UNIVERSITI TEKNOLOGI MARA
Cawangan Perlis
Kampus Arau

i-IDeA™2023
THE 6TH INTERNATIONAL INNOVATION, DESIGN AND ARTICULATION

5th i-IDeA 2023 ISTEC

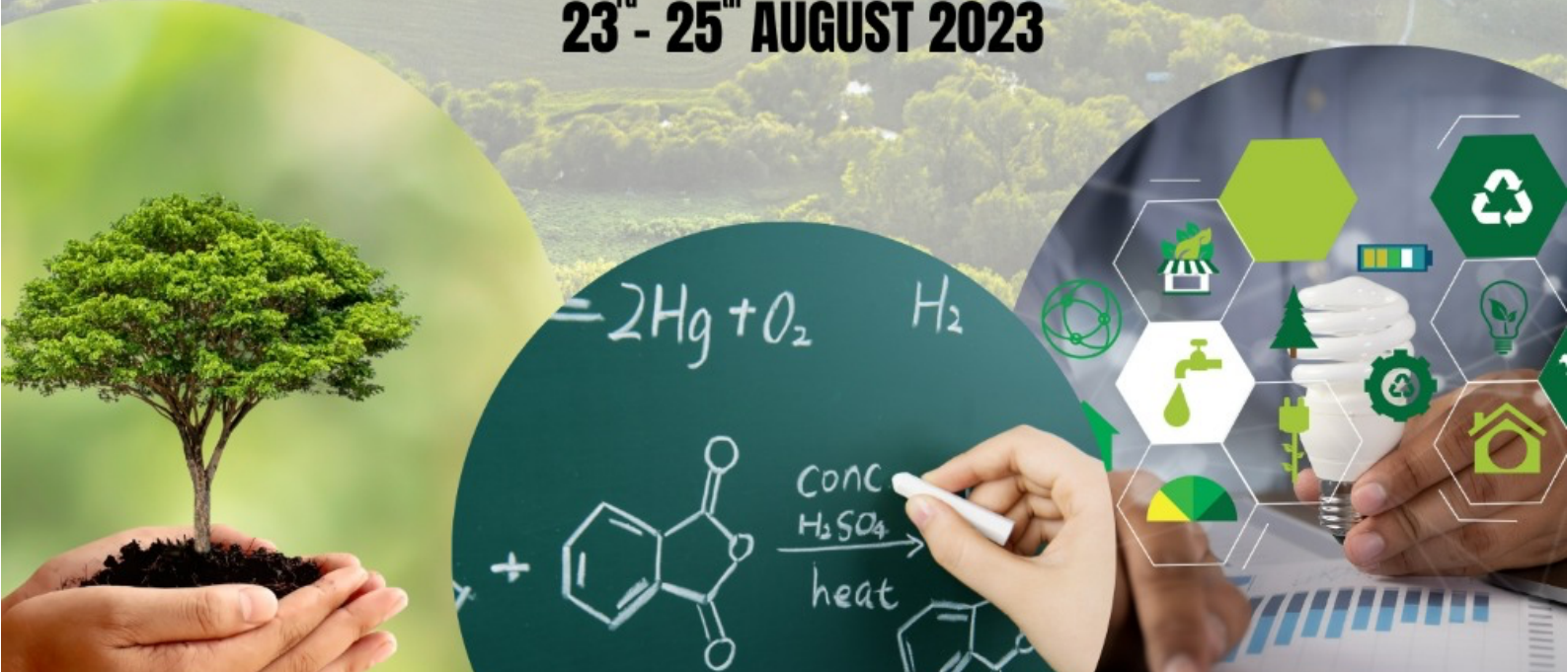
GLOBAL ADVANCED MATERIALS & SURFACES

BAYVIEW HOTEL
GEORGETOWN, PENANG

Empowering Materials Towards Future Sustainability

BOOK OF ABSTRACTS

23rd - 25th AUGUST 2023



BOOK OF ABSTRACTS

THE 5TH INTERNATIONAL SCIENCES, TECHNOLOGY AND ENGINEERING CONFERENCE (ISTEC 2023)

Copy Editors
Dr. Solhan Yahya
En. Muhammad Syukri Noor Azman

Publisher

Research, Industry, Community, Alumni, Entrepreneurship & Network (RICAEN),
Universiti Teknologi MARA (UiTM) Perlis Branch,02600, Arau, Perlis.

Tel: 04-9882028/2296

Fax: 04-9882304

RICAEN,
The 5th International Sciences, Technology and Engineering Conference (ISTEC-GAMS2023) Book of Abstracts.

Preface

Welcoming Remarks

Assalamualaikum, warahmatullahi wabarakatuh. Salam Sejahtera and greetings to all.
On behalf of the organising committee, I would like to welcome all the delegates and guests to the 5th Edition of the International Sciences, Technology, and Engineering Conference—Global Advanced Materials & Surfaces 2023 (5th ISTEC-GAMS 2023). This hybrid conference is organised by Universiti Teknologi MARA (UiTM), Perlis Branch, Arau Campus, Malaysia, as part of the 6th International Innovation, Design, and Articulation Conference (i-IDeA 2023).

With the theme of "Empowering Materials Towards Future Sustainability," I believe this conference is a great platform for researchers to share and discuss the latest developments and findings in related fields. The conference, which is held on August 23–25, 2023, features one prestigious plenary speaker, Professor Datuk ChM. Ts. Dr. Taufiq Yap Yun Hin, keynote speakers, invited talks from well-known scientists, and physical and virtual oral parallel sessions.

We are pleased to announce that all selected research papers submitted by the deadline will be considered for publication in a specific scientific journal. We anticipate that this conference will serve as a networking opportunity for students, professors, and researchers from Malaysia and throughout the world.

We would like to express our gratitude to all the authors for their amazing contributions to such a vast number of entries.

Finally, we expect the conference to be enjoyable, educational, and entertaining, with a high-quality programme to contribute to what will be a memorable event. I'd like to thank my organising committee, chairpersons of parallel sessions, reviewers, all presenters, and the Universiti Teknologi MARA Perlis branch for their support and commitments. Finally, on behalf of the 5th ISTEC-GAMS 2023 committee, I would like to humbly welcome you to the 5th Edition of the International Sciences, Technology, and Engineering Conference—Global Advanced Materials & Surfaces 2023 and look forward to your active participation. Have a great day.

Best Regards,

Ts. Gs. Dr. Ernieza Suhana Mokhtar (Chairman)

Deputy Rector RICAEN
Universiti Teknologi MARA Cawangan Perlis Kampus Arau

Table of Content

Title **Page**

Use of optimization techniques based on multi-response surface methodology to improve the fracture life of materials working under adverse creep conditions

Roberto Fernandez Martinez[1]*, Pello Jimbert[1], Lorena M. Callejo[2] and Jose Ignacio Barbero[2]

[1]College of Engineering in Bilbao, University of the Basque Country UPV/EHU, 48013 Bilbao, Spain
[2]Foundry & Steelmaking Area, Fundacion TECNALIA Research & Innovation, 48160 Derio, Spain

[*]Corresponding authors: *roberto.fernandezm@ehu.eus*

ABSTRACT

The aim of this work is to improve the design process of new steel materials by analyzing its composition and heat treatment. This process is analyzed based on mathematical optimization systems with the goal of improving the useful life of several steels under adverse creep operating conditions. To this end, different design requirements are considered to determine the ideal material composition and the ideal manufacturing heat treatment, in order to achieve the most appropriate final mechanical properties at the end of the manufacturing process, and thereby improve the useful life of the material under fatigue. Mathematical models are trained in order to predict material fatigue life using 16 variables related to the composition of the material, 4 variables related to the heat treatment performed during manufacturing and 2 variables related to the creep working conditions. Based on these features, several models to predict material fatigue life are trained and tested applying the response surface methodology (RSM). With the selected model and different desirability functions, the process is optimized and the most appropriate values to be used in the design are determined to improve the material useful life. Once optimal design conditions have been achieved for this type of product, the mechanical properties are validated through real tests performed under creep conditions similar to the actual operating conditions in power generation plants. The obtained results confirm the validation of RSM to understand better the behavior of this type of materials, and also confirm this methodology as a useful support for decision-making in relation to the optimization of the material design in order to improve several final mechanical properties.

Keywords: *Response Surface Methodology; Mathematical Optimization; Steel Manufacturing; Creep Conditions; Creep Damage.*

Comparison Study on The Silver Oxosalts Photocatalyst for The Photodegradation Of 2-Chlorophenol

Mohammad Saifulddin Mohd Azami[1]*, Abu Hassan Nordin[1], Aishah Abd Jalil[2], Che Rozid Mamat[3], and Wan Izhan Nawawi Wan Ismail[1]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 2300 Arau, Perlis, Malaysia

[2]School of Chemical and Energy Engineering, Faculty of Engineering,
Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

[3]Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

[*]Corresponding authors: *saifulddin@uitm.edu.my*

ABSTRACT

2-chlorophenol (2-CP) has been extensively utilized in various industrial such as agricultural, cosmetic, paper, and biocide. The 2-CP has become a dangerous pollutant that can cause serious water pollution. Photocatalytic degradation is one of the effective destructive methods to remove 2-CP pollutant. In this works, silver oxosalts photocatalysts (Ag_3PO_4, Ag_2SO_4, Ag_2CO_3) were prepared using precipitation method in order to investigate the photodegradation of 2-CP under visible light irradiation. The photocatalysts were characterized using UV-Vis DRS, FTIR, and FESEM analyses. The result demonstrated that the percent degradation was in the following order: Ag_2CO_3 (70%) > Ag_3PO_4 (63%) > Ag_2SO_4 (60%). The best performance, shown by Ag_2CO_3 was due to this semiconductor shows the narrowest of band gap as compared to the others silver oxosalts. The narrowest band gap of the Ag_2CO_3 give advantageous to harvest more visible light that can absorbed during photocatalytic degradation. The scavenger study of the optimum photocatalyst shows that the main species in the degradation of 2-CP was hydroxyl radicals on the catalyst surface ($\bullet OH_{surface}$). This study highlighted the contribution of the photocatalyst silver oxosalts that could be give beneficial toward the degradation of organic pollutants in wastewater treatment.

Keywords: *Silver oxosalts, photocatalytst, 2-Chlorophenol, precipitation,bandgap*

The Potential of Soybean and Glycine as Corrosion Inhibitors for Steel in Hydrochloric Acid

Solhan Yahya*, Zuliahani Ahmad, Nor Hafizah Che Ismail, Nurul Izzati Rosli, Nurul Hayani Ramlan and Nur Aina Radin Sukimi

Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 02300 Arau, Perlis, Malaysia

Corresponding authors: solhan@uitm.edu.my

ABSTRACT

The potential of soybean and glycine as organic corrosion inhibitors for steel in acid solution was examined through weight loss tests and potentiodynamic polarization. Both soybean and glycine were characterized via FTIR and UV-visible. Result shows that the soybean and glycine contain isoflavone and nitrogen bond respectively as a beneficial element in inhibiting the corrosion of steel. Corrosion tests were performed with and without the presence of soybean and glycine for 3 days immersion in the acidic medium. Corrosion inhibition efficiency measured via electrochemical test found that both soybean and glycine give an excellent corrosion inhibition efficiency at 1.5 g/L in 0.5 M HCl up to 96% and 94% respectively. Tafel analysis reveals both inhibitors perform mixed types inhibitors which predominantly anodic inhibition. Pseudo-passivation was observed in the Tafel curve indicating the capabilities of both inhibitors to passivate the corrosion at anodic potential. However, result also depicts that both inhibitors may inhibit both anodic and cathodic reactions. Observation of the steel samples through an optical microscope shows that the corrosion of the steel surface was inhibited in the addition of soybean and glycine in HCl. The roughness of the steel surface affected by the combination of uniform and pitting corrosion was also reduced. In overall, soybean and glycine exhibit excellent anticorrosive properties due to the presence of significant chemical structures and active functional groups. Analysis of the inhibition mechanism through isotherm showed that soybean and glycine followed Langmuir isotherm, indicating the adsorption type for both inhibitors is chemisorption. The results obtained from this study could be a good reference in diversifying the study of amino acids as metal corrosion inhibitors to benefit metal-based industries.

.

Keywords: Corrosion, stainless steel, soybean, potentiodynamic polarization, adsorption

One-step Method for Preparation of Keratin Nanomaterials: Steam Flash Explosion Treatment

Haiyue Feng[1,2], Zifang Wang[1],Shien Chen[2] and Gongtao Ding [1]*

[1] China-Malaysia National Joint Laboratory, Biomedical Research Center, Northwest Minzu University, Lanzhou 730030, PR China
2 College of Life Sciences and Engineering, Northwest Minzu University, Lanzhou 730030, PR China

[*] Gongtao Ding, *dinggongtao@outlook.com*

ABSTRACT

The steam flash explosion treatment (SFE) is a novel environmentally friendly and sustainable nanopelletizing technology. The traditional nanoparticle granulation technology of natural biomass proteins generally face the technical bottleneck of complicated processes, low yields and difficult of nanoparticle-solvent separation. In the SFE process, high-pressure steam was injects into polymeric biomaterials slowly, and held for a certain period, then released in 0.0875s. The high energy release in a rapid time causes the biomaterials to self-assemble, producing homogeneous nanoparticles. In this study, the application of SFE treatment to yak keratin is the first report to prepare the nanoparticles. After 3.25 MPa and 1 min of holding pressure, the firm and regular secondary structure of keratin was changed, and the specific gravity of α-helix was significantly decreased. SFE effectively caused the transition from intermolecular β-folded structure to intramolecular β-folded structure. The effect of disulfide bond depolymerization of keratin fibers was obvious, the distance between the crystalline faces of keratin fibers was expanded and the crystallinity was reduced, the keratin backbone was not destroyed. As treatment pressure increased, the melting temperature of keratin decreased and the steric structure of the protein was opened, and finally spherical concave pore keratin nanoparticles with a diameter of 1 μm were obtained. SFE treatment enhances keratin utilization as a protein carrier, preserves its inherent stability, and increases the adaptability of keratin molecules for medical application development.

Keywords: *Steam flash explosion treatment, nano-pelletizing, yak horn keratin*

Effect of Low Temperature on Properties of MoS_2-C Composite Films

Chufeng Sun[1,2*], Xuanyu Li[1,2], Ma Jing[1,2],Haohao Ren [1,2] and Jianghong Yang[1,2]

[1] School of Chemical Engineering, Northwest Minzu University, Lanzhou 730030, China
[2]Key Laboratory of Environment-Friendly Composite Materials of the State Ethnic Affairs Commission , Gansu Provincial Biomass Function Composites Engineering Research Center, Key Laboratory for Utility of Environment-Friendly Composite Materials and Biomass in University of Gansu Province, Lanzhou 730030, China

[*] Chufeng Sun ：chufengsun@xbmu.edu.cn

ABSTRACT

MoS2-C composite films were deposited by closed field unbalanced magnetron sputtering technology. The film was tested by the ultra-low temperature friction test machine in different temperature environments. The structure changes of the wear tracks and wear scars were analyzed by Raman, XRD, TEM and other analytical techniques. The effects of low temperature on the changes of the structure, mechanical properties, and friction performances were investigated in this study. The results showed that the friction coefficient (0.07) and wear rate (2.15×10-6 mm3/N·m) was the highest at 50K. Meanwhile, the film shows the ultra-low friction coefficient (0.01) and wear rate (7.36×10-7mm3/N·m) at 300K. During the friction process, the stiffening observed for the composite films could be explained by the ultra-low temperature (50K) . The surface of the wear track has a thick (about 60nm) tribolayer composed of a highly orderly crystalline MoS2. When changing to random orientation, this structure suppresses the formation of the transfer film. As the temperature increases (300K), the surface of the wear tracks only has a thin (about 5nm) tribolayer. Under the effect of low shear force, it is easy to generate transfer film mainly consisting of MoS2 and C, indicating that the effect of ultra-low temperature on MoS2-C composite film friction is unfavorable.

