ISIR),
Universiti Teknologi Malaysia (UTM).

Foreword by Director of National Nanotechnology Centre (NNC), MOSTI

Bismillahirahmanirahim.

Assalamualaikum Warahmatullahi Wabarakatuh dan Selamat Sejahtera,

We are deeply grateful to Allah SWT, the Most Merciful and Most Beneficent, for the successful organisation of this year's Bionanotechnology Research Seminar and Conference (BioNanoSem) 2022. My gratitude also goes to the Centre for Sustainable Nanomaterials (CSNano), Universiti Teknologi Malaysia (UTM), Malaysian Biomaterial Society (MBS) for co-organising BioNanoSem 2022 with the National Nanotechnology Centre (NNC), Ministry of Science, Technology and Innovation (MOSTI).

In August 2011, MOSTI established the National Nanotechnology Centre (NNC), formerly known as the National Nanotechnology Directorate (NND). NNC is responsible for and functions as the national nanotechnology reference centre. NNC coordinates national development of public policies and Research and Development (R&D) initiatives on nanotechnology, including from the aspects of product development and new technologies, as well as standards and regulations development for safe applications of advanced materials and nanotechnology in Malaysia. The culmination of these past efforts at both national and international levels, is the official launch of the National Nanotechnology Policy and Strategy (DSNN) 2021–2030 and the recently launched National Nanotechnology and Products Roadmap 2021–2025 as an official supporting document to the DSNN. NNC has been entrusted to ensure the aspirations of these two public reference documents are achieved by the timeline prescribed but these cannot be executed solitarily without partners, shareholders and stakeholders in nanotechnology.

Hence, the BioNanoSem 2022 is a great platform for all nanotechnologist to exchange ideas, scientific findings, fostering collaborations and best practices in nanotechnology, in line with Strategic Thrust 2 in DSNN: Advancing Research and Development (R&D). Furthermore, it supports the objectives of BioNanoSem 2021 and the scope of UTM's Research and

Innovation Blueprint in 2021, intended to serve as a guide for UTM's pursuit of excellence in R&D, commercialisation and innovation (R, D, C & I). I trust a lot of learnings and experiences will be shared over the course of two days and the thoughts of inspiration and motivation are all set to move along with us outside this venue as our lifelong learnings, together as collaborating partners. Therefore, participation in BioNanoSem 2022 and the outcome will potentially improve our progress in nanotechnology R&D and assist us to navigate dynamic and ever-changing global environment, which calls for experts who are knowledgeable in sailing the challenging currents and lead society for a better future through nanotechnology.

Congratulations to everyone who contributed to making this year's BioNanoSem a resounding success. Once again, thank you to CSNano (UTM), MBS and the team from NNC for all their effort and commitment. I also would like to record my thanks to the participants of this year's BioNanoSem and I am looking forward to meeting you again in the near future.

Terima kasih.

Sincerely,

ASSOCIATE PROF. DR. RUSLINDA A. RAHIM
Director,
National Nanotechnology Centre (NNC),
Ministry of Science, Technology and Innovation (MOSTI)

Foreword by President Malaysian Biomaterial Society

Assalamu'alaikum Warahmatullahi Wabarakatuh and Salam Sejahtera.

First and foremost, it is a great pleasure to welcome all of you to the 3rd Bionanotechnology Research Seminar and Conference (BioNanoSem) 2022, hosted by Centre for Sustainable Nanomaterials (CSNano), Universiti Teknologi Malaysia (UTM), National Nanotechnology Centre (NNC), MOSTI and Malaysian Biomaterial Society (MBS) proud to be one of the collaborator.

MBS is a national organization that incorporates scientists, engineers, and clinicians to promote the knowledge of biomaterial sciences towards the betterment of fundamental and clinical sciences. In line with the MBS aims and objectives, this research seminar will promote primary goals of enhancing research, innovation, and commercialization in the bionanotechnology field. Beside that MBS always encourage establishment of research linkage within organisations and exchange of information in biomaterial science and commercialization.

We welcome all the participants to join our exciting post-conference workshops entitled Nanotechnology in Biomaterials: Current Perspectives in 5th of August 2022.

On behalf of the MBS, I take this opportunity to thank to BioNanoSem committee members for given us an opportunity to collaborate in this prestige conference and to bring together researchers from around the country. Finally, my deepest appreciation goes to every person in organizing committees for their hard works and strong commitment and also support from MBS and BioNanoSem to make this conference a grand success.

Wishing all of you may have an informative discussion and enjoy the wonderful moment.

Thank you.

PROFESSOR TS. DR. ISMAIL BIN ZAINOL
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BioNanoSem
BIONANOTECHNOLOGY RESEARCH

Tentative Program

4 August 2022

Duration (min)	Time	Program			Location
25	800 - 825 am	**REGISTRATION**			FOYER
		PARALLEL SESSION			SEPARATE ROOM
		Session 1 (Ballroom) Chairperson: Assoc. Prof. ChM. Dr. Khairul Anuar Mat Amin, UMT	**Session 2 (Room 1)** Chairperson: ChM. Dr. Mohd Hayrie Mohd Hatta, AMU	**Session 3 (Room 2)** Chairperson: Ts. Dr. Rabiatul Basria S. M. N. Mydin, USM	
15	0830-0845 am	IS-Phy-My-002	IS-Phy-My-004	IS-Phy-My-006	
10	0845-0855 am	P-Phy-My-001	P-Phy-My-002	P-Phy-My-019	
10	0855-0905 am	P-Phy-My-004	P-Phy-My-016	P-Phy-My-006	
10	0905-0915 am	P-Phy-My-007	P-Phy-My-008	P-Phy-My-009	
10	0915-0925 am	P-Phy-My-022	P-Phy-My-011	P-Phy-My-021	
20	0940-1000 am	**Keynote Speaker 1** **Prof. Dr. Ismail Zainol, UPSI /Malaysian Biomaterials Society** Chairperson: Assoc. Prof. Ts. ChM. Dr. Hanis Mohd Yusoff, UMT			BALLROOM
20	1000 -1020 am	**Keynote Speaker 2** **Prof. Dr. Rosli Md Illias, UTM** Chairperson: Assoc. Prof. Ts. ChM. Dr. Hanis Mohd Yusoff, UMT			
15	1020-1035 am	**COFFEE BREAK AND BOOTH SESSION**			FOYER
30	1035 - 1105 am	**Plenary Lecture 1** **Dr. Rezal Khairi Ahmad, Nano Malaysia Berhad** Chairperson: Assoc. Prof. Ts. ChM. Dr. Nik Ahmad Nizam Nik Malek, UTM			BALLROOM
30	1105 - 1135 am	**Plenary Lecture 2** **Assoc. Prof. Dr. Ruslinda A. Rahim, National Nanotechnology Centre (NNC), MOSTI** Chairperson: Assoc. Prof. Ts. ChM. Dr. Nik Ahmad Nizam Nik Malek, UTM			
45	1150 am-1250 pm	**OPENING CEREMONY**			
10	1250 - 0100 pm	**POSTER AND BOOTH SESSION**			FOYER
50	**0100 - 0150 pm**	**LUNCH BREAK**			**RESTAURANT**
		PARALLEL SESSION			SEPARATE ROOM
		Session 4 (Ballroom) Chairperson: Dr. Rosnani Hasham, UTM	**Session 5 (Room 1)** Chairperson: Dr. Rabihah Alawi, USM	**Session 6 (Room 2)** Chairperson: Assoc. Prof. Ts. ChM. Dr Noor Aniza Harun, UMT	
15	0215 - 0230 pm	IS-Phy-My-001	IS-Phy-My-003	IS-Phy-My-005	
10	0230 - 0240 pm	P-Phy-My-013	P-Phy-My-015	P-Phy-My-014	
10	0240 - 0250 pm	P-Phy-My-005	P-Phy-My-017	P-Phy-My-018	
10	0250 - 0300 pm	P-Phy-My-003	P-Phy-My-020	P-Phy-My-012	
10	0300 - 0310 pm	P-Phy-My-010	P-Phy-My-023	P-Phy-My-024	
15	0310 - 0325 pm	IS-Phy-My-007	IS-Phy-My-008	IS-Phy-My-009	
20	0330-0350 pm	**COFFEE BREAK AND BOOTH SESSION**			FOYER
20	0350-0410 pm	**Keynote Speaker 3** **Prof. Ir. Dr. Srimala Sreekantan, USM** Chairperson: Dr. Juan Matmin, UTM			BALLROOM
20	0410-0430 pm	**Keynote Speaker 4** **Dr. Mariani Abdul Hamid, UTM/BioPro Consortium Sdn Bhd** Chairperson: Dr. Juan Matmin, UTM			
50	0430-0520	**AWARDS AND CLOSING CEREMONY**			

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3	**Way from Lab to Market: Experience Sharing** Prof Ir Dr Srimala Sreekantan, *USM*	**28**
4	**DERMAGS® Skin Solution – Intensive Brightening Series & Anti-Aging with Alpha-MAGs®** Dr Mariani Abdul Hamid, *UTM/BioPro Consortium Sdn Bhd*	**29**

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2	IS-Phy-My-002	**Development of Green Silver Nanoparticles and Its Application: A Transdisciplinary Approach** Assoc Prof Ts ChM Dr Nik Ahmad Nizam Nik Malek, *UTM*	**31**

Category: Oral Presentation

Category: Video Presentation

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No	Code	Title and Name	Page
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BioNanoSem
BIONANOTECHNOLOGY RESEARCH

PLENARY SPEAKERS

Plenary Speaker 1

REVOLUTIoNT – Commercialising High Value Nanotechnology Solutions to the Market

Rezal Khairi Ahmad, Daniel Bien Chia Sheng*, Devandran Krishnan, A. Mulia Hafizayatullah Amiruddin, Nurul Aini Azam, Nurul Izyan Supiandi, Shalini Muniandy, Priyaa Darshinie Chanthira Sakaran, Norhaizam Mustaffa, Nur Diyana Syazwani Zambri, Farhan Haziq Azharollah, Mohamad Haziq Alias, Muhammad Hidayat Mohtar Apandi

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Abstract

Nanotechnology helps to considerably improve, even revolutionise technologies and industrial sectors: information technology, homeland security, medicine, transportation, energy, food safety, and environmental science, among many others. The Internet of Nano Things (IoNT) is a network of nanosensors and nanodevices, that are connected to the Internet and NanoMalaysia Berhad believes that IoNT will be the core driver of the 4th Industrial Revolution, catalysing. the revolutionary changes in the industry, business, and society. Hence, under the 12 Malaysia Plan, NanoMalaysia Berhad, a company limited by guarantee (CLBG) under the Ministry of Science Technology and Innovation (MOSTI) has established the REVOLUTIoNT Programme with GraphneNovation and iNanovation as sub-programmes to pursue the revitalization of industries and innovation through successful development and commercialisation of high value nanotechnology intellectual properties, products and solutions in Malaysia.

Ensuring that a sustainable ecosystem is established for the REVOLUTIoNT Programme, NanoMalaysia have identified four critical strategic sectors which presents the most significant growth opportunities in the medium to long term for the country, namely Electronic Devices and Systems, Energy and Environment, Food and Agriculture, and Wellness, Medicine and Healthcare. Supporting these key initiatives are Advanced and Nano Materials namely Graphene driven by the GrapheneNovation Programme; Nanocellulose, Nano-Silica, Carbon Nanotubes and NanoCoatings driven by the iNanovation Programme to ensure a complete value chain and local supply ecosystem is established where most of these nanometrials can be produced from agriculture biomass waste that is highly available in Malaysia; enabling Waste to Wealth for a Circular Economy.

As a summary, since the start of NanoMalaysia's commercialisation programmes in 2016, to-date more than 70 technologies, products and solutions has been developed with various industries resulting in more than 50 project Intellectual Properties developed for value creation; with more than 30,000 potential job opportunities and over RM34 billion in potential GNI contribution over the next 5 years.

Keywords: nanotechnology; commercialisation; industrial revolution 4IR

Plenary Speaker 1

Biography

	Dr. Daniel Bien Chia Sheng is a Senior Vice President at NanoMalaysia Berhad leading the Nanotechnology Programme Delivery Office. In his role, he is responsible to drive diffusion of nanotechnology-based materials, processes, products and solutions to the market in Malaysia through collaborative projects between industries, government agencies, professional services companies, research institutions and universities. He also leads NanoMalaysia's technology and product development activities enabling Malaysian industrial migration to these innovative processes, intermediaries and products to move up the global value chain through strategic technology roadmaps, IPR licensing, and market positioning. In his previous experience, he has chaired the National Mirror Committee for the International Electrotechnical Committee, IEC TC-113 on Nanotechnology Standardisation for Electrical and Electronic Product and Systems for Malaysia from 2010 to 2015 and has more than 50 international patent filings and technical publications respectively.

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Plenary Speaker 2

Nanotechnology in Malaysia 2030: The Journey Begins

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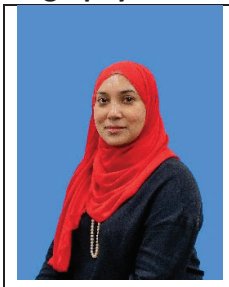
Abstract
The National Nanotechnology Centre (NNC), Ministry of Science, Technology and Innovation (MOSTI) is responsible on national policy formulation and execution, as well as the development of nanotechnology R&D in Malaysia. The ability to manipulate and engineer materials at nano scale, brings with numerous opportunities for socio-economic wellbeing. For Malaysia, our National Nanotechnology Policy and Strategy 2021-2030 (DSNN) was launched last year in November 2021 to create a dynamic and progressive nanotechnology ecosystem, highlighting the potential of nanotechnology as a new economic driver and in solving various challenges faced by the country. This national policy comprised four strategic thrusts, supported by 15 strategies and 32 initiatives across the various economic sectors that would provide a sustainable nanotechnology ecosystem development in Malaysia. The aspirations of the DSNN are further enhanced by an official supporting document, the National Nanotechnology and Products Roadmap 2021-2025. These two important documents set out Malaysia's plans and aspirations to be a high technology nation with robust nanotechnology industry and innovation ecosystem by 2030. The possibilities leading to 2030 are endless as nanotechnology can exist in almost all levels of and verticals of applications, be it the medical and healthcare, industrial sector, and even in food security.

Keywords: nanotechnology; policy; development.

Biography



Ruslinda binti A. Rahim obtained her Ph.D in Nanoscience and Nanoengineering from Waseda University, Japan. She graduated with M. Eng and B. Eng in Electrical and Electronic Engineering from Muroran Institute of Technology, Japan. Currently, she is the Director of National Nanotechnology Centre (NNC), Ministry of Science, Technology and Innovation (MOSTI). She is a Research Fellow in Institute of Nano Electronic Engineering (INEE), Universiti Malaysia Perlis (UniMAP), Associate Research Fellow in Institute of Microengineering and Nanoelectronics (IMEN), the National University of Malaysia (UKM) and Visiting Professor in Czech Technical University in Prague. Her research interests include nanoelectronics, nanostructure device, nanosafety, biosensors, bioelectronics, DNA and protein detection, Aptamer and surface chemistry on carbon-based materials. She is actively involves in Board of Engineers Malaysia, Professional Technologist Malaysia (MBOT) (Nanotechnology), serves as Exco of Asia Nano Forum (ANF), Committee member of Malaysia Nanotechnology Association, Board of Member Malaysia Sensor Society and Editor of the International Journal of Nanoelectronics and Materials.

