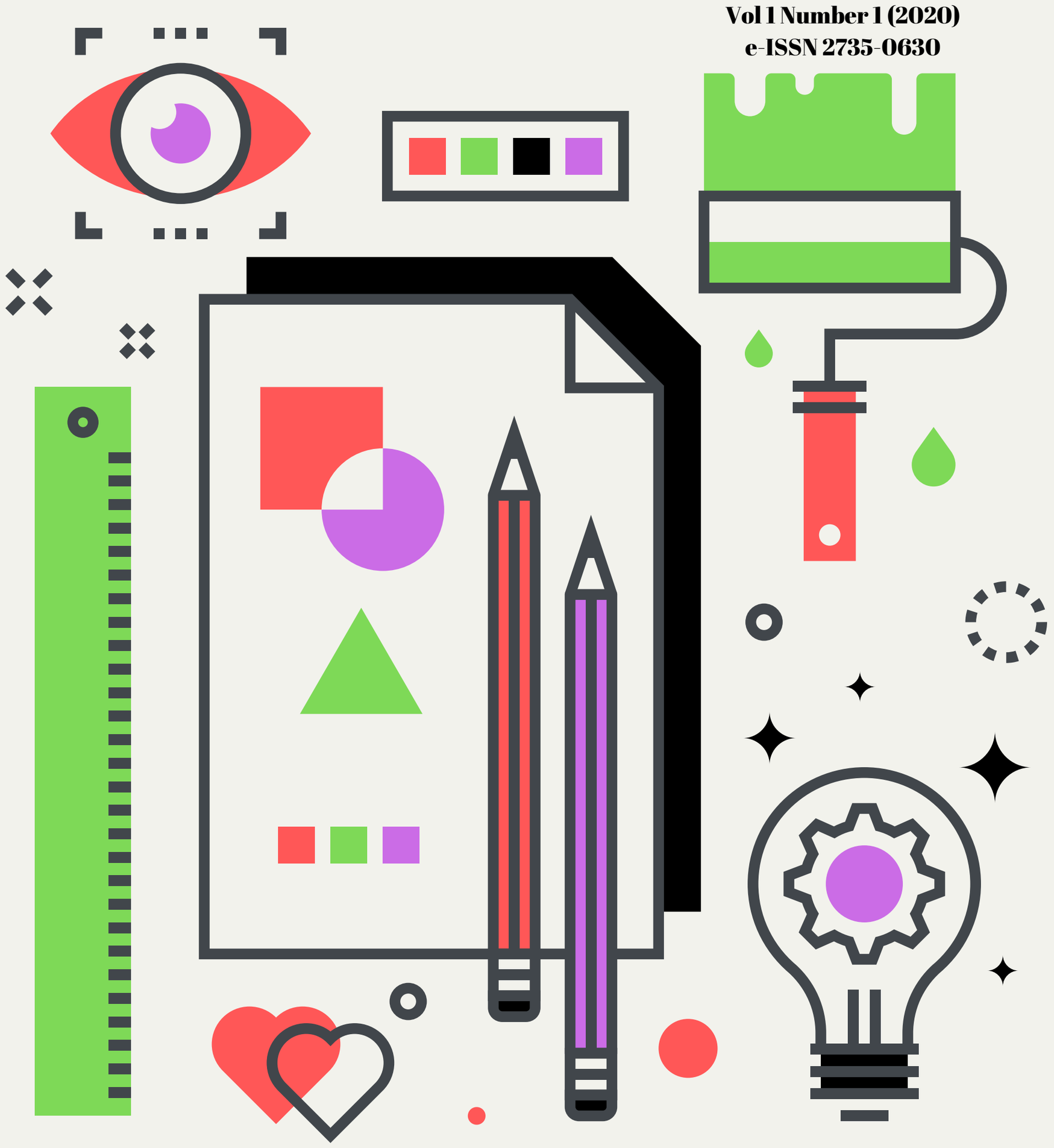
e-Proceeding

9th SIIC 2020

9th Virtual Science, Invention, Innovation & Conference 2020

Vol 1 Number 1 (2020)
e-ISSN 2735-0630



AUGUST 3rd - 5th 2020

FACULTY OF CHEMICAL ENGINEERING

Universiti Teknologi MARA (UiTM)
Cawangan Pulau Pinang

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PREFACE

9th Virtual Science, Invention, Innovation & Conference 2020 (SIIC 2020) is organised by Faculty of Chemical Engineering and co-organised by Chemical Engineering Student Society (ChESS) that serves as a platform for final year students from Faculty of Chemical Engineering, UiTM Cawangan Pulau Pinang to highlight idea, innovation, invention and design in their respective field. The event was formerly known as Science, Invention, Innovation & Conference. It has garnered multiple successes following the preceding events from 2016 to 2020. SIIC 2020 showcases products commercialization, ideas, inventions and designs that are highly innovative, competing against each other to be recognized as the best among the best. Adhering to the Industrial Revolution 4.0 movement, the competition seeks out outstanding products that are able to keep up with the rise of automation and artificial intelligent innovations – ideas that can change the way we live, work, and communicate for the better. It is also in line with the government's desire to encourage innovation activities in Malaysia.

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SIIC001

STATISTICAL OPTIMIZATION AND ARTIFICIAL NUERAL NETWORK MODELLING OF *ANNONA MURICATA* (SOURSOUP) LEAVES IN SUPERCRITICAL CARBON DIOXIDE EXTRACTION

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Abstract: Supercritical fluid extraction (SFE) using carbon dioxide as a solvent is one of the non-conventional method recently used in extraction. Carbon dioxide is used as a solvent in this extraction because it is a non-toxic solvent. From the previous study, *Annona Muricata* Leaves have effectiveness as an anti-inflammatory, anticancer and also antioxidant. Response Surface Methodology (RSM) and Artificial Neural Network (ANN) were used in this research to investigate and compare the performance of RSM and ANN in optimization total yield, antioxidant activity and total phenolic content from extract of *Annona Muricata* Leaves using SFE technique. All the responses (optimization total yield, antioxidant activity and total phenolic content) were modeled and optimized as functions of four independent parameters with were temperature, pressure, size of particle and percentage of co-solvent using RSM and ANN. the coefficient of determination (R^2) and root mean square error (RMSE) were employed to compare the performance of both modelling tools. From the results, ANN show higher predictive potential compare to RSM with higher correlation coefficient 0.9594, 0.9876, 0.917 for total yield, antioxidant activity and total phenolic content respectively. ANN also shows the lower RMSE compare to RSM with 0.461 for total yield, 0.998 for antioxidant activity and 23.697 for total phenolic content. Thus, as conclusion ANN model could be a better alternative in data fitting for SFE for extraction of total yield, antioxidant activity and total phenolic content from *Annona Muricata* Leaves.

***Keywords*:** Supercritical fluid extraction (SFE), *Annona Muricata* Leaves, Optimization, Response Surface Methodology (RSM), Artificial Neural Network (ANN)

SIIC002

POST HARVEST PHYSICAL AND MECHANICAL PROPERTIES OF *BACCAUREA MOTLEYANA* FRUITS

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Abstract: Some post harvest physical and mechanical properties of *Baccaurea motleyana* fruits were determined in order to facilitate the design of machines or equipments to handle, process and store the fruits. They consist of the mean moisture content, length, width, thickness, geometric mean diameter, mass, volume, surface area, sphericity, aspect ratio, true density, bulk density, porosity and coefficient of static friction on different types of surface. The physical and mechanical properties were determined at the moisture content (wet basis) of 80.79 (±1.49) %. The mass, volume and dimensions of *Baccaurea motleyana* fruits were measured by using electronic balance, water displacement method and vernier caliper respectively. The geometric mean diameter, surface area, sphericity, aspect ratio, true density, bulk density and porosity were calculated using different theoretical equations. The mean length, width and thickness of the fruits were 24.69 (± 1.49), 22.49 (±1.65) and 20.35 (±2.15) mm, respectively. The average value of geometric mean diameter, mass, volume, surface area, sphericity, aspect ratio, true density, bulk density and porosity were 22.43 (±1.69) mm, 5.885 (±1.236) g, 6146.67 (±1505.64) mm^3, 1589.16 (± 238.85) mm^2, 90.77 (±2.46) %, 91.04 (±3.57) %, 1039.70 (±125.24) kgm^{-3}, 484.71 (±24.95) kgm^{-3} and 97.48 (±0.61) %, respectively. The mean value of coefficient of static friction on four types of structural surface were found to be varying from 0.158 (±0.028) for galvanized steel sheet to 0.209 (±0.034) for rubber surface.

Keywords: physical properties, *Baccaurea motleyana*, rambai, design, machine

SIIC003

APPLICATION OF ARTIFICIAL NEURAL NETWORK TO SIMULATE PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY DURING SPONTANEOUS FERMENTATION OF *CARICA PAPAYA* LEAF

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Abstract: In this research project, artificial neural network (ANN) is being used to model the nonlinear pattern for phenolic content and antioxidant activity of *Carica papaya* leaf during spontaneous fermentation. This study was conducted by collecting the experimental data from the spontaneous fermentation of *Carica Papaya* leaf. The parameters involved were the day of fermentation (1 to 100 days) and the volumes of fermenter (5L and 50L) as the inputs for training the ANN model. The responses of the output layer were phenolic content and antioxidant activity of fermented *Carica papaya* leaf. The data set was trained by the hyperbolic tangent sigmoid (tansig) transfer function and Levenberg-Marquadt (trainlm) training algorithm. The performance of neural network design is evaluated based on the Mean Square Error (MSE) and relative error to determine the best optimum model. Based on the results, the best neural network architecture for the prediction of the antioxidant activity and phenolic content are 2-12-12-1 and 2-11-11-1 respectively. The MSE training for antioxidant activity and phenolic content are 0.00044367 and 0.00024449 respectively. The average relative error for phenolic content and antioxidant activity is evaluated to make sure the accuracy of the predicted data.