Keywords: *MoS_2-C composite films, Cryogenic, Lattice orientation, Tribological properties, Transfer film*

Tribological properties of organoguanidine phosphate ionic liquids in polyethylene glycol

Yanbin Wang[1,2*], Xiaoyan Yan[1,2], Jing Ma [1,2], Haohao Ren [1,2], Jianghong Yang[1,2], Chufeng Sun[1,2] and Su Qiong [1,2]

[1] School of Chemical Engineering, Northwest Minzu University, Lanzhou 730030, China
[2]Key Laboratory of Environment-Friendly Composite Materials of the State Ethnic Affairs Commission , Gansu Provincial Biomass Function Composites Engineering Research Center, Key Laboratory for Utility of Environment-Friendly Composite Materials and Biomass in University of Gansu Province, Lanzhou 730030, China

[*] Yanbin Wang :ybwang@126.com

ABSTRACT

To explore the feasibility of phosphate organizations ionic liquid (P_8-G) as a lubricant additive, its theological properties were investigated in polyethylene glycol (PEG 400) in this paper. The toxicological properties of the P_8-G system were tested at room temperature and high temperature using a SRV-IV reciprocating friction tester. The test results showed that P_8-G has good lubricating properties in PEG 400 at both room temperature and high temperature. In order to study the lubrication mechanism, the surface morphology and elemental distribution of the wear spots were analyzed by 3D morphometry, scanning electron microscopy and EDS spectroscopy. The analysis showed that P_8-G adsorbed on the surface of the friction substrate and formed a stable friction chemical reaction film by the synergistic effect of N-P. The P_8-G system is green, does not contain halogen and other highly polluting substances, and can be widely used as a green and efficient lubricant additive.

Keywords: *Ionic liquids, lubrication, Lubricant materials, friction chemistry*

Preparation of biomass-derived carbon materials and their application in supercapacitors

Wei Shuai[1,2], Chen Qi[1,2], Wang Qing[1,2], Yu Hao[1,2], Yanbin Wang[1,2*] and Su Qiong[1,2*]

[1] School of Chemical Engineering, Northwest Minzu University, Lanzhou 730030, China
[2]Key Laboratory of Environment-Friendly Composite Materials of the State Ethnic Affairs Commission , Gansu Provincial Biomass Function Composites Engineering Research Center, Key Laboratory for Utility of Environment-Friendly Composite Materials and Biomass in University of Gansu Province, Lanzhou 730030, China

** Yanbin Wang , ybwang@126.com; *Su Qiong , hgsq@xbmu.edu.cn*

ABSTRACT

Biomass-derived carbon materials have received a lot of attention in the field of supercapacitors due to their abundant and renewable source of precursors and their varied macroscopic structures. Biomass-derived carbon is a widely available sustainable material with a rich pore structure, large specific surface area, environmental friendliness and objective economic value. This paper reviews the advantages of biomass-derived carbon materials over other materials in supercapacitors, various methods for preparing various biomass-derived carbon materials, and also discusses the challenges and prospects associated with biomass-derived carbon materials to provide new ideas for further rational design of biomass-derived carbon electrode materials.

Preparation and performance study of biomass straw foaming material

Xinyu Lu[1,2], Hongjie Nie [1,2], Jinqin Zhao[1,2], Ren Fang[1,2], Su Qiong[1, 2*]and Yanbin Wang[1,2*]

[1] School of Chemical Engineering, Northwest Minzu University, Lanzhou 730030, China
[2]Key Laboratory of Environment-Friendly Composite Materials of the State Ethnic Affairs Commission, Gansu Provincial Biomass Function Composites Engineering Research Center, Key Laboratory for Utility of Environment-Friendly Composite Materials and Biomass in University of Gansu Province, Lanzhou 730030, China

**Su Qiong* , *hgsq@xbmu.edu.cn* ; *Yanbin Wang* , *ybwang@126.com*

ABSTRACT

In recent years, synthetic foam materials are widely used, but because of flammability, difficult to degrade, etc. This has led to a number of environmental problems. Plant fiber-based foams have the potential to replace traditional foams because of their biodegradability and renewable nature. In this paper, pretreated and esterified modified wheat straw is used as raw material, water is used as foaming agent and carboxymethyl cellulose is used as cross-linking agent. Hydrophobic cellulose-based foams with certain strength were prepared by freeze-drying method. It has a contact angle of 145°, a porosity of 92.51%, an average pore size of 30.85 μm, and an apparent density of 1.57g/ml. After 10 cycles of compression after wetting the foam material still retains its original appearance and has excellent resilience. In addition, potassium persulfate was used as initiator and grafted with methyl methacrylate. The results showed that the modification was successful at 0.5g of potassium persulfate and 7.5ml of methyl methacrylate, and the maximum yield was 97.6%. The contact angle is 121.1°and it has hydrophobic properties. Freeze-drying foaming with 2% carboxymethyl cellulose solution resulted in a material with a porosity of 96.5%, an average pore size of 53.34μm, and an apparent density of 2.03g/ml.

Keywords: *Wheat straw; Modification; Freeze-drying; Foaming; Cellulose-based*

Tensile And Chemical Properties Of Clinical-Grade Kidney Phantom Based On Blend Polydimethylsiloxane

Izdihar Kamal [1], Muhammad Khalis Abdul Karim[2*], Syamsiah Mashohor[3], Josephine Ying Chyi Liew [3], and Yiin Jian Low [3],

[1] Department of Medical Imaging, School of Health Sciences, KPJ Healthcare University College, Nilai 71800, N. Sembilan, Malaysia; izdihar.kamal@kpjuc.edu.my, Ieqa_zz@yahoo.com.my, tirasyima@gmail.com
2 Department of Physics, Faculty of Science, University of Putra Malaysia, Seri Kembangan 43400, Selangor, Malaysia; mkhalis@upm.edu.my (M.K.A.K) , yiinjian5447@gmail.com, josephine@upm.edu.my, izdihar.kamal@kpjuc.edu.my,

[3] Department of Computer and Communication Systems, Faculty of Engineering, University of Putra Malaysia, Seri Kembangan 43400, Selangor, Malaysia; syamsiah@upm.edu.my

* *Correspondence: izdihar.kamal@kpjuc.edu.my*

ABSTRACT

Medical imaging phantom has an important role in mimicking the properties of human tissue for calibration, training, surgical planning, and simulation purposes. Thus, the stability and accuracy of the phantom play a significant role in diagnostic imaging, especially for diagnostic performance. This work aimed to introduce an alternative and straightforward polymer-based phantoms with specific mechanical and chemical properties at the utmost suitable for the fabrication of computed tomography-based kidney phantom. The aim of this study is to evaluate the influence of Hydrogen Silicone (HS) and water (H_2O) on the tensile strength, chemical properties, and density of the blend Polydimethylsiloxane (PDMS) samples to improve the pure PDMS properties. A polymer blend is a mixture of two or more polymers that have been blended to create a new material with different physical property. Four samples were prepared with different compositions were studied, and denoted as samples S1, S2, S3, and S4, which consisted of PDMS 100%, HS/PDMS 20:80, H_2O/PDMS 20:80, and HS/H_2O/PDMS 20:40:40, respectively. The elasticity and Fourier Transform Infrared (FTIR) Spectroscopy were studied, and HS/PDMS 20:80 was superior elasticity. There were more peaks of the sample HS/PDMS 20:80 compared to HS/H_2O/PDMS 20:40:40 especially at Si-O-Si deformation, C-H bending in methyl group and CH_3 stretching. Hence the shift of wavenumber denotes the interaction that occurred. The peak for Si-C and Si-O stretching is slightly shifted compared to pure PDMS. The CH_3 stretching peak waveform bigger shift for HS/PDMS 20:80 compared to pure PDMS. Notably, the blend PDMS permits a wide range of possibilities for exploiting textural analysis and radiation dosimetry. Hence, it promises to be of value for use in both research and clinical settings for the CT modality as it is physically stable.

Keywords: *PDMS, kidney phantom, tensile, FTIR*

Effectiveness Of Metal Artifact Reduction (MAR) Algorithm For Orthopedic Metal Implants In Computed Tomography (CT) Image Reconstruction: A Phantom Study

Siti Aishah Abdullah Suhaimi [1]*, Izdihar Kamal[2], and Kishel Kaur[3]

[1 2] Department of Medical Imaging, School of Health Sciences, KPJ Healthcare University College, Nilai 71800, Negeri Sembilan, Malaysia

[3] Diagnostic Imaging Services, KPJ Puteri Specialist Hospital, 80000 Johor Bahru, Johor, Malaysia

Corresponding author: ucn.aishah@kpjuc.edu.my

ABSTRACT

Patients with orthopedic metal implant undergoing CT scanning will have images with pronounced metal artifact. While several conventional ways have been introduced in the past years, these approaches have only resulted in an upsurge of radiation dose given to patient with minimal refinement of image quality. MAR software was introduced to reduce the artifacts caused by these metals without having to give extra radiation dose to patients, and achieving an optimum image quality. Therefore, this study is done to evaluate the effectiveness of Metal Artifact Reduction (MAR) algorithm of Computed Tomography (CT) image reconstruction on three different metal implants. A standard phantom, metals implants with CT protocols was set up in two selected KPJ hospitals. This study compares the mean CT number (in HU), standard deviation (SD) and signal-to-noise (SNR) for pre and post MAR image reconstruction. Mean HU values further support reading of HU values when both readings get closer to the control image in post MAR application (p=0.043). SD readings decrease in post MAR, as compared to pre MAR reconstruction, and SNR reading increases in post MAR reconstruction of ROI's, indicating an improvement in image quality. Qualitative subjective analysis was also carried out by six experienced correspondents in the field. Scores recorded a high agreement that images in post MAR reconstruction are better in quality and less noise compared to pre-MAR application. All results showed a significantly difference and highlighted that the post MAR is excel in image quality evaluation ($p<0.05$). Scanning the patients with orthopedic implants using MAR algorithm does lessen the radiation dose to the patients with the used of post-scan image reconstruction, thus, improve the overall image quality.

Keywords: *Metal Artifact, Image Reconstruction, MAR, Algorithm, CT*

Graded Bandgap Device Architecture of Perovskite Solar Cells

Nor Azlian Binti Abdul Manaf[1]*, Asyraf Hakimi Bin Azmi[2] and Azraai Shamshuddin[3]

[1]Physics Department, National Defence University of Malaysia, Kem Sungai Besi, 57000 Kuala Lumpur, Malaysia
[2]Faculty of Defence Science and Technology, National Defence University of Malaysia, Kem Sungai Besi, 57000 Kuala Lumpur, Malaysia
[3]Physics Department, Faculty of Applied Science, University Technology MARA, 40450 Shah Alam, Selangor, Malaysia.

[*]Corresponding authors: azlian@upnm.edu.my

ABSTRACT

This study purposes graded bandgap design for lead-free perovskite solar cells which aim to maximize the solar spectrum with good output current and and better power conversion efficiency (PCE) by improving the solar cell archtecture. Titanium dioxide (TiO_2) was used as electron transport layer (ETL) and Spiro-OMeTAD was used as hole transport layer (HTL) due to its facile implementation and high performance in electronic device. Lead-free BiOI was chosen to replace conventional lead-halide perovskite absorber layer. BiOI has iso-electronic properties to lead-halide perovskite with high efficient light absorption, high thermal stability and photocatalic activity, excellent photo-generated charge carrier. The variation of ioidine concentration in BiOI estabishes bandgap tuning and conductivity type of the layer BiOI films. The increse of iodine concentration would reduce band gaps and induce the change of semiconductor behavior from n-type to p-type. In this strategy, the absorbance component consists of three BiOI perovskite layer with different concentration of iodine that form n- and p- type homojuctions. BiOI with half concentration of iodine (BIOI 0.5) is first perovskite layer, then the second perovskite layer is BiOI with same concentration of iodine (BIOI 1.0) and the third perovskite layer is BiOI with double concentration of iodine (BIOI 2.0). This configuration produces cells with desirable perforamance that effectively absorb the photons in almost all parts of the solar spectrum. Both open circuit voltage (V_{oc}) (940 mV) and fill factors (~58%) for the best cells have shown drastic improvement over single active layer device and the short current densities (J_{sc}) measured are in the range (20-30) $mAcm^{-2}$. The effects of quasi-electric fields, caused by the band-gap variation of the active semiconductor, upon the illumination current density and open-circuit voltage of a solar cell will be discussed.

Keywords: *Graded Bandgap, Perovskite Solar Cells, Bismuth Oxyiodide*

Effect of Pr^{3+} Substitution at the A-Site on the Structural and Electrical Properties of Hole-Doped La-Based Manganites

Rozilah Rajmi[1*], Norazila Ibrahim[2], Suhadir Shamsuddin[3], Shahrulnizam Md Salleh[4], Muhamad Hazri Othman[4]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM) Cawangan Perlis,Kampus Arau 02600 Arau, Perlis, Malaysia

[2]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor, Malaysia.
[3]Faculty of Applied Sciences and Technology,Universiti Tun Hussein Onn Malaysia (UTHM), Pagoh Campus, 84600 Pagoh, Muar, Johor Darul Ta'zim, Malaysia

[4]Industrial Centre of Innovation in Advance Materials, SIRIM Industrial Research, Lot 34 Jalan Hi-Tech 2/3, Kulim Hi-Tech Park, 09000 Kulim Kedah, Malaysia

**Corresponding author's E-mail: rozilahrajmi@uitm.edu.my*

ABSTRACT

The influence of praseodymium substituting at La-site in $La_{0.5}Ba_{0.5}MnO_3$ has been investigated, in structural and electrical transport properties. Polycrystalline $La_{0.5-x}Pr_{0.5x}\ Ba_{0.5}MnO_3$ (x = 0, 0.50, 1.00) were synthesized using a conventional solid-state method. The powder X-ray diffraction patterns show a single-phase orthorhombic distorted perovskite structure with space group Pnma. The Rietveld refinement analysis showed that the unit cell volume decreased as Pr^{3+} substitution increased which may be attributed to the different ionic radii of ions. Electrical resistivity measurements by using standard four-point probe resistivity measurement in a temperature range of 30 K to 300 K. As the Pr^{3+} concentration increases, metal-insulator transition, T_{MI} decreases from 264K (x=0) to 157K (x=1.00) while resistivity increases from 1.16 Ω.cm (x = 0) to 20.3 Ω.cm (x =1.00).The decreased T_{MI} are attributed to the decrease in tolerance factor which indicates enhancement in MnO_6 octahedral distortion consequently reduce double exchange interaction. The electrical resistivity in the metallic region for all samples was fitted with the combination of domain/grain boundary, electron-electron, electron-magnon and electron-phonon scattering processes. The resistivity behaviour in the insulating region for all samples was attributed to small polaron hopping model which revealed that the activation energies increased as Pr^{3+}content increased due to the enhancement in the distortion of MnO_6 octahedral.

Keywords: *Manganese perovskites; Scattering Model, Hoping Model; lattice distortion; Electrical Properties.*

The Effect of 1-Ethyl-3-Methylimidazolium Acetate on the Structural, Morphological and Electrical Properties of PMMA-Based Electrolytes Films

Nurul Nur Syafiqah Azriza[1], Nabilah Akemal Muhd Zailani[1]*, Ahmad Anas Nagoor Gunny[2], Khuzaimah Nazir[1] and Famiza Abdul Latif[3]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA, Cawangan Perlis, Kampus Arau, 02600 Arau, Perlis, Malaysia

[2]Faculty of Chemical Engineering Technology, Universiti Malaysia Perlis, Kompleks Pusat Pengajian Jejawi 3, Kawasan Perindustrian Jejawi, 02600, Arau, Perlis, Malaysia

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

Corresponding authors: nabilahakemal@uitm.edu.my

ABSTRACT

Previously, the brittleness of PMMA-based polymer electrolyte (PE) films has been successfully improved by the incorporation of bulky-structured ionic liquid (IL), 1-methyl-3-pentamethyldisiloxymethylimidazoliumbis(trifluoromethylsulfonyl)imide,([(SiOSi)C1C1im][NTf2]). However, the ionic conductivity obtained is still low for further application as energy storage devices. This might be due to the large structure of ([(SiOSi)C_1C_1im][NTf_2]) which limits the movement of ions. Thus, in this study, IL with less bulky structure and lower molecular weight namely 1-ethyl-3-methylimidazolium acetate, [EMIM][Ac] was incorporated into the PMMA-based PE via solution casting technique. Lithium triflate (LiTf) was also doped into the system to provide additional charge carrier. The effect of various amount [EMIM][Ac] towards the structural, morphological, and electrical properties of PMMA-based PE films were determined using Fourier Transform Infrared Spectroscopy (FTIR), optical microscope (OM) and electrochemical impedance spectroscopy (EIS) respectively. Solid, flexible and free-standing films of PMMA-based PE were successfully obtained after the addition of IL. As confirmed from FTIR analyses, there occurs interaction between the oxygen atoms of PMMA with the imidazolium cation of the IL. With the addition of IL, the ionic conductivity was also observed to increase which can be related to the large structure of IL which occupy the space between PMMA chain hence hindered the formation of hydrogen bonding. This has been further confirmed by the OM analyses which showed the increase in grain size for the modified PMMA system after the doping of IL. The highest conductivity of 9.86×10^{-7} S cm^{-1} was obtained when 0.5 mL IL (PMMAIL5) was incorporated into the PMMA/LiTf system. This is due to the increase in the amorphosity of the sample which improved the ion diffusion within the polymer complex. The increase in the amorphosity of the sample is confirmed by the reduced in the number of grains as observed in the optical micrograph of PMMAIL5