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KEYNOTE SPEAKERS

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BIONANOTECHNOLOGY RESEARCH

Keynote Speaker 1

Green Silver Nanoparticles as Antibacterial Agent in Biogenic-Hydroxyapatite/Collagen Composite for Bone Filler Applications

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Abstract

The major component of human bone are collagen and hydroxyapatite. The biomimetic collagen–apatite composites material provides excellent mechanical and biological properties suitable for bone fillers applications. Incorporation of silver nanoparticles (AgNPs) in the collagen-hydroxyapatite composite is expected to enhance the antibacterial properties of the materials. The aim of the present study was to prepare antibacterial fish scales hydroxyapatite/fish collagen/silver nanoparticles (FsHA/FsCol/AgNPs) in the form of beads for bone fillers applications. The FsHA and FsCol were extracted from fish scales whereas AgNPs was synthesised using green chemistry method. The synthesized FsHA, FsCol and FsHA/FsCol/AgNPs composite materials were characterized using Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), energy dispersive x-ray analysis (EDX) and x ray diffraction analysis (XRD) to identify the chemical structure and surface morphology. The cytotoxicity of the FsHAp/FsCol/AgNPs composites was evaluated using Alamar blue assay. Antibacterial property of the composite was conducted against *Escherichia coli* (*E. coli*) and *Staphylococcus aureus* (*S. aureus*). The results had proved the presence of hydroxyapatite and collagen functional groups in the samples from FTIR, EDX and XRD analysis. FESEM-EDX analysis had shown the morphology of porous composites beads with AgNPs well dispersed in the FsHA matrix. The FsHA/FsCol/AgNPs composite produced has shown good antibacterial properties and was found to be biocompatible material. The composite produced has high potential to be used as bone filler materials.

Keywords: fish scale hydroxyapatite, silver nanoparticles, antibacterial, bone filler

Biography

Prof. Ts. Dr Ismail Zainol received his PhD from UMIST, Manchester, United Kingdom in 2001 and he was a senior researcher at SIRIM Berhad for 15 years before joining Chemistry Department, Universiti Pendidikan Sultan Idris (UPSI) in 2008. He is elected President of Malaysian Biomaterials Society (MBS) since 2020. His main research interests are biomaterials and polymer composite. Currently, he explores the usage of fish scales in biomaterials application with collagen as wound dressing and hydroxyapatite as fillers in biopolymer for biomedical applications.

Keynote Speaker 2

Advancing Biorefinery by Nanobiocatalysts

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Abstract

Bioeconomy has been seen as one of the ways to solve issues and challenges face by the world today. Biorefinery is among the strategy that contributed to sustainable circular bioeconomy where biomass resources are converted into valuable bioproducts and energy. Enzymes are nature's catalyst that are designed to accelerate specific reactions with high selectivity. Their role in converting biomass into products is crucial in biorefinery. However, limitations involving enzyme as biocatalysts include its performance in terms of stability and reusability that affecting cost and timeline of the reaction process. Immobilization of enzyme is one of the preferred methods to solve these issues. The advancement of nanomaterial and enzyme technology has led to the development of nanobiocatalysts. Nanobiocatalysts with its enhanced properties is expected to improve and advance enzyme technology usage in biorefinery.

Keywords: enzyme technology; biorefinery; nanobiocatalyst

Biography

	Professor Dr. Rosli Md Illias is the Deputy Vice Chancellor (Research & Innovation) and a lecturer at Department of Bioprocess and Biopolymer, School of Chemical and Energy Engineering, Faculty of Engineering, Universiti Teknologi Malaysia (UTM). His expertise is in molecular enzymology and enzyme expression. He has been working for more than 25 years in enzyme reaction, protein engineering and immobilization of enzyme especially for the conversion of biomass. Currently working in the development of nanobiocatalysts and also looking at the molecular level of nanomaterial as well as enzyme molecule interactions.

Keynote Speaker 3

Way from Lab to Market: Experience Sharing

Srimala Sreekantan[a,b]

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Abstract

Commercialization is the process of bringing new products or services to market. The growing need to commercialise university research has forced every academic institution to rearrange its research efforts in order to create marketable products. It begins with concept development and progresses through proof of concept, field validation, certifications, and finally commercial deployment. It may appear simple, yet achieving the ultimate aim often involves several obstacles. My journey from the lab to the market is shared in this talk. Every customer's pain point is a business opportunity. Determine the existing offering's limitations and begin working on it differently. Make competition irrelevant to your invention. Also, stakeholder engagement such as policymakers, industry, and customers at the research and developmental stage will perfectly align you to build a market fit product rather than just a minimum viable product. Apart from that, research and development (R & D) efforts must telegraph the feasibility, cost, scalability, intellectual property, etc. to ensure the product is commercially viable and has a degree of public value that could potentially result in increased profitability for the company. In short, design smartly your journey from lab to market to achieve the ultimate goal.

Keywords: commercialization; invention; lab to market; experience.

Biography

Prof Ir Dr Srimala Sreekantan is a Professor in the School of Materials & Mineral Resources Engineering, USM. She is an enthusiastic academician and researcher with extensive involvement in teaching and material engineering research. She has been spent almost 16 years to develop, optimize and simplify the technology involved in the synthesis of nanomaterials which has great significance for green energy, biomedical and environment applications. Her unique and innovative inventions have also received many gold and special awards in the national and international exhibition. She has been published more than 150 ISI research articles, and her research works have been presented in 130 over conferences. Unlike many in the community who regard entrepreneurship and academia as incompatible, she views entrepreneurship as an opportunity for academic professionals to contribute to nation development. She also has been awarded as Top Research Scientist Malaysia 2015 and Great Women of Our Time 2016 Award of Science & Technology for her distinguishable contribution in Science and Technology. She has been awarded 10th National Academic Awards for innovation commercialization category; for her outstanding contribution in innovation and commercialization achievements. In 2021, she formed a spin off to commercialize her inventions. The international awards, recognition and being a business lady shows the strength to drive the research from lab to the market.

Keynote Speaker 4

DERMAGS® Skin Solution – Intensive Brightening Series & Anti-Aging with Alpha-MAGs®

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Abstract

DERMAGS® Skin Solution is an-award winning skincare range that focusing on correcting hyperpigmentation, skin brightening and anti-aging with Alpha-MAGs®. Research collaboration between Universiti Teknologi Malaysia and Dongguk University, South Korea, the distinctive characteristic of these products is its unique delivery system, which involve niosome technology as nano carrier to enhance the penetration and distribution of Alpha-MAGs® to the stratum corneum and skin epidermis. Study shows that Alpha-MAGs®, a xanthone extracted and purified from mangosteen pericarp, directly inhibits the production of melanin formation and intracellular tyrosinase activity, promoting skin brightening as well as inducing collagen synthesis from within. The upward trend of cosmetics industry towards employing natural/herbal-based contents (44%) justifies the huge market potential of DERMAGS®. Technology using mangosteen pericarp fits well with sustainable ecosystem engineering for the betterment of mankind.

Keywords: niosome technology; Alpha-MAGs®; DERMAGS®; anti-aging; hyperpigmentation

Biography

	Dr Mariani Abdul Hamid is currently a Senior Lecturer at School of Chemical and Energy Engineering, Faculty of Engineering at Universiti Teknologi Malaysia. She served as a principal investigator (PI) and co-PI on several grants funded by the Ministry of Higher Education of Malaysia. She has published widely in the field, with over 20 publications in peer reviewed international journals and book chapters. She is also currently the Managing Director for Biopro Cosmeceutical Sdn. Bhd. (UTM's spin-off company). Determined to find a natural solution for Malaysian women's skin problem, her efforts eventually bore fruit when made a huge discovery. Dr Mariani had discovered a natural compound namely Alpha mangostin or Alpha-MAGs®, a compound that can whiten human skin cells and alleviate skin problems such as oily and dull skin as well as stimulates collagen production. Three years of comprehensive investigation with Professor Park Chang Seo from Korean International Cosmetic Research Institute, had given Dr Mariani enough confidence to convert her research into a premium skincare product. DERMAGs® is her first-ever skincare product.

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INVITED SPEAKERS

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IS-Phy-My-001

Gellan Gum Biopolymer Incorporated Fillers in the Development of Wound Dressing Materials

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Abstract
Gellan gum (GG) has gained considerable attention in the food, chemical, and pharmaceutical industries due to its functional characteristics. It has versatile properties, such as water solubility, easy bio-fabrication, good hydrogel formation, biodegradability, and biocompatibility. These properties render GG a promising material in biomedical applications, specifically in the development of wound dressing materials. Various fillers, such as titanium dioxides, clay, drug, and honey, have been incorporated in GG to produce film, hydrogel, or scaffold materials. The effects of filler on the mechanical performance, physical properties, antibacterial activities, and healing activities of GG biocomposites through in-vitro and in-vivo studies were explained. In conclusion, it shows that GG incorporated with various fillers has shown a promising result to be used as wound dressing products.

Keywords: gellan gum; wound dressing; honey; collagen

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IS-Phy-My-002

Development of Green Silver Nanoparticles and Its Application: A Transdisciplinary Approach

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Abstract

Silver nanoparticles (AgNP) are an advanced nanomaterial with strong market demand for antimicrobial applications and applications in the electronics sector. AgNP can be synthesized using a variety of processes, including physical and chemical ones. Because of the issues with traditional methods, such as high energy consumption and the use of harmful chemicals, AgNP can be synthesised utilising a biological approach, which is considered a green and sustainable process. It begins with the selection of a bioresource as a bioreducing agent, followed by biosynthesis optimization, AgNP characterisation, AgNP modification for a specific use, and then the specific application. Plant extracts (spices, herbs, fruits, and so on), microalgae, bacteria, fungi, and honey are among the bioresources. The biosynthesized AgNP is a hybrid organic-inorganic substance that is difficult to comprehend. As a result, the development of biosynthesized AgNP and its multiple applications is a multidisciplinary endeavour that necessitates a fundamental understanding of a wide range of fields, including biology, chemistry, physics, mathematics, biomedical science, and others. Understanding these fundamental principles may assist researchers in optimising AgNP production and use it effectively and sustainably.

Keywords: Silver nanoparticles; transdisciplinary; biosynthesis

IS-Phy-My-003

NanoTechnopreneur: The Catalyst for Low Carbon Research-to-Revenue

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Abstract
Being an entrepreneur from an academician is not an easy transformation. As innovation is crucially needed to transform knowledge into applications, academicians are facing a challenging journey to ensure research is successfully transformed into commercialization. A NanoTechnopreneur – a term used quite often nowadays for the growth mindset to transform ideas into commercialization in nanotechnology especially in mitigating the climate change. The talk presents the challenging route in nanotechnology research and innovation such as: 1. Why Research-Development-Innovation-Commercialization-Economy (RDICE) is important in translating research-to-revenue? 2. The CEO Thinking in nanotechnology 3. What are needed to set up and accelerate a research start-up? 4. What are the elements in Business Model Canvas (BMC) for low carbon research? 5. Start-up nation and its dynamic execution, and other experience sharing in materializing the nanotechnopreneurship. The business plan and the impact of the technopreneur covers multiplier impact on socioeconomic drivers of quintuple helix which consists of society, academia, government, industry, and environment.

Keywords: Nanotechnopreneur; start-up nation; low carbon emission; accelerator; climate change

IS-Phy-My-004

Green Synthesis of Zinc Oxide Nanoparticles (ZnO-NPs): Synthesis, Characterizations and Potential Applications

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Abstract

Green synthesis of zinc oxide nanoparticles (ZnO-NPs) has gained more interest among researchers because of its simplicity, low cost and wide range of applications. Green synthesis approach of ZnO-NPs can be carried out by using plant extracts, microorganisms, algae or even industrial or agricultural wastes. During synthesis process, the synthesis conditions can be modified to produce specific desired morphologies, however that are mostly favourable in chemical synthesis of ZnO-NPs. It is very important to optimize synthesis in green synthesis route of ZnO-NPs to produce comparable NPs with chemical synthesis route. The synthesis conditions include species of plants, reaction time, and several calcination temperatures. ZnO-NPs display excellent applications ranging from physical to biological applications such as antibacterial properties.

Keywords: ZnO-NPs; green synthesis; plant extracts

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IS-Phy-My-005

Harnessing Microbes for Nature's Hidden Wealth: Nanocellulose – Our Research Experience

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Abstract

Bacterial nanocellulose (BNC) is a multifunctional nanomaterial that is classified as highly versatile biorenewable biopolymers that is non-toxic. The unique properties of BNC such as high crystallinity, water holding capacity, tensile strength and flexibility offers good potential applications in industrial applications such as biomedical, health care and the environment. In our search for nanocellulose producing bacteria, shake flasks experiments were carried out using the modified Hestrin and Schramm (HS) medium under static condition. In general, BNC was observed at the interface of the liquid and air of the culture medium in the form of white gelatinous layer. However, in some cases, pellicles were formed at the bottom of the flasks. Diverse types of samples ranging from rotten mixed fruits, wastewater samples and commercial organic vinegar were used. Identification of the bacteria *via* 16S rRNA analyses showed the presence of *Glucanoacetobacter* spp, *Asaia* sp, *Burkholderia* sp., *Kozakia baliensis* and *Bacillus velezensis*. The purified BNC samples were either oven dried and/ or freeze-dried to a constant weight. The physiochemical characteristics of BNC were determined using the Scanning Electron microscopy (SEM), X-Ray diffraction (XRD), Fourier Transform infrared spectrum (FTIR) and Thermogravimetric analysis (TGA). Initial studies had shown good potential application of BNC for the biomedical field and environment. Work is currently in progress to chemically modify BNC for environmental applications

Keywords: bacterial nanocellulose; Hestrin and Schramm medium; Fourier Transform infrared spectroscopy; X-ray diffraction; thermogravimetric analysis; biodegradable

IS-Phy-My-006

Nanotechnology-Based Studies on Herbal Extract Delivery for Cosmeceutical Application

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Abstract

The cosmetic industry is monitored by the pharmaceutical regulatory body in most countries, where its rapid growth is associated with the increasing demand from consumers. In view of this, advanced technologies were developed to provide cosmetic functions with optimum effects for skin and hair, such as skin lightening, anti-ageing, anti-acne, and haircare treatment. Transdermal and topical delivery of bioactive compounds or drugs have been established extensively and are promising methods to improve the bioavailability of the actives to the targeted site. Previously, the frequent systems used were topically applied creams and ointments for dermatological problems. Transdermal and topical drug delivery approaches such as nanoemulsions, liposomes, niosomes, ethosomes, solid lipid nanoparticles, nanostructured lipid carriers, micelles, and polymeric nanoparticles have significant advantages over other means of drug administration. The distinctive physical and chemical properties of nanoparticles enable the transport of substances such as drugs and cosmetic active ingredients directly to the skin (local or systemic) without going through the first-pass metabolism and improve patient compliance.

Keywords: transdermal; topical; cosmetic; nanotechnology; nanocarrier

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BIONANOTECHNOLOGY RESEARCH
IS-Phy-My-007

Discovering A New World of Ultra-High Resolution Imaging With Atomic Force Microscope (AFM)

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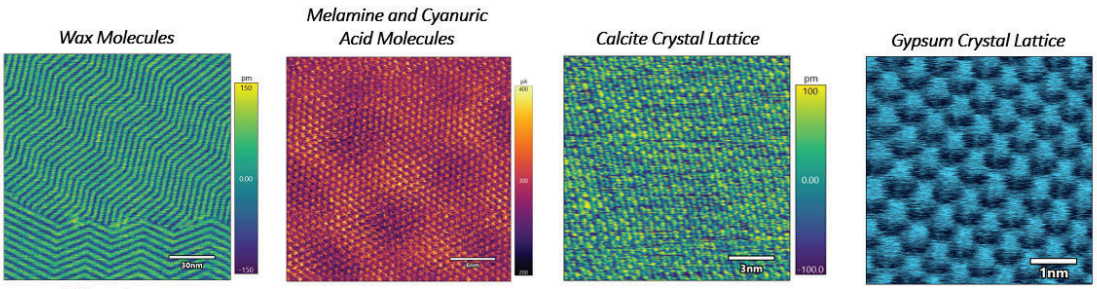
Abstract

Since its invention over 30 years ago, the atomic force microscope (AFM) has become firmly established as a high-performance tool for applications throughout biology, materials science, chemistry, and physics. The AFM's core capability, namely nanoscale structural characterization by imaging topography (height), has only improved with time. Tapping mode is by far the most used AFM imaging mode. That is because it provides the highest resolution, the fastest results, it is gentle on samples, and it can measure not just topography, but also mechanical, electrical, and magnetic properties of samples. But not all implementations of tapping mode are created equal. Asylum's blueDrive excitation technique uses a laser to directly excite the cantilever resonance, making tapping mode simpler, more stable, and more quantitative. Furthermore, miniaturization of cantilevers for AFM has increased their resonant frequencies and decreased their thermal noise, allowing faster, lower noise measurements. When used in our extremely low-noise Cypher AFM, these levers have enabled significant improvements in imaging resolution in air and especially in liquids. On crystals, individual atomic point defects can now be routinely resolved and this higher resolution also extends to biological samples. In this technical talk, we will journey into a new world of ultra-high resolution AFM imaging using our Asylum Research's blueDrive™ tapping. This talk is ideal for all current AFM users, both novice and advanced, and those wanting to explore new possibilities of the nano world.