***Keywords*:** Artificial Neural Network, Phenolic Content, Antioxidant Activity, Transfer Function.

SIIC004

A REVIEW: SYNTHESIS OF BIODIESEL FROM WASTE COOKING OIL USING NANOHYBRID CATALYST WITH LOW METHANOL TO OIL RATIO

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Abstract: Biodiesel can act as an alternative fuel to reduce the emission level of some pollutant. Manufacturing biodiesel from Waste Cooking Oil (WCO) is one of another succesful way to reduce the cost of raw materials and has many environmental benefits. However, the sustainable of biodiesel production is quiet challenging due to difficulty in securing cheap raw material. To reduce the cost, low ratio of methanol to oil used is suggested to limit the methanol user but the influence and effect to the yield need to study. This literature study aim were to study on the yield of biodiesel synthesis from waste cooking oil using nanohybrid catalyst with low methanol to oil ratio by transesterification process and to find the suitable ratio of low methanol to oil and the highly reactive nanohybrid catalyst which lead to high yield of biodiesel. For this study review, the online researches of the synthesis biodiesel yield by nanohybrid catalyst and the effect on the molar ratio methanol to oil data was collected from the relevant publish papers to compare the yield of biodiesel produce and their effect to the molar ratio methanol to oil. When the data processing is complete, the detail were go through and known as data analysis to make discussion and conclusion. Result obtained proved that nanohybrid catalyst can produce high yield of biodiesel above 90% in low ratio of methanol to oil. A very synergetic effect was noted in catalytic activity when hybrid (mixed) catalyst was used. The suitable low molar ratio of methanol to oil is 6:1 compare to 3:1 since stoichiometric molar ratio of alcohol to oil for the transesterification is 3:1. The biodiesel properties such density, flash point and kinematic density are following the ASTM D-6751 and EN-14214 requirement.

***Keywords*:** Waste cooking oil, Biodiesel, Transesterification, Hybrid catalyst, Methanol to oil molar ratio

SIIC005

PROCESS MODELING OF SONOCATALYTIC DEGRADATION OF CAFFEINE USING CeO_2 VIA BLACK BOX METHOD

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Abstract: In order to meet the human demands, the pharmaceuticals industries are increasing over the years. Caffeine ($C_8H_{10}N_4O_2$), representative as one of pharmaceuticals and personal care products (PPCPs) was considered to be contaminating to human and other aquatic life which has exerted water pollutions crisis. In this study, the mathematical modeling of sonocatalytic degradation of caffeine using CeO_2 was developed via artificial neural networks. The artificial neural network (ANN) was employed for developing the suitable modeling of the CeO_2 catalyst in determine the efficiency of sonocatalytic degradation (%). The operating parameter of this study involved initial pH of caffeine, initial concentration of caffeine (g/L) and dosage of CeO_2 (g/L). Thus, a three layered feed forward back propagation neural network with 12 neurons in the hidden layer was built to give the optimal results on efficiency of sonocatalytic degradation. ANN predicted high accuracy which R^2, MSE and MAE value were 0.996, 0.3109 and 0.07885, respectively. It was also revealed that the ANN model was provided excellent predictive performance by giving the highest value of R^2.

***Keywords*:** Artificial neural network, Modeling, Caffeine, Sonocatalytic degradation, CeO_2

SIIC006

A REVIEW OF POLLUTANT'S INTERACTIONS ONTO CARBON NANOTUBES IN WASTEWATER TREATMENT USING DENSITY FUNCTONAL THEORY

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Abstract: Due to the abrupt developments in industrialization and urbanization, various pollutants especially heavy metals and organic pollutants are largely found in the wastewater system. The removal of the pollutants in aqueous solution by using carbon nanotubes as adsorbent has become a popular topic in research studies. However, the theoretical study regarding on determination of the interaction mechanism between carbon nanotubes and wastewater pollutants have never been reviewed. In this study, a review of interactions between pollutants in wastewater and carbon nanotubes using density functional theory method are provided. The objectives of performing this study are to summarize the differences of density functional theory (DFT) method in different wastewater system and describe the mechanism of interactions of pollutants in wastewater onto carbon nanotubes (CNTs) surface using DFT method. Two significant methods have been carried out in the study. Firstly, the relevant literature from online database is collected and filtered by using the following keywords: "quantum mechanics method" OR "density functional theory (DFT)" OR "interaction mechanism" AND "carbon nanotubes (CNTs)" AND "pollutants". Secondly, the useful content in selected literature was tabulated by extracting information based on some research questions. Based on the findings, the wastewater pollutants that studied using DFT consist of heavy metals such as zinc (II), mercury (II), lead (II) and chromium (VI) and organic pollutants likes phenols, reactive blue dye, methylene blue, acridine orange dye and anthracene. Whereas, the carbon nanotubes found in the DFT studies are pristine SWCNTs and functionalized SWCNTs likes carboxylic functionalized CNTs and amidoamine functionalized CNTs. The common interaction mechanism found between the carbon nanotubes and organic pollutants are van der Waals interaction, electrostatic interaction, π- π interaction and hydrogen bond. Meanwhile, the interaction found between carbon nanotubes and heavy metal are electrostatic attraction, coordination bond and complexation interaction. The DFT method that are widely used is B3LYP method and split valence with diffusion and polarization basis set such as 6-31+G and 6-31++G (d.p). From the findings, the DFT computational method is proven to be a great tool in providing the insight of the nature of the adsorption of wastewater pollutants onto carbon nanotubes.

***Keywords*:** DFT, Quantum mechanics, Interaction mechanism, Carbon nanotubes, Wastewater pollutants

SIIC007

TENGKU NUR NAZIHAH BINTI TENGKU ENDUT

SIIC008

EVALUATION OF AIR POLLUTION IN MALAYSIA BASED ON HAZE PHENOMENA FROM 2000 TO 2019 USING SATELLITE DATABASE

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Abstract: Air pollution in Malaysia based on haze phenomena from year 2000 to 2019 by using satellite database was evaluated. Haze phenomena is a phenomenon that happened almost every year in Malaysia. Usually, the pollutants emitted from haze were based on API readings that was provided by DOE using API. For this research work, satellite database was collected to compare the correlations between ground-based data and remote sensing data. The satellite database used was from GIOVANNI which was a portal that accommodates multiple satellite sensors that provides various parameters which some of them were haze pollutants concentrations (PM2.5, SO2, CO, Ozone). The study areas selected for both ground-based and satellite database collected were at Sarawak and Sabah as some of the hazardous and worse haze pollutant concentrations values are at these study areas. For data analysis, linear regression analysis was conducted between ground-based data and remote sensing data to find out the correlation and relationship of the model. The linear regression analysis was done using Microsoft Excel and from that analysis, R and p values were obtained to find out how strong the correlation coefficient and statistical significance of the linear models. The R value ranged from weak, moderate to strong relationship while all the p values obtained are below 0.05 which meant that the analysis was statistically significance. The factors that contributed to haze phenomenon was also investigated by collecting meteorological data such as wind speed and surface temperature and it can be concluded that both factors have an inversely proportional relationship with haze pollutions.
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***Keywords*:** haze, giovanni, remote sensing, air pollution index, $PM_{2.5}$.

SIIC009

PRODUCTION OF BIODIESEL FROM PALM FATTY ACID DISTILLATE : SIMULATION STUDY

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Abstract: Palm fatty acid distillates (PFAD) is one of the new alternatives feedstock to produce biodiesel. It is a common residue found in palm oil refinery as it is a low value byproduct formed from the oil palm industry. It is high in free fatty acid (FFA) with palmitic acid and oleic acid as the major components. PFAD mainly used in soap industry, animal feed industry and in a manufacture of candles, cosmetics and toiletries. To produce biodiesel or fatty acid methyl ester (FAME), the PFAD is react with alcohol by esterification reaction. Production of FAME from PFAD gain the attention of the world and many experimental works on it but lack in simulation studies. Thus, this study aims to conduct a simulation study on esterification reaction of PFAD with methanol and to determine the optimum condition such as temperature and molar feed ratio of methanol to oil via sensitivity analysis by using ASPEN PLUS V8.8. The data need is obtained from the experimental works and previous study. The process flow diagram to produce biodiesel by reacting PFAD with methanol acquire from previous study and the sensitivity analysis done by varies the temperature and molar feed ratio of methanol to oil from 110^{o}C to 200^{o}C and from 1:1 to 6:1, respectively. At the end of the simulation, the result shows that at temperature of 170^{o}C and molar feed ratio of methanol to oil is 2:1, the FAME percent content achieved until 80%. The result indicates that PFAD is a potential feedstock that can be utilize to produce high value products such as biodiesel. On this basis, it is recommended that future studies focusing more to increase the FAME percent content by PFAD by using another simulation software as alternative.

Keywords:biodiesel, palm fatty acid distillates, fatty acid methyl ester, simulation.

SIIC010

REMOVAL OF Cr AND Zn USING $AgNP_S$ / TiO_2 NANOCATALYST

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Abstract: Presently, water pollution is increasing by years. Water pollution is occur when there is pollutant or foreign substance contain in the water that decrease the quality of water and become toxic to living organism. One of the major causes that lead to water pollution are heavy metals. Heavy metals is the toxic substance even though at low concentration that can cause adverse effect. The objective of this research are to synthesis and characterize of titanium dioxide nanotubes (TNTs) decorated with silver nanoparticles (AgNPs) and to evaluate the removal of zinc and chromium ions by using the TNTs / AgNPs catalyst with different contact time and initial concentration of Cr and Zn ions. In this research, the TNTs were prepared by using anodisation process at constant 60 V for 20 minutes and by using EG / NH_4F / K_2CO_3 as electrolyte. Besides, the AgNPs were prepared by using salt reduction method with chemicals $AgNO_3$, *K. brevifolia* extract and NaOH. Next, the TNTs / AgNPs were prepared by using wet impregnation method. Lastly, the removal of chromium and zinc ions were remove by putting the TNTs / AgNPs into each different concentrations which are 5 ppm and 10 ppm. Furthermore, the characterization of the, TNTs, AgNPs and TNTs / AgNPs were done by using Field Emission Scanning Electron Microscopy (FESEM), and Energy Dispersive X-ray Analysis (EDX) and for zinc and chromium ion removal were analysing it by using Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES). From the result obtained, TNTs / AgNPs has high efficiency for the removal of Zn ions since the percentage removal of 5 ppm and 10 ppm were 90.81% and 37.16% for Zn ions while percentage removal of 5 ppm for Cr ions was 9.53% respectively. Apart from that, the performance of Zn ions removal by using TNTs / AgNPs are better compared to Cr ions removal under visible light condition.