Keywords: *PMMA, ionic liquid, polymer electrolytes, thin film, flexible film*

Effect of Ce^{3+} and Ce^{4+} in Boro-Tellurite Based Glass on Optical and Structural Properties

Nur Arina Mat Rusni[1], Azuraida Amat [1]*, Nurazlin Ahmad[1], Wan Yusmawati Wan Yusoff[1], Nur Azlian Abdul Manaf[1] and Hasnimulyati Laoding[2]

[1]Physics Department, Centre for Defence Foundation Studies, Universiti Pertahanan Nasional Malaysia, 57000 Sungai Besi, Kuala Lumpur, Malaysia

[2]Faculty of Applied Science, Universiti Teknologi MARA Cawangan Pahang, Kampus Jengka, 26400 Bandar Pusat Jengka, Pahang

[*]Corresponding authors: *azuraida@upnm.edu.my*

ABSTRACT

Enhancement of optical and structural properties of rare earth ions doped boro-tellurite glasses with high density modifiers become a new approach to achieve innovative optical glass devices. Motivated by this idea, three glass samples with the composition of $[(TeO_2)_{0.7}(B_2O_3)_{0.3}]_{0.75}(Bi_2O_3)_{0.25}$, $\{[(TeO_2)_{0.7}(B_2O_3)_{0.3}]_{0.75}(Bi_2O_3)_{0.25}\}_{0.99}(CeO_2)_{0.01}$ and $\{[(TeO_2)_{0.7}(B_2O_3)_{0.3}]_{0.75}(Bi_2O_3)_{0.25}\}_{0.98}(CeO_2)_{0.02}$ were successfully synthesized by conventional melt quenching method. A small amount of CeO_2 can enhance the glass density. The presence of Ce^{3+} and Ce^{4+} ions from CeO_2 assist in a compaction of the glass network which affects the result in density and molar volume. The absence of a sharp peak in X-ray Diffraction (XRD) spectra confirmed that all glass samples in this work are in an amorphous nature. Based on Fourier Transform Infrared Spectroscopy (FTIR) analysis, most of the glass samples consist of TeO_3, TeO_4, BO_3 and BO_4 structural units. The increase in refractive index value is also due to the presence of Ce^{3+} and Ce^{4+} ions in the glass network which leads to dense packing and is also affected by the increment in both electronic polarizability and optical basicity. The Urbach energy value continuously decreased after the addition of 0.02 mol CeO_2 signifies the reduction of defect concentration in the glass network. This in turn causes the reduced fragility nature of the glass and produces glass with high stability and connectivity.

Keywords: *Boro-Tellurite, Bismuth Oxide, Cerium Oxide, Optical Properties*

Kapok Derived Activated Carbon Catalyst for Biodiesel Production from Waste Cooking Oil

Jeyashelly Andas* and Nur Adilah Zahari

Faculty of Applied Sciences, Universiti Teknologi MARA Cawangan Perlis, Campus Arau, 02600 Arau, Perlis, Malaysia

**Corresponding authors*: *drshelly@uitm.edu.my*

ABSTRACT

The present study aims to synthesize green carbon-based catalyst from kapok (*Ceiba pentandra*) using two different activating agents: KOH (CB1) and K_2CO_3 (CB2) with 1:1.0 (raw material: activating agent), at activation temperature of 400°C and impregnation time of only 15 min. The synthesized catalysts were evaluated in the transesterification of waste cooking oil (WCO) into biodiesel. CB1 registered higher iodine number and percentage yield (1446.30 mg/g, 62.60%) compared 1200.23 mg/g and 53.50% obtained for CB2. Several physico-chemical characterizations were subjected for kapok and the carbon catalysts such as Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscope (SEM) and CHNS/O Analyzer. FTIR investigation showed the disappearance or reduction in peak intensity of several peaks at 1512-1200 cm^{-1} in the carbon catalyst compared to raw kapok, arising due to carbonization and activation processes. CHNSO analysis verified that both CB1 and CB2 registered high carbon content of 63.93% and 62.86%, respectively compared to the raw kapok (43.54%). Morphological studies by SEM analysis showed appearance of cylindrical tube for all the samples. The biodiesel synthesis from WCO at 0.2 wt.% catalyst loading, methanol to oil (molar ratio of 3:1), reaction temperature of 60˚C for 1 h resulted in high catalysis over CB1 (89.57%), followed by CB2 (87.46%) and without catalyst (35.46%). Large iodine number and high carbon content exhibited by CB1 was the probable reasoning for the accelerated activity of CB1 in the transesterification of WCO. To conclude, the present work showed a successful conversion of waste biomass into promising carbon catalyst for green synthesis of biodiesel from WCO.

Keywords: *Kapok, Activated carbon, Biodiesel, Waste cooking oil, Catalyst*

Conductive and Mechanical Properties of Silicone Electrically Conductive Adhesives (ECAs) Filled Graphene-Carbon Black (GR-CB)

Zuliahani Binti Ahmad [1]*, Muhammad Hanif Bin Azhar[1] Diana Nasuha Binti Muhamad Kamsani[1], Adzrie Bin Baharudin[1], Nur Raihan Binti Mohamed[1], and Munirah Binti Onn[2]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 2300 Arau, Perlis, Malaysia

[2]Faculty of Applied Sciences, Universiti Teknologi MARA, Pasir Gudang Campus, 81750 Masai, Johor, Malaysia.

[*]Corresponding authors: *zuliahani@uitm.edu.my*

ABSTRACT

Soldering was an important electric and electronic attachment method that possess lead-material which are poisonous and dangerous to humans and the environment. Hence, electrical conductive adhesives (ECAs) were introduced to replace lead-solder based with graphene (GR) and carbon black (CB) as conductive filler. This work examined silicone ECAs filled with various ratio of GR and CB (0:0, 1:0, 0:1, 10:5, 5:10, 5:5, and 3:5) on characterization, electrical characteristics, and mechanical properties of silicone ECAs using film casting method. The characterization was performed on the conductive adhesive film by using Fourier Transform Infrared Spectroscopy (FTIR). Whilst electrochemical impedance spectroscopy (EIS) was investigated the Nyquist plot and conductivity of silicone film. The mechanical properties were measured by tensile and hardness test. FTiR spectrum confirming that the interaction between silicone matrix with GR-CB was happen with the appearance of sharp peak at 687 cm-1 (Si-C) and in range 694 – 697 cm-1 (Si-CH3). From the electrical testing through electrochemical impedance spectroscopy (EIS), the optimum ratio with the highest conductivity value 7.98×10-8 Ω-1 cm-1 was obtained by the synergistic effect of conductive fillers which is GR with CB at 10:5 GR-CB ratio. While the mechanical properties of silicone ECAs samples through tensile and hardness test show that the optimum ratio of synergistic GR-CB was at 5:10 ratio with the highest tensile strength, young modulus, elongation at break and hardness with value 1.16 MPa, 2.02 MPa, 25.64 mm and 47.56 respectively. In conclusion, the optimum synergistic effect of GR and CB was found at 10:5 ratio and mechanical properties revealed that the incorporation of GR and CB enhanced the conductivity, strength and toughness in the silicone ECAs composites.

Keywords: *Silicone, Graphene, Carbon Black, Electrically Conductive Adhesive, Synergistic.*

Effect of Sequential Pre-treatment on the Thermal Behavior of Pretreated Palm Empty Fruit Bunch using Thermal Gravimetric Analyzer

Nur Nasulhah Kasim[1]*, Alina Rahayu Mohamed[2], Mohd Azlan Mohd Ishak[1], Razi Ahmad[3], Siti Nurlia Ali[1], and Khudzir Ismail[1]

[1]Faculty of Applied Science, Universiti Teknologi MARA, Cawangan Perlis, Kampus Arau, 02600 Arau, Perlis, Malaysia

[2]Faculty of Chemical Engineering Technology, Campus Uniciti Alam, Universiti Malaysia Perlis, 02100 Padang Besar Perlis, Malaysia

[3]Faculty of Civil Engineering Technology, UniMAP Jejawi Complex of Academics (3), Arau 02600 Perlis, Malaysia

Corresponding authors: nurnasulhah@uitm.edu.my

ABSTRACT

Bio-oil produced from untreated biomass through pyrolysis process consists of undesirable oxygenated chemical compounds that contribute to the low quality of products. Utilizing sequential pre-treatment of demineralization and torrefaction on biomass prior to pyrolysis has showed to be promising in enhancing the solid fuel feedstock properties. In this study, the thermal behaviour profile of torrefied palm empty fruit bunch (TPEFB) and torrefied-demineralized palm empty fruit bunch (TDPEFB) were compared with that of the untreated palm empty fruit bunch (PEFB) using thermogravimetric analyzer (TGA). The aim of this study is to further investigate the suitable biomass feedstock for pyrolysis process by monitoring the thermal degradation behaviours of different pretreated PEFB prior to pyrolysis process. Thermal analyses of all samples were performed using a Mettler Toledo TGA at a heating rate of 20 °C min^{-1} with nitrogen flow of 100 mL min^{-1} from ambient temperature to 900 °C. The thermogravimetric analysis displayed that the TDPEFB has experienced major weight loss of 61.53% at its active degradation temperature. Meanwhile, TPEFB shows a lower amount of weight loss compared to TDPEFB since the presence of alkali and alkaline earth metal (AAEM) in TPEFB which inhibits the primary reaction, thus leads to the retention of mass in the biochar fraction. In comparison, percent weight loss for untreated PEFB was recorded to be the lowest among the three samples which is about 33.9% during the active pyrolysis process. The results support the argument that the demineralization process has assisted primary reactions by the removal of AAEM. This in turns contribute to higher weight loss of sample as more volatile matters and cellulose content could be released during thermal degradation of the TDPEFB. Subsequently, the quality and quantity of bio-oil produced could be enhanced. This sequential pre-treatment was suggested to be an effective approach for upgrading the quality of solid fuel feedstock for further thermal conversion processes such as pyrolysis.

Keywords: *Thermal degradation; Palm Empty Fruit Bunch; Torrefaction; Demineralization; Pyrolysis.*

The Analysis of Rice Bran-Latok (RiLa) xtracts For Hyperpigmentation Serum

Nur Fatihah Khaironezam, Noor Hafizah Uyup, Nurul Huda Zainol, Siti Nur Azila and Non Daina Masdar*

Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM) , 2300 Arau, Perlis, Malaysia

**Corresponding authors*: *daina*@uitm.edu.my

ABSTRACT

Rice bran-Latok (RiLa) bioactive compounds are beneficial in the food industry, cosmetics, and pharmaceutical industries. In this study, the chemical and biological properties of RiLa extracts were investigated and evaluated as new ingredients in formulated hyperpigmentation serum. The bioactive compounds were extracted using Soxhlet for rice bran dan Maceration for Latok. The total phenolic compound (TPC) and the antioxidant capacity of the extracts were analyzed using Folin-Ciocalteau and DPPH assay. The Disc Diffusion method was used to determine the antibacterial activities of both extracts by an inhibition against E. coli and B. Lichen bacteria. The result shows that the bioactive compound yields are 37.15% and 29.14% for rice bran and latok respectively. The total phenolic compound (TPC) value for rice bran is 0.075 ± 0.002 mg GAE/g and sea grapes is 0.063 ± 0.003 mg GAE/g. The IC50 values of antioxidant capacity is 950.80 ppm and 127.52 ppm for rice bran and Latok extracts respectively. The heavy metal analysis reveals most metals present are below the maximum limit of concentration for cosmetic products. The extracts were used to formulate three types of hyperpigmentation serum. The pH obtained ranges between 6.61-6.90, which is acceptable for human skin condition. The appearance analysis of physical colour, texture, homogeneity, and formulation condition of the serums are stable after seven days observation in room temperature.

Keywords: *Rice bran; Latok; Hyperpigmentation; Appearance analysis; Anti-bacterial.*

Effect of Various Plasticizer to the Properties of Biodegradable Film Derived from Fruit Peels-Microcrystalline Cellulose (MCC)

Noradurrah Samsudin[1], Wahida Abdul Rahman[2]*, Noor Aishatun Majid[3] and Muhammad Syafiq Kamaruddin[4]

[1,2,3,4]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM) Cawangan Perlis, Kampus Arau, 02600 Arau, Perlis, Malaysia

[*]Corresponding authors: *wahida811@uitm.edu.my*

ABSTRACT

A biodegradable plastic is an alternative in improving the environmental quality due to pollution by synthetic plastic packaging. This bioplastic made up from MCC of fruit peels of mango (*Mangifera indica L.*), papaya (*Carica papaya L.*) and banana (*Musa sp.*) with addition of difference plasticizer. The aim of this study to characterize the chemical, physical and mechanical properties of MCC bioplastic derived from different type of fruit peels. To evaluate the effect of different type of plasticizer on MCC bioplastic derived from different type of fruit peels and to evaluate the effect of MCC. Bioplastic produce by combination of MCC from difference fruit peels and corn starch as filler and with various plasticizer of sorbitol, glycerol and matrix with glycerol-sorbitol as plasticizer. The method used for this study is mixing 0.25 g of MCC extraction powder, 3ml glycerol, 3g sorbitol, 10g corn starch and 200ml NaOH and dried in oven for overnight at temperature of 40˚C. The result obtained in the form of thin film of bioplastic were analyses chemical component by using ATR-FTIR, physical and chemical properties also the sensory evaluation. In term of characterization, spectra of FTIR show a slightly same peak for both MCC commercial film. Based on the analysis glycerol plasticizer from different MCC fruit peels most soluble in water with 13.1%, 13.98%, 11.59% and 13% for C-MCC, B-MCC, P-MCC and M-MCC film. Moisture content showed that glycerol plasticizer higher than sorbitol plasticizer with 26.67%, 53.62%, 28.44% and 33.16% for C-MCC, B-MCC, P-MCC and MMCC film. Biodegradation result glycerol plasticizer over sorbitol and mixture of glycerol and sorbitol plasticizer most degraded in soil with higher gradient loss weight. The elastic of the film has been conducted with Tensile Strength test. Sorbitol reached higher Tensile Strength over glycerol and mixture of glycerol and sorbitol with 1.21 MPa, 0.52 Mpa, 0.8 Mpa and 0.32Mpa and decrease lower Elongation at Break (EAB) at 0.14 mm/mm, 0.11 mm/mm, 0.14 mm/mm and 0.1mm/mm for for C-MCC, B-MCC, P-MCC and M-MCC film. From there, MCC in extracted film has been determine and had been discuss its function to mechanical and physical properties of film when compare with commercial film as control film.

Keywords: *Bioplastic, fruit peel, plasticizer, biodegradable*

Electrical and Mechanical Properties of Silicone Electrically Conductive Adhesives (ECAs) Filled Carbon Black.

Adzrie Baharudin[1 2]*, Nu'man 'Abqariy Saipul Bahri[1], Zuliahani Ahmad[1], Diana Nasuha Kamsani[1], Luqman Musa[3], Azniwati Abd Aziz,[4] and Mohd Azlan Mohd Ishak[1]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 02600 Arau, Perlis, Malaysia
[2]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor, Malaysia.
[3] Pusat Pengajian Kejuruteraan Bahan, Universiti Malaysia Perlis (UniMAP),02600 Jejawi, Perlis, Malaysia.
[4]Bioresource, Paper & Coatings Technology Division, University of Science Malaysia (USM), 11800, Penang, Malaysia.

Corresponding authors: adzrie95pls@gmail.com

ABSTRACT

ECAs were used as replacement for conventional solder that harmful to the human health due to soldering dust and fume. Low mechanical and conductivity limited the application of the ECAs which can be enhance with addition of carbon black as conductive filler. This work examined silicone ECAs filled with various ratio of carbon black (0,5,10,15 and 20%) on characterization, electrical characteristics and mechanical properties. Carbon black (CB) as conductive fillers was prepared by added into silicone PDMS with various loading of CB (0,5,10,15 and 20%) on silicone ECAs using film casting method. The highest conductivity was achieved with 20% carbon loading at 5.15^{-7} Ω/cm while the lowest conductivity is exhibit by the film with 0% CB loading at 2.21^{-7} Ω/cm. This is due increasing carbon in the silicone matrix will increase the conductive path. Thus, this will increase the electrical conductivity of the film. Characterization of the CB/PDMS using FTIR had showed that the transmittance of 20% carbon loading shift upward compared to 0% carbon loading. This is because the carbon loading inside the film absorbing higher transmittance. Mechanical characterization of the film was done using tensile and hardness was also conducted on the film. The hardness and tensile test showed that with increasing carbon black loading that increased the mechanical property of the film from 0.296 MPa to 1.66 MPa for tensile properties. It proved that carbon loading increased the stiffness of the silicone film.