Keywords: AFM; blueDrive; ultra-high resolution; tapping mode; atomic point defect

IS-Phy-My-008

Patenting for Nanotechnology: Lost in Translation?

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Abstract
Nanotechnology is a science and the ability to engineer, manipulate and operate materials at nano scale. This nanoscale, potentially promising and novel abilities or phenomena can be observed and ultimately engineered, leading to numerous innovation and new applications. These novel applications and innovation may be assumed to qualify for protection under the patent law, subject to the fulfilment of required patentability conditions. However, the unique phenomena and new properties that can be achieved at this extremely small scale can present a different set of challenges to secure sufficient protection as patents for new nanotechnology. In any innovation-driven economies, intellectual property protection framework plays a crucial role to achieve competitive advantage and continuously promoting innovation. Companies should adopt relevant intellectual property strategies to remain competitive. The risk of inability to protect and enforce patents for new nanotechnology inventions, applications and products can negate further investment in this technology domain, hinder commercialisation and industry growth. This talk will explore the challenges in patenting for nanotechnology.

Keywords: nanotechnology; patents; intellectual property.

BioNanoSem
BIONANOTECHNOLOGY RESEARCH
IS-Phy-My-009

Preclinical Evaluation of Biomaterial Products and Animal Studies

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Abstract
Biomaterial innovation is facilitated by accelerating a revolution that meets the needs of the 21st-century healthcare system. Technology development for medical treatment, prevention, and diagnostic applications requires preclinical research. Performance optimization of biomaterial product with targeted biological system covers *in vitro*, *in vivo*, *ex vivo*, and *in silico* models before the clinical trial stage. Preclinical evaluation of nano-based biomaterial products has become more stringent recently, especially involving animal studies. The principle of animal research is to determine the efficacy, compatibility, and potential toxicity risk typically for short-term and long-term applications. The ideal animal model selection and experimental design in biomaterial research provide dual importance for pre-commercialization strategies, especially in the biomaterials third wave revolution.

Keywords: Biomaterial product, nano-based biomaterial, preclinical animal model

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ORAL PRESENTATION

BioNanoSem
BIONANOTECHNOLOGY RESEARCH
P-Phy-My-001

Biosynthesis of Silver Nanoparticles Loaded Zeolite Y using *Persicaria odorata*

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Abstract

Because of their exceptional antibacterial properties, silver nanoparticles (AgNP) are being investigated as a potential antibacterial agent. Nonetheless, developing a method for a safe and environmentally friendly synthesis is crucial. As a result, *Persicaria odorata* was used to biosynthesize AgNP, which was then immobilized on zeolite Y (ZeoY-AgNP) as a possible antibacterial agent. *P. odorata* has high potential as reducing agent because it has high ability to reduce Ag^{+} to Ag^{0} (AgNP). X-ray Diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR) investigations were used to characterise and confirm the crystalline nature and structure of the ZeoY-AgNP in this study. Even after loading with Ag ions, the zeolite Y structure remained unaltered, according to the characterization data. As a result, the Ag was successfully immobilized on the zeolite Y framework without causing damage to its structure. Disc diffusion technique (DDT) and degree of bacteria viability were used to test antibacterial activity against Gram-negative bacteria (*Escherichia coli* ATCC 11229 and *Pseudomonas aeruginosa* ATCC 15442) and Gram-positive bacteria (*Staphylococcus aureus* ATCC 6538). In comparison to *S. aureus* and *E. coli*, *P. aeruginosa* was more susceptible to the material. Meanwhile, tests of bacterial viability in saline and distilled water revealed that *E. coli* and *S. aureus* were more vulnerable than *P. aeruginosa*. The findings indicated that biosynthesized AgNP-incorporated zeolite Y using *P. odorata* as bioreducing agent could be an effective antibacterial agent.

Keywords: silver nanoparticles; *Persicaria odorata*; zeolite Y; antibacterial

BioNanoSem
BIONANOTECHNOLOGY RESEARCH
P-Phy-My-002

Antibacterial Activity of Kaolinite Incorporated with *Persicaria odorata*-Biosynthesized Silver Nanoparticles

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Abstract

Nowadays, researchers prefer a greener synthesis method that is safe and does not harm the ecosystem or environment during the process. They are looking for novel alternatives to chemical methods. The potential of *Persicaria odorata* plant extract to efficiently synthesise silver nanoparticles was validated in this work. Silver ions were reduced to silver nanoparticles by *P. odorata*, which works as a reducing agent. Silver nanoparticles biosynthesised by *P. odorata* were immobilized into kaolinite surfaces to stabilise them. There were four (4) samples prepared for antibacterial activity and characterisation. Kaolinite-AgNP was kaolinite that had been incorporated with *P. odorata* biosynthesized AgNPs, whereas kaolinite-$AgNO_3$ and kaolinite-PE were both kaolinite that had been incorporated with silver nitrate or plant extract. Field Emission Scanning Electron Microscopy with Energy Dispersive X-ray (FESEM-EDX), X-Ray Diffraction (XRD), and Fourier-Transform Infrared Spectroscopy were used to characterise four different samples (FTIR). Antibacterial activity of the samples using disc diffusion technique (DDT) was evaluated against two different types of bacteria which are *Escherichia coli* ATCC 11229 (Gram negative) and *Staphylococcus aureus* ATCC 6538 (Gram positive) (Gram positive). According to the findings, both the kaolinite-AgNP and kaolinite-Ag sample killed the bacteria effectively, as evidenced by the appearance of the zone of inhibition. Overall, this research suggests that kaolinite-AgNP could be a promising antibacterial agent for use in a variety of applications, particularly in the biomedical field.

Keywords: silver nanoparticles; *Persicaria odorata*; kaolinite; antibacterial

BioNanoSem
BIONANOTECHNOLOGY RESEARCH
P-Phy-My-003

Biosynthesis of Antibacterial Silver Nanoparticles using the Root of Mas Cotek

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Abstract

Ficus deltoidea var. *kunstleri* (King) Corner is a herb also known as Mas Cotek in Malaysia has been used as a traditional remedy to treat diabetes, blood pressure, improve blood circulation, gout and skin infections. Usually, the leaf of Mas Cotek had become the centre of research. However, the biosynthesis of antibacterial silver nanoparticles (AgNP) using the root of *F. deltoidea* (AgNP-FdRoot) is still lacking. About 119 phytochemical compounds were found in the root of *F. deltoidea* determined using Liquid Chromatography Mass Spectrometry (LCMS), and 50% amongst it belong to phenolics and flavonoids compounds. These compounds are known to be reducing, capping and stabilizing agents for AgNP. The AgNP was synthesized for 21 hours at 90°C after the root extract (3 mL) was adjusted to pH 12, and intense peak localised surface plasmon resonance (LSPR) was observed at 409 nm. In addition, Fourier Transform Infrared (FTIR) spectroscopy revealed the vibration and stretching of -NH, $-CH_3$, $-CH_2$, -CH, C=O, and -OH functional groups, confirming the capping and stability of AgNP by phytochemical substances. Using Transmission Electron Microscopy (TEM), the particle size of the AgNP was spherical (15.7 ± 2.9 nm). The AgNP showed antibacterial activity against *Escherichia coli* and *Staphylococcus aureus* with the inhibition zone of 15.7 ± 0.6 and 15.3 ± 0.6 nm, respectively. In conclusion, the root of *F. deltoidea* contains phytochemical compounds that can reduce, cap and stabilize AgNP, which can be utilized as an antibacterial agent to fight *E. coli* and *S. aureus* bacteria.

Keywords: *Ficus deltoidea*; root; silver nanoparticles; antibacterial

BioNanoSem
BIONANOTECHNOLOGY RESEARCH
P-Phy-My-004

Synergistic Antibacterial Effect of *Persicaria odorata* Synthesized Silver Nanoparticles with Antibiotic Towards Drug Resistant Bacteria

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Abstract

For many years, combination therapies using two or more known antimicrobial agents, especially nanoparticles, have garnered interest to tackle this emergence of antibiotic resistance problem. However, the antibacterial activity of phytosynthesized silver nanoparticles (AgNPs) combined with antibiotics is not yet extensively studied. Therefore, our study aims to study the antibacterial activity of the phytosynthesized AgNPs with different antibiotics against two common pathogenic bacteria, methicillin-resistant Staphylococcus aureus (MRSA) and *Pseudomonas aeruginosa*. AgNPs were prepared using an aqueous extract of *Persicaria odorata* as a green reducing and stabilizing agent. The formation of AgNPs was confirmed by using ultraviolet-visible (UV-Vis), Fourier transform infrared (FTIR), X-ray diffraction (XRD), energy-dispersive X-ray spectroscopy (EDX), and high-resolution transmission electron microscope (HR-TEM) analyses. Notably, strong absorption spectra corresponding to surface plasmon resonance peaks of AgNPs were measured at 424 nm. Transmission electron microscope analysis (TEM) showed that the AgNPs have a nanosize ranging from 10 nm to 23 nm. The antibacterial activity of *P. odorata* AgNPs alone and in combination with antibiotics was investigated using the disc diffusion technique. The MRSA and *P. aeruginosa* used were initially 100% resistant to antibiotics. The disc diffusion assay showed a significant increase in the zone of inhibition when ampicillin/AgNPs, cefoxitin/AgNPs, and chloramphenicol/AgNPs were used in combination. This means that the synergistic effect of antibiotics was significantly increased in the presence of AgNPs compared with antibiotics alone. In short, AgNPs show good synergistic effect with antibiotics, which may open the door for future combination therapy against resistant pathogenic bacteria.

Keywords: Silver nanoparticles; *Persicaria odorata*; synergistic; antibacterial activity; resistant bacteria

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BIONANOTECHNOLOGY RESEARCH
P-Phy-My-005

Microalgae-Mediated Biosynthesis of Titania Nanoparticles and Its Antibacterial Activity

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Abstract
Of late, the biosynthesis of nanoparticles (NPs) has received tremendous attention and is becoming a futuristic alternative in providing a safer, greener, economic and energy-efficient approach. Such features can outperform the existing chemical and physical methods that involve the usage of toxic chemicals and are non-eco-friendly. Apart from implementing a green approach, this research also aims to sort out unresolved issues in NPs production, such as dispersion and agglomeration of NPs. Therefore, microalgae-mediated biosynthesis of TiO_2 NPs using 3 different species of microalgae, namely *Chlorella sp., Spirulina sp.,* and *Oscillatoria sp.,* will be studied. Bioactive compounds present in the microalgae will act as reducing and capping agents responsible for the NPs production. It is expected that differences in terms of morphologies, such as surface area, shape, size, and dispersity, will be seen with each type of microalgae used. The instrumental analysis, such as nitrogen sorption (N_2 sorption), X-ray diffraction (XRD) and field emission scanning electron microscopy (FESEM), will be used to characterise the morphological properties of the TiO_2 NPs synthesised from each species. The biosynthesised TiO_2 NPs will be tested for their antibacterial activity against *Staphylococcus aureus* (Gram-positive bacteria) and *Escherichia coli* (Gram-negative bacteria) using the agar well diffusion method. It is expected that TiO_2 NPs will show a significant zone of inhibition towards the biosynthesised TiO_2 NPs.

Keywords: titania nanoparticles; biosynthesis; microalgae; antibacterial activity.

P-Phy-My-006

Characterization of Fibre Reinforced Nano Hybrid Dental Composite Made of Nano Silica Rice Husk and Kenaf Fiber

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Abstract

Fibre reinforced and nano hybrid dental composites were introduced due to the development of new biomaterials and more effective treatment approaches. Up to this date, no fibre reinforced nano hybrid dental composite derived from natural fibres is available in the market. This study characterized the fiber reinforced nanohybrid dental composites made of rice husk nano silica and kenaf fiber. The kenaf cellulose was treated using tetraethyl orthosilicate (TEOS) sol-gel. Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM) were used to investigate the treated kenaf cellulose. The samples for experimental and commercial composite groups were prepared (n=6) for flexural and compressive strength tests. The SEM was used to examine the surface of fractured flexural strength samples. SEM showed the average diameter and length of the fibres were reduced after the treatment; 7.4µm and 537µm respectively. The FTIR results demonstrated presence of chemical bonds between kenaf cellulose and silica from TEOS sol- gel. The flexural strength of the experimental composite was increased as the fibre load increased, however the values were lower than the commercial composites. The experimental group with 2% treated kenaf cellulose resulted in comparable compressive strength with the Neofil (Kerr™, USA) composite. SEM analysis showed smoother fibre surface with presence of lesser voids between matrix and kenaf fibre, suggested enhanced interfacial bonding. Fibre reinforced nanohybrid dental composites using nano silica rice husk incorporated with 2% treated kenaf fibre was comparable to the commercial composite group tested demonstrating a potential application of this material in dental restorative field.

Keywords: fiber reinforced composite; kenaf cellulose; flexural strength; compressive strength; nano silica

P-Phy-My-007

Optical Properties of Carbon Nanotubes-Coated Tellurite Glass: Judd-Ofelt Analysis for Future Fiber Optics

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Abstract
In the present work, carbon nanotubes-coated zinc borotellurite glass doped with erbium nanoparticles denoted as ZBTEr (NPs)-CNTs glass was investigated as an approach to improve the optical properties of glass materials. Herein, a melt-quenched technique was used for the preparation of ZBTEr (NPs)-CNTs glasses meanwhile, a simple and low-cost spray coating technique was employed to directly deposit the CNTs onto the glass surfaces. The morphological studies of ZBTEr (NPs)-CNTs glass were carried out via scanning electron microscope (SEM), revealing the images of highly twisted CNTs and relatively agglomerated structures on the glass surfaces. TEM images prove the existence of Er (NPs) with average diameters ranging from 20.07 to 23.53 nm, respectively. The presence of structural disorder and amorphous nature of glasses were confirmed by the XRD pattern. Judd-Ofelt analysis was studied to obtain the intensity parameters (Ω_λ), radiative transition (A), branching ratio (β_R), and radiative lifetimes (t_r). The radiative parameter and branching ratio values demonstrated that the $^2H_{11/2} \rightarrow {}^4I_{15/2}$ transition has a higher stimulated emission radiative than other transitions, which corresponds to the strong green emission. These findings highlight the significant effect of CNTs deposited onto tellurite-based glass and hence, this study proposed the potential coating materials for the improvement of current optical fiber applications.

Keywords: carbon nanotubes; Judd-Ofelt; tellurite glass

BioNanoSem
BIONANOTECHNOLOGY RESEARCH
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Green Synthesis of Zinc Oxide Nanoparticles (ZnO-NPs) using *Hibiscus sabdariffa* Aqueous Leaves Extract and its Band Gap Properties

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Abstract
Zinc oxide nanoparticles (ZnO-NPs) are one of the best utilized nanoparticles among various metal oxide nanoparticles, particularly because of its wide band gap properties, excellent thermal and chemical stability. In this study, green synthesis approach was applied to synthesize ZnO-NPs using the extract of *Hibiscus sabdariffa* leaves. The ZnO sample produced was tested for its thermal stability before further calcination at 700 °C and 900 °C for 6 hours. The product obtained was then characterized using Fourier-Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Energy Dispersive X-ray (EDX) and UV-Vis spectroscopy. The band gap properties of ZnO-NPs were determined via UV-Vis reflectance spectrum. The FTIR spectrum shows a broad O-H peak in the pre-calcined sample which verifies the existence of phenolic compound that is responsible as the reducing and stabilizing agent. Besides, the FTIR peaks within 450 cm^{-1} to 600 cm^{-1} indicates the existence of ZnO compound. The crystallinity of ZnO-NPs increases at higher calcination temperature. The ZnO-NPs obtained was in hexagonal wurzite structure. The calcined sample at 700 °C has porous-like structure whereas calcined sample at 900°C has polyhedral rod-shaped NPs. The elemental analysis confirms the ZnO is in highest purity as composition of zinc and oxygen was 83.68% and 16.32% respectively. The UV-Vis absorption showed an obvious red shift with increasing temperature. The band gap energies of all samples range from 3.27 eV to 3.31 eV where it decreases at higher concentration of starting material and calcination temperature. Therefore, the ZnO-NPs produced through green synthesis using *Hibiscus sabdariffa* leaves extract has showed wide band gap properties of semiconductor.