***Keywords*:** Silver nanoparticles, Titanium dioxide nanotubes, *Kyllinga brevifolia* extract; Photocatalyst; Heavy metals

SIIC011

COMPARATIVE STUDY FOR OPTIMIZED ALKALINE PRETREATMENTS FOR PRODUCTION OF REDUCING SUGAR FROM VARIOUS TYPE OF BIOMASSES

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Abstract: Lignocellulosic biomass is a renewable source that can be found plentifully that contribute to a global yield of up to 1.3 billion tons in a year and is an appropriate raw material that can be used in numerous applications for human sustainability. It is mainly consisting of cellulose, hemicellulose, and lignin, which are strongly associated with each other. The aim of pretreatment for lignocellulosic biomass is to break down the complex structure of biomass and to provide better accessibility to the components to be converted into useful reducing sugar, thus becoming a crucial step in a extensive range of applications mainly for biomass to energy, fuels and other useful materials. However, a main obstacle is the removal of strong and uneven lignin component which is highly unaffected to solubilization and is also a major inhibitor for hydrolysis of cellulose and hemicellulose. This has led to wide research in the development of numerous pretreatment processes. The major pretreatment methods are physical, chemical, and biological methods. Thus, alkaline pretreatment is the essential stage in production of reducing sugar from lignocellulosic biomass. The optimization of alkaline pretreatment by using Design Expert software is required to attain the optimum value for the variables affecting the pretreatment to get high conversion of reducing sugar. The total reducing sugar was determined by using DNS method. The data for comparative between of optimized alkaline pretreatment using various type of alkaline reagents for production of reducing sugar is obtained from previous studies or research. Different types of biomass have different optimum conditions for pretreatment and different types of alkaline reagents used also influenced the production of reducing sugar.

***Keywords*:** Lignocellulosic biomass, alkaline pretreatment, optimization, reducing sugar.

SIIC012

LEACHING OF PRECIOUS METALS FROM WASTE PRINTED CIRCUIT BOARDS WITH DIFFERENT LEACHING REAGENTS

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Abstract: Electronics is the biggest and fastest-growing manufacturing sector in the world. The global production of electronic waste is increased 3-5% each year due to the lifetime of electronic devices is continually minimized. Waste printed circuit boards is one of the electronic wastes. The recovery of precious metals inside printed circuit boards is necessary to prevent the depletion of natural resources. This study was carried out to evaluate various leaching reagents for precious metals. The alternative leaching reagent must be identified to replace the conventional method of leaching which is cyanide leaching. This is due to the toxicity of cyanide solution. Since the use of cyanide as a liquid solution has contributed to serious water contamination in different metal recovery plants worldwide, this serious problem is to be solved by using more environmentally friendly leaching agents as alternators for the leaching process. SALSA method which is part of systematic literature review (SLR) is used to collect, synthesize, and analyze data. A total of six leaching reagents are identified and presented collectively in this review paper. There are several studies were considered to assist with the choice of non-cyanide reagents for the precious metal leaching. The environmental effects of leaching should be taken more attention to evaluate the best leaching reagent in order to develop an environmental friendly leaching for the recovery of precious metal from waste PCBs. A critical comparison of six leaching reagents is analyzed based on screening and scoring method. This method compared the total of six alternatives of leaching reagents with selected criteria like leaching rate, reagent cost, toxicity level, corrosivity level and its reliability. From the result obtained, thiourea, thiosulfate and iodide leaching have been recommended to replace cyanide leaching more efficiently.

***Keywords*:** Electronic waste, recovery, leaching, precious metals, waste printed circuit boards.

SIIC013

FORMATION OF DIHYDROXYSTEARIC ACID (DHSA) FROM EPOXIDIZED PALM OLEIN BY HYDROLYSIS AND ITS KINETIC MODEL

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Abstract: Vegetable oil are mainly used as a raw material for the chemical industry because it is very valuable due to ability of their main components, which is triglycerides and can undergo various reactions to produce a usable product. Epoxy ring opening as known as epoxide cleavage or epoxide ring degradation occurs in the epoxidation of vegetable oils. It is essential to minimize process losses via ring opening in order to obtain good yields and high peroxide values of the epoxidized vegetable oil. DHSA has been successfully produced from palm-based oleic acid via epoxidation with performic acid or peracetic acid with the hydrolysis of the epoxide. Previous researcher patented improved process for the production of palm-based hydroxyl fatty acid (DHSA). This study is conducted to compare the latest result obtained with previous study for a better result. This research paper was conducted to investigate the effect of types of vegetable oil towards epoxidation by using palm olein, palm kernel oil and sunflower oil at optimum condition by using peracid mechanism, to determine physicochemical properties of production dihydroxystearic acid (DHSA) by DSC, XRD and TGA analysis method and to determine reaction kinetic of DHSA production based on different raw materials of vegetable oils. Experiment is conducted in FKK laboratory, molar ratio selected is 1:1:1 for OA:FA:H_2O_2. Experimental design for the epoxidation and DHSA production undergoes at temperature and stirrer speed which are 50 ^oC to 75 ^oC and 300 rpm respectively. Analitycal data need to be concern is the relative conversion to oxirane (RCO) that contain epoxy and final product is DHSA. Product characterization conducted by using pycnometer to determine densities, while X-ray Diffraction (XRD) to determine functional group and Differential Scanning Calorimetry (DSC) and Thermogravimetric Analysis (TGA) to determine thermal analysis. All the spectroscopy spectrum result verified and proved that samples contain epoxy and DHSA functional group, which is the important properties in the product sample. Further research need to be focused in the future to expand the knowledge and obtain more findings of the vegetable oil.

Keywords: Vegetable oil, Epoxidation, DHSA, Characterization, Analysis.

SIIC014

A REVIEW ON WASTE DERIVE HETEROGENEOUS CATALYST FOR FENTON-LIKE OXIDATION PROCESS

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Abstract: Fenton process is one of the most popular method used to treat organic wastewater where Fe^{2+} is used as catalyst and hydrogen peroxide (H_2O_2) as an oxidant. İn this comperative study, a waste derived heterogeneous catalyst from many type of materials such as metal waste and agricultural waste were analyse. The aims of this study is to review the potential of waste derived heterogeneous catalyst for the removal of organic pollutant in wastewater and to analyse the limitation of the potential waste derived heterogeneous catalyst for Fenton-like process. The data used in this study were the secondary sources such as online journals and articles and online books. Process parameters such as pH, catalyst dosage, H_2O_2 concentration, initial dye concentration and temperature were reviewed. From the results, catalyst derived from waste material can degrade more than 90% of the organic pollutant in the wastewater. The result also shows that the catalyst can operates at wider pH range. İnstead of using room temperature, some of the waste derived catalyst can also operates at temperature more than 40 ºC. Lastly, the used of waste derive heterogeneous catalyst can reduce the cost of operating and reduce the amount of solid waste send to the landfill. Hence, it is a good practice to save the environment.

Keywords: Fenton, waste-derive catalyst, dye, wastewater, decolourization

SIIC015

APPLICATION OF ARTIFICIAL NEURAL NETWORK TO SIMULATE PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY DURING SPONTANEOUS FERMENTATION OF *GARCINIA MANGOSTANA* PERICARP.

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Abstract: In spontaneous fermentation process and antioxidant activity in fruits, there is unpredictable nature of the spontaneous fermentation that cannot be able to predict. While Artificial Neural Network (ANN) is a model for the signal processing modelling which is appropriate for prediction to solve the problem like classification problems and predictions. The ability of the artificial neural network can do as well as human brain such as learn a new thing and adapt to the new changing of environment. ANN architecture modelling is required to solve this critical problem which is the prediction of non-linear pattern of the activities. The network is consisting of three layers which is input layer, the hidden layer and the output layer. The method use in this modelling is Levenberg-Marquardt backpropagation training function of neural network since the method is the simplest among the other artificial neural network modelling. Several trials were made by using different of transfer function which is "tansig", "logsig" and "purelin". The ANN model used NN 2-7-1 neurons in input-hidden-output layers. The model developed which is NN 2-7-1 has an acceptable generalization accuracy and capability. The predictive ability of the ANN methods by assessed the basic of the mean square error (MSE), and coefficient of determination (R^2) between the predicted values of the networks and the actual result from experimental data. the efficiencies of ANN modelling can be concluded by observed the result of MSE, and R^2. The minimum value of mean squared error (MSE) and the regression value (R-value) which is closed to 1 showed that the neural network architecture was performed with high accuracies. For total phenolic content, R= 0.99157 while for antioxidant activity, R= 0.99879 respectively. Mean squared error (MSE) showed a very good result from ANN model which is for phenolic content testing value was equal to 0.0009697 while for antioxidant activity testing value was equal to 6.89e-05. As a result, ANN modelling was effectively simulated and predicted the total phenolic content and antioxidant activity in *Garcinia Mangostana* pericarps.

***Keywords*:** Phenolic content, Antioxidant activity, Mangosteen, Artificial neural network

SIIC016

SELECTIVE REMOVAL AND RECOVERY OF GOLD AND COPPER IONS FROM AQUEOUS SOLUTION BY PKFAD-IMPREGNATED CHITOSAN

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Abstract:

Chitosan is one of the developing biosorbent that becomes main interest among the researchers since it can be used to recover various types of heavy metals in the aqueous solution. A lot of physical and chemical modification had been done toward the chitosan in order to increase its effectiveness for heavy metals recovery. In this research, the recovery of gold and copper ions from the aqueous solution has been investigated by using PKFAD-impregnated chitosan as biosorbent. The objectives are to investigate the effects of different parameters on the selective sorption of gold and copper from aqueous solution by PKFAD-impregnated chitosan and to propose suitable desorbing agents for gold and copper recovery from PKFAD-impregnated chitosan by literature review. To synthesis the PKFAD-Chitosan beads, it can be done through the impregnation method by which the viscous solution of chitosan is mixed with PKFAD. The investigated parameters for gold and copper ions recovery are pH of the aqueous solution, initial ratio concentration of aqueous solution and biosorbent dosage. Based on the result obtained, the highest percentage adsorption of Au(III) and Cu(II) can be achieved at pH = 3.24 (96.9%) and pH = 5.53 (71.1%) respectively. When the pH is increasing, the selectivity of Au(III) over Cu(II) reduced from 28.772 to 0.328. For the initial ratio concentration, it can be observed that the adsorption capacity of gold increasing from 6.66 mg/g to 30.719 mg/g with the initial ratio Au(III):Cu(II). However, the selectivity of Au(III)/Cu(II) is much lower compared to Cu(II)/Au(III) even though the concentration of Au(III) is five times higher than Cu(II). For the adsorbent dosage, the adsorption capacity were decreased for both Au(III) (13.29 mg/g to 3.94 mg/g) and Cu(II) (12.59 mg/g to 2.53 mg/g). The selectivity of gold over copper start to surpass at the adsorbent dosage 0.16 g. For the desorption process, the combination of eluents, thiourea and HCl is highly potential to recover Au(III) from PKFAD-Chitosan beads. Meanwhile, the recovery of copper can be done by using HCl, HNO_3 and EDTA that act as the eluents.