Keywords: *Silicone, Carbon Black, Electrically Conductive Adhesive, Conductivity.*

Amino acid derived imidazolium zwitterion as green interfacial corrosion inhibitor for Cold Rolled Steel: Experimental and Theoretical studies

Jiyaul Haque, Mohammad Fakhratul Ridwan Zulkiflia, and W.B. Wan Nika*

Faculty of Ocean Engineering Technology and Informative, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Malaysia

W.B. Wan Nik: niksani@umt.edu.my

ABSTRACT

A natural amino acid methionine-derived imidazolium zwitterion (IZ) was synthesized and investigated as a corrosion inhibitor on Cold Rolled Steel (CR Steel) in an acid environment using, weight loss, SEM, FTIR, and DFT techniques. The synthesized IZ inhibitor was fulfilled with green parameters: multicomponent single-step reaction, reaction at ambient temperature and water used as a solvent. The product was obtained in pure form with high yield (80%), high atom economy (86.01%) and low E factor (2.592). The corrosion studies results show that IZ exhibit effective inhibition efficiency (87.64%) at very low concentration (30ppm). The IZ exhibit the excellent inhibition efficiency (81%) at high temperature (65 °C). SEM and FTIR results supported the formation of inhibitor film on metal surface. The DFT results show the reactive adsorption sites of inhibitor molecules.

Keywords: *Zwitterions; Corrosion Inhibitor; Green Chemistry; Surface Studies; DFT Studies*

Characterization and Diffusion Study of Green Epoxy

Nur Diana Nasuha Mohamad Kamsani [1], Zuliahani Ahmad [1], Solhan Yahya [1], and Azniwati Abd Aziz[2]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 02600 Arau, Perlis, Malaysia

[2]Faculty of Applied Sciences, Universiti Sains Malaysia (USM), 11800, Pulau Pinang, Malaysia

[*]E-mail: dianasuha98@gmail.com

ABSTRACT

This study was successfully conducted in reducing the corrosion and enhance the barrier protection against harsh conditions, especially in the oil and pipeline industry by using epoxy resin incorporated with Microcrystalline Cellulose (MCC) as the primer coating. Various MCC loadings (0, 3, 5, 7 and 9 wt%) were used in order to determine the optimum formulation that gives the highest barrier performance. Fourier Transform Infrared Spectroscopy (FTIR) analysis was performed to analyze the chemical interactions and diffusion of MCC and epoxy resin. Morphological study was conducted using Field Emission Scanning Electron Microscope (FE-SEM) analysis, where 5 wt% MCC produced the optimum coating qualities with minimum coating failures and no agglomeration in the cross-section morphology. The MCC loading of 5wt% is adequate to give a better diffusion process, and the MCC particles are also well dispersed, providing uniform coverage on the metal surface. As seen in the FTIR data, an increase in MCC concentration of more than 5 wt% contributes to agglomeration. When the MCC particle concentration reaches 7 wt%, the strength of the C-O-C band in the FTIR spectra increases steadily, but there are no changes in the O-H band spectra. Since the MCC is compatible with epoxy resins and has a better dispersion, this ultimately leads to an improvement in the mechanical strength and anti-corrosive properties of the primer coating. As a result, the development of MCC- Epoxy coating for metal corrosion prevention and the diffusion investigation between MCC and epoxy was a success.

Keywords: *Epoxy, Microcrystalline Cellulose (MCC), Primer Coating, Diffusion*

Rheological and Mechanical Performance of Highly Flowable Concrete Incorporating Eggshell Powder as Partial Cement Replacement

Noor Amnani Mohd Sofi[1]*, Mohd Raizamzamani Md Zain[1,2] and Mohd Fadzil Arshad[1]

[1]School of Civil Engineering, College of Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

[2]Structural and Construction Materials Engineering Group (SCME), School of Civil Engineering, College of Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia.

[*]Corresponding authors: *2020649594@student.uitm.edu.my*

ABSTRACT

This research focuses on the rheological and mechanical performance of Highly Flowable Concrete (HFC) incorporating eggshell powder as a partial replacement of cement. In the present construction industry context, the need for vast and complicated structures frequently results in difficult concreting circumstances. It is difficult to be certain that a substantial amount of heavy reinforcement is fully compacted without voids or honeycombs in a part of reinforced concrete. Compaction using mechanical vibrators or hand isn't easy in such a situation. This has resulted in the invention of green highly flowable concrete (HFC) to enhance the quality of concrete utilized for construction while tackling the issue. HFC has been recognized for its ability to flow on the weight itself and does not require vibration, allowing it to avoid segregation, honeycombs, and bleed. It is ecologically sound to substitute eco-materials for cement in the production of HFC. Eggshell powder, which contains a calcium component, is one of the probable cement replacement alternatives in HFC. The present research examines the rheological and mechanical properties of HFC incorporating eggshell powder via experimental assessment. The laboratory tests were carried out on specimens with 5%, 10%, 15%, and 20% eggshell substitution to the weight of cement and then compared to control specimens. Slump flow, T500, L-box, and sieve segregation tests were used to evaluate the fresh properties of the mixture. Meanwhile, specimens of 100 x 100 x 100mm were tested for compressive strength, and specimens of 50 x 100mm were tested for split-tensile strength. These two tests were employed to assess the mechanical performance of the HFC. The mode of failure of the test's specimens were also observed. The mechanical properties of all specimens were evaluated at 7, 28 and 90 days. Experimental findings revealed that all HFC mixtures which comprise eggshell meet the EFNARC requirements for fresh properties. The results of various investigations demonstrate that substituting the cement with 5%, 10%, 15% and 20% of eggshell powder influences the fresh and mechanical properties of HFC.

Keywords: *Highly flowable concrete, eggshell powder, fresh properties, rheological properties, failure mode*

Ag-doped TiO_2 with Tunable Ag^0 and Ag^+ for Enhanced Photocatalytic Degradation of RR4 Dye

Nureel Imanina Abdul Ghani, Nur Izzati Nabilah Zanal, Abu Hassan Nordin, Mohammad Saifulddin Mohd Azami, and Wan Izhan Nawawi Wan Ismail*

Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 02600 Arau, Perlis, Malaysia
**Corresponding author: wi_nawawi@uitm.edu.my*

ABSTRACT

This study proposed to manipulate the formation of Ag^0 and Ag^+ on the TiO_2 surface by controlling the dissolved oxygen (DO) level on the silver nitrate ($AgNO_3$) precursor. The Ag-TiO_2 was obtained through photo-deposition at various loadings of Ag (1-5%) to TiO_2 under controlled dissolved oxygen conditions with N_2 gas purging for 0, 10, 30 and 60 min (denoted as DO^0, DO^{10}, DO^{30}, and DO^{60}). The photocatalytic performance of the prepared immobilized Ag-TiO_2 was determined under photodegradation of Reactive Red 4 (RR4) dye. Complete degradation of 30 mg L^{-1} RR4 dye was accomplished within 1 hour under 55W fluorescent lamp irradiation, which is 63.1% better than unmodified TiO_2. The results obtained from XRD and FTIR revealed the existence of Ag^+ and Ag^0 corresponding to Ag_2O and Ag-TiO_2. The spheroid shape of Ag-TiO_2 with 0.20 and 0.24 nm of d-spacing representing Ag metal and Ag_2O respectively was observed under HRTEM. Lower PL intensity for Ag-TiO_2 compared to unmodified TiO_2 indicates that Ag-TiO_2 has a low e^-/h^+ recombination rate. The strong visible light absorption of Ag-TiO_2 was obtained through UV-Vis/DRS analysis due to the surface plasmonic resonance (SPR) effect. This study proves that Ag_2O can increase photocatalytic performance as electron injectors to the Ag-TiO_2, however, too much formation of Ag_2O can retard the photocatalytic activity. It was found that the optimum percentage of Ag doping is 3% at 30 min N_2 purging time (denoted as 3AT-DO^{30}). The increasing order of photocatalytic performance of Ag-TiO_2 was as follows: TiO_2 < 3AT-DO^{60} < 3AT-DO^0 < 3AT-DO^{10} < 3AT-DO^{30} and all samples exhibit stable photocatalytic performance upon 10 cycles.

Keywords
Silver, Dissolved oxygen, RR4 dye, Titanium dioxide, Wastewater

Performance of Autoclaved Aerated concrete (AAC) Containing Recycled Ceramic and Gypsum Waste

Efil Yusrianto[1], Noraini Marsi[1,2*], Noraniah Kassim[1], Izzati Abdul Manaf[1] and Hafizuddin Hakim Shariff[3]

[1]Faculty of Engineering Technology, University Tun Hussein Onn Malaysia (UTHM), Hub Pendidikan Pagoh, KM1, Jalan Panchor, 84600 Pagoh, Muar, Johor, Malaysia

[2]Advanced Manufacturing and Material Centre (AMMC), Institute of Integrated Engineering, Universiti Tun Hussein Onn Malaysia, Parit Raja, 86400 Batu Pahat, Johor, Malaysia

[3]C Kim Hoe Thye Industries Sdn. Bhd., No.99, Lot 143, Jalan Air Manis, Bukit Mor, 84150 Parit Jawa, Johor, Muar, Malaysia

Corresponding authors: mnoraini@uthm.edu.my

ABSTRACT

The normal growth population and development in big cities have caused many problems such as municipal solid waste (MSW) and noise pollution. To solve these problems, two type of eco-friendly autoclaved aerated concrete (AAC) containing recycled ceramic and gypsum waste (CGW) with different ratio (0, 5%, 10%, 15%, 20%, 25%, and 30% wt) have been prepared. Type one (I) is AAC containing recycled CGW as a partial replacement for sand. Type two (II) is AAC containing recycled CGW as additional material. The performance of sample such as physical, mechanical and acoustic properties have been carried out. All samples showed normal color behavior such as grey and free crack. The compressive strength of AAC samples in the range of 6.10% to 29.88% for AAC Type I and in range of 29.27% to 45.73% for AAC type II. The maximum compressive strength was 2.13 MPa and 2.39 MPa for AAC type I and II at 15% wt and 5%wt of CGW respectively. Generally, AAC type I have higher sound absorbance coefficient compare to AAC type II and were categorized as class B absorbers at low frequency (500Hz). Our results show that GCW has succeeded in improving the performance of AAC sample such as mechanical and acoustic properties.

Keywords: *Physical, mechanical, acoustic properties, autoclaved aerated concrete (AAC), ceramic-gypsum waste*

The Role of Nitrogen-Doped TiO2 Supported by Platinum Catalyst Synthesized via Various Mode Preparations for Photocatalytic Enhancement

N.S. Natar[1,2,*], N.I. Ghani[1], S.R. Hamzah[1], M.A. Rosli[1], N.A. Muhamad[1], M.S. Azami[1], M.A.M Ishak[1], S. Razak[3], W.I. Nawawi[1*]

[1]Fakulti Sains Gunaan, Universiti Teknologi MARA Cawangan Perlis, 02600 Arau, Perlis, Malaysia.
[2]Fakulti Sains Gunaan, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia.
[3]Fakulti Kejuruteraan Kimia Teknologi, Universiti Malaysia Perlis, 02600 Arau, Perlis, Malaysia.

ABSTRACT

The limitation of TiO_2 on insufficient utilization of visible light energy has been overcome by modifying with nitrogen (N) and platinum (Pt) dopants. This study will report the role of the N and Pt co-dopant on modification of TiO_2 photocatalyst for photocatalytic degradation of methylene blue dye under different mode preparations i.e.; sequential and vice-versa modes. About 1.58 wt.% N element was found in NP_{seq}-TiO_2 photocatalyst while there is no presence of N element was detected in PN_{rev}-TiO_2 confirmed through elemental analyzer and EDX analysis. The optimum weight percentage of Pt was detected about 1.8 wt.% for NP_{seq}-TiO_2 photocatalyst which has been confirmed by ICP-OES. The photoactivity of NP_{seq}-TiO_2 photocatalyst is 2 and 1.5 times faster as compared to the unmodified TiO_2 and PN_{rev}-TiO_2 where the photodegradation rate was *ca.* 0.065 min^{-1} and 0.078 min^{-1} respectively. This is due to the N elements being in cooperated with the TiO_2 lattice where the band gap energy of NP_{seq}-TiO_2 was reduced from 3.2 eV to 2.9 eV respectively. The preparation order does not affect the Pt dopant but otherwise for N element. Therefore, different mode preparation for N and Pt co-dopant on modification of TiO_2 is significant to be investigated to produce a good quality photocatalyst for photocatalytic study under photodegradation of MB dye.

Keywords: platinum, nitrogen, titanium dioxide, methylene blue, photocatalysis

Immobilized TiO_2 Surface Interactions with ENR/PVC as Polymer Binder in Acid Photoetching for RR4 Dye Photodegradation

Siti Raihan Hamzah, Muhammad Afiq Rosli, Nadiah Sabihah Natar, Nureel Imanina Abdul Ghani, Nur Aien Muhamad, Mohammad Saifulddin Azami, Mohd Azlan Mohd Ishak, Razif Nordin, and Wan Izhan Nawawi*

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 2300 Arau, Perlis, Malaysia

Corresponding authors: wi_nawawi@uitm.edu.my

ABSTRACT

Titanium dioxide with polymer binder (TiO_2/ENR/PVC) are successfully immobilized on a glass substrate by dip coating technique and then treated with conventional and acid photoetching treatment (NP and AP respectively). A 65W compact fluorescent lamp and reactive red 4 (RR4) dye solution were used to study the photocatalytic activity for 5 cycles (1 cycle = 10 hours). All the samples before and after both treatments are characterized by FESEM, 3D profilometer, XRD, FTIR and PL to ascertain the surface interactions of the immobilized TiO_2 in the presence of hydrochloric acid (HCl) and proposed the reaction mechanism. AP sample shows a highest photocatalytic performance with 0.0694 min^{-1} pseudo 1st order rate constant (k) value compared to the NP sample. The opening and crosslinking ring reaction after the acid photoetching treatment enhance the photocatalytic activity. The deterioration trend of NP after the 3rd cycle was due to the percolated of polymer binder. It is believed that this finding can give a significant impact to help other researchers on enhancing the photocatalytic activity in immobilizing TiO_2 with polymer binder.

Keywords: *Immobilized TiO_2, Photoetching, Acid Photoetching, Photocatalytic Activity, Polymer Binder*

Aqua-mediated hydrothermal synthesis in the production of g-C_3N_4/TiO_2 composite for photocatalytic efficiency on RR4 dye

Nur Aien Muhamad[1], Muhamad Afiq Rosli[1], Siti Raihan Hamzah[1], Nureel Imanina Abdul Ghani[1], Nadiah Sabihah Md Natar[1], Mohammad Saifulddin Mohd Azami[1], Mohd Azlan Mohd Ishak[1], Sumiyyah Sabar[2] and Wan Izhan Nawawi Wan Ismail[1*]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 2300 Arau, Perlis, Malaysia

[2]School of Distance Education, Universiti Sains Malaysia, 11800 Minden, Pulau Pinang, Malaysia

[*]Corresponding authors: *wi_nawawi@uitm.edu.my*

ABSTRACT

A successful synthesis of a composite material, comprising g-C_3N_4/TiO_2, was achieved using a simple sol-gel and hydrothermal method with water as the solvent. The g-C_3N_4 component was synthesized by thermally polymerizing urea. The resulting g-C_3N_4/TiO_2 composite exhibited superior performance compared to both individually synthesized TiO_2 and pure g-C_3N_4. This composite material demonstrated excellent photocatalytic activity when exposed to visible light. Various characterization techniques such as XRD, FTIR, FESEM-EDX, elemental mapping analysis, and UV-Vis DRS confirmed the combination of g-C_3N_4 with TiO_2 nanoparticles. Subsequently, the photocatalytic degradation ability was tested using the composited sample by using RR4 dye for one hour observation. The results indicated significantly improved degradation compared to TiO_2 and g-C_3N_4 alone. Notably, the optimal composition was achieved with a 5% composition of g-C_3N_4 into TiO_2, resulting in a rate constant (k) value of 0.0920 min^{-1} and a percent degradation of 99.70%. This improvement can be attributed to the heterojunction effect between these two semiconductors.