Keywords: green synthesis, zinc oxide nanoparticles, band gap, *Hibiscus sabdariffa*

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BIONANOTECHNOLOGY RESEARCH
P-Phy-My-009

In vitro Cytocompatibility of Biosynthesized AgNP using Kesum Leaf Extract

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Abstract

Green biosynthesis of silver nanoparticles (AgNP) method using various plant extracts could replace the use of harmful chemicals syntheses. Therefore, kesum leaf extract was used to biosynthesize AgNP and the *in vitro* cell compatibility towards human skin fibroblast cells (HSF 1184) was performed and reported here. The aqueous extract of kesum leaf was evaluated for its total flavonoid content (TFC) and total phenolic content (TPC). Afterwards, kesum leaf extract at different volumes (0.1, 0.2, 0.3, 0.4 and 0.5 mL) was used to synthesize AgNP from $AgNO_3$ 100 ppm precursor. The cytocompatibility of the biosynthesized AgNP was assessed at a different concentration in comparison to other commercial AgNP products. Kesum leaf extract exhibited the highest TPC and TFC in comparison to its stem or whole plant. In addition, 0.5 mL kesum leaf extract was the optimized volume used to synthesize AgNP with a significant peak at 440 nm. For the cytotoxicity result, the mean inhibition concentration (IC_{50}) value for the biosynthesized AgNP was found at 27.24 mg/mL which is the lowest as compared to the other commercial products. Thus, the biosynthesized AgNP is not toxic at a concentration < 27.24 mg/mL. In conclusion, kesum leaf extract is a potential substitute for a greener AgNP biosynthesis with acceptable cytocompatibility.

Keywords: silver nanoparticles; biosynthesis; kesum; *in vitro*; cytocompatibility

P-Phy-My-010

Antibacterial Activity of Clinoptilolite Incorporated with Kesum Leaf- Biosynthesized Silver Nanoparticles

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Abstract

Antibacterial activity of clinoptilolite (Cli) incorporated with biosynthesized silver nanoparticles using kesum leaves (Cli-AgNPs) were investigated together with raw Cli as a comparison. Cli which acted as cation carrier was loaded with Ag ions from, silver nitrate (Cli-Ag). Kesum extract provided natural reducing agent to generate Ag-NPs in Cli. Some characterization tools including X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), energy dispersive X-ray (EDX) and dispersion behaviour test were employed to characterize the samples. Subsequently, antibacterial activity of the samples was tested against gram-negative *Escherichia coli* and gram-positive *Staphylococcus aureus* through disc diffusion technique (DDT) and minimum inhibition concentration (MIC). From the result, XRD and FTIR confirmed the structural basis of Cli, Cli-Ag and Cli-AgNPs which overall indicates to Cli and did not change after loaded with Ag. On the other hand, SEM visualized stable surface morphologies of the samples after Ag loading and EDX revealed the content of Ag in Cli-Ag-NPs. However, in Cli-Ag none silver was detected due to insufficient Ag loaded. In addition, dispersion behaviour test revealed weak dispersive of Cli-Ag and Cli-Ag-NPs in a mixture of water and oil. Meanwhile, DDT revealed equivalent antibacterial activity of the samples against both bacteria. However, MIC differently revealed antibacterial activity of the samples in dH_2O and saline solution. In dH_2O, antibacterial activity of Cli-Ag was found to be significantly greater than Cli-Ag-NPs. While in saline, Cli-Ag-NPs capable of sustaining its antibacterial activity better than Cli-Ag. Saline solution contains free chloride ion that immediately precipitate Ag to AgCl but not Ag-NPs, thus making Cli-Ag-NPs remain sustain in salinity condition. In conclusion, Cli as Ag carrier able to remain stable chemically and structurally despite external changes it encounters and Cli-Ag and Cli-Ag-NPs exhibit remarkable antibacterial action that could be used in future against bacteria.

Keywords: silver nanoparticles; *Persicaria odorata*; zeolite clinoptilolite; antibacterial

P-Phy-My-011

Nanoporous Cellulose Microspheres and Nanoparticles for Controlled Release of Fertilizer

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Abstract

Fertilizers (e.g. urea) have immense impacts on plant growth and the relative profitability of agriculture. However, studies have shown that about 40-70% of the fertilizers are not absorbed by plants, but are lost via leaching, volatilization, denitrification, surface runoff and other chemical processes in soils. Losses of fertilizers are not only resulted in poor harvests and a significant economic loss but also caused serious environmental problems in terms of hazardous greenhouse gas emissions (e.g. nitrous oxide) and water eutrophication. This proposed project aims to study the release kinetics profiles and mechanisms of fertilizer from nanoporous cellulose microspheres and nanoparticles. Nanoporous cellulose microspheres and nanoparticles were prepared from cellulose fibers derived from locally available lignocellulosic wastes such as wastepapers. The effects of synthesis conditions on the physical properties (e.g. surface morphology, porosity, mean particle size range, pore size distribution, etc) and chemical properties (hydrophilicity/hydrophobicity, chemical functionality, etc) of cellulose microspheres will be investigated using various established characterization methods (FTIR, SEM, TEM, etc). Model fertilizers such as urea will be loaded within these cellulose microspheres and nanoparticles.

Keywords: nanoporous; cellulose; microspheres, nanoparticles, controlled release

P-Phy-My-012

MyNanoria: The Self-Exploration on Nanomedicine Mobile Application Module

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Abstract

Research has shown the significance of nanotechnology in modern medicine over the past three decades. Nanotechnology have been developed to improve health, which is referred to as nanomedicine. The application of nanomedicine has been extensively applied in drug delivery, cancer treatment, diagnostic process and the latest one is for nucleic-acid based vaccine delivery which is rapidly undergoing development in current COVID-19 pandemic era. Due to the importance of nanomedicine for current and future health, this field has been introduced to the secondary level of chemistry education. However, there is still lack of exposure and knowledge level of the teachers and students about nanotechnology. The aim of this study was to provide a platform for an easy access of nanotechnology information, focusing on nanomedicine to students and teachers via mobile application. Other than that, students' achievement and interest towards nanotechnology field should be enhanced.

Keywords: nanotechnology; mobile application; chemistry education; nanomedicine

P-Phy-My-014

Effect of Zinc Substitution in Magnesium Oxide Nanoparticles on Morphology and Band Gap Energy

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Abstract

In this research, the novel properties and potential applications of magnesium oxide nanoparticles (MgO-NPs) and zinc doped magnesium oxide nanoparticles ($Mg_{1-x}Zn_xO$-NPs) were studied. MgO-NPs and its doped materials were synthesized using a self-propagating combustion method. The study on doped compounds is to investigate band gap changes in the new materials. The calcined samples of MgO-NPs and its doped materials were characterized using XRD, SEM, EDX and UV-Vis spectroscopy. In this research, it was found that the synthesis route using triethanolamine for the combustion synthesis is suitable for obtaining pure and single phase substitutionally doped $Mg_{1-x}Zn_xO$-NPs up to 27 wt% of Zn^{2+} at a calcination temperature of 800 °C. The presence of substitutional element in the MgO lattice has caused changes in the morphologies and crystallite sizes of the materials. The band gaps were studied and found to be quite intimately connected with their functionalities. The band gap energies of MgO-NPs and $Mg_{1-x}Zn_xO$-NPs obtained from the synthesis (6.05 eV-3.53 eV) exhibit lower band gap energies than the standard value of the bulk MgO (7.8 eV). It was also found that the presence of substitutional elements Zn in MgO lattice, modifies the band spectra causing band gap narrowing in the materials. Therefore, it can be observed that for band gap tuning, other than adjusting the crystallite size, it can also be done, by doping of foreign metals into the host structure.

Keywords: MgO-NPs; $Mg_{1-x}Zn_xO$-NPs; combustion; triethanolamine; band gap

BioNanoSem
BIONANOTECHNOLOGY RESEARCH

P-Phy-My-015

Quantification of Lateral Detachment Force for *Alteromonas litorea* and *Bacillus niabensis* using Atomic Force Microscopy

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Abstract

Microbial fouling (biofilms) can lead to undesirable microfoulers formation on the marine man-made structures. Regular maintenance is required, which could result in severe financial lost. Therefore, a deeper knowledge on the relationship between single marine bacteria species and coated paint embedded with modified kaolinite is highly relevant for the development of antibiofilm paint coating. The objective of this study was to determine the lateral detachment forces of *Bacillus niabensis* and *Alteromonas litorea* against modified kaolinite paint layer using atomic force microscopy (AFM). A reduction of approximately 25 nN lateral detachment forces was observed for *B. niabensis* on Hexadecyltrimethylammonium-Silver-Kaolinite (HDTMA-Ag-Kao) paint coating layer compared to non-modified commercial paint layer (control). Whilst 19 kN reduction was recorded for *A. litorea* tested on the same material. These findings were supported by a reduction in both bacteria's contact surface area on the HDTMA-Ag-Kao paint coating layer when compared to the control, demonstrating that coating's success reduced bacteria adhesion to coated surfaces. A decrease in lateral detachment forces and contact surface area of both marine species on the modified paint layer demonstrates the antibiofilm of HDTMA-Ag-Kao's paint efficiency, suggesting that it might be a potential approach for preventing biofilm formation on marine structures.

Keywords: lateral force; biofilm; atomic force microscopy; *Bacillus niabensis*; *Alteromonas litorea*

P-Phy-My-016

Thermal Properties, Structure and Morphology of Graphene Nano-Platelets (GNPs) Reinforced High-Density Polyethylene (HDPE) Nanocomposite

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Abstract

Graphene nanoplatelets (GNPs) are just one of the attractive graphene-based nanomaterials that are rapidly emerging and have sparked the interest of many industries. These small stacks of platelet-shaped graphene sheets have a unique size and morphology that quickly disperse into other materials such as polymers, resulting in higher-value composite materials with improved thermal and mechanical capabilities. A detailed analysis of reinforced High-Density Polyethylene (HDPE) using different sizes (2, 15, 25 μm) and compositions (8, 10, 15 wt.%) of Graphene Nanoplatelets (GNPs) has been conducted. The microstructure of the HDPE/GNPs nanocomposites was extensively examined during the melt blending and injection moulding processes. Based on the results, the nanocomposites with different sizes of GNPs exhibited dissimilar behaviour with different compositions. Furthermore, scanning electron microscope (SEM) results indicated a homogeneous dispersion for GNP in melt mixing. Moreover, thermogravimetric (TG) data demonstrate that increasing filler showed a slight increase in the material's thermal stability. The use of GNPs improved mechanical properties, as evidenced by the increases in Young's modulus of yield strength from around 100 Pa to over 400 Pa. This study provides a practical reference for the industrial preparation of polymer-based graphene nanocomposites.

Keywords: graphene nano-platelets; high-density polyethylene; thermal properties; mechanical properties; morphology

P-Phy-My-017

Thymoquinone Nanoparticles and Its Implication in Cancer Therapy

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Abstract

The use of nanotechnology to increase bioavailability and drug delivery is becoming more important for the treatment of various human diseases. Therefore, numerous nanoformulations of various medications have been developed. This review introduces applications of thymoquinone (TQ) nanoparticles that produced greater therapeutic effect as an anti-cancer. Here, we provide an overview of the various TQ-nanoformulations and highlight their efficacy in the prevention of cancer. Therefore, from this review, it can conclude that TQ nanoformulations may be considered as a potential anti-tumour agent for clinical translation.

Keywords: thymoquinone; TQ-nanoparticles; anti-cancer

P-Phy-My-018

Synergistic Antibacterial Effect of Biosynthesized Silver Nanoparticles using *Zingiber officinale* and *Coleus amboinicus*

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Abstract

The alarming rise of antibiotic resistance among pathogenic bacteria poses a significant risk to human health. Antibiotic-resistant organisms infections are becoming more common as a cause of mortality and morbidity globally. Silver nanoparticles (AgNPs) have emerged as novel tools that can be utilized to combat fatal bacterial infections, namely antibiotic resistance. Although the development of bacterial resistance to antibiotics has been extensively covered in scientific literature, the possibility of resistance to the synergistic activity of AgNPs has not been thoroughly investigated. Therefore, the present study aimed to address the antibacterial activity of AgNPs synthesized by employing two medicinal plants, *Z. officinale* and *C. amboinicus*. The synergistic aqueous extract of *Z. officinale* and *C. amboinicus* was used for the green synthesis of AgNPs. The biosynthesized extracts were characterized using UV–visible spectroscopy. The results revealed the potential of the extracts as reducing and capping agents, with the surface plasmon resonance (SPR) peak at 433 nm wavelength, corresponding to the stabilization and reduction of Ag^+ to Ag nanoparticles. Disc diffusion method was used to evaluate the synergistic antibacterial activity of the biosynthesized AgNPs against two antibiotic resistance strains, *Staphylococcus aureus* and *Pseudomonas aeruginosa*. The synergistic AgNPs demonstrated potent antibacterial activity against *S. aureus* and *P. aeruginosa* as indicated by the zones of inhibitions. The aforementioned results indicate that the synergistic effects of biosynthesized medicinal plants can be an alternative solution in replacing commercial antibiotics, which cause side effects and are less effective with a combination of local herb extract that possesses antibacterial properties.

Keywords: *Zingiber officinale*; *Coleus amboinicus*; synergistic; silver nanoparticles; antibacterial

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P-Phy-My-019

Biosynthesis and Characterization of Gold Nanoparticles using *Diopatra claparedii* Grube, 1878 (Polychaeta: Onuphidae) and Evaluation of Its Antibacterial Activity

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Abstract

Gold nanoparticles (AuNPs) have unique and outstanding optical properties that can be applied in various applications. The current productions of AuNPs are cumbersome owing to the use of reducing agents which are highly reactive and toxic in nature. Hence, a biogenic synthesis of AuNPs by exploiting local marine tube worm (Polychaeta), *Diopatra claparedii* as potential reducing agents was conducted. AuNPs were biosynthesised by using different masses of polychaete extracts (5, 10, 15, and 20 g) and observed up to 3 months. The formation of AuNPs was confirmed by the appearance of red-ruby colour and the presence of surface Plasmon resonance (SPR) absorption peaks (540–560 nm) from UV-Vis spectroscopy. The AuNPs were in spherical-like shapes with large aggregations based on scanning electron microscope (SEM). The average particle size and morphology of AuNPs were confirmed using transmission electron microscopy (TEM) (25–60 nm) and dynamic light scattering (DLS) (50–100 nm). Fourier transformed infrared (FTIR) analysis was carried out on polychaete extracts to explore the functional groups existing and also to prove the absence of AuNPs in them. Lastly, the antibacterial assessment of AuNPs was examined using Kirby-Bauer disc diffusion method and revealed the exhibition of antibacterial activity on both Gram-positive and Gram-negative bacteria.

Keywords: antibacterial; biosynthesis; *Diopatra claparedii*; gold nanoparticles; polychaetes

P-Phy-My-020

Superoleophilic-Hydrophobic Nanoporous Kapok Fibers as Effective Oil Sorbents

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Abstract

Functional sorbent with high oil sorption and excellent oil retention is pivotal to remediating offshore oil spills. This work demonstrated one-step, facile and energy-efficient carbonization of superoleophilic-hydrophobic nanopores kapok fibers as effective oil sorbent. The surface roughness and intrinsic graphite phase of kapok fibers were tunable by varying the carbonization temperature, enhancing their oil sorption and retention. The carbonaceous kapok fibers demonstrated tunable oil sorption capacities of 34.0 g/g – 95.5 g/g for 12 oils with different densities and viscosity. Owing to lumen preservation and nanopore formation, the carbonaceous kapok fibers selectively absorbed oil slick and repelled water even under vigorous water vortex, indicating distinctly 100% oil retention of under gravitation force. The adsorption-desorption isotherms deduced that these nanoporous kapok fibers fell into H3 IUPAC classification, showing the presence of non-rigid lamellar pores appearing on each fibers. Multiple oil sorption-desorption cycles hold a considerable promise of the carbonaceous kapok fibers for high reusability with low environmental impact for oil spill recovery.