***Keywords*:** Adsorption; Modified chitosan; Desorption; Au(III) and Cu(II); Selectivity

SIIC017

SYNTHESIS AND CHARACTERIZATION OF METAL OXIDES CATALYST FOR PRODUCTION OF FAME: A COMPARATIVE STUDY

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Abstract: The accelerating growth and demands in energy consumption, together with growing environmental concerns has sparked renewed attention on the search for an alternative fuel to replace conventional diesel. At present, the pressing awareness on global environmental problem contributed by the burning of fossil fuel as non- renewable energy urge researchers around the world to perform study on biodiesel as an alternative for current world energy sources. Numerous research studies have shown the potential of the usage of heterogenous catalyst in the transesterification process for the production of biodiesel varied through various parameters. Despite the success of numerous heterogenous catalyst in the industry, mixed metal oxides catalyst continues to show its promising capability and performance in catalyzing the transesterification reaction. In this regard, this research paper presents a comparative approach of synthesis and characterization process of these metal oxides catalyst for production of FAME. The performance of these mixed oxides catalysts was reviewed through its catalytic activity under optimal condition as well as its surface area and pore volume characterization study. This review also includes the recent application of mixed metal oxides catalyst in biodiesel conversion as well its future outlook and suitability for industrial application.

***Keywords*:** Methyl ester, Biodiesel, Metal oxides, Transesterification, Heterogenous catalyst

SIIC018

COMPARATIVE STUDY OF FRAGRANCE COMPOUND FROM MANGIFERA INDICA.L BY DIFFERENT METHOD EXTRACTION

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Abstract: Mangifera Indica.L known as mangos where the genus and the family have been categorized as an Anacardiaceae. The genus Mangifera has contained several species that have edible fruit and the lower quality fruit is commonly known as wild mangos Mangifera India.L that has consisted chemical constituent include aliphatic compounds, terpenoids, flavonoids, alkaloids, coumarins, terpenoids saponins, polyphenolics, tannins, and essential oils. Mangifera Indica.L has fragrance compound or aromatic compound which it consists in more than 270 volatile compound that can be found where the sesquiterpenes and monoterpenes most abudance in these mangos. Monoterpenes compound consist limonene, β-pinene, δ-3-carene, α-phellandrene, β-myrcene, α-terpinene, α-terpinolene, β-phellandrene, (E)-β-ocimen and terpinene while sesquiterpenes consist β-caryophyllene, α-gurjunene, α-copaene, α-and caryophyllene. Three method of extraction of volatile compound would be compared such as simultaneous distillation, solid phase micro extraction and solvent extraction. These all compound have been detected and analyse using GC-MS where the fragrance compound of Mangifera Indica is identify. Simultaneous distillation–extraction (SDE) from three previous study which is total 29 compounds has been identify.The class of compound has been found were monoterpene, sesquiterpene, alcohol, aldehyde, acids and alkene. Solvent extraction have been found 19 volatile compounds of mango while Solid Phase Micro-extraction. (SPME) from previous study 21 compounds have been identify. The similarity of volatile compound identified in the three-method extraction only monoterpene such as beta phellandrene, beta myrcene, alpha thujene, δ-3-Caren, alpha-terpinene, limonene and terpinolene. The high yield extraction of Mangifera Indica.L determine using formulate after extraction from previous study. Solid phase Micro extraction has high yield extraction of volatile compound.

Keywords: Mangifera Indica.L, Fragrance compound of mango, Simultaneous Distillation, Solid Phase Micro Extraction, Solvent extraction

SIIC019

COMPARATIVE STUDY ON TREATMENT OF WASTEWATER USING VARIOUS TYPES OF NATURAL COAGULANT

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Abstract: Demand of potable water keep increasing as the population growth. Water has been used in a variety of purposes such as in industries, daily activities and drinking. However, anthropogenic activities have degraded the quality of water and turbidity becomes a major concern in treating surface wastewater. Coagulation is a simple, effective and widely practiced wastewater treatment method. Chemical coagulant conventionally been used in treating turbid wastewater but it may pose adverse effect on human health and environment as well as producing voluminous toxic sludge. This review paper was conducted to determine the potential of natural coagulant to work as effective as chemical coagulant and analyse the coagulation parameter that effect the coagulation activity. A systematic literature review (SLR) which is SALSA method is used to identify, collect, synthesize and analyse data. A total of 10 plant-based coagulant and waste material are determined and demonstrated collectively in this review paper. FTIR spectrum result has verified that natural coagulant contains carboxyl and hydroxyl group which is the important properties in coagulating and flocculating. Turbidity removal efficiencies were verified to be remarkbly affected by solvent extractions, pH variations and coagulant dose. Most of fruit peels showed to effectively reduce turbidity using sodium hydroxide (NaOH) as solvent extraction and some of plant-based coagulant worked successfully using distilled water due to plant's active component was water-soluble protein. İn this review, most of studied natural coagulants required low dosage to achieve high removal turbidity which was in the range of 0.03-1.0 g/L. Some coagulant can effectively work either in highly acidic or alkaline, also in both or neutral pH. Overall, plant-based coagulant and waste material can potentially behave as chemical coagulant in treating turbid wastewater.

***Keywords*:** Natural coagulant, Water treatment, Turbidity removal, Coagulation parameter

SIIC020

SYNTHESIS AND CHARACTERIZATION OF BEIJING GRASS MEDIATED SILVER NANOPARTICLES

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Abstract: Biosynthesis of silver nanoparticles appear as a new alternative approach that is important in utilizing the green source of mother earth. The biomediated silver nanoparticles were synthesized using Beijing grass, an attentive plant that were used by ancient people mainly for medication purpose. The Beijing grass extract were made using spray dried Beijing grass powder using hot extraction method. The effect of silver nitrate concentration as precursor and reactant volume ratio on the synthesis of silver nanoparticles were studied. All samples then proceeded to UV-Vis analysis to verify the formation of nanoparticles. Generally, as preliminary conformation, the color changes on the solution indicated the formation of the silver nanoparticles. Based on the result obtained, 5 mM of silver nitrate at volume ratio of 5ml: 5ml of silver nitrate to BGE were chosen as the most optimum reaction condition for synthesis of silver nanoparticles. Even though silver nanoparticles have all the benefits, it still poses toxic characteristic as silver nitrate is a hazardous substance. Hence, the toxicity of the silver nanoparticles should be assess first by performing cytotoxic test before proceed to any broad applications. Lastly, in this report, comparative study on cytotoxicity of silver nanoparticles on living cells were emphasized.

***Keywords*:** Biosynthesis, Silver Nanoparticles, Beijing Grass, Volume Ratio, Cytotoxic

SIIC021

PRODUCTION OF BIO-COAL FROM DUCKWEED BY DRY TORREFACTION

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Abstract: Dry torrefaction is a thermal process that convert biomass into a coal-like material. It is a process of heating of biomass in the absence of oxygen to a temperature of typically 200 to 300 °C. This process does not only used to improve the structure of biomass, but increases its calorific value and energy density. Duckweed has become a popular prospective source of biomass, because it has high proportion of cellulose and starch and low lignin content, which becomes an ultimate choice because it requires minimum pretreatment compared with other biofuels feedstocks such as pine woods, bamboo and corn cob. This study focused on determining the optimum operating condition for dry torrefaction of duckweed in order to transform into bio-coal and reviewing the fuel properties such as moisture content, higher heating value (HHV), O/C ratio, H/ C ratio and solid yield of bio-coal derived from duckweed. The series of experimental work of torrefaction process was conducted with constant residence time which is 60 minutes. The effect of temperature and flowrate of nitrogen as carrier gas was studied. The torrefied duckweed was analyzed using high heating value (HHV), proximate analysis and ultimate analysis. From the experimental result, severe torrefaction (400 °C) does not suitable for duckweed torrefaction due to very low solid and energy yield. Thus, 300 °C was chosen as the most suitable dry torrefaction temperature. Although the impact of nitrogen flow rate as carrier gas is uncertain, nitrogen supply of 90 ml/min was chosen as the optimum carrier gas used in duckweed torrefaction because it records the highest HHV at all temperature variations.

***Keywords*:** Renewable energy, thermal conversion, torrefaction, duckweed, biocoal

SIIC022

COMPARATIVE STUDY OF CHEMICAL CHARACTERISTIC OF WASTE COOKING OIL BIODIESEL SYNTHESIZED VIA NOVEL METHOD

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Abstract: Biodiesel is a great alternative of clean fuels and energy and has already received great attention due to spike in demand. Biodiesel is a petroleum diesel substitute and one of the favorable source of biofuels due to its biodegradability and environmental compatibility. The chemical characteristic of Waste Cooking Oil biodiesel novel method was evaluated. The objective of this research is to compare synthesized biodiesel from waste cooking oil and to characterize the properties of biodiesel from different transesterification variables. The properties is to be compared with fuel quality standard which is standard ASTM D6571 and European Norm EN-14214. One Step Transesterification and Two Step Transesterification was compared with molar ratio alcohol to oil, reaction temperature and reaction time as parameter. Different online library such as Science Direct and Google Scholar is used to gather relevant articles for the comparison. The result from the collected articles is compared to the quality standard and the best quality of fuel is to be determined. The study found that the optimum condition for One Step Transesterification to produce biodiesel with high yield is at 6:1 molar ratio of alcohol to oil, 65 ℃ reaction temperature and 120 min reaction time. While for Two Step Transesterification the optimum condition to produce biodiesel with high yield is at 6:1 molar ratio of alcohol to oil, 25 ℃ reaction temperature and 60 min reaction time. and the best quality of biodiesel in regards low acid value and iodine value. The study also found that One Step Base Catalyzed Transesterification produce the best quality of biodiesel in regards of high cetane number and low saponification value while The study also found that Two Step Acid-Base Catalyzed Transesterification produce the best quality of biodiesel in regards of low acid value and low iodine value.