Keywords: *Photocatalysis, Graphitic Carbon Nitride, Titanium Dioxide, Hydrothermal*

Electron-Driven Enhancement of RR4 Dye Photoelectrochemical Degradation using ENR/PVC Polymer Binder Ag-TiO_2

Muhammad Afiq Rosli[1], Siti Raihan Hamzah[1], Nadiah Sabihah Md Natar[1], Nureel Imanina Abdul Ghani[1], Mohd Azlan Ishak[1], Muhammad Zahiruddin Ramli[2], Mohammad Saifulddin Mohd Azami[1] and Wan Izhan Nawawi[1]*

[1]Faculty of Applied Sciences, Universiti Teknologi MARA, 02600 Arau, Perlis, Malaysia

[2] College of Engineering, Universiti Teknologi MARA Cawangan Pulau Pinang, Kampus Permatang Pauh, 13500 Permatang Pauh, Pulau Pinang

*Corresponding author: *wi_nawawi@uitm.edu.my*

ABSTRACT

In this study, a commercially available Degussa P25 TiO_2 was used as photocatalyst modification with silver (Ag) as a dopant to enhance the photocatalytic performance. The preparation of Ag-TiO_2 was conducted via the photo-deposition method with silver nitrate (AgNO3) mixed with Isopropyl Alcohol (IPA) and distilled water (DW) as Ag precursor at various ratios of Ag dopant to TiO2. The immobilization of Ag-TiO2 was prepared via polymer-based immobilization by using epoxy natural rubber-50 (ENR50) and polyvinyl chloride (PVC) and the obtained photocatalyst was characterized by FESEM-EDS, XRD, HRTEM, 3D Profiler, FTIR and EIS. Photoelectrochemical (PEC) was applied for photocatalytic performance measurement by using reactive red 4 (RR4) dye. The optimum photocatalytic performance of immobilized Ag-TiO_2 was obtained at 24V labeled as (3ATE) with almost complete degradation of 30 ppm RR4 dye achieved below 10 min under 55W fluorescent lamp irradiation which is faster compared to immobilized unmodified TiO_2. The acquired results from FESEM-EDS and XRD analyses indicated the presence of Ag on Ag-TiO_2 with no phase transformation. The 3ATE sample has shown the same photocatalytic degradation rate under immobilization and normal suspension modes due to the polymer-base formulation in the post-preparation of immobilization that is able to retain the photocatalytic activity.

Keywords: *Photoelectrochemical, Photocatalysis, immobilization titanium dioxide, silver, RR4 dye,*

Comparing Ag-Decorated Photocatalysts with Different g-C_3N_4 / TiO_2 Preparations for Red Reactive 4 (RR4) Dye Degradation

Nur Hidayatul Syazwani Suhaimi[1], Wan Izhan Nawawi Wan Ismail[1*], and Mohd Azlan Mohd Ishak[1]

[1]*Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), Arau Campus, 02600 Perlis, Malaysia.*

**Corresponding author: wi_nawawi@uitm.edu.my*

ABSTRACT

The performance of silver-decorated photocatalysts with different graphitic carbon nitride (g-C_3N_4)/titanium dioxide (TiO_2) preparations for the degradation of Red Reactive 4 (RR4) dye was investigated in this study. Recognising that organic dyes are widespread in industrial effluents, photocatalytic degradation of these dyes is crucial. Attributing to their synergistic effects and improved photocatalytic activity, the combination of g-C_3N_4 with TiO_2 has shown encouraging results in dye degradation. This study compared three different preparation methods for g-C_3N_4/TiO_2 composites, namely dry solid-state, wet-solid state and in-situ solvothermal synthesis. The nanocomposites were further modified with silver nanoparticles (AgNPs) using the photodeposition method to boost their photocatalytic enhancement and efficiency. AgNPs facilitate the formation of an efficient Z-scheme heterojunction system in the nanocomposite while operating as electron traps, which aids in charge separation and higher photocatalytic efficiency. Several advanced characterisation techniques, such as XRD, FESEM-EDX and UV-Vis DRS, were used to analyse the structural, morphological, and optical features of the produced Ag:g-C_3N_4/TiO_2 nanocomposites as evidence of their enhancement. The photocatalytic degradation of RR4 dye using the Ag:g-C_3N_4/TiO_2 samples was conducted under a 55-W fluorescent lamp irradiation. The results showed that Ag:g-C_3N_4/TiO_2 nanocomposites exhibit much higher photocatalytic activity compared to pristine g-C_3N_4, TiO_2 and undecorated g-C_3N_4/TiO_2 nanocomposite. The wet solid-state synthesis method outperformed the other preparation methods in terms of photocatalytic degradation, owing to the regulated development and distribution of g-C_3N_4/TiO_2 components. This comparative study shed light on the effect of various g-C_3N_4/TiO_2 synthesis methods and the efficacy of Ag doping on the nanocomposites in the photodegradation of RR4 dye. The findings contribute to the development of efficient and sustainable photocatalytic materials for environmental remediation applications, enabling solutions for dye-contaminated wastewater treatment.

Keywords: *Ag:g-C_3N_4/TiO_2, dry solid-state, wet solid-state, in-situ solvothermal, RR4 dye*

Fabricated Of TiO_2/Pt/G-C_3N_4 Photocatalyst for Enhanced Photocatalytic Performance On RR4 Dye Degradation

Rahil Azhar, Mohd Azlan Mohd Ishak, Wan Izhan Nawawi Wan Ismail*, Nur Syamimi Abd Adzis, Nur Hidayatul Syazwani Suhaimi, Nur Izzati Nabilah Zanal, and Nur Hafikah Mustapha

Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 02600 Arau, Perlis, Malaysia

**Corresponding author: wi_nawawi@uitm.edu.my*

ABSTRACT

The aim of this research is to determine the role of Pt-doped in different TiO_2/g-C_3N_4 preparation techniques batchwise and in-situ. RR4 dyes were used as a model pollutant to measure the photocatalytic activity of prepared TiO_2/Pt/g-C_3N_4. The physicochemical catalyst of the catalyst was studied using XRD, FTIR, and FESEM-EDX for the characterization study. The optimal k-value was determined, revealing that 70:30 g-C_3N_4 coupling TiO_2/Pt exhibited the best photodegradation ability as it showed the lightest color of RR4 dye with the percent remaining of 6.36% and 6.31% for in-situ and batchwise, respectively. TiO_2/Pt/g-C_3N_4 photocatalyst containing different amounts of Pt (e.g., 0.3, 0.6, 1.0, and 1.5%) and g-C_3N_4 (10:90, 30:70, 50:50, and 70:30 ratio) were successfully fabricated. Increasing Ag and g-C_3N_4 content to 1% and 70:30, respectively in the TiO_2/Pt/g-C_3N_4 enhanced photocatalytic activity by lowering the bandgap energy and promoting charge generation and separation. However, exceeding 1% Pt and 70:30 g-C_3N_4 content considerably deteriorated photocatalytic activity due to the masking effect of excess dopants on TiO_2 reactive sites. Hence, optimal dopants incorporation in the TiO_2 promotes the photocatalytic activity of TiO_2/Pt/g-C_3N_4 by controlling their bandgap energy, charge generation, and separation processes. These findings may contribute to the development of photodegradation active substances for water treatment in organic solution.

Keywords: TiO_2/Pt/g-C_3N_4, In-situ, Photocatalytic activity, TiO_2, RR4 dye, Batchwis

Enhancement The Role of Platinum as Electron Mediator in Z-scheme Platinum Doped Bismuth Tungstate/Graphitic Carbon Nitride via In-situ and One-step synthesis for Photodegradation of Rhodamine B Dyes

Nur Syamimi Abdul Adzis[1], Mohd Azlan Mohd Ishak[1] and Wan Izhan Nawawi Wan Ismail[1*]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 02600 Arau, Perlis, Malaysia

[*]Corresponding authors: *author email*

wi_nawawi@uitm.edu.my

ABSTRACT

The enhancement the role of platinum as an electron mediator in the Z-scheme system of platinum doped bismuth tungstate/graphitic carbon nitride was investigated under different mode preparation. This study reports the construction of Pt in the Z-scheme of Pt-Bi_2WO_6/g-C_3N_4 via in-situ and one-step hydrothermal-reduction synthesis to enables the Pt noble metal to fulfill its function as an electron mediator. Primarily, Pt, the electron mediator, need to be located at the middle of between two nanocomposites to enhance its performance to accumulate or works as a bridge for the accumulation of electron in the photosystems. The doping of Pt with Bi_2WO_6 was done prior the coupling with g-C_3N_4 to ensure the position of the Pt to be in the middle and impregnated more into the pores. The Pt metal from chloroplatinic acid precursor with the aids of sodium borohydride as the reducing agent was added together in the hydrothermal during the formation of Bi_2WO_6, then followed with combination of g-C_3N_4. The optimum condition for the preparation of Pt-Bi_2WO_6/g-C_3N_4 was found to be under in-situ method with degradation rate of 1.248 x 10^{-1} min^{-1} for 45 minutes until fully degraded the 10 ppm of RhB dyes. The method was proven to give high dispersion of Pt in between of Bi_2WO_6 and g-C_3N_4 without disrupting the morphology of Bi_2WO_6 has been observed through FESEM-EDX and mapping analysis. All characteristics of absorption bands of g-C_3N_4 and Bi_2WO_6 appear in the spectra of g-C_3N_4(30%)/Bi_2WO_6 and Pt(0.15%)-Bi_2WO_6/g-C_3N_4(30%) composite, indicating no structure change appears during the hybridization process. XRD analysis also shows high crystallinity of BWO, g-CN and Pt found in the sample. High spectra of PL were found shown a high recombination occurred in the photosystem aligned with the high photocatalytic degradation suggests the heterojunction effect from Pt-Bi_2WO_6/g-C_3N_4. The role of Pt to assist in the Pt-Bi_2WO_6/g-C_3N_4 as a bridge to help the movement of e^- between two nanocomposites by creating a Z-scheme pathways was elucidated as it proven to improve the photocatalytic performance and reduce the tendency to become a type-II heterojunction instead.

Keywords: *Electron Mediator, Z-Scheme, In-Situ Preparation, Photocatalytic Degradation*

Effect Of Different TiO2 Phases on Silver Dopant for Photodegradation of Methylene Blue Dye

Nur Izzati Nabilah Zanal[1], Nureel Imanina Abdul Ghani[1], Zuliahani Ahmad[1], and Wan Izhan Nawawi Wan Ismail[1]*

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 02600 Arau, Perlis, Malaysia

**Corresponding author (e-mail: wi_nawawi@uitm.edu.my)*

ABSTRACT

This paper proposed to study the formation of metallic silver (Ag^0) and silver oxide (Ag_2O) on different titanium dioxide (TiO_2) phases; anatase, rutile and anatase/rutile. Anatase and rutile were synthesized from titanium (IV) isopropoxide (TTIP) as a TiO_2 precursor for the preparation of single phase and mixed phases of TiO_2. Degussa P25 was also used as a comparison study. The Ag-TiO_2 was obtained by dipping the TiO_2 plate into silver nitrate ($AgNO_3$) solution as a silver precursor at various concentrations (10, 20, 40, 60 and 80 ppm). The photocatalytic performance of the prepared immobilized Ag-TiO_2 was determined under photodegradation of Methylene Blue (MB) dye. Complete degradation of 12 mg L^{-1} MB dye was accomplished within 1 hour under 55W fluorescent lamp irradiation. A single phase of TiO_2 tends to form Ag_2O rather than Ag^0 in forming Ag-TiO_2. Additionally, Ag doping on mixed phases (anatase/rutile) of TiO_2 with different bandgap (E_g) energies will reduce the formation of Ag_2O due to the heterojunction effect, resulting in better photocatalytic performance. The results obtained from XRD and FTIR revealed the existence of Ag_2O in the single phase of immobilized Ag-TiO_2 while the formation of Ag^0 can be observed in the 80:20 and 90:10 mixed phases of anatase/rutile Ag-TiO_2. UV-Vis/DRS confirms that rutile has a slightly narrow band gap than anatase. The lower PL intensity of 80:20 and 90:10 of mixed phases Ag-TiO_2 than the single phase indicates that mixed phases have a low e^-/h^+ recombination rate with better photocatalytic performance. XPS spectra shows the existence peaks of Ag_2O and Ag^0 in single phase and mixed phases respectively. This study proved that a single phase of Ag-TiO_2 will form Ag_2O rather than Ag^0 where Ag_2O formation can poison the active sites of TiO_2 surface and affect the charge separation and transfer process of photogenerated e^-/h^+ thus resulting in poor photodegradation process. It was found that the optimum sample of immobilized Ag-TiO_2 is 60 ppm Ag of 90:10 mixed phases of anatase/rutile (denoted as 60Ag-90A/10R).

Keywords: *Silver; Mixed Phases; Heterojunction; MB Dye; Titanium Dioxide*

A Review on Various Metal Doped ZnO for Efficient Degradation of Methylene Blue and Rhodamine B Dyes

Nur Hafikah Mustapha, Siti Najiha Mohd Fudzi, Abu Hassan Nordin, Mohammad Saifulddin Mohd Azami, Wan Izhan Nawawi Wan Ismail, Zuliahani Ahmad, and Mohd Azlan Mohd Ishak

Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 02600 Arau, Perlis, Malaysia

**Corresponding author: wi_nawawi@uitm.edu.my*

ABSTRACT

This review focuses a study on the photodegradation of methylene blue (MB) and rhodamine B (RhB) dyes using various metal dopants on ZnO as the photocatalyst. Researchers reported photocatalyst with dopants prepared via co-precipitation, wet impregnation method and hydrothermal technique. Most study uses dopants like Ag, Cu, Mn, $NiFe_2O_4$, TiO_2, Fe and Au doped on ZnO photocatalyst to boost the photocatalytic effectiveness which were thoroughly summarized in this review study. The results obtained was revealed unmodified ZnO does not completely degraded both dyes effectively as compared to metal doped ZnO where TiO_2 has completely degraded RhB solution in 180 minutes followed by Au and Fe where the time taken to complete degradation are 330 and 660 minutes respectively. Study also reported Ag can degrade MB dye effectively in 85 minutes followed by Cu, Mn and $NiFe_2O_4$. This study comprises the ability of metals as dopant on ZnO where it produces different reaction processes in degrading MB and RhB dyes, they have a wide range of applications and potential in the organic wastewater in industrial wastewater treatment.

Keywords

Photodegradation, methylene blue, rhodamine B, photocatalysis, metals dopants

Modification on Pt Doped TiO_2 Supported Various Dyes Sensitizer for Hydrogen Production under Photo Electrochemistry Process

Ommy Madina Abdul Halim[1], Azie Awatif Azizi[1], Nur Aien Muhamad[1], Siti Raihan Hamzah[1], Muhammad Afiq Rosli[1], Nureel Imanina Abdul Ghani[1], Zuliahani Ahmad[1], Md. Uwaisulqarni Osman[2], Mohammad Saifulddin Mohd Azami[1], and Wan Izhan Nawawi Wan Ismail[1]*

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 26000 Arau, Perlis, Malaysia

[2]Faculty of Science and Marine Environment, Universiti Malaysia Terengganu (UMT), 21030 Terengganu, Malaysia

[*]Corresponding authors: *wi_nawawi@uitm.edu,my*

ABSTRACT

Hydrogen (H_2) fuel is one of the potential sources of clean and renewable energy to replace the use of fossil fuels. Photoelectrochemical (PEC) water splitting is a sustainable approach that has been used to produce H_2. In this study, PEC process was carried out by using Pt doped TiO_2 as photoanode. Photo-deposition method was used to prepare Pt doped TiO_2, while dip coating technique was applied to immobilize Pt-TiO_2 onto photoanode. The characteristics of TiO_2's coating were improved when PVP polymer was used as a binder in the formulation of the coating. Methylene blue (MB), methyl orange (MO), rhodamine B (RhB), and malachite green (MG) dyes were used as model pollutants or photosensitizers to measure the photocatalytic hydrogen production of immobilized Pt-TiO_2 in PEC and EC (electrochemical) processes. The percentage weight (wt%) of Pt detected in 1% Pt-TiO_2 was 0.6% observed by FESEM-EDX, while for FTIR analysis observed the crosslinking of the PVP may occurred after PEC process due to the loss of the Ti-O peak at 615 cm^{-1} and the formation of a new C-N bond peak at 1109 cm^{-1} in Pt-TiO_2 sample. In XRD, a small shoulder peak arises at 2 theta diffraction angles of 40° for Pt-TiO_2 spectra, which could prove the existence of Pt. For photocatalytic hydrogen production, all dyes produced the difference volume of O_2 and H_2 gases based on their photocatalytic activity performance using both immobilized unmodified and modified Pt doped TiO_2 under with and without light irradiation for 30 minutes treatment processes. It was found that 1% Pt-TiO_2 exhibited higher photocatalytic hydrogen production for all dyes in comparison to unmodified TiO_2. MG was considered optimal as it has higher photocatalytic hydrogen production compared to other dyes under PEC and EC processes, with the production of gases at 4.3 and 3.9 mL, respectively, during 6 minutes of treatment in this study.