Keywords: oil sorption; oil retention; superoleophilic; hydrophobic

P-Phy-My-021

Issues with Nano-Products in the Market

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Abstract
The general public are all too familiar with having the label ‘nano’ on their products. A general definition says nanomaterials must have at least one dimension that is less 100 nanometres. However, other terms associated with nano are being re-revisited by experts and regulators. This matter is further complicated when conventional test methods may not be suitable or reliable for nanomaterial testing. This paper will discuss these nano-products with regards to their quality, efficacy and safety.

Keywords: nano-product; nanosafety

P-Phy-My-022

Nano-Palm Frond Titania Fiber Membrane for Industrial Wastewater Treatment Application

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Abstract
Increasing industrial activities increases the occurrences of water pollution activities. The demand for efficient pollutants removal from industrial wastewater are on an alarming need. Malaysia is one of the world's largest producers of palm oil. Palm oil plantation produces a high levels of palm oil biomass waste including oil palm frond (OPF). The abundance of this biomass creates research interest to utilize the waste materials for waste to wealth purposes. The Nano-Palm Frond Titania Fiber or Nano-PFTF membrane was prepared with cellulose acetate (CA) obtained from waste OPF using electrospinning method. This nanofiber membrane has the capability of adsorption and photocatalytic degradation of the water pollutants through combination with nitrogen-doped titanium dioxide (N-TiO_2). The synthesized CA, N-TiO_2, and Nano-PFTF membrane were characterized using Field Emission Scanning Electron Microscope (FESEM) and Raman Spectroscopy. The efficiency of the Nano-PFTF membrane was tested with methylene blue (MB) dye and hexavalent chromium (Cr(VI)) under UV-C and visible light irradiation. Within 120 minutes, the results showed 97.82% rejection percentage of 10 ppm MB by Nano-PFTF membrane (CA/N-TiO_2) while 99% rejection percentage of 10 ppm Cr (VI) was achieved by Nano-PFTF membrane under visible and UV light irradiation respectively. Based on these findings, the Nano-PFTF membrane showed remarkable potential in industrial wastewater treatment application and increase the potential usefulness of waste OPF.

Keywords: oil palm frond; cellulose acetate; titanium dioxide; nanofiber; photocatalytic degradation

P-Phy-My-023

Antibacterial and Degradation Properties of Hybrid Polycaprolactone-Multiwalled Carbon Nanotubes-Selenium Nanoparticles Nanofibre

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Abstract

Antibacterial materials are now used in a variety of applications, including disinfecting surfaces and maintaining a healthy, clean environment. This reduces the risk of bacterial infection and eliminates potentially harmful microbes that can cause morbidity and mortality. Poly-(-caprolactone) (PCL) and nanoparticles combine to form a biodegradable, antibacterial biomaterial that is essential for preventing and combating dangerous bacterial infections. This study explores the incorporation of multi-walled carbon nanotubes (MWCNTs) and selenium nanoparticles (SeNPs) into poly-(-caprolactone) (PCL) nanofibers to create PCL-MWCNTs-SeNP nanofibres. FESEM images revealed the formation of aligned fibres less than 530 nm in size, which were produced before degrading after four months. The presence of nanoparticles accelerated the biodegradation process by agglomerating nanofibres containing MWCNTs and SeNPs, creating holes that aid in the degradation of the PCL-MWCNTs-SeNP nanofibre. The inhibition zones on *Staphylococcus aureus* and *Escherichia coli* were around 16 and 13 mm, respectively, based on the disc diffusion technique for PCL-MWCNTs-SeNPs nanofibre. In the fourth month, the synergistic effects of MWCNTs and SeNPs in the nanofibre were more effective in inhibiting both bacteria and began degradation. In the PCL-MWCNTs-SeNP nanofibre, the characteristics of PCL nanofibre were retained and capable of reducing hydrophobicity and increasing biodegradation rate, as well as antibacterial properties. According to the findings of this study, PCL-MWCNTs-SeNPs nanofibre can be used in a wide range of applications, from consumer items to specific applications, particularly in healthcare and medical applications.

Keywords: poly(ε-caprolactone) nanofiber; multi-walled carbon nanotubes; selenium nanoparticles; antibacterial; degradation

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P-Phy-My-024

Nanotechnology Projects Funded by MOSTI Under 10th And 11th Malaysian Plan

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Abstract
Nanotechnology have received high increase in publicity globally. The potential of intellectual property and patent portfolios have driven most of the countries, governments, stakeholders, industries, and individuals towards this nanotechnology revolution. Moving forward, the global nanotechnology market will swell to approximately $173.95 billion by 2025. Nanotechnology in Malaysia started way back in the year 2001 as part of the several research groups in institutions of higher learning and research institutes that embarked on nanotechnology research. Throughout the year 2011 to year 2019, Ministry of Science, Technology and Innovation (MOSTI) have funded nanotechnology projects through various of funds in order to support the nanotechnology development in the country. Thus, the data was collected from Fund Unit of Ministry of Science, Technology and Innovation and all of these funds are compiled and data analysis was carried out. As a conclusion, 187 project have been funded by MOSTI under 5 funds. According to key strategic jumpstart sectors, Electronic Devices and Systems and Wellness, Medical and Healthcare have the most nano related project funded with 57 projects respectively, followed by Energy and Environment with 30 projects, Food and Agricultural with 18 projects and last but not least other sectors with 25 projects. Most of this project recipients are from universities with 137 projects, Government Research Institutes with 46 projects and small medium enterprise with 4 projects. Moving forward, all of this research projects have to go through commercialisation with new funds introduce in MOSTI as this will ensure the sustainability of nanotechnology in our country.

Keywords: nanotechnology; projects; funds.

P-Phy-My-025

Portal and System Directory of National Nanotechnology Laboratory Network Malaysia

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Abstract

Amongst the issues and challenges in managing and operating Science, Technology and Innovation (STI) activities are low optimization usage of technical and research infrastructures, difficult access to state-of-the-art scientific instruments and technical expertise, and high financial expenditure outside Malaysia to obtain nanotechnology testing and fabrication services. In order to overcome these issues and challenges, the National Nanotechnology Laboratory Network's (NNLN) portal and system directory were developed and launched by the Minister of Science, Technology, and Innovation (MOSTI) Malaysia on 3rd February 2021. The NNLN initiative aims to establish a network of research infrastructure institutions that can be used collaboratively to develop technologically advanced scientific innovations supported by expert scientists and nanotechnologists. Furthermore, The NNLN was created to develop a National Nanotechnology Inter-Laboratory platform that would offer more access to equipment for quick prototype creation and upgrading newly generated technology to a higher degree of technology readiness level. Data was collected through physical and online surveys conducted in 2019 and 2020 involving 29 institutions. The data collected were categorized into three (3) types of laboratories: Testing Laboratory, Synthesis Laboratory and Fabrication Laboratory. The information available on the portal and system directory are the number of laboratories, researchers, technical equipment, publications, intellectual properties and commercialisation. Overall, the NNLN initiative was introduced to create a reliable research infrastructure network for scientific innovation and a coalition of institutions with cutting-edge technology and research expertise.

Keywords: NNLN; portal; system directory; laboratories; nanotechnology

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V-Phy-My-002

Oleate–Loaded Polymeric Micelles: Optimization and Evaluation using Response Surface Methodology (RSM)

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Abstract

Skin discoloration due to melasma and post-inflammatory hyperpigmentation (PIH), develops when melanin pigment is abnormally produced in melanocytes via the melanogenesis process which requires enzyme tyrosinase throughout the process. Therefore, the concern of tyrosinase inhibition has become increasingly vital in cosmeceutical industry. A well-known tyrosinase inhibitor called kojic monooleate or Oleate has been proven able to hinder the over-production of melanin content in the skin. In this study, a Oleate-loaded polymeric micelles (PMs) formulation was developed. PMs was chosen as the nano-delivery system due to their ability to deliver the active ingredients to the target site efficiently, ease of preparation and practicability for a large-scale production. Response Surface Methodology (RSM) was used to optimized and analyzed the effect of three variables, namely stirring time (55-85 min), stirring rate (1000-1500 rpm) and temperature (30-70^{o}C) on droplet size as a response. The optimized OLeate-loaded PMs formulation with desirable criteria was stirring time (55.155 min), stirring rate (1494.301 rpm) and temperature (30.123 ^{o}C) with droplet size (97.29 nm), a residual standard error (% RSE) < 1.0% and encapsulation efficiency (95.82%) was obtained. The analysis of variance (ANOVA) showed the fitness of the model with *F*-value (5.95), a *p*-value (p<0.0500) and a non-significant lack-of-fit. The model also showed the coefficient of determination, R^2 was 0.8562. The physicochemical characterization of optimized OLeate-loaded PMs formulation had -5.18 ± 3.75 of zeta potential, 0.223 of PDI value, 0.284 mS/cm of conductivity with pH 5.69 indicating that the optimized formulation produced was stable. The cleansing test showed KMO-loaded PMs formulation is effective to be used as a facial cleanser.

Keywords: Kojic monooleate; polymeric micelles; response surface methodology; hyperpigmentation; Optimization

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V-Phy-My-004

Facile Synthesis and Characterization of Thin Gold/Silica Film Nanocomposites on Anodized Aluminium Oxide–Glass Substrate

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Abstract

Thin film based gold nanoparticles is typically used as heterogeneous catalyst in the industrial processes, due to their high stability and good reusability. For the first time, a thin gold/silica film nanocomposite ($[Au_3Pz_3]C_{10}$TEG/silica) on various substrates were fabricated from sol-gel method to be used as potential catalyst. To synthesis the $[Au_3Pz_3]C_{10}$TEG/silica composite, a medium comprised of dry ethanol, deionized water, and hydrochloric acid was added to gold(I) pyrazolate complex ($[Au_3Pz_3]C_{10}$TEG) according to the ratio of $[Au_3Pz_3]C_{10}$TEG/ [TBOS]/ [EtOH]/ [HCl]/ $[H_2O]$ = 1:60:504:10:1.2:266. Interestingly, 70 μL of the sol-gel solution can be spin-coated on substrates such as glass, anodized aluminium oxide (AAO) or mixture of AAO-glass. It was found that $[Au_3Pz_3]C_{10}$TEG/silica fabricated in combination of both AAO-glass substrates gave the best quality based on its surface thickness, layer uniformity and film brittleness. Thin film of $[Au_3Pz_3]C_{10}$TEG/silica_AAO-glass showed a light brownish colour under daylight and a pinkish red colour under UV light, suggesting the preservation of Au(I)-Au(I) interaction. Moreover, there were no apparent peaks observed in X-ray diffraction results of the film suggesting that the sample was grown perpendicularly to the glass substrate and in parallel according to the 1D direction of AAO pores. Based on the scanning electron microscope (SEM) images, the presence of $[Au_3Pz_3]C_{10}$TEG/silica on the AAO had successfully filled the channel of 100 to 200 nm diameter. The SEM images also suggested the successful penetration of the nanocomposites along the direction of AAO pores to give a 1D arrangement with the channels oriented perpendicularly to the glass substrate.

Keywords: Anodized aluminium oxide; glass; gold nanocomposites; thin film

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V-Phy-My-005

Synthesis of Two Dimensional $Ti_3C_2T_x$ MXene with Alkali Etching Treatment via Microwave-Assisted Hydrothermal Route

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Abstract

MXene, a fast-growing family of two-dimensional material derived from layered ternary carbides, nitrides and carbonitrides materials. It has become the limelight among researchers because of its remarkable properties. The success of MXene synthesisation using hydrofluoric acid in etching aluminium from the ternary compound became an eye-opener for all the researchers to improve the MXene synthesisation routes. Various etchants have been introduced to avoid using *ex-situ* hydrofluoric acids, such as in-situ hydrofluoric acid, molten salts, ammonia, and phosphoric acid. Hydrothermal, electrochemical and microwave irradiation techniques have been implied for MXene synthesisation routes to improve the prolonged conventional mixing at room temperature. Although extensive synthesis MXene routes research has been done, a safer, facile, and fast path is still difficult to establish. Thus, this work proposes an etching route via microwave-assisted hydrothermal method, for $Ti_3C_2T_x$ MXene preparation from Ti_3AlC_2 MAX phase using sodium hydroxide (NaOH) as an alkaline etchant. The microwave hydrothermal reaction is controlled by heating time, temperature, and NaOH concentration. A controlled microwave hydrothermal reaction process using a 20 M of NaOH heated at 180°C for 45 min has led to the best removal of aluminium from the Ti_3AlC_2. The MXene then characterised for X-Ray diffraction and FESEM analysis. This work proffers a shorter etching time and free-fluorine termination synthesis route. This discovery unlocks the number of etching methods to develop MXenes while contributing to an environmentally friendly and facile etching path.

Keywords: two-dimensional material; MXene; microwave-assisted hydrothermal; synthesis

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V-Vir-My-001

Fractional Casson Blood Flow with Gold Nanoparticles (AuNPs) in a Slip Velocity Cylinder

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Abstract
Technology of nanofluid in the blood flow has been attracted researchers to further study theoretically and experimentally due to its importance in treating the tumour and delivering the drugs effectively. In the case of gold nanoparticles (AuNPs), studied experimentally consume time and money. Therefore, many researchers studied theoretically by using analytical and numerical methods. However, most of the researchers obtained results analytically by considering no-slip velocity effect. Thus, the present paper aims to obtain analytical solution of the Casson blood flow with gold nanoparticles in the cylinder with the natural convection flow and slip velocity effect. The dimensionless governing equations will be modelled with the Caputo-Fabrizio fractional derivative approach. Next, the joint methods of Laplace transform and finite Hankel transform will be used to obtain the analytical solution. Then, the results of velocity profile will be plotted and analysed graphically with the related parameters such as Casson parameter, fractional parameter, slip velocity parameter and nanoparticles volume fraction parameter. The obtained results are beneficial for the accuracy checking of the numerical methods. Besides, the results are significant to study the human blood flow behaviour with nanoparticles that helpful in diagnose and treat the tumour cell.

Keywords: Casson blood flow; gold nanoparticles; Caputo-Fabrizio, slip velocity, finite Hankel transform

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BIONANOTECHNOLOGY RESEARCH
V-Vir-My-002

Gene Expression Analysis of Signalling Pathway Associated with Collagen Type 1- induced Osteogenic Differentiation of Dental Pulp Stem Cells

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Abstract

Stem cell-based therapy offers a promising strategy for the treatment of bone defects and reconstruction of craniofacial bones upon major fractures. Successful osteogenic differentiation relies on a harmonious interplay between stem cells, scaffolds, and growth factors. The main component of the bone extracellular matrix, Collagen Type 1 (Col 1) has been widely proposed as a suitable material for bone tissue engineering, with excellent evidence on biocompatibility and osteoconductivity. However, the key signaling pathway associated with Col type 1-induced osteoblast proliferation and differentiation remains underexplored. The present study investigated the osteoinductive capacity of Col 1 in inducing the osteogenic differentiation of dental pulp stem cells (DPSC). 10,000 cells/cm^2 cells were plated in various combination of Col I + Matrigel, without the presence of other external inducing factors. Alizarin red staining and PCR analysis were performed to ascertain bone nodule deposition and osteogenic genes (*OPN, OCN, OSX*) expression. Further analysis was performed with inhibitors to assess the predominant signaling pathway involved in Col I induction of DPSC into forming committed bone cells. Targeted pathways included were P13/Akt, ERK, and TGFβ/Smad. Col I (2mg/ml) demonstrated the highest osteoinductive ability to transform DPSCs into bone cells via activation of the identified signaling pathway. The data provided by this study, on the fundamental knowledge of stem cell biology and scaffold component may then be used to design an efficient stem cell-based treatment in accelerating the process of bone repair and regeneration.