***Keywords*:** Characteristic, Waste Cooking Oil, Biodiesel, Transesterification, Biodiesel Standard

SIIC023

HAZARD IDENTİFİCATİON AND RİSK ASSESSMENT IN ACADEMİC LABORATORY

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Abstract: In Malaysia, laboratory work, practical work as well as practical work-related experiment usually are carried out in a student-oriented laboratories as it is more comprehensive. In this paper, a systematic literature review on hazard and risk assessment was conducted to to discuss on hazard and to address the various control measure to overcome or eliminate the hazard in academic laboratory. A total of 64 publications on the hazard and risk assessment in academic laboratory were identified from Scopus, IEEE, Google Scholar, and manual searching. The 9 selected journals were reviewed and integrated. 44% discussed on specified hazard which is chemical and electrical and 56% discussed on non-specified hazard. 43% used qualitative, 36% semi- qualitative and 21% quantitative method. Based on reviewed paper, there are various types of hazard can be found in academic laboratory hemical, physical, biological, electrical, and psychosocial. Several avenues for future research are identified to advance and make progress in this field.

***Keywords*:** hazard identification, risk assessment, academic laboratory

SIIC024

COMPARATIVE STUDY ON FABRICATION OF MODIFIED COTTON FABRIC FOR OIL/WATER SEPARATION

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Abstract: Oil spill has become a significant water pollution all around the world. The oil particles that spread throughout the entire column of the water bodies would pose a great threat to human beings and the surrounding environment. Many conventional methods have been done in overcoming this problem. However, those conventional methods like floatation, combustion and skimming is hassle, time-consuming, expensive and would bring harmful effects to environment. Instead of cleaning out the oil spill, more problems come out and harming the environment. For that reason, absorbent material like cotton fabric has attracted a great attention scientifically due to its simplicity, cost-effective and availability. However, cotton fabric has its own shortcoming where it absorbs water and oil simultaneously due to its poor hydrophobicity surface. Therefore, fabrication of selective wettability of cotton fabric where it only absorbs oil while repelling water that has high potential in separating oil from water is needed. An approach has been made in fabricating a modified superhydrophobic cotton fabric with SiO_2 and TiO_2 nanoparticles via sol-gel method. With this modification, the cotton fabric will able to absorb oil and repel water at the same time. Hence, better separation of oil from water. This article conducts a critical state-of-the-art review in fabrication of modified cotton fabric for oil/water separation using different types of material; TiO_2 and SiO_2. In this study, different range of papers have been collected and is then distributed properly into eight different method in modifying the cotton fabric; dip coating, wet chemical deposition, electro assisted chemical deposition, spray coating, sol-gel, chemical etching, plasma processing and polymer grafting. The collected papers were reviewed by published journal, different parameters applied and characterization devices used by the previous studies. From the comparative study, it shows that the most used method by previous researchers in synthesizing nanoparticles is sol-gel method with 45.83% since the process is simple and convenient. The surface morphology and water contact angle were studied and compared by using Scanning Electron Microscope (SEM) and contact angle devices (CA) from different researches. The oil/water separation efficiency were investigated and most of the studies achieved at least 97% separation efficiency.

***Keywords*:** superhydrophobic, sol-gel, silica and titanium dioxide, cotton fabric, oil/water separation

SIIC025

EVALUATION OF CARBON DIOXIDE EMISSIONS IN MALAYSIA'S HIGHLANDS USING AIRBORNE REMOTE SENSING

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Abstract: Environmental issue is one of the serious issues affecting the ecosystem. Release of CO2 emissions is really important that need to be considered. Most of spatial region at highlands in Malaysia were affected due to the excessive release of CO2 emissions and many changes occur such as air temperature and atmospheric moisture changes. In this study, the relationship between several factors affected by the CO2 emissions and the CO2 concentration itself will be considered. However, some previous study shows that the CO2 emission forecasting is hardly being considered on multiple factors. Therefore, the Grey Relational Analysis approach was proposed in this study to investigate the correlation between multiple factors and CO2 emission. In order to analyse statistically, the data of the two factors need to be collected within various highlands in Malaysia and in this case, satellite database remote sensing will be used in observing the temporal of highlands in Malaysia. The satellite database remote sensing that suitably used for the collection of the data is Giovanni. It is one of the satellites databases that can be used for multinational purpose as it is one of the useful technologies used in order to discover the earth region. Furthermore, after getting all the various raw data from Giovanni remote sensing database, Grey Relational Analysis will be used in this study as an approach for multiple – criteria decision making. The comparison between the multiple factors shows that the proposed method has higher accuracy compared on forecasting method. Thus, the studying in satellite database remote sensing in analysing CO2 emissions in Malaysia's highlands can be proved in this study.

Keywords: Grey Relation Analysis, Carbon Dioxide Emission, Giovanni, Airborne Remote Sensing, Highlands

SIIC026

COMPARATIVE STUDY ON SYNTHESIS AND ACTIVITY OF METAL OXIDES CATALYSTS FOR PRODUCTION OF FAME VIA TRANSESTERIFICATION OF OILS

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Abstract: This paper reviews on the synthesis and activity of metal oxides catalyst for production of fatty acid methyl ester (FAME) via transesterification of oils. Transesterification process requires the presence of catalysts to react vegetables oils with methanol. Heterogeneous catalysts become the most prefer catalysts to be used due to the least problems to the overall reaction. Heterogeneous catalysts also can promote the best conditions to the operating systems compare to homogeneous catalyst and enzymes. However, catalytic activity of heterogeneous catalysts such as mixed metal oxides, sulphated metal oxides and sulphated zirconia can be influence by its reaction conditions. Paper gives a brief introduction on transesterification process and detailed review on the heterogeneous catalysts. It found that reaction conditions such as catalyst loading, reaction time, reaction temperature and methanol to oil molar ratio can give significant impact on the catalytic activity of the catalysts and thus, influence production of FAME. In addition, the effect of catalyst synthesis conditions such as calcination time, calcination temperature and metal ratio can give impact towards the catalytic activity and the FAME content. The work of many researchers on the effect reaction conditions and catalyst synthesis conditions based on various catalysts are reviewed, compared, and discussed.

Keywords: Metal oxides, Heterogeneous catalyst, Transesterification, Biodiesel, Methyl ester

SIIC027

CHARACTERIZATION OF SnO_2 BY HYDROTHERMAL TREATMENT AND ETHANOL GAS SENSING PROPERTIES ANALYSIS

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Abstract: Tin(IV) oxide SnO_2 is a semiconductor material with a wide bandgap energy (3.6 eV). It is particular interesting, because it has high a thermal and chemical stability and high surface to-volume ratio. This study was carried out to analyze the data of SnO_2 nanostructured which was prepared *via* hydrothermal treatment at different heat treatment duration (6, 12, 18, and 24 hours) under constant temperature, 180 °C. The effect of different heat treatment duration on the structure, size and morphology was investigated by X-ray diffraction (XRD), Ultraviolet-visible spectroscopy (UV-vis), Field emission scanning electron microscope (FESEM), and Fourier-transform infrared spectroscopy (FTIR). It was found that the formation of SnO_2 nanorods for all sample grew into closely packed flower-like nanostructures. The diameter of the SnO_2 nanorods reduced from 43.30 to 24 .96 nm for heat treatment duration at 6 to 24 hours, respectively. In second part of study, the best prepared SnO_2 sample was tested on ethanol gas at different operating temperature (200 °C -450 °C). The highest sensor response (R_o/R_g ~ 1645.265) was obtained at temperature 450 °C. Therefore, the operating temperature with the highest sensor response was selected as the operating temperature.

***Keywords*:** Hydrothermal, tin oxide, heat treatment duration, ethanol gas sensor, operating temperature

SIIC028

COMPERATIVE STUDY:SYNTHESIS OF BIODIESEL FROM WASTE COOKING OIL USING ONE-STEP AND TWO-STEP OF TRANSESTERIFICATION METHOD

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Abstract: Fuel demand is growing while the fossil fuels, cause their degradation and increasing their market value in the world. Climate change and air emissions caused by burning of fossil fuels face the problem with increase the greenhouse effects. So it created by the use of the fossil fuels, the focus had been paid to biodiesel production as alternative way to petrodiesel. Biodiesel is an eco-friendly synthetic diesel fuel that derived from renewable energy generated from the vegetable oil, animal fats and waste cooking oil. The present biodiesel processing process is the transesterification method of the inedible oil with the addition of alcohol and the presence of catalyst to faster the rate of reaction. The transesterification reaction mechanism is highly sensitive to parameters and oil quality such as free fatty acid (FFA) content, density, kinematic viscosity, acid value and flash point. Others parameters that involved in the reaction are temperature, alcohol to oil ratio, concentration catalyst, and reaction time. This research attempts to carry out a comparative study of the transesterification methods (one-step and two-step) for the production of biodiesel from waste cooking oil. The optimum parameter for one-step base catalyzed transesterification is temperature at 60˚C with the concentration 1.013 wt.% KOH and molar ratio methanol to oil 6.5:1 for 20 minutes reaction time. For two-step acid base catalyzed transesterification, this method will handled at temperature 60˚C with the molar ratio 10:1 and concentration H_2SO_4 at 1.0 wt.% for 1 hour 5 minutes the response time.

***Keywords*:** Waste cooking oil, One-step base catalyzed transesterification, Two-step acid base catalyzed transesterification, Biodiesel and Yield of biodiesel

SIIC029

DEGRADATION OF CATALYTIC EPOXIDATION OLEIC ACID PALM OIL BY IN SITU PERFORMIC ACID

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Abstract: The world consumption of raw material has been change from a non-renewable material into a renewable material. The study on the epoxidation has also changed in a much cos-effective and a greener product which is safer than the non-renewable material. The increasing study of vegetable oil has been in demand. The study of a greener epoxidation by using vegetable oil to produce an eco-friendly epoxide is also increasing. Epoxidation of oleic acid was carried out by in situ performic acid to produce epoxidized oleic acid. Since epoxide ring is highly reactive, the degradation of the oxirane was tested by using hydrogen peroxide, formic acid and water. The degradation of the epoxide is mainly focus on the production of DHSA. Therefore, the study on degradation of the epoxide is lacking. Analysis by using FTIR, NMR and X-ray Diffraction are conducted to know the characterization of the degradation product. As a result, the degradation is highly effective in an acidic condition such as hydrogen peroxide and formic acid which lead to a formation of side products such as diol and α-glycol (carboxylic acid). Then, the kinetic rate, k parameters obtained by using an ODE45 function on MATLAB software is k_{11}= 6.6442, k_{12}= 11.0185, k_{21}= 0.1026, for epoxidation palm oleic acid, and k_{41}= 0.0021, k_{51}= 0.0142, in degradation process. The minimum error of the simulation is 0.0937.