Keywords: *Hydrogen, photoelectrochemical, water splitting, titanium, platinum*

Bismuth iron manganese oxide nanocomposite as an efficient electrode material for supercapacitor application

Fazila Ashiq[1], Dilawar Ali[1], M. Fahad[1], Anjam Waheed[2], I. Muneer[3], M. Z. Butt[1], Riaz Ahmad[1], and M. F. Mohd Razip Wee[2]

[1]Department of Physics, Government College University Lahore-54000, Pakistan

[2] Institute of Microengineering and Nanoelectronics, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia

[3]Department of Chemistry, Superior University, Main Raiwind Road Lahore, Pakistan

Corresponding author: m.farhanulhakim@ukm.edu.my

ABSTRACT

In the present work, bismuth iron manganese oxide (Bi2Fe2Mn2O10) nanocomposite has been identified as a promising electrode material. Sol-gel / ultrasonic assisted coprecipitation method has been adopted for the fabrication of Bi2Fe2Mn2O10 nanocomposite. The influence of Mn content on the structural and electrochemical properties of Bi2Fe2Mn2O10 nanocomposite has been investigated. The structural and morphological study was performed using X-ray diffraction (XRD) and transmission electron microscopy (TEM) techniques. XRD analysis confirms the formation of Bi2Fe2Mn2O10 nanocomposite. TEM micrographs reveal a change in surface morphology from a spherical shape to mixed spherical shape and rod-like structure by increasing Mn concentration. For supercapacitor application, Bi2Fe2Mn2O10 nanocomposite was used as an electrode material. Cyclic voltammetry (CV) and galvanostatic charge/discharge (GCD) techniques were used to examine the electrochemical properties of electrodes. Both CV and GCD measurements reveals that Bi2Fe2Mn2O10 nanocomposite possesses battery like features. The Bi2Fe2Mn2O10 nanocomposite with 30 % Mn shows an exceptional specific capacitance and energy density value of 664 F g^{-1} and 18 Wh kg^{-1}, respectively, at 0.35 A g -1 in 6M KOH as an electrolyte. The nanocomposite shows an excellent cyclic stability with 91 % retention of the specific capacitance for consecutive 1000 charge/discharge cycles. It proves to be an electrode material as compared to frequently used Bi2O3 and Bi2O3-based composite materials.

Keywords: Nanocomposite; Electrochemical properties, Specific capacitance; Super capacitors; Energy Storage

Photocatalytic Activity and Stability of TiO_2/ZnO Catalyst for Phenol Degradation Under Visible Light Irradiation

Muhammad Farhan Hanafi[1], Nazatulshima Hassan[1], Mohammed Danish[2], Umar Kalmar Nizar[3] and Norzahir Sapawe[1]*

[1]Universiti Kuala Lumpur, Branch Campus Malaysian Institute of Chemical and Bioengineering Technology, Lot 1988 Vendor City, Alor Gajah, Melaka, Malaysia

[2]School of Industrial Technology, Building G07, Persiaran Sains, Universiti Sains Malaysia, 11800 Pulau Pinang, Malaysia

[3]Jurusan Kimia, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Padang, Sumatera Barat, Indonesia

[*]Corresponding authors: *norzahir@unikl.edu.my*

ABSTRACT

Photocatalytic reaction has emerged as a promising approach for efficient and sustainable wastewater treatment. In this study, we investigated the photocatalytic activity and stability of TiO_2/ZnO catalyst for phenol degradation under visible light irradiation. The TiO_2/ZnO catalyst was synthesized via a simple combination method of microwave-electrolysis, and its structural and morphological properties were characterized using X-ray diffraction (XRD) and filed emission scanning electron microscopy (FESEM). The catalyst had a mixed-phase structure, which led to improved visible light-driven performance. The photocatalytic activity of TiO_2/ZnO catalyst was evaluated by monitoring the degradation of phenol under visible light irradiation. The results revealed a significant enhancement in the photocatalytic performance compared to pure TiO_2 or ZnO. The presence of ZnO facilitated the generation of electron-hole pairs and suppressed their recombination, leading to improved photocatalytic efficiency. The stability of the prepared catalyst was assessed through multiple reaction cycles. The catalyst demonstrated excellent stability with negligible loss in its photocatalytic activity over five consecutive cycles, indicating its robustness and potential for practical applications. In conclusion, the TiO_2/ZnO catalyst exhibited remarkable photocatalytic activity and stability; as well the synergistic effect of TiO_2 and ZnO in the catalyst composition significantly enhanced the visible light absorption and photocatalytic performance. These findings contribute to the development of efficient and sustainable photocatalysts for the removal of phenolic compounds from wastewater, offering a promising solution for environmental remediation.

Keywords: *Photocatalytic, Degradation, Synergistic Effect, TiO_2/ZnO Catalyst, Phenol*

Investigation of morphology and Compressive Properties of diamond reinforced Porous Aluminium Composites

Bisma Parveez[1], Nur Ayuni Jamal*[1], Farazila Yusof [2], and Nur Emellia Eliza Ruslan[1]

[1]Department of Manufacturing & Materials Engineering, Kulliyyah of Engineering, International Islamic University Malaysia,53100, Kuala Lumpur, Malaysia

[2]Department of Mechanical Engineering, Faculty of Engineering, Centre of Advanced Manufacturing & Material Processing (AMMP Centre), Universiti Malaya, 50603, Kuala Lumpur, Malaysia

*Corresponding author*s: ayuni_jamal@iium.edu.my

ABSTRACT

Researchers are increasingly interested in porous aluminium (Al), particularly in applications requiring light weight, high strength, and energy absorption capability. In this study, porous Al composites were developed via powder metallurgy technique using polymethylmethacrylate (PMMA) as a space holder and different diamond particle (4, 6, 8, and 10) weight percentages (wt.%). Further, the influence of different diamond content on porosities, sintered densities, microstructure, and compressive behaviors were studied. According to the findings, the porous structure of porous Al composites successfully replicates the shape and size of PMMA particles and was uniformly distributed with less micro-pores and crack formation. Especially the composite containing 4wt.% of diamond particles resulting in higher value of plateau stress and an energy absorption capacity of 30 MPA and 2.25 MJ/m^3 respectively among all compositions.

Keywords: *Porous Aluminium Composite, Diamond, Polymethylmethacrylate, Space Holder Technique, Energy Absorption Capacity*

Characterisation of recycled HDPE/LDPE Blends

Norazura Ibrahim*, Ahmad Faiza Mohd, Mohd Iqbal Misnon and Mona Rita Othman[1]

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

[*]*Corresponding authors*: *noraz371@uitm.edu.my*

ABSTRACT

Competitiveness of pipe manufacturer in Malaysia depends on the quality and price they offered in the open market. Thus, usage of a recycled thermoplastic as a raw material has been a popular option for manufacturers in reducing their cost. In this study, the recycled high density polyethylene (HDPE) and recycled low density polyethylene (LDPE) as post-processed plastic wastes were modified with blending process to improve the properties of those plastic wastes. The recycled HDPE and recycled LDPE in various ratio as referred to rLDPE/rHDPE blends were prepared by co-twin screw extruder. Characterization tests including tensile, impact, toughness as well as hardness have been performed in order to understand the behavior of these blends. However, the properties are lower than those of virgin pipe grade polyethylene. To overcome this problem, an additive that could entangle between breakages or branched polymer chain was introduced during extrusion. Additive plays its function to diffuse and associate the flaw of the recycled polymer chain and this contributed to the more significant tensile properties. By introducing additives, the mechanical properties improve and approach those of virgin pipe grade polyethylene. The success of this project will enhance polymer pipe's properties where a new formulated pipe is comparatively cheaper and stronger for a faster and safer installation process than the existing ones.

Keywords: *High density polyethylene, Low density polyethylene, Recycling, Polymer blend, Mechanical properties*

Less Toxic Colour Smoke Bomb Characteristics

Nurnadia binti Andenan[1]*, Wan Md Zin Wan Yunus[2], Victor Feizal b Knight Victor Ernest[3], Shazwani Abdul Latif [4] , Hafiza Ariff [4], Ruwaida Jamian[5] and Nor Afizah Salleh[6]

[1] Centre for Research and Innovative Management, National Defence University of Malaysia (UPNM), Malaysia
[2] Faculty of Defence Science and Technology, National Defence University of Malaysia (UPNM), Malaysia
[3]Centre for Tropicalisation (CENTROP), National Defence University of Malaysia (UPNM), Malaysia
[4] Chemical Defence Research Centre (CHEMDEF), National Defence University of Malaysia (UPNM), Malaysia
[5] Malaysian Japan International Institute Of Technology (MJIIT), UTM, Malaysia
[6] Science and Technology Research Institute for Defence (STRIDE), Ministry of Defence, Malaysia

Corresponding authors: nurnadia@upnm.edu.my

ABSTRACT

Smoke bombs are predominantly used for a variety of purposes, such as signaling, crowd control, special effects in movies and stage productions, and military training exercises. A smoke bomb is a device that releases a thick cloud of smoke when ignited. The main characteristic of a smoke bomb includes smoke output which is the amount and density of smoke generated by a smoke bomb depend on the type of material used to create the smoke. Smoke bombs can produce different colors of smoke, such as white, black, blue, red, and green. The duration of smoke emission varies depending on the size of the smoke bomb and the type of material used to create the smoke. Smoke bombs can last anywhere from a few seconds to several minutes. In this study, the characteristics off less toxic colour smoke bomb was observed. The future development in smoke bomb have been discussed and highlighted for further improvement in terms of safety, reliability and performance of the smoke bomb for military technologies.

Keywords: *Pyrotechnic, Smoke bomb, Military application, Organic dye*

Hydroxylation Treatment Study On The GaN Samples For Surface Functionalisation

Farah Liyana binti Muhammad Khir[1]*, Hamizah Mohd Zaki[1], Norzaini Zainal[2] and Annie Maria Mahat[1]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 40400 Shah Alam, Selangor, Malaysia

[2]Institut Penyelidikan dan Teknologi Nano Optoelektronik (INOR), Universiti Sains Malaysia, 11800 USM, Pulau Pinang

Corresponding authors: farah668@uitm.edu.my

ABSTRACT

Surface functionalization is a process required for an active sensing region of a sensor to detect the target of interest. By understanding the surface behavior, a highly selective and sensitive sensor can be developed for sensing purposes. III-V materials are one of the advanced materials that preferred to be an alternative to the traditional sensing material as it possessed excellent physical and chemical characteristics. Here, surface study was carried out on the uppermost layer of an Alumiuum Gallium Nitride/ Gallium Nitride (AlGaN/GaN) samples. This uppermost surface has undergone the hydroxylation process. For the surface study, the Field Emission Scanning Electron Microscopy (FESEM) and Energy Dispersive Spectrometer (EDS). From the analysis, the samples with ultra-violet (UV) light treatment show the absence of the oxygen element in comparison to the surface without the UV treatment. It is suggested the method of hydroxylation plays a role on the uppermost surface and the understanding of it helps in the further development of the sensing area.

Keywords: *GaN, surface behavior, hydroxylation*

Effect of Sodium Benzoate Concentration on Zinc Corrosion in Seawater

Norfahana Mazlan Huzairi, and Chan Kok Sheng*

Faculty of Science and Marine Environment, Universiti Malaysia Terengganu, Kuala Nerus 21030 Terengganu, Malaysia.

Corresponding authors: chankoksheng@umt.edu.my

ABSTRACT

The growing environmental concerns have led to intensive investigations on the corrosion behavior of metals and alloys in tropical seawater. The main aim of this study is to investigate the effect of sodium benzoate concentration on the corrosion of zinc (Zn) in seawater. The corrosion rate was determined from the weight loss measurement against immersion time. According to the finding, weight loss increases with immersion time, which means that the prolonged time causes more Zn to be eroded. Weight loss and corrosion rate show a slight decrease when the Zn is immersed in the lowest sodium benzoate concentration of 10 wt%; conversely, they increase when the concentration of sodium benzoate increases from 20 wt% to 50 wt%. These results indicate that sodium benzoate only has a corrosion inhibitory effect on Zn at a relatively low concentration. Also, the surface morphology as examined by a metallurgical microscope exhibits the formation of pits and scratches on the corroded sample.

Keywords: *Sodium benzoate, zinc, corrosion, weight loss, corrosion rate*

Solubility, Mechanical and Thermal Properties of Starch-Chitosan Film Containing Red Cabbage Extract

Norasmah Mohammed Manshor[1]*, Adibah Ayuni Abdul Karim[2], Nur Nabilah Husna Mohd Fuad[3] and Asdarina Yahya[4]

[1, 2, 3, 4]College of Engineering, School of Chemical Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

[*]Corresponding authors: *norasmah@uitm.edu.my*

ABSTRACT

Plastics from synthetic petroleum for food packaging raised a concern in waste disposal and food safety. Therefore, biodegradable polymers or biopolymers have emerged as a viable alternative to non-biodegradable plastics in food packaging and preservation besides protecting the environment. In this work, starch-chitosan films containing red cabbage extract were prepared by casting method. The solubility, tensile strength, elongation at break and thermogravimetric analysis (TGA) of the films were investigated. The solubility of starch-chitosan film was 58.33%, followed by 58.88%, 59.65% and 61% for starch-chitosan films containing 5 ml, 10 ml and 15 ml red cabbage extract, respectively. The incorporation of 15 ml red cabbage extract into the film had increased the solubility by 4.6% due to hydrophilic characteristic of the extract and the film matrix. The tensile strength of film containing 5 ml red cabbage extract was higher than starch-chitosan film without red cabbage extract which are 0.533 MPa and 0.417 MPa, respectively. This was due to strong hydrogen bonding between anthocyanin in red cabbage extract and the composite film matrix. Meanwhile, elongation at break of the film without red cabbage extract increased from 22.2% to 30.34% with the increasing of red cabbage extract. The increasing trend could be explained by the fact that the compatibility between starch and chitosan was altered by anthocyanin of the red cabbage extract. From TGA, the decomposition process of the films with and without red cabbage extract started at 266ºC until 591ºC in two consecutive steps, with mass losses of 17.7% and 9.56%, respectively. Film with red cabbage extract degrades at high temperature, which may boost thermal stability compared to film without red cabbage extract. Overall, this study concluded that the incorporation of red cabbage extract improved the properties of starch-chitosan film which can be employed as an alternative material in food packaging application.

Keywords: *chitosan, film, red cabbage, starch, tensile strength*

Performance of Azadirachta indica as bio-coagulant in landfill leachate treatment.

Siti Nor Farhana Zakaria[1*], Elfreda Peter[1], Hamidi Abdul Aziz[2,3], Monika Selvam[1], and Nurmin Bolong[1]

[1]Faculty of Engineering, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia.

[2]School of Civil Engineering, Engineering Campus, Universiti Sains Malaysia, 14300 Nibong Tebal, Penang, Malaysia.

[3]Solid Waste Management Cluster, Science and Technology Research Centre, Engineering Campus, Universiti Sains Malaysia, 14300 Nibong Tebal, Penang, Malaysia.

[*]Corresponding authors: *snfarhanazakaria@ums.edu.my*

ABSTRACT

Coagulation-flocculation process has been extensively used in landfill leachate treatment. The existing inorganic coagulants show a good performance; however, byproduct produce (sludge) is hazardous, difficult to be disposed and potentially pollute the environment back. Hence, the usage of chemical coagulant can be replaced or reduced by combining with botanic-based coagulant/flocculant as it is biodegradable and environmentally friendly. Application of bio-coagulant *Azadirachta indica* (b-Ai) in water treatment is effectively removes pollutants; however, comprehension research gap on the uses of b-Ai in leachate treatment is lacking and significant for studies. Therefore, the main objective of this study is to determine the characteristics and performance of b-Ai with the landfill leachate treatment. Based on the data obtained, b-Ai recorded optimum removal 76.8% and 48.4% of suspended solid and chemical oxygen demand (COD), respectively, at raw pH of sample 8 and dosage 10 g. According to Zeta Potential test, the surface charge for b-Ai is -10.9 mV and it was classified as anionic group which more appropriate to assist as bio-flocculant.

Keywords: *bio-coagulant, Azadirachta indica, landfill leachate treatment, coagulation flocculation*

Ge Passivation for A Quasi 2D/3D Perovskite Solar Cell

Chi Huey Ng[1,2], Kengo Hamada[2], and Shuzi Hayase[2,3]

[1] Faculty of Engineering, Universiti Malaysia Sabah, Jalan UMS, 88400, Kota Kinabalu, Sabah, Malaysia.
[2] Kyushu Institute of Technology, Japan, 204 Hibikino Wakamatsu-ku, Kitakyushu - Fukuoka, 808, Japan.
[3] Info-Powered Energy System Research Center, The University of Electro-Communications, 1-5-1 Chofugaoka, Chofu, Tokyo, 182-8585, Japan.