Keywords: bone; regeneration; osteoblast; collagen; scaffold

BioNanoSem
BIONANOTECHNOLOGY RESEARCH
V-Vir-My-003

Comparison of Nanocellulose Extracted from Plant Leaves

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Abstract
Agriculture waste usually leads to environmental deterioration. However, they can be recycled and reused in various applications that bring us advantages. In this study, nanocellulose was extracted from plant leaves of coconut, sugarcane and lemongrass which are abundant agriculture waste. Chemical pre-treatment was carried out by boiling at 80°C in NaOH. The extraction was conducted under homogenous condition using high-shear homogenization at 1000 RPM for 30 min to produce nanocellulose. The samples were characterized on surface morphology, UV-Vis spectrum, Fourier transmission with FTIR and water absorption. The properties that displayed by the formed nanocellulose are potential to be applied in different field towards sustainable world.

Keywords: Sodium hydroxide; homogenization; agricultural biomass; morphology

V-Vir-My-004

Sensitivity Optimization of Au/Ti based SPR Sensor by Controlling Light Incident Wavelength for Gas Sensing Application

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Abstract

Exposure to harmful gases such as benzene (C_6H_6) and carbon dioxide (CO_2) can cause health problem like bone marrow deficiency, which eventually drop down the number of red blood cells, causing anemia and many other harmful diseases. This simulation work was carried out to theoretically study the development of highly sensitive Kretschmann based surface plasmon resonance (SPR) sensor for gas sensing application by using hybrid thin films of gold/titanium (Au/Ti). To optimize the excitation of surface plasmon polaritons (SPP), light incident wavelength was varied from visible to infrared spectra. Thickness of Au thin film with refractive index of n= 0.1758 + 3.4101k was fixed at 50nm, meanwhile the thicknesses of Ti were controlled between 1nm to 5nm to optimize the SPR signal. Four different types of gas samples such as benzene, methane, carbon monoxide and carbon dioxide had been exposed to the sensor's surface. It was found that the utilization of p-polarized light at near infrared region (NIR) with λ=900nm using Au/Ti at thicknesses of 50nm/3nm respectively, resulted the best sensitivity up to 2412.06 °/RIU. The sensor's sensitivity was successfully enhanced as additional material, Ti was coated on the Au thin film's surface. Apparently, amount of light absorption to generate SPR mainly affected by the incident wavelength, types of materials and their thicknesses. Too thick of film results the light absorption by material itself, meanwhile if the thin film is too thin, electron damping phenomenon occurs in which producing weak SPR signal. In conclusion, the high sensitivity SPR sensor for gas sensing applications able to be developed by deployed Au/Ti with incident wavelength of 900nm to excite strong SPR signal.

Keywords: SPR; Au/Ti; incident wavelength; Kretschmann; gas sensing

V-Vir-My-005

Plastic Optical Fiber pH Sensor Based on Sol-Gel Film

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Abstract

A plastic optical fiber (POF) pH sensor based on a sol-gel film is developed. A sol– gel film was prepared by mixing tetramethyl orthosilicate (TMOS), trimethoxymethylsilane (MTMS), ethanol, distilled water and NR powder. Then, a plastic optical fiber is coated by manually depositing the sol-gel film onto the tip of the POF. The sensing probe is dissolved into analytes ranging from acidic to alkaline level such as Cola, tomato sauce, black coffee, tea, distilled water, soap, baking soda and Clorox. The value of refractive index increased as the analytes level became more acidic or more alkaline due to high concentration of hydrogen and hydroxide ions. The output power is varied based on the chemical reaction with the pH sol–gel film in the fiber-optic sensing probe. From the experimental results, it is concluded that the sensitivity of coated POF sensor which is 0.0566 a.u/RIU is higher than the sensitivity of uncoated POF which is 0.0429 a.u/RIU.

Keywords: Fiber-optic sensor; pH sensor; sol–gel; plastic optical fiber

V-Vir-My-006

AgroZIDE™: A New Nano-Fungicide to Control the Growth of *Aspergillus flavus* in Grain Corn during Storage

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Abstract

Grain corn (*Zea mays* L) is the third most important cereal grains worldwide after wheat and rice and has been used as feed for livestock due to its nutritional content. Grain corn is classified as hygroscopic and tends to absorb or release moisture. Exposure to moist and humid conditions during storage and the presence of broken kernels will cause the absorption of water, encouraging fungal growth such as Aspergillus flavus, a common fungal species in grain corn that produces the mycotoxin Aflatoxin, a hepatotoxic, teratogenic and immunosuppressive agent in humans and animals. The use of chemical fungicides is controversial because it can lead to the acute or chronic poisoning in animals. Hence, the development of a new non-toxic fungicide is the best possible alternative. AgroZIDE™, a new nano-fungicide developed by MARDI contained a natural ingredient that has strong growth inhibitory activity against *A. flavus* in stored grain corn for up to 6 months. AgroZIDE™ was developed using nano-emulsion based formulation that consists of cinnamon oil as a main ingredient, water, surfactant, and co-surfactant. The nanodroplet size of AgroZIDE™ ranges from 120 to 180 nm allows an efficient penetration of cracks or broken kernels that A. flavus spore can hide and grow. The toxicology test carried out by SIRIM Berhad, classified AgroZIDE™ as a non-toxic substance according to CLASS Regulation 2013 demonstrating the safety of AgroZIDE™. It is expected with the application of AgroZIDE™, the revenue losses in the corn grain industry due to fungal contamination can be reduced by 30%.

Keywords: *Aspergillus flavus*; grain corn; aflatoxin; nano-fungicide; nano-emulsion

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BIONANOTECHNOLOGY RESEARCH
V-Vir-My-007

UV-Vis Spectroscopy Trends based on Liquid Exfoliation of Graphite at Various Sonication Period

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ABSTRACT

Graphene is the most attractive two-dimensional (2D) carbon allotrope that has attracted worldwide attention owing to its excellent properties. Various exfoliation techniques were employed to generate the best form of exfoliated graphene. Liquid phase exfoliation of graphite in a suitable solvent is advantageous since it is simple, safe, and economically practical. However, little is known about different sonication time effects on the exfoliation process. Thus, this study deliberates the liquid-phase exfoliation of graphene in chloroform by applying UV-Vis spectroscopy. Graphite powder in different weight percentages (wt.%) was soaked in chloroform and sonicated at different sonication times from 0.5 to 3 hours followed by centrifugation at 4000 rpm for 30 minutes. The supernatant was collected and subjected to UV-Vis spectroscopy at a wavelength between 220 nm to 800 nm. The UV absorbance intensity showed a contrast solubility profile with different graphite concentrations. A comparative study was further evaluated with graphene as controls could potentially provide an idea for better materials formulation strategy. The UV absorbance reporting confirmed the presence of graphene by sonicating various weight percentages of graphite particles, thus the addition of other biomaterials in the suspension can be further investigated and could applied in diverse applications including biomedical engineering.

Keywords: graphite; graphene; sonication; liquid-phase exfoliation; UV-Vis

V-Vir-My-008

Development of Honey-PLGA Microparticles for Treatment of Chronic Periodontitis

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Abstract

Application of honey in certain areas like the oral cavity might pose problem due to its liquidity. Thus, honey has been explored to be used in other form for suitable application. One method of drug delivery system is through the incorporation of drug into microparticles. Therefore, the aim of this study is to investigate the potential of honey to be incorporated into microparticles to enhance antibacterial activity. Three types of honey were used; Kelulut, Tualang and Manuka. Honey-PLGA microparticles were prepared using the diffusion-solvent-evaporation method. Then the honey-PLGA microparticles were subjected to a variety of analyses and tests, including FESEM, zeta potential analysis, *in-vitro* release and an antibacterial test. The results showed that all types of honey used in this study can be incorporated into microparticles ranging from 1 to 10 micrometres and appeared in the form of white powder. FESEM analysis showed honey-PLGA microparticles has a smooth surface and spherical in shape. But zeta potential analysis showed the microparticles had low zeta potential. The microparticles showed slow-release characteristics but did not show any antimicrobial activity against the tested microorganisms. Within the limitations of this study, it can be concluded that honey can be incorporated with PLGA and other materials to produce microparticles, but further study is needed in terms of improving the formulation to produce microparticles that are highly effective against target microorganisms.

Keywords: honey microparticles; FESEM; zeta potential; *in-vitro* release; antibacterial

V-Vir-My-009

Sol-Gel Bioglass/β-Tricalcium Phosphate for Potential Application in Dental Pulp Tissue Engineering: A Preliminary Study

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Abstract

Bioglass (BG) and β-tricalcium phosphate (β-TCP) are widely implemented for bone tissue engineering, both in orthopaedics and dentistry due to the resemblance of its inorganic constituent with bone or dental tissue. Sol-gel derived BG is recognised for having a greater surface area than melt-generated BG, making it more bioactive. In this study, β-TCP was combined with sol gel-derived BG for potential application in dental pulp tissue engineering. BG/β-TCP powder at 40/60 composition ratio was homogeneously mixed in a zirconia planetary ball mixer, compacted into a pellet, and was sieved to obtain particle size less than 50 microns. The BG/β-TCP powder composite was analysed using Scanning Electronic Microscopy (SEM), X-ray Diffraction (XRD), laser diffraction particle size analyser and *in-vitro* bioactivity were observed by immersing the BG/β-TCP powder at different time points (1, 4, 7, 14 and 28 days) in simulated body fluid (SBF). The results based on XRD confirmed the primary crystalline phase was identified as whitlockite [$Ca_3(PO_4)_2$, ICCD Ref. Pattern: 00-009-0169] and silico-rhenanite [$Na_2Ca_4(PO_4)_2SiO_4$, ICCD Ref. Pattern: 00-032-1053] was also detected as a secondary phase. The crystalline patterns in BG/β-TCP composite exhibits stronger peaks when compared to BG and weaker peaks compared to β-TCP. Based on SEM, irregular shaped particles appeared to be agglomerated to each other, and hydroxyapatite (HA) was detected on the surface following SBF immersion. The pH tends to be in the range of 7.5 to 8.0 throughout the study period when immersed in SBF. In this preliminary study, *in-vitro* HA formation ability on the BG/β-TCP composite surface should be explored further for potential application of this composite in bone and dental tissue engineering.

Keywords: bioglass; β-tricalcium phosphate; dental pulp; tissue engineering.

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V-Vir-My-010

Polychaete-based Silver Nanoparticles (AgNPs) Inhibit the Growth of Antibiotic-Resistant Bacteria

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Abstract

Antibiotic resistance (AR) is a condition where antibiotics are no longer effective toward some bacteria. As years go by, the number of bacterial species that are resistant to various types of antibiotics keeps on increasing. This will cause burden on the healthcare system to treat the affected patients. Thus, urgent alternatives are greatly needed. Biological-based silver nanoparticles (AgNPs) are gaining popularity as they are easy to synthesise and environmentally friendly. It also possesses broad-spectrum antibacterial activity, making it one of the alternatives to combat AR. In this study, biosynthesised AgNPs using polychaete extract was used to synthesise AgNPs to observe their effects on Methicillin-resistant *Staphylococcus aureus* (MRSA) and extended-spectrum beta-lactamases (ESBL) *Escherichia coli*. The synthesis of AgNPs was initiated by mixing the polychaete extract and silver precursor. The successful synthesis was indicated by the colour changes from reddish pink to brown, which is the typical colour of AgNPs. Other characterisations such as UV-Vis spectroscopy, dynamic light scattering, scanning and transmission electron microscopy, Fourier transform infrared spectroscopy and x-ray diffraction were also done to validate the AgNPs formation. From the characterisations, spherical AgNPs was produced with mean size of 17 nm. Antibacterial assessments such as disk diffusion, minimum inhibitory concentration and minimum bactericidal concentration were also done. AgNPs exhibited antibacterial effects once tested on MRSA and ESBL-*E. coli.* These positive outcomes mark further AgNPs optimisation in combating AR.

Keywords: antibiotic resistance; bacteria; polychaete; silver nanoparticles

V-Vir-My-011

Antibacterial Properties of Water Synthesized Silver/Zeolitic Imidazolate Frameworks-8

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Abstract

Antibacterial compounds are immobilised on a zeolite imidazolate framework carrier system to address antibacterial infection threats in a different way. HyperChem 8.0 software was used to examine the molecular structure of ZIF-8 and the interaction of 2-methylImidazole (2-MeIM) with water in order to better comprehend the intricacy of the water-based synthesis process. The ZIF-8 was successfully synthesized from zinc nitrate hexahydrate ($ZnNO_3.H_2O$), 2-methylimidazole as organic linker and water as a solvent with ratio of 1:6:500. The ZIF-8 was used as a carrier system by incorporating silver (Ag) into ZIF-8 frameworks with ratio of silver nitrate ($AgNO_3$) to ZIF-8, 1:31.25. According to the XRD and FTIR measurements, the ZIF-8 framework stability was maintained after the introduction of Ag elements, indicating that it was successfully incorporated into the frameworks. The existence of Ag elements on the hexagonal surface of Ag/ZIF-8 was also confirmed by the FESEM-EDX examination. In term of antibacterial studies, the antibacterial assay of the samples was conducted against Gram-positive bacteria (*Staphylococcus aureus*) and Gram-negative bacteria (*Escherichia coli*) through disk diffusion technique (DDT). The DDT results indicated that both ZIF-8 ad Ag/ZIF-8 samples were released into the media because of the formation of inhibition zone around the agar plates towards both types of bacteria.

Keywords: zeolitic Imidazolate framework; antimicrobial agent; silver nanoparticles; water-based synthesis

V-Vir-My-012

Effective and Facile Dispersive Microextraction of Tricyclic Antidepressants by Bio-Based Sporopollenin Composite

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Abstract

Tricyclic antidepressants are among a wide range of xenobiotics that have been ascertained in environmental water in trace level amounts. Concerning the unforeseen threat exposed to aquatic life, monitoring and measuring its concentration levels are of vital importance. In line with green analysis principles, a simple vortex-assisted dispersive-micro-solid phase extraction (VA-D-µ-SPE) method applying eco-friendly bio-based sporopollenin composite was demonstrated for the determination of selected tricyclic antidepressants in water samples. Sporopollenin-based biosorbent was chosen as the base sorbent for its natural resource availability, dispersibility, and reusability. To obtain the best extraction using the proposed biosorbent, several important VA-D-µ-SPE parameters were optimized and validated statistically by Box-Behnken design. The optimum VA-D-µ-SPE conditions were 5.85 min vortex-assisted extraction time, sample solution pH, 10.5; 1 min vortex-assisted desorption time. The method was successfully applied to different water samples including tap water, river water, lake water and wastewater samples. The developed method provided low LODs (3*s*) at ppb levels (0.25-0.44 µg L^{-1}), good linearity ($R^2 \geq 0.9973$) and accuracy (> 86%). The VA-D-µ-SPE employing sporopollenin composite offered simple, rapid, and eco-friendly tool for effective drugs analysis in water samples.

Keywords: sporopollenin; tricyclic antidepressants; dispersive-micro-solid phase extraction

V-Vir-My-013

Application of Nanotechnology in the Treatment of Women's Cancer

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Abstract
Women's cancers such as breast, ovarian and cervical cancers are the most common cancers among women globally. In addition, these cancers are often aggressive and difficult to treat. This is due the lack of insufficient diagnostic tools that can assist in early cancer detection. Consequently, they are often diagnosed at later stages when symptoms become more prominent. These cancers mostly rely on surgery, radiotherapy and chemotherapy as effective targeted therapies are not currently available too. In the recent years, application of nanotechnology in medicine has shed light in promising cancer treatment and management. Nanomaterials possess excellent physical and chemical properties and biological functions that are versatile. These unique characteristics and the application of nanotechnology in medicine are presumed to provide possibilities in early cancer diagnosis, significant targeted therapeutics and therapies leading to enhanced treatment and management of women's cancer. In summary, it is hoped that these nanotechnology approaches promise to improve patient survival rates by reducing side effects, allowing for targeted therapeutic options that are more selective and specific, hence increasing anti-tumor activity.