***Keywords*:** palm oil, epoxidized oleic acid, oxirane ring, degradation, kinetic rate

SIIC030

HIRARC ON WASTE DISPOSAL AT TEACHING AND LEARNING LABORATORY AND SAFETY PRACTICES AMONG LABORATORY STAFF

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Abstract: Teaching and learning laboratories provide academic assistance in all subject areas which often generate many types of hazardous wastes such as chemical waste, biological/ regulated medical wastes, sharps and laboratory glassware. Proper laboratory waste disposal management as well as safety practice, is significant to maximize safety and minimize environmental impact. This study is initiated to identify the current and potential hazards, to estimate the risk and to propose control measures for waste disposal process at teaching and learning laboratory in UiTM Cawangan Pulau Pinang based on Hazard Identification, Risk Assessment and Risk Control (HIRARC) model. Furthermore, this study also assesses the safety practices on waste disposal of the laboratory staff as well as the individual risk estimate on the hazard at teaching and learning laboratory. The hazard was identified by using hazard checklist, workplace inspection and interview session with the laboratory staff. The risk assessment was carried out for each of the hazard identified and the risk level was determined based on severity and likelihood of occurrence. A questionnaire with a sample size of 50 was distributed among laboratory staff to assess the knowledge and safety practice on the waste disposal process in the laboratory which was analyzed using SPSS. A total of fifty-seven important hazards were identified in the waste disposal process. The HIRARC result shows that 51% of the hazard are of medium risk followed by high risk and low risk at 30% and 19% respectively. This shows that the waste disposal process can be considered as risky to the laboratory staff. Majority of the hazards are chemical hazard at 47%, physical, 30%, biological, 16 % and ergonomics at 7%. High risk was associated with chemical and biological hazard. Control measures should be applied to eliminate or reduce the risk especially for high risk activities. This include engineering control, administrative control and PPE. Safety practices among laboratory staff were acceptable but some improvement are needed in the area of chemical waste management which can be enhanced by providing more education and training for laboratory staff.

***Keywords*:** HIRARC, Teaching and learning laboratory, Laboratory waste disposal, Hazard, Risk assessment

SIIC031

3 DAYS AHEAD PREDICTION OF DAILY AVERAGE CONCENTRATION OF PM_{10} USING REGRESSION TREE APPROACH

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Abstract: The air pollution in Malaysia are always fluctuated throughout the year. This is corresponding to the growth of industrial area and emission from vehicle. These episodes had indirectly significant impact on the air quality of Malaysia. Hence this study aims to study the trend and predict the 3 days ahead of daily concentration of PM_{10} by using IBM SPSS and rapidMiner Studio respectively. The station is located at Jerantut, Pahang as it is significant to the centre of Peninsular Malaysia. As for the trend, air pollution hourly, monthly, and yearly monitoring records from 2004 until 2017 were used in analyzing the statistical data analysis. There are eight parameters were selected in this study which known as PM10, CO, SO2, NO2, O3, relative humidity (RH), temperature (T) and wind speed (WS). The results obtained for the trend shows that it is higher reading of PM_{10} in June until September every year due to the factors are usually coming from the neighbouring country and wind direction projectile to Malaysia. For the prediction, the results obtained for Root Mean Squared Error are 10.164, 13.853, and 13.281 respectively for day 1, day 2 and day 3. As for absolute error, the results obtained are 5.893, 8.268, and 9.052 respectively for day 1, day 2 and day 3. The results also indicated that dispersion of PM10 in Malaysia were significantly affected by temperature, wind speed and relative humidity.

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***Keywords*:** PM_{10}, Regression Tree, Root Mean Squared Error, Absolute Error, rapidMiner Studio

SIIC032

COMPARATIVE REVIEW ON EXTRACTION OF ANTIOXIDANT FROM HIBISCUS ROSA SINENSIS BY USING NATURAL DEEP EUTECTIC SOLVENT

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In this Final Year Project (FYP) entittled Comparatıve Revıew on Extraction of Antioxidant From Hibiscus Rosa Sinensis by Using Natural Deep Eutectic Solvent is focusing on the comparative review from the previous articles regarding to the topic. The objective of this project is to compare the extraction method on antioxidant from the plants to be applied to Hibiscus Rosa Sinensis species from the various previous articles avalaible. Besides, it is also to suggest the best method on extraction of antioxidant component for Hibiscus Rosa Sinensis plant. There are various types of antioxidants extraction techniques from plants that are used in many studies. In the study by Selvamuthukumaran and Shi in 2017, they divide the extraction method into conventional and non-conventional extraction. In conventional extraction, there three process approach which are soxhlet extraction, maceration, hydrodistillation. In non-conventional method, it can be divided into Ultrasound-assisted extraction (UAE), Pulsed electric field (PEF) extraction and Enzyme-assisted extraction. All of the methods have its own effectiveness based on different properties to be compared. It cannot be compared into a specific range based on the specific properties. However, it is found that there is widely usage of conventional solvent in the industry. With the continues consumption and large amounts of these volatile and hazardous organic solvents may yet effecting the pollution to the environment and unacceptable residues in extracts. So, by using Deep Eutectic Solvent (DES) which a non-conventional solvent is the most recommended due to the green technology and sustainability. It also green, eco-friendly, sustainable and low cost solvents that can be used as the new alternative in extraction technology the many fields.

SIIC033

CATALYST DEACTIVATION ANALYSIS ON Cu/Zn/Al/Zr CATALYST IN METHANOL SYNTHESIS VIA CO_2 HYDROGENATION REACTION

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Abstract: Global warming issue had become most challenging issue which believe due to the increasing of greenhouses gases mainly CO_2 that gradually increase the global temperature. Hence, the conversion of CO_2 gases to value-added chemical and fuel received a significant attention. In this regard, the hydrogenation of CO_2 in methanol synthesis was one of the effective strategies in utilization of CO_2 emission. Though, due to the complexities that associated with CO_2 high stability, the stability/activation of CO_2 into methanol becomes one of challenging issues. Also, the loss over time of catalytic activity of heterogeneous catalyst had been a significant concern in operation plant and has been studied for many industrial catalytic applications. Thereby, this research highlights the recent effective investigation in prepare and characterize a single formulation of multi-metallic Cu/Zn/Al/Zr catalyst. Also, to evaluate the deactivation behavior of Cu/Zn/Al/Zr catalyst during methanol synthesis via CO_2 hydrogenation reaction. The deactivation behavior of co-precipitated Cu/Zn/Al/Zr catalysts has been studied over 48h of reaction that associated to their performance in methanol by CO_2 hydrogenation reaction. In synthesis of methanol process, the conventional Cu/Zn/Al/Zr catalyst system typically prone to the sintering and coking. Nevertheless, the prove of this deactivation behavior was presented based on the chemical and physical characterization of these catalyst system. The characterization of the fresh and spent catalyst using BET indicated that the Cu particles sites been blocked which decreased surface area of the catalyst sample after the performance testing. Next, TPR analysis shows that the spent catalyst reduction peak area was shifts to a higher temperature which 354.21 ^oC, it is mainly illustrated the Cu reducibility becomes weaken which decrease of the Cu dispersion and H_2 consumption after the reaction takes place. Thus, the result shows that coking is the predominant cause of deactivation of catalyst. In addition, based on the mechanism reaction hydrogenation of CO_2, the catalyst system proved that it undergone a deactivation process by carbon deposition.

***Keywords*:** CO_2 hydrogenation, Methanol synthesis, Deactivation, Cu/Zn/Al,Zr

SIIC034

COMPARATIVE STUDY ON PHYTOCHEMICAL PROPERTIES, ANTIBACTERIAL AND ANTIOXIDANT ACTIVITIES OF DIFFERENT SOLVENT EXTRACTS OF MEDICINAL PLANTS

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Abstract: The present study was undertaken to evaluate the phytochemical properties and to study the antibacterial and antioxidant activities of different solvent extracts (ethanol, methanol, water and hexane) of medicinal plants. 12 medicinal plants were selected and the presence of bioactive compounds (flavonoid, terpenoid and alkaloid) were analyzed. Both evaluations of antibacterial and antioxidant activities were based on the detection of zone of inhibition and the detection of antioxidant activities by different solvent extracts,respectively. The selected medicinal plants for this study were *Euphorbia wallichii, Hypochaeris radicata, Boerhaavia diffusa* Linn, *Tinospora cardifolia, Eclipta alba, Heliotropium bacciferum, Crotalaria pallida, Hibiscus sabdariffa, Lantana camara, Sida rhombifolia, Cirsium wallichii,* and *Pogostemon benghalensis.* The results of phytochemical properties evaluation showed that water extract have the highest percentage of bioactive compounds (24.11%) followed by ethanol (22.77%), methanol (19.2%) and hexane (11.61%). In both of antioxidant and antibacterial activities evaluations, the trend went to hexane < ethanol < water < methanol for the detection of antioxidant activities and detection of zone of inhibition, respectively.