ABSTRACT

Hydrophobic 2D phenylethylammonium (PEA^+) doping alters the crystal growth orientation and improves the connectivity of the perovskite crystal grains. Nevertheless, solely PEA^+ in the perovskite lattice cannot fully passivate the recombination sites due to Sn vacancies, leading to low power conversion efficiency for an Sn-based solar cell (3.86%). When an optimum amount of Ge was added, we noticed that the power conversion efficiency of the Ge-doped perovskite solar cell was substantially improved, which could be due to the defects passivation by Ge that reduces current leakage and recombination sites at the surfaces and grain boundaries. FESEM images have verified the defects passivation effect of Ge with the fulfillment of Ge ions on the pinholes and grain boundaries. Opposing, the morphology of the film without Ge was observable with pinholes. The addition of a considerable amount of Ge enhances charge transportation, as proven through electrochemical measurements. Opposing the Ge-free device, the Ge-based solar cells exhibited larger charge recombination resistance, improved carrier dynamics, and prolonged decay time, indicating remarkable suppression of interfacial charge recombination sites credited to Ge passivation, thus giving rise to a power conversion efficiency of 7.45%. In addition, the formation of a thin GeO_2 layer to prevent moisture ingress has enhanced the stability of the Ge-doped solar cell. This work provides deep intuition into the trap landscape, which is vital for the performance enhancement of lead-free perovskite solar cells.

Keywords: Ge-doped solar cell; power conversion efficiency, charge dynamics, defect states; stability;

A Perovskite Solar Cell Using Lanthanum-doped Nickel Oxide Hole Transporting Layer

Siow Hwa Teo[1], Shuzi Hayase[2], and Tingli Ma[3]

[1]Industrial Chemistry Program, Faculty Science and Natural Resources, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia.
[2]Graduate School of Life Science and Systems Engineering, Kyushu Institute of Technology, Kitakyushu, Fukuoka 808-0196, Japan.
[3]i-Powered Energy System Research Center (i-PERC), The University of Electro-Communications, 1-5-1 Chofugaoka, Chofu, Tokyo, Japan.

ABSTRACT

A high-performing inverted perovskite solar cell (PSC) always relies on the hole transporting layer (HTL) quality and its interfaces. This work investigates the impact of La incorporation within the NiO_x matrix for defects passivation, thus leading to high charge extraction ability and stability without compromising its power conversion efficiency. In the presence of La, the La–NiO_x quality is clearly improved; without the formation of pinholes. In addition, the inclusion of La alters the energy band alignment; consequently, enhancing the hole transportation and widening the V_{oc} (>1 V), as compared to the pristine NiO_x. The beneficial effect of La was further revealed through the photoluminescence measurement, in which trap states are passivated by La. More importantly, the perovskite solar cell, with La–NiO_x as the HTL, exhibits 21 % enhancement in efficiency and a remarkable stability that is greater than that of pristine NiO_x. This also unlocks an opportunity for commercialization.

Keywords: Inverted solar cell; lanthanum; hole transporting layer; power conversion efficiency; stability

The Influence of Geopolymer on Soil Mechanical Strength in Landfill Soil Liner Application

Atiqah Najwa Zainuddin*[1], Mazidah Mukri[2], Nurul Ain Umaiban Yusof[1], Diana Che Lat[1], Asmawati Che Hassan[1] and Norizzati Ibrahim[1]

[1]School of Civil Engineering, College of Engineering Universiti Teknologi MARA (UiTM) Cwg Johor, Kampus Pasir Gudang, Jalan Persiaran Alam Masai Johor, 81750, MALAYSIA

[2]School of Civil Engineering, College of Engineering Universiti Teknologi MARA (UiTM) Shah Alam Selangor, 40000, MALAYSIA

Corresponding authors: atiqa387@uitm.edu.my

ABSTRACT

Landfill soil liner is an essential component, designed as a barrier between waste and groundwater for the environment. Improper soil liner design and weak soil properties can cause a leak, thus, resulting in leachate infiltration into the environment on long-term exposure that may be risky for human health. Compression of soil is vital to enhance the soil strength, improve bearing capacity, and soil stiffness of chemically modified soils or in-situ (natural). This paper aims to investigate the effect of the water content in geopolymer affecting the soil mechanical strength of compacted residual soil constructed according to existing standards. Residual soil was mixed with 5, 10, 15, and 20% of geopolymer by weight. The test carried out was divided into physical properties and compaction of residual soil, mix with geopolymer. Mixture samples were tested using a standard proctor and samples were compact at dry, wet, and optimum moisture content ranging from -2 and +2 of the optimum moisture content. The result shows the addition of geopolymer as an additive in residual soil has significantly given positive results on maximum dry density due to alteration in geopolymerization. The increases in geopolymer content at 15% are associated with a decrease in water content, leading to a significant increase in soil mechanical strength (maximum dry density) thus giving positive soil strength.

Keywords: *Geopolymer, soil liner, soil compaction, maximum dry density*

Couroupita Guianensis Fruit as Electrode Material for Electric Double Layer Capacitor (EDLC)

Nurul Jannah Abdul Rahman[1], Mohd Ruzaleh Nurdik[1]*, Nor Faranaz Shamin Nor Azmi[1] and Ajis Lepit[1]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM) Sabah Branch, Locked Bag 71, 88997 Kota Kinabalu, Sabah, Malaysia

* *Corresponding authors: mohdruza@uitm.edu,my*

ABSTRACT

Rapid depreciation of fossil fuels has led to finding sustainable energy source. Malaysia's government has launched the National Biomass Strategy 2020 to develop new industries that transform biomass into useful product such as energy storage device like supercapacitor. The performance of supercapacitor are highly dependent on the electrode material preferably Activated Carbon (AC) due to the surface characteristic. In this study, we examine the *Couroupita Guianensis* (CG) fruit as active material in supercapacitor. As far as we know, only two reported study of AC from CG with only one for supercapacitor application but by using its dead flower as precursor. Therefore, this will be the first study using its fruit shell waste as precursor. AC is prepared by chemical activation at 350 ^{o}C and potassium hydroxide (KOH) as activating agent. Symmetric AC electrodes separated by filter paper and 1M KOH as electrolyte were fabricated. The supercapacitive performance is evaluated by using charge-discharge circuit that has revealed a capacitance that can go up to more 20 cycles life with specific capacitance 6.44 F/g and a specific energy density 13.7 Wh/kg. In conclusion, CG fruit as electrode material has high potential as high-performance ideal Electric Double Layer Capacitor (EDLC) with high life cycle.

Keywords: *Couroupita Guianensis, Activated Carbon, Electrode, Supercapacitor*

Studies On The Plasticizing Efficiency Of Deep Eutectic Solvent With Different Hydroxyl Positions In Producing Flexible Poly(Methyl Methacrylate) Electrolyte Films

Intan Qhuzairin Zaharuddin[1], Nabilah Akemal Muhd Zailani[1*], Khuzaimah Nazir[1], Siti Zafirah Zainal Abidin[2], Famiza Abdul Latif[2], and Fazni Susila Abdul Ghani[2]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), Cawangan Perlis, Kampus Arau, 02600 Arau, Perlis, Malaysia

[2]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor, Malaysia

[*]Corresponding authors: *nabilahakemal@uitm.edu.my*

ABSTRACT

The brittle properties of poly(methyl methacrylate) (PMMA) electrolyte film was due to the interchain crosslinking that occurred between polar PMMA chains. The incorporation of ionic liquid (IL) during free radical polymerization of MMA has been proven to improve the brittleness of PMMA film by occupying the space between the polymer chain. Unfortunately, the usage of IL involves high costs and present toxicity. Thus, deep eutectic solvent (DES) which has similar properties as IL with further advantages such as being cheaper and less toxic is seen as the best alternative to produce flexible PMMA electrolyte film. Thus, in this study, DES with different hydroxyl positions (i.e.: Choline chloride (ChCl): 1,2-butanediol (1,2-BD), ChCl: 1,3-butanediol (1,3-BD), ChCl: 1,4-butanediol (1,4-BD)) were incorporated during free radical polymerization of MMA. Interestingly, it was observed that the PMMADES film showed an improvement in its flexibility and ionic conductivity compared to the pure PMMA film. It was also observed that the PMMADES system with the incorporation of ChCl: 1,2-BD type of DES exhibited the highest ionic conductivity (~10^{-8} S cm^{-1}) at room temperature compared to the other PMMADES system (~10^{-9} S cm^{-1}). The increment in the ionic conductivity of the PMMADES system has been supported by its amorphous nature upon incarceration with DES.

Keywords: *Polymer electrolyte, PMMA, Deep eutectic solvent, Flexible film*

Study of the Radiation Effect on Glucose-6-Phosphate Dehydrogenase (G6PD) Deficiency Erythrocytes

Nur Suhaily Azmi[1] and Siti Amira Othman[2*]

[1]School of Materials Engineering, Universiti Malaysia Perlis, 02600 Jejawi, Arau, Perlis

[2]Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, 84600, Pagoh, Johor.

[*]Corresponding authors: *sitiamira@uthm.edu.my*

ABSTRACT

Glucose-6-Phosphate Dehydrogenase (G6PD) deficiency is a genetic disorder that mainly affects erythrocytes. G6PD is an enzyme found especially in erythrocytes that catalyze the oxidation of glucose-6-phosphate in glucose metabolism. Erythrocytes are one of the blood cells that are produced in bone marrow stem cells. Previous researchers of G6PD deficiencies are more focused on patients with the genetic disorder. Therefore, the purpose of this research study are to optimize the effect of pH level and temperature of G6PD on the enzyme activities, to determine the effect of G6PD deficiency on erythrocytes and to study the morphology of the normal and G6PD deficiency erythrocytesafter irradiation with gamma radiation. As for the methodology, dilution method is used to study the suitable parameter for the G6PD. The enzymes G6PD is purchased while the erythrocytes obtained from G6PD patient and normal people. Substances for example uncoated aspirin and broad beans solutions are added to the erythrocytes in order to study the reactions occurred. The morphology of the erythrocytes is studied by exposing erythrocytes to Cesium-137 which emit gamma radiation and after a week the sample is observed under a Nikon Eclipse LV/UDM microscope. The result from the irradiation can be as one of the evidence on the effect of G6PD deficiency on erythrocytes and dangerous substances that can cause the deficiency.

Keywords: *Radiation, G6PD, erythrocytes, deficiency, gamma*

Fabrication and Characterization of Er^{3+}-Doped SiO_2-TiO_2 Nanofiber Produced by Electrospinning Technique

Nurul Syaheera Razali, Siti Nurbaya Supardan and Suraya Ahmad Kamil*

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

**Corresponding authors*: *suraya_ak@uitm.edu.my*

ABSTRACT

Silicon dioxide (SiO_2) and titanium dioxide (TiO_2) are often used in optical film because of their chemical stability and were proved to be a suitable host for rare earth ions. SiO_2-TiO_2 composite materials are expected to have a broad range of refractive indices due to the large difference in refractive index between the two compounds. Nanostructured materials have been extensively studied due to their optical properties. They also have a large surface area per volume ratio and are highly porous, which may have a significant effect on its properties. Among nanostructured materials, nanofiber have been widely studied because of its inexpensive cost of production and simple fabrication. In this study, Er^{3+}-doped SiO_2-TiO_2 nanofibers were synthesized and fabricated using the sol-gel and electrospinning techniques, correspondingly with the ratios of SiO_2/TiO_2 being varied. The morphological, structural, and optical properties of the nanofiber were studied. The FESEM results showed that fabricated nanofibers have diameters in the range of 67 nm to 538 nm. The EDS result revealed that the ions were homogenously distributed within the host matrix. The FTIR spectra demonstrated that despite of the increasing content of TiO_2, the main structure of the nanofiber remains the same. The XRD results implies that all samples corresponds to the amorphous phase. Besides, the optical transparency of all the samples demonstrated high transmittance from 88% to 93% which were ideal for photonic application. The PL spectra exhibit strong green emission peaks which were ascribed to $^2H_{11/2} \rightarrow {}^4I_{15/2}$ of Er^{3+} transitions under the excitation wavelength of 350 nm.

Keywords: *Rare earth, nanofiber, photoluminescence, optical materials*

Unravelling the Efficient Removal of Tetracycline Hydrochloride Over Fibrous Silica Bismuth Oxide Photocatalyst

Nik Muhammad Izzudin Nik Lah[2], Aishah Abdul Jalil[1,2]* and Nurul Sahida Hassan[1,2], Nur Farahain Khusnun[1], and Nur Izzati Hannani Hazril[2]

[1]Centre of Hydrogen Energy, Institute of Future Energy, 81310 UTM Johor Bahru, Johor, Malaysia

[2]Faculty of Chemical and Energy Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

[*]Corresponding authors: *aishahaj@utm.my*

ABSTRACT

The emergence of antibiotic compounds in the hydrosphere has arises a lot of environmental concerns recently. Among them, tetracycline hydrochloride (TC-HCl) was reported to be frequently detected in the water matrix, exposing human and other terrestrial lives to unparallel impacts. To date, the photocatalysis approach has aroused as an excellent method for removing various water pollutants. In addition, several semiconductor materials such as TiO_2, Fe_2O_3, CuO and Bi_2O_3 have been investigated in photocatalytic studies. Among them, bismuth oxide (Bi_2O_3) has demonstrated outstanding potential for eliminating water pollutants which can be attributed to its remarkable photocatalytic properties such as narrow bandgap (2.20 eV) and marked photoconductivity and photoluminescence Nevertheless, its photocatalytic performance is limited by the rapid recombination of photogenerated charges and low surface area. In the meantime, the development of fibrous silica materials which exhibits large surface area and high accessibility of actives sites has attained tremendous interest recently. The fabricated fibrous silica materials not only enhanced the photocatalytic properties but also demonstrated superior photocatalytic activity than the commercial metal oxides. Inspire by this finding, herein reported the fabrication of fibrous silica bismuth oxide (FSBi) for photocatalytic cleanup of TC-HCl. The FSBi catalyst was successfully synthesized via microemulsion method which is evidenced by the SEM analysis. The FTIR analysis confirms the presence of Si-O-Bi interaction. Moreover, the FSBi catalyst demonstrated higher efficiency towards the degradation of TC-HCl (73.0%) compared to the commercial Bi_2O_3 (54.6%) and KCC-1 (13.1%), possibly due to the high surface area and low recombination of electron-hole. This study has brought new insight into the advanced fibrous silica materials, especially FSBi for the sustainable removal of water pollutants.

Keywords: *Photocatalysis, Bismuth Oxide, Fibrous Silica, Tetracycline Hydrochloride*

Preparation of Sulfonated Lignin-based Carbon Catalyst for Glucose Ethanolysis to Ethyl Levulinate

Kamarul Ridwan Zainuddin[1], Muzakkir Mohammad Zainol[1]*, Abdull Hafidz Hassan[1], Mohd Asmadi[2], Syed Shatir Asghrar Syed Hassan[1], Mohd Yazid Yusof[1] and Didi Dwi Anggoro[3]

[1]School of Chemical Engineering, College of Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

[2]Faculty of Chemical and Energy Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

[3]Department of Chemical Engineering, Diponegoro University, Semarang 50273, Indonesia St. Prof. Soedarto, SH, Tembalang, Semarang, Indonesia

**Corresponding authors*: *muzakkir@uitm.edu.my*

ABSTRACT

An abundance of biomass material or waste derived from living plants or animal material (organic wastes) is generated throughout many countries. It can be converted to various chemicals due to its valuable organic compounds in biomass structure. Ethyl levulinate (EL) is one of the biochemicals potentially derived from biomass and its derivative components. Therefore, this work was conducted to study the catalytic ethanolysis reaction of biomass component which is glucose to EL. The sulfonated lignin-based carbon catalyst was prepared to catalyze the glucose ethanolysis reaction to yield EL. The sulfonated lignin-based carbon catalysts were prepared via thermal heating of lignin at different temperatures (400 to 600 °C) followed by sulfonation, and the characterization of selected catalyst was carried out using ion-exchange titration, Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), energy dispersive X-ray (EDX), nitrogen sorption analysis, and thermalgravimetric analysis (TGA). The various carbon catalysts prepared were screened for glucose ethanolysis reaction and selected based on the high EL yield obtained. Based on the results, a high surface area of the catalyst was obtained with good surface chemistry for the conversion of glucose to EL. The screening result shows that the sulfonated carbon catalyst obtained from carbon precursor prepared at 450 °C provides a high EL yield of 22.54 mol% as compared to other carbon catalysts. This result shows the potential of sulfonated lignin-based carbon as a solid acid catalyst for glucose ethanolysis reaction. Further reaction study is required to obtain optimum EL yield through the glucose ethanolysis reaction catalyzed by sulfonated lignin-based carbon catalyst.