Keywords: breast cancer; ovarian cancer; cervical cancer; nanotechnology

V-Vir-My-014

Seaweed Based Green Synthesis of Copper Nanoparticles (CuNPs) for Wastewater Treatment

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Abstract

Water pollution is one of the major challenges faced globally in recent years due to industrialization to meet the increasing demands of the growing population. Various supported metal nanoparticles have been utilized as a catalyst for the reduction of water pollutants. Nowadays Copper nanoparticles (CuNPs) are showing elevated demand due to their availability, cost-effectiveness, and vast applications. Therefore, we followed a simple, one-pot green synthesis method as it tends to be the best substitute for conventional methods because of their limitations of involving toxic chemicals and maintenance. The current study is the first to utilize a local seaweed (*Sargassum cervicorne*) for the preparation of CuNPs. The characterization of CuNPs was carried out using UV–visible (UV-vis) spectrometry, Fourier Transform Infrared (FT-IR) spectrometry, Scanning Electron Microscopy-Energy Dispersive X-ray (SEM-EDX) analysis, Transmission electron microscopy (TEM), powder X-ray diffraction (XRD) analysis, Thermogravimetric Analyzer (TGA), and Brunauer-Emmett-Teller (BET) analysis. The characterized CuNPs was further employed the for degradation of harmful carcinogenic azo dyes water pollutants. Finally, this study revealed the successful synthesis of seaweed-based CuNPs using the aqueous seaweed extract of very small size ranging from 2.6 to 3 nm in size. The CuNPs also shows the capability of reducing the azo dyes like CR, MO, and MR with degradation efficiency of 97.7%, 98.8%, and 91.31% respectively.

Keywords: copper nanoparticles; green synthesis; *Sargassum cervicorne*

V-Vir-My-015

In vitro Bioactivity of Mesoporous Borosilicate Bioactive Glass via Titanium Dioxide Inclusion Synthesized by Sol-Gel with Evaporation-Induced Self-Assembly (EISA) Technique

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Abstract

It is reported on the *in-vitro* bioactivity properties of mesoporous borosilicate glass via titanium dioxide inclusion (MBBGT). The MBBGT was synthesized using a sol-gel technique with the evaporation-induced self-assembly (EISA) method with compositions of $yTiO_2$ – $10B_2O_3$ –$(70\text{-}y)SiO_2$-$15CaO_2$-$5P_2O_5$, where y = 0.2,0.4,0.6,0.8 mol%. The in vitro degradation of the pellets and their conversion to hydroxyapatite-type materials in SBF for 3 hours, 24 hours, and 168 hours were analyzed using weight loss measures and pH changes in the solution. The glass degradation rate was shown to be quicker over time as the titanium dioxide content of the glass increased. The presence of hydroxyapatite-type (HAP) materials in the MBBGT sample have been confirmed using X-ray diffraction (XRD) and Fourier transforms infrared (FTIR) spectroscopy. Field Emission Scanning Electron Microscopy (FESEM) confirmed the formation of the HAP layer on the surface of MBBGT in 3 hours and 168 hours. The apatite crystals exhibit a flake-like shape with diameters between 50 to 100 nm, showing that the titanium dioxide concentration of the MBBGT samples has increased. Using inductively coupled plasma, the concentrations of [Ca], [P], and [Si] ions following immersion of the MBBGT were determined. During the first 168 hours of immersion, the concentrations of [Ca] and [Si] ions increased, but the concentration of [P] decreased. This is because the structure's size is decreasing and the mesoporous pore structure is opening up, allowing for quicker ion exchange, which is the first stage of the dissolution/bioactivity process.

Keywords: mesoporous borosilicate glass; bioactivity; evaporation-induced self-assembly

V-Vir-My-016

Influence of Boron Content on Structure Properties of Mesoporous Borosilicate Bioglass with PCL/PLA Scaffold

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Abstract
The characteristic of mesoporous bioglass scaffold is easily been controlled with a small change in the sample preparation. A series of mesoporous borosilicate bioglass (MBBG) with the composition of $x B_2O$ - $(80-x)SiO_2$ - $15CaO$ - $5P_2O_5$ where x are 0, 5, 10 and 15 were prepared using the combination of sol-gel and evaporation induced self-assembly (EISA) and characterized. Then, the solvent casting process is used to combine the PCL, PLA and MBBG in the scaffold form. The X-ray diffraction pattern showed the crystalline peak of PCL phase overlapping with amorphous curves of PLA and MBBG in all samples. Characteristic bands of CH2 at 2950 and 2853 cm^{-1}, C=O at 1720 cm^{-1}, and carboxylic groups at 1250 and 1170 cm^{-1} for PCL are shown in FTIR pattern. The Si-O-Si band (800 and 460 cm^{-1}) and Si-OH band (960 cm^{-1}) are indicate the basic structure of silicate glass. The absorption bands of the carbonate group at 1488 cm^{-1} is increase with the increase of boron content. All the composite scaffold exhibits macroporous structure with interconnected open pores channels, and the pore size varies from 70 to 350 µm. The improvements mesoporous borosilicate bioglass with PCL/PLA Scaffold in term of structure properties should be helpful for the extensive applications of PCL scaffold in tissue engineering.

Keywords: bioactive glass; scaffold; structure

V-Vir-My-017

Evaluation of Plant Growth Regulator Induced *Orthosiphon stamineus* Extracts for Silver Nanoparticles Synthesis

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Abstract

Orthosiphon stamineus (*O. stamineus*), often known as 'misai kucing,' is a local herb with high antioxidants. The antioxidant compounds play important role as reductants and stabilisers in the biosynthesis of silver nanoparticles (AgNP). High antioxidant activity could be achieved by manipulation of plant growth regulator (PGR) such as BAP in vitro condition. However, the effect of different BAP concentrations on shoot biomass, the antioxidant activity of *O. stamineus* extracts and its effectiveness towards the synthesis of silver nanoparticles is not studied. This study aimed to evaluate the effect of plant growth regulators (PGR) on the frequency of shoot regeneration, shoot biomass, antioxidant activity of *in vitro O. stamineus* extracts and AgNPs synthesis. Nodal explants (1 cm long) were cultured on MS plates supplemented with 1–4 mg L^{-1} BAP. All cultures were incubated and subcultured every two weeks for six weeks. Antioxidant activity was determined using the FRAP and DPPH assays. Results showed that nodal explants treated with 4 mg L^{-1} BAP produced the most shoots (15.80 $\pm$ 0.76) and shoot length (6.63 $\pm$ 2.32 cm). For antioxidant activity, 4 mg L^{-1} BAP had the highest FRAP value (7200.00 $\pm$ 103.02 M Fe (II)) and the lowest EC_{50} (56.65 $\pm$ 0.17 g mL^{-1}) as compared to other treatments. The 4 mg L^{-1} BAP-treated extracts was chosen for AgNPs synthesis. FTIR spectra indicated the participation of biological molecules in AgNPs synthesis, while UV-visible spectra revealed a surface resonance peak of 430 nm corresponding to AgNP creation. In conclusion, PGR had increased antioxidant activity of *in vitro* shoot biomass which contributed to the synthesis of AgNPs.

Keywords: *Orthosiphon stamineus* shoot; regeneration; plant growth regulators; antioxidant activities; silver nanoparticles

V-Vir-My-018

Antibacterial Evaluation of Bioactive Glass-Polymer Conditioned Medium

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Abstract

Biocomposite film containing a combination of bioactive glass (BG), poly-Ɛ-caprolactone (PCL) and chitosan (CS) were fabricated using solvent casting method. The *synthesized* BG/PCL/CS film has the potential to be used externally as a patch for skin dehiscence that will facilitate wound healing in defective tissue. This study investigated the antimicrobial effects of the biofilm conditioned medium extracts in broth at various concentration against *Staphylococcus aureus* using broth dilution method for determining the minimal inhibitory concentration (MIC). The MIC study revealed the lowest dose at 0.39 mg/ml up to the highest dose at 50 mg/ml had obvious effects on the bacterial growth inhibition. However, in several dose groups besides 50 mg/ml, the bacterial numbers tend to increase after 0.5 hour of treatment. At the concentration of 50 mg/ml, the growth of *Staphylococcus aureus* was significantly inhibited which produced an obvious downward trend suggesting the BG/PCL/CS film possess antimicrobial activity supporting their potential for wound healing. Further research is required using other types of bacteria with longer incubation periods to evaluate its effectiveness for biomedical application.

Keywords: biofilm; bioactive glass; minimal inhibitory concentration; cytotoxicity assay

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BIONANOTECHNOLOGY RESEARCH
V-Vir-My-019

Design of Tripeptide Heteroligand System as Capturing Agents for Mercury Plasmonis Detection

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Abstract

Mercury is one of the priority metals classified as a human carcinogen according to the U.S. Environmental Protection Agency and the International Agency for Research on Cancer. This metallic element has a high degree of toxicity, known to be able to induce multiple organ damage and has severe adverse effects on human health and the environment even at low levels of exposure. In this work, two novel tripeptides were designed and synthesized based on ATCUN motif. Two system, namely, monoligand and heteroligand system were compared in this work. Tripeptides were individually immobilized onto AuNPs (gold nanoparticles) surface via covalent coupling. In a monoligand system only a particular tripeptide-AuNPs will be used, while in a heteroligand system, two kinds of tripeptide-AuNPs will be used in a mixture. The heteroligand system was found to be more effective compared to the monoligand system. The interaction of heteroligand enhances the selectivity and sensitivity of the plasmonic sensor for mercury (II) ions. Upon the addition of metal ions, the red-to-blue colour change, and the degree of AuNPs aggregation formed by the heteroligand system were doubled when compared to the monoligand system. These two novel tripeptides were selected among twelve novel tripeptides as the best capturing agents for mercury ions with an absorbance ratio (A683/A524) of 1.098. The finding was supported by UV-Vis spectra, Dynamic Light Scattering (DLS) spectroscopy, and Transmission Electron Microscopy (TEM) analysis. The limit of detection (LOD) for mercury detection was 25 parts per billion (ppb). Validation of the heteroligand system was further carried out by conjugation of tripeptides onto different sizes of AuNPs (20nm and 40nm) resulting in the formation of AuNP s' nanoflower. This new approach has the potential to constitute a more effective detection system, particularly in targeting small molecules.

Keywords: gold nanoparticle; heteroligand system; mercury (II) ions; spectroscopy

V-Vir-My-020

Study on Rheological and Stability of Natural Derived Carbon Nanosphere Nanofluids

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Abstract

In this work, carbon nanosphere derived from a waste rice husk (RH) were prepared through chemical treatment and calcination process. Moreover, the carbon nanofluids (CNF) were developed using simple chemical treatment assisted by ultrasound technique. Different composition of carbon nanosphere (CNS) were taken into experiment to determine the optimum and best properties. Ultrasound techniques were introduced in this study to reduce the agglomeration of the particle. Surface morphology of CNS were analysed by Scanning Electron Microscopy (SEM). The sphere shape from the particle/grain were identified from the nanoparticle and proves the terms of "nanosphere". Viscosity of the nanofluids were studied by rheological testing (Antoon PAR, MAR 3). Flow curve of nanofluids showed that at minimum inclusion of CNS improved the stress of the fluid significantly. More to the addition, dynamic viscosity measure possesses that addition of CNS stabilized the properties of the fluid compared to virgin base fluid. The stability of the CNF was investigated through UV-Vis. Findings shows that, the stability of the nanofluids stabilized starting from 1 week onwards as evidenced by UV-Visible spectrophotometer analysis. Furthermore, little to no precipitate noticed even after 8 weeks. This work offers greener approach for nanofluids which organic derived and environmentally friendly (very low percentage of nanoparticle, 0.02 vol% (equivalent to 0.002 wt %).

Keywords: carbon nanosphere; nanoparticle; nanofluids; ultrasound technique; rheological study

V-Vir-My-021

Green Synthesis and Characterization of Silver Nanoparticles using Carrageenan

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Abstract

Silver nanoparticles (AgNPs) is one of the most fascinating metallic nanomaterials due to its excellent antibacterial properties. Despite this promising feature, AgNPs synthesised using the conventional chemical synthesis route is prone to aggregation, which deteriorates its catalytic function and bactericidal effect. In this study, carrageenan was used as reducing and stabilising agents to mediate green synthesis of AgNPs through a facile hydrothermal reaction at 90°C for 2 hours. Reduction of silver nitrate ($AgNO_3$) to AgNPs was evident by a colour change from colourless to dark brown and further confirmed by the surface plasmon resonance (SPR) peak at 420 nm measured using UV-Visible spectrometer. The physicochemical properties of the AgNPs were further characterised using various methods including Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), Energy Dispersive X-ray (XRD) analysis, Transmission Electron Microscope (TEM), X-ray diffraction (XRD), and Atomic-Force Microscopy (AFM). The SEM, TEM and AFM analyses depict the shape of AgNPs to be spherical, with size in the nanometer scale, ranging from 30-400 nm. The EDX indicates the presence of elemental silver (85.87 wt%). The FTIR and XRD analyses of the AgNPs confirms the crystalline nature of the AgNPs with face centred cubic structure. This study therefore suggests that carrageenan, a polysaccharide extracted from red seaweed, can be used as a green and effective reducing agent in the synthesis of AgNPs for a broad range of food and biomedical applications.

Keywords: silver nanoparticles; green synthesis; carrageenan; seaweed

V-Vir-My-022

Effect of Yttria-Stabilized Zirconia (YSZ) and Sintering Temperature on the Production of β-Tricalcium Phosphate (β-TCP)

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Abstract
The utilization of fish scale hydroxyapatite (FsHA) in medical field has been on demand for its biocompatibility and bioactivity properties. The FsHA also is more beneficial because it is lower in cost and in comply with HALAL requirement in compared to hydroxyapatite (HA) that is produced synthetically and derived from mammals. However, HA is only limited to bone filler application due to its low degradation rate. This issue can be overcome by the presence of β-tricalcium phosphate (β-TCP) from the decomposition of HA as β-TCP has degradation rate of 3 to 12 times faster than HA. The decomposition of HA has been done by pressure less sintering using conventional furnace. In addition, yttria-stabilized zirconia (YSZ) has the ability to fasten the decomposition of HA at a relatively lower sintering temperature which will reduce the cost as well as possessing great mechanical properties. Different amount of YSZ (5 wt%, 10 wt% and 15 wt%) made up different composition of FsHA/YSZ composites. These composites were then sintered at the sintering temperature of 1200°C, 1300°C, 1400°C and 1500°C and then were characterized using X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR). The highest amount of YSZ (15 wt%) produced the most β-TCP at the ideal sintering temperature of 1200°C. The HA also was not fully decomposed at this sintering temperature thus forming biphasic calcium phosphate (BCP). The chemical conjunction, crystallite size and the percentage of crystallinity of the FsHA/YSZ composites were also studied.

Keywords: fish scale hydroxyapatite; yttria-stabilized zirconia; sintering temperature

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POSTER PRESENTATION

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BIONANOTECHNOLOGY RESEARCH
Po-Phy-My-001

Hydrogen Bonding Interactions between Starch and Water: A Computational Modelling Approach

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Abstract

This study aims to elucidate the role of hydrogen bonding interaction between polymeric starch and water via computational analysis. Density functional theory (DFT) and molecular dynamic (MD) simulation methods were employed to study the respective interaction of starch and water. From the simulation obtained by DFT, the bond length of 1.85 Å measured between O11 and H111 was obtained using a basis set of DFT/6-31 (d.p) model for the possibility of hydrogen bonding between natural starch and water. In addition, the decreasing value of Mulliken charge for atom O11 in both structures of amylose with or without water suggests the possible formation of a hydrogen bond with H111. Furthermore, simulation studies using MD calculated that the average number of hydrogen bonds present was 13, thus suggesting the possibility of the successful formation of hydrogen bonds. Analysis of density maps showed that the water molecules tend to interact strongly with amylose chains, thus reducing the hydrogen bonding among amylose structures and increasing the interaction with water. This increment in interaction indicates the ability of starch to absorb water efficiently for the application as a superabsorbent.

Keywords: density functional theory; hydrogen bonds; molecular dynamic; natural starch superabsorbent.