***Keywords*:** Phytochemical, Antioxidant, Antibacterial, Medicinal plant, Solvent extract

SIIC035

REMOVAL OF LEAD AND COBALT USING SILVER NANOPARTICLE IMMOBILISED TITANIUM DIOXIDE NANOTUBES

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Abstract: This study is conducted to synthesis the silver nanoparticle (AgNPs) and immobilization on titanium dioxide (TiO2) nanotubes. Evaluation of TiO_2/AgNPs catalytic activity is performed in work to eliminate Co and Pb heavy metals. In order to achieve the objectives, several scopes need to be study .The preparation of AgNPs by salt reduction method. The reducing agent and metal precursor in this study are K. Breivifolia leaves and silver nitrate respectively. The factors that need to be consider are pH at 6, temperature where it is in a room temperature and the concentration of reducing agent and metal precursor. Preparation of silver nanoparticle (AgNPs) immobilized titanium dioxide (TiO_2) nanotubes as a substrate by anodisation method. Ti wire will be used as anode and platinum electrode as cathode. The electrolyte for anodisation are 97 ml of ethylene glycol, 0.3 g of ammonium fluoride (NH_4F) and 3 ml of 1.0 M potassium carbonate (K_2CO_3). The parameters is the voltage which it is kept constant at 60V for 20 mins. Preparation of for the TiO_2/AgNPs nanocatalyst by wet impregnation method. Catalytic analysis will be performed using the TiO_2/AgNPs nanocatalyst to extract lead and cobalt ions. The lead and cobalt were prepared at different initial concentration which are 5, 10, 15 ppm. Percentage of Pb and Co removal on TiO2/AgNPs increases with increasing in contact time. The maximum removal of 5 ppm Co is at time contact of 210 min which is 26%.

***Keywords*:** heavy metals, lead, cobalt, titanium dioxide nanoparticles

SIIC036

SYNTHESIS OF SILVER NANOPARTICLES USING PLANT EXTRACTS

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Abstract: This review is a comprehensive contribution in a field of green synthesis, characterization and antibacterial activity of silver nanoparticles (AgNPs) using various plant sources. Green synthesis of AgNPs is an environmentally friendly synthesis methods which is becoming more and more popular in field of nanotechnology, with the aim is to avoid hazardous byproduct. Other important advantages of green synthesis of AgNPs lies in its cost effective and in the abundance of raw materials. Use of plants in synthesis of AgNPs among all other green method available is preferred due to their various metabolites which not only act as reducing but as stabilizing or capping agents. Characterization of the synthesized AgNPs performed through TEM, SEM and AFM were comparatively analyzed for their size in term of nanometer and their shape. Besides, the clinically significant of the AgNPs conferring the antibacterial activity by studied against some pathogenic gram-positive and gram-negative bacteria and some pathogenic fungus. This can conclude that due to these unique properties, AgNPs will have a key role in many of the nanotechnology-based processes. This review will help researchers to develop novel AgNPs based drugs using green technology.

***Keywords*:** green synthesis, silver nanoparticles, plant extract, characterization, antibacteria

SIIC037

OPTIMIZATION OF CATALYST ELEMENTAL COMPOSITION AND REACTION PARAMETERS FOR METHANOL SYNTHESIS ON Cu/Zn/Al/Zr CATALYST

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Abstract: Catalytic hydrogenation of methanol involves metal catalyst with its operating reaction parameters such as temperature, pressure, and space velocity. In this report, higher operating conditions is consider to obtain higher selectivity of product yield as well as determining the conversions of carbon dioxide with the appearance of active catalyst, Cu – based. The experimental of methanol synthesis will be carry out to characterize a different composition of multi – metallic catalysts consist of Cu/Zn/Al/Zr and also to optimize the catalyst elemental composition as well as reaction parameters for methanol synthesis via CO_2 hydrogenation. The catalyst were synthesized from its metal nitrate with its ratio by co – precipitation (CP) method. CP method includes the stages of precipitation, drying, and calcination process to get metal solid catalyst. The catalyst then characterize with BET surface area and Temperature Programme Reducibility (TPR) techniques. Response Surface Methodology (RSM) using Minitab software analysed the multiple data in order to obtain one set optimum parameter of methanol synthesis. The parameter involved were temperature of 200°C – 300°C, with a pressure range of 10bar – 50bar and the conversions of carbon dioxide at 10% - 30%. The data were collected at 10,000h^{-1} of gas hourly space velocity. This kind of technique is to ensure that all parameter and values covers the boundary of sample. The best catalytic performance of the reaction parameters for methanol synthesis were optimized at the temperature and pressure of 281.11°C and 45.56bar with appropriate conversions at 0.2857 and 0.2661 respectively. The optimum graph has been expressed from the Response Optimizer.

***Keywords*:** Optimization, Methanol synthesis, CO_2 conversion, Response Surface Methodology, Minitab software

SIIC038

A COMPARATIVE STUDY ON CHARACTERIZATION OF LIGNOCELLULOSE BIOMASS AFTER USING CHEMICAL PRETREATMENT METHODS

(TIMES NEW ROMAN, 14 FONT SIZE, BOLD, ALL CAPS, CENTERED)

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Abstract: Agricultural industry is one of major contribution in Malaysia's economy which produce tremendous biomass resourcess, contain any organic matter. This known as a lignocellulose biomass, the most abundantly renewable resourcess on Earth. Lignocellulose biomass is compose a biological polymer namely lignin, hemicellulose and cellulose, which associated with each other by covalent and hydrogen bond. Therefore, the structure of lignocellulose biomass is highly recalcitrance and almost completely unavailable for conversion into commercial products. Thus, the chemical pretreatment which is acid and alkaline pretreatment methods is one of the strategies to desruption of lignocellulose structure. The aim of this study is to determine the effect of characterization and compare the strusture of lignocellulose biomass after chemical pretreatment methods. Sodium hydroxide for alkali pretrreatment and sulfuric acid for acid pretreatment was chose, has the greater effective to enhanced lignocellulose structure. After both pretreatment was done, the physical and chemical structure can be observe. The results of disruption is to enhace the structre by increasing the accessibility of cellulose and also degrade hemicellulose and lignin content. Based on cheractrerization of lignocellulose structure, acid pretreatment is mainly remove hemicellulose succefully while alkali pretreatment is degrade a lignin structure and partia;y remove hemicellulose. Futhremore, the comparison of chemical structure on lignocellulose biomass is observed after done the SEM and FTIR analysis. 4% of sodium hydroxide pretreatmet shown more destruption compare to 4% of sulfuric acid it is because the the degradation of lignin structure lead to hemicellulose removal and enhance the cellulose structure.

***Keywords*:** Lignocellulose biomass, chemical pretreatment.

SIIC039

A COMPARATIVE STUDY ON CHEMICAL CHARACTERISTICS OF WASTE COOKING OIL BIODIESEL SYNTHESIZED USING NANOHYBRID CATALYST WITH LOW METHANOL-TO-OIL RATIO

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Abstract: Biodiesel is considered among the developed biofuels as a promising replacement for fossil diesel, which can minimize greenhouse gas and pollutant emissions. Biodiesel fuel, which is non-toxic, biodegradable and considered as renewable resources can be produced from new or used vegetable oils and animal fats. Due to the decreasing trend in economic oil reserves, environmental problems triggered by the use of fossil fuel, and the price of petroleum products that costing a bomb on the global market, biodiesel production from waste cooking oils (WCO) for diesel substitute is particularly important. Enormous quantities of waste cooking oils (WCO) and animal fats are available worldwide, particularly in developed nations. The present review paper briefly cover the effect of different process conditions, type of catalyst used, low methanol-to-oil molar ratio (<6), reaction time, the chemical component which includes flash point, pour point, cloud point, acid value, cetane number and the optimum process condition for the waste cooking oil (WCO) biodiesel production. The recent advancements involving nanohybrid catalyst for enhancing the overall quality of biodiesel have been discussed. In conclusion, all the catalyst investigated in this present review paper shown the positive result where the quality of the biodiesel produced meets the ASTM D6751 standard. Graphical representation in this present review paper shows that among all the catalysts investigated in this present review paper, the Na_2SiO_3 has great potential to be used as a low-cost catalyst in waste cooking oil (WCO) biodiesel production.

***Keywords*:** Waste cooking oil, Biodiesel, Methanol-to-oil molar ratio

SIIC040

SYNTHESIS AND STUDY ON PREPARATION METHOD AND CHARACTERIZATION OF MIXED METAL OXIDE CATALYST FOR FAME PRODUCTION: A COMPARATIVE STUDY

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Abstract: Studies relating to fatty acid metyl ester(FAME) have gained much interest in recent year due to the demand for eco-friendly energy resouce to replace petroleum. The common process to produce FAME is transesterification of vegetables oil/fats in the presence of the catalyst either homogenous or heterogenous catalyst. Homogenous catalyst is widely acceptable for their fast reaction, however the impact from the aqueous quenching lead to high cost and application of heterogenous catalyst has given attention by most of the researchers. The heterogenous catalyt, mixed metal oxide has known as excellent catalytic activity because of the increasing basic or acid sites and directly give high yield. In this review, the preparation method such as co-precipitation, impregnation and sol-gel been compared on their effect to the FAME yield. It is discussed in detailed how the preparation method effect the catalytic activity of the catalyst. In the comparison, co-precipitation method is the most frequently used and give better performance of the catalyst. Furthermore, characteristic of mixed metal oxide such as crystalline structure, morphology, surface area and functional group were also reviewed using various characterization method like X-ray diffraction (XRD), scanning electron microscope (SEM), brunauer–emmett–teller (BET) and fourier transform infrared spectroscopy (FTIR) respectively. This characterization necessity also relating to the catalytic activity. Catalytic activity is a function of its specific surface area, surface area, base strength and base site concentration. For active transesterification process, the characteristic of catalyst is high specific surface area, strong base strength, and high concentration of base sites. In this review, the comparison between metal mixed oxide has being made to review the effect of method and characterization

***Keywords*:** Fatty acid methyl ester, transesterification, heterogenous, mixed metal oxide, characterizarion

SIIC041

DYNAMIC ACCIDENT MODELLING TO IMPROVE RISK ANALYSIS IN THE CONTEXT OF BHOPAL INDUSTRIES

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Abstract: Chemical industries are complicated and dynamic to handle. Dynamic characteristics could include inspection time interval, ageing of components in plants and other dependent criteria can influence dynamic processes. The conventional risk assessment could measure dynamic changes in processes but only in limited capacity. Hence, it is significant to develop method for time-dependent effects to predict the probabilities failure rates for components in plant with time. In this study, dynamic risk assessment has been developed a technique based on Bayesian network (BN). BN is a structure optimal which organize cause-effect relations and dynamic BN capture change variables over time. This study proposed to develop dynamic accident modelling to improve risk analysis in the context of Bhopal industries, estimating dynamic probabilities of accident sequences which includes incident data and also updating in real time the risk estimation. A case study on Bhopal disaster was provided to illustrate the application of the method. A MIC gas leakage scenario in the plant was quantified through identifying hazards through fault tree analysis. It has been observed that the developed method was able to provide updated probability failure of different components with time. In this study, Bhopal cases would be illustrated the mapping procedure of FT into BN and to identify factors to have significant influence on an event occurrence. Therefore, the finding showed a method for dynamic risk assessment which enable of providing updated probability of event occurrences through failure rates, considering sequential dependencies with time. In other hands, dynamic characteristics could reduce cost of inspection, downtime and other maintenances. The possibilities of failure rate values for components tend to increase with time. But with maintenance work were done on equipment in every one year, then possibilities of failure rates become decreases and low possibilities of breakdown. This Bhopal disaster and its problem were studied to demonstrate the effect of sequential; dependency of one component on another component contributes to the risk. It could be concluded that with the increases in year of inspection interval, the probability of top event, MIC gas released to the surrounding.