Keywords: *Lignin, Carbon, Catalyst, Ethyl levulinate, Glucose*

Enhancement Of Solid Soap Organophosphate Decontamination Efficacy Using 2-Pyridine Aldoxime Methiodide (2-PAM): A Physicochemical Properties Of The Synthesied Soap

Nur Shazwani binti Abdul Latif[1*], Wan Md Zin bin Wan Yunus[2*], Hafizah binti Ariff[1], Rauda binti A. Mohamed[3], Nurnadia binti Andenan[4] and Victor Feizal bin Knight Victor Ernest@Abd Shatar(B)[5]

[1]Centre for Tropicalisation, Universiti Pertahanan Nasional Malaysia (UPNM), 57000 Sungai Besi, Kuala Lumpur, Malaysia
[2]Faculty of Defence Science and Technology, Universiti Pertahanan Nasional Malaysia (UPNM), 57000 Sungai Besi, Kuala Lumpur, Malaysia
[3]School of Applied Sciences, Nilai University, 71800, Nilai, Negeri Sembilan, Malaysia
[4]Centre for Research and Innovative Management, Universiti Pertahanan Nasional Malaysia (UPNM), 57000 Sungai Besi, Kuala Lumpur, Malaysia
[5]Research Centre for Chemical Defence, Universiti Pertahanan Nasional Malaysia (UPNM), 57000 Sungai Besi, Kuala Lumpur, Malaysia

[*]*Corresponding authors*: shazwani@upnm.edu.my and *wanmdzin@upnm.edu.my*

ABSTRACT

Decontamination of surfaces contaminated by hazardous chemicals or agents is critical in various fields, including healthcare, industrial, and military operations. Organophosphates (OPs) are toxic chemicals that are used in large quantities, and have been recorded that they are threats to human and the environment. When these compounds are released into the environment, besides through an inhaling or/and ingesting processes, they can enter our body through skin penetration. The OPs in the blood deactivate acetylcholinesterase to hydrolyse acetylcholine causing organophosphate poisonings with symptoms of such as sweating, salivation, diarrhea, muscle tremors and if not treated promptly it can worsen to cause loss of lives. Therefore, at early stage of exposure to OPs, immediate and effective decontamination step is crucial to prevent the OPs from further absorbing into the skin. Traditionally, soap is a common cleaning agent used for decontamination but it only washes away and/or dilute the chemicals but not adequately deactivate and/or destroy them. It is expected that soap decontamination efficacy can be improved by incorporating an oxime, 2-pyridine aldoxime methiodide (2-PAM) as it forms complexes with OPs which later can be degraded into non-toxic products. In this report, we describe a procedure to synthesize 2-PAM incorporated solid soap and its physicochemical properties related its use as decontaminant. Fourier transform infrared (FTIR) spectroscopy and other parameters including pH analysis, moisture content, foaming ability were used to characterize the soap. The results show that the incorporation of 2-PAM in the soap does not alter its physicochemical properties. This study provides valuable insights into the use of 2-PAM-incorporated solid soap as an effective decontamination agent and lays the foundation for further studies on its practical applications.

Keywords: *Decontamination, organophosphate, solid soap, oxime.*

Fresh and Hardened Properties of Self-Compacting Concrete Incorporating Eggshell Powder as Partial Cement Replacement Exposed to Elevated Temperatures

Siti Anisah Awang[1]*, Mohd Raizamzamani Md Zain[1,2] and Oh Chai Lian[1,2]

[1]School of Civil Engineering, College of Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

[2]Structural and Construction Materials Engineering Group (SCME), School of Civil Engineering, College of Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia.

[*]Corresponding authors: anisse_anwar@yahoo.com

ABSTRACT

This research focuses on the fresh and hardened properties of self-compacting concrete (SCC) containing eggshell powder as a partial replacement for cement exposed to elevated temperatures. Concrete materials are utilized extensively in the building and construction industries. Ordinary Portland cement (OPC), one of the basic materials, is often expensive and emits carbon dioxide (CO_2) during production. One tonne of cement produces approximately 900 kg of CO_2 greenhouse gases. Approximately 5-7% of the total volume of emissions from cement factories are emitted into the environment. As a consequence, the cement industry is being encouraged to reduce and partially replace cement production with supplementary cementitious materials (SCMs) due to social and environmental concerns. Because eggshell contains a calcium component, it has become one of the conceivable alternatives for cementitious material. This effort is primarily motivated by landfill site restrictions and a desire to reduce the warming effect. The present study examines the fresh and hardened properties of SCC incorporating eggshell powder exposed to elevated temperatures via experimental assessment. The laboratory tests were carried out on specimens with 5%, 10%, 15%, 20% and 25% eggshell substitution to the weight of cement and then compared to control specimens. Slump flow, T500, L-box, and sieve segregation tests were used to evaluate the fresh properties of the mixture. To assess the hardened properties, compressive strength, split tensile strength, and flexural strength tests were performed. The concrete's strength was tested after 7 and 28 days of curing. The cubes (100 x 100 x 100 mm) and cylindrical specimens (50 mm x 100 mm) were heated to 100°C, 200°C, and 300°C, respectively. The mode of failure of the test's specimens exposed to elevated temperatures was also observed. The results of the experiments demonstrated that all SCC mixtures incorporating eggshells met the EFNARC standards for fresh properties. The compressive strength, splitting tensile strength, and flexural strength of all specimens decrease with increasing temperature. The majority of SCC cube specimens had vertical cracks at the edges and a noticeable horizontal crack pattern was found at the centre of all cylindrical specimens.

Keywords: *Sel-compacting concrete, eggshell powder, fresh properties, hardened properties, failure mode*

Efficacy Evaluation of Oxime Incorporated Oil Palm Based Liquid Soaps to Decontaminate Organophosphate Compounds

Hafizah Ariff[1*], Nur Shazwani Abdul Latif[1], Nurnadia binti Andenan[2], Norli Abdullah[3], Junaedy Osman[3], Victor Feizal b Knight Victor Ernest@Abd Shatar[4] and Wan Md Zin Wan Yunus[5*]

[1] Centre for Tropicalisation

[2] Centre for Research and Innovation Management (CRIM)

[3] Centre of Defence Foundation Studies

[4] Centre for Chemical Defence

[5]Faculty of Defence Science and Technology

Universiti Pertahanan Nasional Malaysia, Kem Sg. Besi, 57000, Kuala Lumpur, Malaysia

[*]Corresponding authors: *wanmdzin@upnm.edu.my; hafizah.ariff@upnm.edu.my*

ABSTRACT

Organophosphate compounds (OPCs) are a class of chemicals containing phosphate derivatives, which are widely used in agriculture industries as pesticides to increase crop yields due to their high insecticidal toxicity. However, the use of pesticides is a global concern as it can cause organophosphate poisonings which occur due to accidental, occupational or intentional exposures. Decontamination is an important step to remove these chemicals from the contaminated surfaces to prevent them from being absorbed into the body. Although washing with soap solutions can effectively remove traces of chemicals from surfaces, it does not effectively convert or neutralize them into innocuous compounds. Oximes are a class of nucleophiles, which rapidly react with various substrates such as carboxylic, phosphoric, and sulfonic acid esters and degrade OPCs to produce less toxic compounds. In this report, we describe a procedure to synthesize oxime incorporated palm oil-based liquid soaps with an oxime concentration in the range of 0.05-1% and the results of characterization to determine their capacity to degrade the OPCs into non-toxic compounds which eventually safe to be disposed of. The synthesized liquid soaps are stable and their pHs of 10-11 are within the acceptable range for the cleaning purposes. Upon reacting it with Methyl Parathion (MP), the selected OPC for the study, the absorbance peak of MP at 290 nm of the UV-Visible spectrum decreases and simultaneously, a new peak at 300-400 appears, indicating degradation of MP and the formation a new product, respectively. The results preliminary study indicate that the oximes incorporated palm oil-based liquid soaps are capable to be used as OPCs decontaminant.

Keywords: *Decontamination, Liquid Soap, Organophosphate, Oxime*

Commercial Hydrophobic Surface for Electrowetting-On-Dielectric Mechanism

Muhammad Zakwan Yaacob and Eli Nadia Abdul Latip*

School of Mechanical Engineering, College of Engineering, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor Darul Ehsan, Malaysia.

*Corresponding author: *elinadia@uitm.edu.my*

ABSTRACT

Electrowetting-on-dielectric (EWOD) is the most widely-used mechanism in digital microfluidics technology due to its versatility and simple architecture. EWOD-based device has the potential to be used as a portable and low-cost platform for rapid point-of-care testing. However, there is one set back to its wide adoption which is the high fabrication cost of the chip. The actuating surface for the liquid droplet motion on the chip is usually made from expensive hydrophobic materials such as Cytop® and Teflon AF™. Therefore, this study presents the investigation on the potential of using three types of low-cost hydrophobic materials as the alternative to the conventional materials. The contact angles of deionized (DI) water droplet with applied voltage on substrates coated with these commercial hydrophobic materials were measured. The samples were prepared using three different deposition methods, namely spin coating, dip-coating and spraying. Surface characterisation (e.g., roughness and thickness) and the tilt angle required to slide liquid droplets on the surface were also investigated. For each deposition method, two types of sample were prepared: one-layer and two-layer samples. From the preliminary results, we discovered that all types of samples except one produced a high initial contact angle of more than 100°. Most of the materials have a better performance in the two-layer sample compared to the one-layer sample. This promising findings suggests the potential of using low-cost materials as the hydrophobic component in EWOD mechanism.

Keywords: *Electrowetting-On-Dielectric (EWOD), low-cost hydrophobic, contact angle.*

Effect of Iodine Adsorption as a Trace Element in Thyroid Disease

Siti Balqis Mohd Shamsuri[1] and Siti Amira Othman[2]*

[1,2]*Faculty of Applied Sciences and Technology, 84600 Pagoh , Johor, Malaysia*

[*]*Corresponding authors*: *sitiamira@uthm.edu.my*

ABSTRACT

Iodine is a trace element which needed in human being since it play vital role for metabolism rate. The iodine will be adsorbs by thyroid gland in order to secrete hormone for controlling metabolism. Iodine is volatile as it readily sublimes at high temperatures. Thus, it is important to keep iodine at suitable temperature and also important for the consumers to take a sufficient amount of iodine in our daily meals. Therefore, the objectives of this research are to verify the temperature and pH properties of iodine, to investigate the effect of radiation on iodized salt and also to evaluate the suitability amount of iodine uptake by human thyroid. This research involved the titration method. The amount of thiosulfate used in the titration is proportional to the amount of iodine in the salt. The absorption peak and functional group present in salt solution is analysed using UV-Visible spectroscopy and FTIR spectroscopy. The iodized salt is radiate with Cs-137 to analyse its composition using FESEM-EDX. Concentration of iodine resulted from titration is converted into parts per million, ppm to determine the iodization level in the salt that approved by World Health Organization, WHO and the suitable amount of iodine uptake for healthy thyroid. From this study, the iodine content is low at high temperature and in acidic condition. The UV and infrared absorption in salt sample solution had shown its peak value and the functional group present in the sample. The non-irradiated and irradiated iodized salts had shown their elemental composition using FESEM with EDX. Also, the iodine concentration in iodized salt and its suitability of iodine consumption in human followed the iodization level by WHO.

Keywords: *Irradiated, detergent, BSA, emulsion, albumin*

Desulfurization and Optimization of High Sulfur Jambi Province Coal by Ultrasonic-assisted Process Using Peroxyacetic Acid (PAA) Treatment

Nurul Fatihah Nazua[1], Syarifah Nursyimi Azlina Syed Ismail[1], Mohd Fauzi Abdullah[1*], Mohd Azlan Mohd Ishak[1], Wan Izhan Nawawi Wan Ismail[1], and Khudzir Ismail[1]

[1]Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM), Arau Campus, 02600 Perlis, Malaysia.

[*]Corresponding authors: *mohdfauziabd@uitm.edu.my*

ABSTRACT

The desulfurization process of high-sulfur coal from Jambi Province, Indonesia was investigated using peroxyacetic acid (PAA) as mild oxidising agent by ultrasonic wave. This study reports the utilization of a mixture of acetic acid and 6% hydrogen peroxide (CH_3COOH: H_2COOH) under sonication to extract organic sulfur from coal. The ultrasonic shockwave separates sulfur from the coal's macromolecular structure by breaking the chemical connections that hold sulfur to coal. The optimum concentration, temperature, and processing time for the coal desulfurization process as were determined using the Central Composite Design-Response Surface Methodology (CCD-RSM) to overcome the traditional methods that make finding the optimal standard difficult and time-consuming, and sonicating coal at 30 ˚C for 30 minutes with 70:30 (CH_3COOH: H_2COOH) was found to be the ideal parameter. Results shows that all inorganic and some of the organic sulfur could be removed from the coal using mild conditions without severely affecting the coal microstructure as observed in the FESEM-EDX. The changes to the thiophene and organic sulfate FTIR peaks may serve as a preliminary measure of the effectiveness of PAA in coal desulfurization. XRD analysis results indicated that the pyrite and some of organic sulfur could be removed after ultrasonic treatment. To clarify its chemical effect, the production regularities of hydroxyl radical under ultrasonic field was determined using the iodine release method. Experimental results also showed that the production rule of hydroxyl radical was consistent with the desulfurization rate. These findings confirmed that the synergistic action of physical and chemical effects of the ultrasonic played an important role in this desulfurization process, which could serve as a reference for further optimizing the coal desulfurization process.

Keywords: *Coal Desulfurization, Peroxyacetic Acid, Sulfur, Ultrasonics, Response Surface Methodology*

Magnetic Beads Catalyst for Organic Pollutant Removal: Photocatalytic Efficiency

Diyana Faziha Mohamad[1], Amin Safwan Alikasturi[1], Dayang Norafizan Awang Chee[2], Siti Kamilah Che Soh[3], Cecilia Devi Wilfred[4], and Norzahir Sapawe[1]*

[1]Universiti Kuala Lumpur, Branch Campus Malaysian Institute of Chemical and Bioengineering Technology, Lot 1988 Vendor City, 78000 Alor Gajah, Melaka, Malaysia

[2]Jabatan Kimia, Fakulti Sains dan Teknologi Sumber, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

[3]Fakulti Sains dan Sekitaran Marin, Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu, Malaysia

[4]Department of Fundamental and Applied Sciences, Centre of Research in Ionic Liquids, Universiti Teknologi PETRONAS, 32610 Seri Iskandar, Perak, Malaysia

Corresponding authors: norzahir@unikl.edu.my

ABSTRACT

The effective removal of organic pollutants from water sources is a critical challenge faced by environmental researchers. Photocatalytic degradation has emerged as a promising technique for pollutant removal, utilizing catalysts that harness solar energy to initiate oxidation reactions. In this study, we investigated the photocatalytic efficiency of magnetic beads catalyst for the removal of organic pollutants from water. The in-situ co-precipitation approach was used to synthesise the magnetic beads catalyst, and were further examined using FTIR, XRD, FESEM, BET, and UV-vis DRS. The efficiency of the magnetic beads catalyst was assessed by monitoring the degradation rate of the pollutant under visible light irradiation. The influence of pH, reaction time, catalyst dosage, and initial pollutant concentration on the degradation efficiency was investigated. The results demonstrated that the magnetic beads catalyst exhibited excellent photocatalytic performance in organic pollutant degradation. The magnetic beads catalyst showed good stability and reusability, making them suitable for continuous pollutant removal applications. The catalyst retained their photocatalytic activity even after multiple reaction cycles, highlighting their potential for practical implementation. In conclusion, this study demonstrates the effectiveness of magnetic beads catalyst for photocatalytic degradation of organic pollutant. The findings contribute to the development of efficient and sustainable water treatment technologies, offering a promising approach to mitigate the harmful effects of organic pollutants on ecosystems and human health. Future research should focus on optimizing the catalyst design and exploring their application in real-world scenarios to enhance their practicality and overall environmental impact.

Keywords: *Photocatalytic degradation, Magnetic beads, Organic pollutant, Light irradiation, Water treatment*

5th ISTEC 2023

i-IDeA

GLOBAL ADVANCED MATERIALS & SURFACES

Organised by:

Research, Industry,Community, Alumni, Entrepreneurship & Network (RICAEN)
Universiti Teknologi MARA Perlis Branch
02600, Arau, Perlis, Malaysia

Strategic Partner

UTM UNIVERSITI TEKNOLOGI MALAYSIA

PENANG 2030

PETACE

penang convention & exhibition bureau

PG