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Po-Phy-My-002

Psychosocial Impact by Islamic Perspective among Low-Income Haemodialysis Patient

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Abstract
The number of haemodialysis patients increasing year by year. Until 2015, there were 37,183 (1220 per million population) patients are dialysis at centre of haemodialysis in Malaysia. In Malaysia, kidney transplantation is very limited and mostly of end-stage renal disease patients require dialysis. In addition, there also high cost to do kidney transplantation. So, these patients will undergo alternative treatment which is haemodialysis treatment. This treatment will ongoing for their lifetime. It will affect their psychosocial in their life. In this study, we explore psychosocial impact and coping activities by Islamic perspective among low-income haemodialysis patients. We recruited a cross sectional study from 20 respondents of haemodialysis patient. The survey collected data on sociodemographic and self-administrated structured questionnaire on psychosocial impact with close questions. Descriptive statistical analysis was analysed using SPSS version 26. A total of 20 respondents were involved, all respondents have negative impact on psychosocial. Our result shown that all respondents express their feelings by praying and worship to get closer to God for releasing the stress. These findings also shows that they got help from family for emotional support. In conclusion, this study found that this lifetime treatment has severe impact on psychological and emotional towards low-income haemodialysis patients and need to provide urgent intervention strategies to avoid uncertainty problems in this ongoing treatment.

Keywords: psychosocial; haemodialysis; low-income; Islamic

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Po-Phy-My-003

Covalent Conjugation of Antibody on Gold Nanoparticles via Carbodiimide for Targeted Drug Delivery System

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Abstract

Due to non-specificity, conventional chemotherapy regimens not only kill fast-growing tumor cells, but also fast-dividing healthy cells and lead to numerous side effects after chemo-treatment. Thus, it is pivotal to timely design the right drug carrier system with improved selectivity, effectiveness and controlled release of the drug into systemic circulation. In this study, we synthesized gold nanoparticles (AuNPs) according to the Turkevich method by chemical reduction and fabricated the surface by thiolated polyethylene glycol (PEG) for carboxyl terminated. 1-Ethyl-3-[3-dimethylaminopropyl] carbodiimide, EDC and *N*-hydroxy-succinimide, NHS were used as a mediator linker for conjugating CD133 monoclonal antibody to AuNPs via covalent bonds. The synthesized products were characterized by X-ray diffraction (XRD), UV-vis spectroscopy, transmission electron microscopy and dynamic light scattering. Conjugation of anti-CD133 mAb onto PEGylated AuNPs was confirmed with the use of UV-vis, BCA protein assay and fluorescence microscopy. Comparison of the peaks in the XRD pattern with the standard database confirmed that the synthesised product comprised the face-centred cubic lattice of Au. The surface plasmon resonance peaks of AuNPs and PEGylated AuNPs were detected at 522 nm and 525.5 nm, with polydisperse index values were 0.408 and 0.521, respectively. The size of AuNPs increased from 13.0 nm to 19.0 nm after the modification with PEG. Based on the BSA standard curve, the efficiency of the uptake of anti-CD133 mAb was 82.35%. Whereas PEGylated AuNPs not conjugated with anti-CD133 mAb accumulated mainly at the cellular membrane, nanoparticles conjugated with anti-CD133 mAb were contained within the nuclear region of the cells. The results of this work demonstrated that simultaneous functionalisation of PEGylated AuNPs with antibodies and chemotherapeutic drugs is a viable strategy to combat cancer through targeted drug delivery.

Keywords: gold nanoparticles; Turkevich method; characterization

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BIONANOTECHNOLOGY RESEARCH
Po-Phy-My-004

Green Synthesis of Silver Nanoparticles by Tualang Honey Modulating Hippocampal Glutathione in Kainic Acid-Induced Seizure in Male Rats

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Abstract

In recent years, green synthesis of nanoparticles using plant-mediated process has been an emerging research and development in the field of medicinal biotechnology. Tualang honey, a potential natural antioxidant medicinal agent, has been shown to protect against neurodegenerative disorders. Present study explored the ameliorative effects of silver nanoparticles (AgNPs) synthesized using Tualang honey on glutathione level following kainic acid (KA)-induced seizure in the rats' hippocampus. Sprague Dawley male rats (n=42) were randomly divided into seven groups such as control, AgNPs 10 mg, AgNPs 50 mg, KA alone, AgNPs 10 mg+KA, AgNPs 50 mg+KA and Topiramate+KA, and each group were pretreated orally with either distilled water, AgNPs (10 mg/kg or 50 mg/kg) or Topiramate (40 mg/kg), respectively, five times at 12 h intervals. Saline or KA (15 mg/kg body weight) were injected subcutaneously 30 min after last oral treatment. All animals were sacrificed 24 h after KA injection and their hippocampus were harvested for determination the level of reduced glutathione (GSH), oxidized glutathione (GSSG) and GSH:GSSG ratio by using commercially available ELISA kits. The significant ($p<0.05$) decrease in the level of GSH in KA alone group was ameliorated by both doses of AgNPs pretreatments. Meanwhile, the elevation of GSSG level in KA alone group was significantly ($p<0.05$) reduced by the pretreatments of AgNPs 10 mg and Topiramate of KA-induced groups. Remarkably, only AgNPs 10+KA group was significantly ($p<0.05$) increases the GSH:GSSG ratio after KA induced. In conclusion, AgNPs showed potential protective effects by modulating the glutathione system in the rats' hippocampus after KA-induced.

Keywords: silver nanoparticles; Tualang honey; glutathione; kainic acid; hippocampus

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BIONANOTECHNOLOGY RESEARCH
Po-Phy-My-005

Evaluation of Physicochemical Properties of Novel Alginate-Agarose/Silver Nanobiocomposite to Promote Wound Healing

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Abstract
Nanocomposite hydrogels also called hybrid hydrogels like alginate (Al) and agarose (Ag) embedded with silver nanoparticles (AgNPs) can be described as a hydrated polymer network. Effectively blending alginate-agarose (Al/Ag) with AgNPs, can contribute to enhanced structural stability and physical properties. Nanobiocomposite hydrogels are prepared by effectively combining alginate and agarose into a hydrogel beads form and embedding the AgNPs within the Al/Ag hydrogel matrix thru random distribution. Hence, this study aims to synthesize and characterize the antimicrobial silver nanoparticles integrated with Al/Ag-based hydrogel as nanobiocomposites that can result in quick healing at an affordable rate, with limited discomfort to the patients. Different concentrations of Al/Ag hydrogels were prepared which are $Al_{1.5}/Ag_{2.3,}$ $Al_{1.8}/Ag_{2.6}$ and $Al_{2.1}/Ag_{2.9}$. The embedment of silver was done first, by immersing the Al/Ag beads in 1% silver nitrate solution for 24 hours and 1% trisodium citrate for 24hours. Upon the successful formation of Al/Ag-AgNPs beads, characterization tests such as structure elucidation using FTIR spectroscopy and surface morphology by SEM-EDX were done to confirm the binding affinities of silver. Degree of swelling ratio analysis and tensile strength mechanical testing was performed on Al/Ag hydrogel with and without AgNPs. The significance of antimicrobial activity exhibited by Al/Ag-AgNPs will be tested by two pathogens, *P. aeruginosa* and Methicillin-Resistant Staphylococcus aureus *(MRSA). The result of this work demonstrated that the silver nanoparticles* randomly distributed in the Al/Ag hydrogel matrix successfully forming Al/Ag-AgNPs exhibited superior structural stability and the antimicrobial properties are yet to test.

Keywords: alginate-agarose hydrogel; nanobiocomposites; antimicrobial agent; silver nanoparticles.

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Po-Phy-My-006

Occult Hepatitis B Virus Infection (OBI) Detection using an Optimized Nested Polymerase Chain Reaction (PCR) and Sequence Analysis of the S-gene of the Hepatitis B Virus

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Abstract

Occult Hepatitis B virus infection (OBI) is a risk factor for chronic liver disease and hepatocellular carcinoma (HCC). OBI is defined as HBV DNA detection in the serum or liver of HBsAg-negative patients with or without serologic markers of previous viral exposure. Naturally occurring mutations happens quite frequently in hepatitis B virus (HBV) due to its replicative strategy, that leads to the production of many non-identical variants during each replicative cycle. These mutants are responsible for false-negative Hepatitis B surface antigen tests which result in the patient being undiagnosed. The objective of this research proposal is to sequence and identify mutations in the S-gene of the hepatitis B virus surface antigen gene in patients with OBI. This study will be conducted in Hospital Universiti Sains Malaysia, Malaysia. Residual blood samples from new and lapsed blood donors will be screened using anti-Hepatitis B core total serology. Samples found to be positive will be further tested with optimized nested-PCR to confirm the presence of HBV DNA. Primers targeting the HBsAg gene will be used. Sera from patients with chronic HBV infection will be used as control. The PCR products found positive will be sent for sequencing. The sequencing results will be compared to wild type sequence obtained from Genbank and analysed using BLAST software. This study will identify the possible genetic cause of OBI.

Keywords: Occult Hepatitis B; mutations; surface antigen; nested PCR; HBsAg

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Po-Vir-My-001

The Reliability of SketchAndCalc^{tm} Area Calculator Software in Evaluating the Obturated Surface Area of Mandibular Premolars and Molars

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Abstract

The measurement consistency of an assessment tool in biomedical research is important for validation of data. This study aims to determine the reliability of SketchAndCalc^{TM} Area Calculator software in evaluating the obturated surface area of mandibular premolars and molars between two examiners and compare to the previous studies. 30 scanning electron microscopy (SEM) images of extracted single rooted mandibular premolars and 30 SEM images of mandibular molars were obtained from previous studies. The extracted teeth were previously obturated with GuttaFlow Bioseal. Calibration between two examiners was done prior to start of the study. SketchAndCalc^{TM} Area Calculator software was used to evaluate the volumetric percentage of obturated surface area. Inter-examiner reliability was determined between two examiners and compared to the previous studies using Intraclass Correlation Coefficient (ICC) with the following categories; ICC <0.50: poor reliability, ICC 0.50-0.75: moderate reliability, ICC 0.75-0.90: good reliability, ICC >0.9: excellent reliability. The ICC values between two examiners were 0.979 in mandibular premolars and 0.918 in mandibular molars. Meanwhile, the ICC values between two examiners and to the previous studies were 0.844 in mandibular premolars and 0.962 in mandibular molars. Excellent inter-examiner reliability was observed in premolars and molars, however when compared to the previous studies, good and excellent inter-examiner reliability were observed in premolars and molars respectively.

Keywords: SketchAndCalc^{TM} Area Calculator software; mandibular premolars; mandibular molars; GuttaFlow Bioseal; Inter-examiner reliability

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BIONANOTECHNOLOGY RESEARCH
Po-Vir-My-002

Antimicrobial Hydrogel Technology for Chronic Wound Treatment

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Abstract

Chronic wound infections are a common and hard-to-resolve problem that associated with morbidity and mortality. These wounds occur as the result of delayed and prolonged healing of the acute wounds, and it is often associated with bacterial infections, which hinder the formation of new blood vessels and tissue healing process. Further patient-related factors such as diabetes and poor initial treatment would worsen the chronic wound management. Present chronic wounds treatment faced with limitations and challenges especially in tackling enduring wide range microbial infections. Hydrogel technology become attention for treating wounds particularly for intense and extended absorption capacity. Hydrogel is a three-dimensional network consisting of hydrophilic polymers, through which the hydrogel is able to absorb water and swell, in addition to its ability to encapsulate bioactive molecules and provide a moist environment that promotes the wound healing process. New-generation wound dressings hydrogel with nano based antimicrobial agents are preferred over conventional antibiotics that known for bacterial resistance propensity. Therefore, combination of precise antimicrobial agent with hydrogel technology could provide promising treatment modalities for chronic wounds.

Keywords: antimicrobial; hydrogel; chronic wounds; microbial Infection; nanotechnology

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BIONANOTECHNOLOGY RESEARCH
Po-Vir-My-003

Surface Technology for Blood Contacting Medical Implant: Apatite Biofouling on Titania Nanotube Arrays Associated with Hemocompatibility and Antithrombogenic Potentials

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Abstract

Hemocompatibility and apatite biofouling are the most decisive factors for medical implant surface technologies. In the market surface coating technologies especially for blood-contacting implants, application faced limitations in thrombogenic and failure risks. Titania nanotube arrays (TNA) surface technology could be a promising solution for medical implant surface technology. Present studies were performed according to ISO 10993-4 guidelines for hemocompatibility profiles and ISO 23317-2007 guidelines for using simulated body fluid (SBF) for apatite forming abilities. In general, TNA nanosurface showed no evidence of thrombogenesis and hemolytic index. TNA nanosurface has reduced fibrinogen adsorption, platelet adhesion, and platelet activation on the surface with less than 0.4 % of hemolytic percentage which recommends a non-hemolytic nature surface that shows negative biofouling qualities. TNA nanosurface also presents with a greater appetite for biofouling and hydrophilic potential than smooth titanium surface. In conclusion, TNA nanosurface could present with double sword biofouling potentials that resist detrimental biofouling properties associated with thrombogenesis and hemolysis risk while positive biofouling for appetite formation. Thus, TNA may involve in excellent surface osseointegration activities which are essential for successful implant surface technology, especially for long-term application.

Keywords: titanium dioxide nanotube arrays; TiO_2 nanotube arrays; surface technology; hemocompatibility; biofouling; blood-contacting medical implant

Po-Vir-My-004

Developing Magnetic Functionalized Carbon Nanotube-Based Buckypaper for Micropollutants Removal

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Abstract

The mutagenic and carcinogenic properties of emerging MPs, especially in the farming and aquaculture industry which used steroid hormone, particularly furazolidone has been detected in wastewater effluent. Furazolidone is currently prohibited by the FDA and no longer available in the US and some developed countries. Many compounds can be treated through conventional methods, but not for MPs. Magnetic nanoparticles incorporated in MWCNTs have attained significant interest from many researchers, especially in water remediation. Nevertheless, it is restricted to commercialization due to an external magnetic field requirement and particles are not completely separated. In contrast, the BP membrane applications are limited due to low mechanical strength. Magnetic functionalized multi-walled carbon nanotubes-based buckypaper (magnetic f-MWCNTs-based BP) membrane was fabricated and infiltrated with polyvinyl alcohol and employed to degrade furazolidone (FZD) from the aqueous phase. Characterization studies were performed to reveal the surface structure, chemical composition, and stability of the f-MWCNTs and magnetic f-MWCNTs. Response surface methodology (RSM) was employed to investigate the influence of pH (4-8), contact time (40-350 min.), and agitation speed (100- 200 rpm) on the prepared membrane. The maximum removal efficiency of 98.54% was achieved at 10 mg/L, adsorption time of 350 minutes, agitation speed of 200 rpm and the pH value of 6.

Keywords: micropollutants; magnetic buckypapers; multi-walled carbon nanotubes; furazolidone removal; wastewater water treatment

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Soothing & Calming

KRIM ANTI-CACING DAN MELEGAKAN

01 Mengawal jangkitan cacing
02 Melegakan kembung perut
03 Membantu tidur lena
04 Mengurangkan sembelit
05 Melegakan hidung tersumbat

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University Industry Research Laboratory (UIRL), Universiti Teknologi Malaysia (UTM) was established to provide testing and analysis services either to external parties or within UTM. To ensure the reliability and credibility of the laboratory, UIRL has obtained and maintained recognition as an accredited testing laboratory under the Malaysian Laboratory Accreditation Scheme (SAMM) from the Department of Standards Malaysia (DSM). The possession of this laboratory accreditation certificate shows UIRL operates in full compliance with the management and technical system requirements under MS ISO/IEC 17025: 2017.

UIRL is equipped with a wide range of state-of-the-art instrumentation and technologies in six major fields:

- Mass Spectrometry & Molecular Spectroscopy
- X-Ray & Thermal Analysis
- Microscopy & Imaging
- Chemical Analysis
- NMR Laboratory
- Micro/Nano Fabrication & Machining

Besides UIRL, UTM have a range of laboratory and business incubators to assist industries carrying out joint R&D in testing proprietary processes and technologies which cater various niche areas including:

- Accredited Calibration
- Accredited Testing
- Non-Accredited Testing
- Accredited Professional Training
- Consultation and Training
- Facilities for Product Development
- Sample Analysis

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