***Keywords*:** Dynamic, fault tree, Bayesian network, Bhopal disaster, Genie software.

SIIC042

FARRIS AQIL BIN MOHD HAFIZAL

SIIC043

KU MUHAMMAD SYAMIL BIN KU AZIF

SIIC044

SYNTHESIS AND CHARACTERIZATION OF PKFAD-IMPREGNATED CHITOSAN AS POTENTIAL SELECTIVE BIOSORBENTS FOR

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Abstract: A new PKFAD-Imperegnated chitosan as a biosorbent was synthesized for the gold and copper sorption from the aqueous solutions. In this reseach, the adsorption capacity of Au (III) and Cu (II) from the aqueous solution on newly developed biosorbent PKFAD-impregnated chitosan beads were evaluated through batch experiments. The PKFAD-İmpregnated chitosan beads were synthesized into two ratio, which are chitosan: PKFAD (1:1) and chitosan: PKFAD (5:3). The sorption experiment is conducted by different value of Ph which is from ph 3, 3.5, 4, 4.5, 5 and 5.5. The sorbent used in the adsorption experiment is 0.1g. The characteristics of chitosan-based biosorbent were reviewed in order to predict the characterization PKFAD-Impregnated chitosan beads. The analysis including the BET, SEM and FTIR spectroscopy of chitosan-based biosorbent were reviewed in order to predict the characterization PKFAD-Impregnated chitosan beads. The maximum adsorption capacity of Au (III) obtained is 9.11 mg/g (98.65%) which is in the ratio of chitosan : PKFAD (1:1). The maximum adsorption of Cu (II) is 8.677 mg/g (87.65%) which is in the ratio of chitosan : PKFAD (1:1). The selectivity (Au (III) / Cu (II)) is higher at a low value of pH for both ratio (1:1 & 5:3). The maximum selectivity (Au (III) / Cu (II)) is 55.633 which is in the ratio of chitosan : PKFAD (1:1). The results show that the PKFAD-İmpregnated chitosan beads were efficient biosorbent for removal gold and copper in aqueous solutions.

***Keywords*:** PKFAD-Impregnated chitosan; Gold; Copper; Recovery; Adsorption

SIIC045

BIOSYNTHESIS OF ZINC OXIDE USING BANANA LEAVES: STRUCTURAL AND OPTICAL CHARACTERIZATION REVIEWS

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Abstract: Nanotechnology as call as nanomaterials are the widely scope of study and application of extremely nano in size can be used related to all the other science fields. Zinc Oxide (ZnO) material notify that it is valuable material in terms of properties, criteria, applications and mechanisms. The characterization of ZnO NPs has been study by using a few instruments to identify a kind of parameters. There are XRD, FT- Raman, Photoluminescence (PL) and SEM are used. The biosynthesis of NPs ZnO use is much better and affordable because the process provide more ecofriendly, economical, free toxic, and easy to compose rather than chemical and physical methods. The objective of this study are to synthesis ZnO NPs by using zinc salt likes zinc nitrate hexahydrate as precursors for the structural quality, stability, optical and surface morphology by biological method and to characterize the nanoparticles of ZnO using banana leaves by different concentration of zinc nitrate hexahydrate by using different analysis equipment. The process of preparation of ZnO NPs is preparation of the banana leaves extract, synthesis and purification and characterization of optical and surface morphology. SEM shows the characteristic of ZnO NPs where hexagonal morphology, agglomerate nanocrystallites and spherical shaped nanoparticles. The structure of crystallizes zinc oxide nanoparticle in three different forms which is hexagonal wurtzite, cubic zinc blende and cubic rock salt. The average particle size is calculated using Debye - Scherrer equation around 29.45 nm. XRD analysis confirm that the purity of ZnO nanoparticles. PL studies showed UV emission peak at 392 nm and broad band visible emission centred in the range 300 - 800 nm. Annealing temperature and concentration of extract cause the PL intensity. FT-Raman showed optical phonon as a function of particle size where are 92.5 cm^{-1} (E_2L), 180.77 cm^{-1} (2TAM), 313.23 cm^{-1} ($2E_2M$), 403.04 cm^{-1} (E_1TO), 565.12 cm^{-1} ($E_2H + E_2L$). The size of crystalline particles change depends on the phonon or vibrational mode due to volume of particles. Phonon Confinement Model (PCM) and Elastic Sphere Model (ESM) is functionally for identify vibrations of a uniform isotropic sphere and confined phonons of the crystalline solid.

***Keywords*:** nanotechnology, zinc oxide, biosynthesis, banana leaf, characterization

SIIC046

A COMPARISON STUDY OF DIFFERENT ACID PRETREATMENT TECHNIQUE ON THE REMOVAL OF LIGNIN AND REDUCING SUGAR PRODUCTION FROM DIFFERENT BIOMASS

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Abstract: Lignocellulosic biomass included rice husks, corn cobs, oil palm, sugarcane bagasse, and bamboo is one of the abundant organic resources in most Asian countries. It basically consists of three fractions, cellulose, hemicelluloses, and lignin. With that, pretreatment steps are required to make each fraction available for further use. This study was designed to compare the efficiency of sulphuric acid, H_2SO_4 and hydrochloric acid, HCl pretreatment on the removal of lignin, and total reducing sugar (TRS) production from different biomass. Determination of lignin removal by using Kappa Number and reducing sugars by 3,5-dinitrosalicylic acid (DNS) method was used. The input variables for each sample consisted of acid concentration, temperature, and solid loading in the range of 1% - 10%, 45˚C - 180˚C, and 1:1-1:10, respectively. The highest lignin removal is pretreated corn cobs that reduced to 90% lignin removal from 0.074g to 0.0085g/g after pretreatment. Process optimisation gave reducing sugar yields of 0.0751 and 0.096 g/L (rice husks), 24.7 and 81.8 g/L (corn cobs), 1.81 and 2.7 g/L (oil palm), 3.67 and 89.4 g/L (sugarcane bagasse), 0.319 and 0.93 g/L (bamboo) for H_2SO_4 and HCl pretreatments respectively. The maximum TRS yield reported about 89.4 g/L, sugarcane bagasse, because the ability of HCl to permeate the lignocellulosic biomass more easily compared to H_2SO_4 pretreatment methods. The highest percentage of cellulose (corn cobs, 90.4%) was also observed with the HCl model. Besides, the optimised HCl pretreatment showed high efficiency at releasing reducing sugars from pretreated biomass.

***Keywords*:** Lignocellulosic biomass, pretreatment, Kappa Number, lignin removal, reducing sugars

SIIC047

CHARACTERISTIC STUDY OF PSAC ADSORBENT MODIFIED WITH METAL OXIDE NANOPARTICLES FOR H_2S REMOVAL

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Abstract: The focus of this research is to synthesised the metal oxide nanoparticles impragnated on PSAC and to study the effects of the adsorbents on removal of H_2S. Metals oxide nanoparticles was synthesised via alkaline precipitation method. The metal oxide nanoparticles that was synthesised were CeO_2, NiO, CuO, and Fe_2O_3. The metal oxide nanoparticles were undergoes SEM analysis, EDX analysis and TGA analysis. İt was found that the average size of the CeO_2 is 66.5 nm, NiO is 91.46 nm, CuO is 91.26 nm, and Fe_2O_3 is 37.17 nm in the SEM analysis. İn the TGA analysis, it was found that the calcine temperature of these metal oxide nanoparticles for remove impurities in the metals oxide nanoparticles were CeO_2 is 250℃, NiO is 450℃, CuO is 300℃, and Fe_2O_3 is 600℃. The synthesised metals oxide were impregnated in the pre-oxidised PSAC adsorbents (Ce/PSAC, Ni/PSAC, Cu/PSAC and Fe/PSAC). These adsorbents were undergoes FTIR analysis. İn this analysis the adsorbents shows the present of graphite groups, carbonyl group, alcohol group, carboxyl group and also free element. These adsorbents also were study the effects of different metal oxide nanoparticle impregnated on PSAC for removal of H_2S. İt shows that different metals oxide nanoparticles impregnated on PSAC shows the different the breakthrough time and the adsorption capacity of the adsorbent. Based on the result of the sorption, the metals oxide nanoparticles impregnated on PSAC adsorbent is more efficient than raw PSAC adsorbent. İt shows that Cu/PSAC has the higher adsorption capacity (86.60 mg H_2S/g Cu/PSAC) and breakthrough time (80 minutes) than raw PSAC which has adsorption capacity 2.85 mg H_2S/g raw PSAC and the breakthrough time is 3 minutes.

***Keywords*:** Metal Oxide Nanoparticles, Palm Shell Activated Carbon (PSAC), TGA analysis, FTIR, H_2S application

SIIC048

ADSORPTION OF COPPER IONS FROM AQUEOUS SOLUTIONS BY MODIFIED ALGINATE BEADS

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Abstract: The performance of modified polyphenolic alginate bead on their ability to adsorb copper ions in water was studied. The aim of the study is to determine the effect of tannic acid content on the modification of immobilized alginate beads for copper ions removal, evaluate the effect of pH, initial concentration and adsorbent dosage on the heavy metal removal and study on the adsorption kinetic and isotherm model. The experimental works started with the preparation of immobilized alginate beads and modification of immobilized alginate beads by tannic acid. Then, batch adsorption process and the characterization of the samples were conducted. Based on the result, the removal amount of Cu^{2+} ions increase from the pH solution of 2 to 7 where the amount of metal uptake increases from 0.003 mg/g to 1.457 mg/g and reach optimum. From 0.50 g of the adsorbent dosage used, the amount of metal ions adsorbed achieved about 0.69 mg/g and it increases gradually 1.007 mg/g at 2.0 g dosage and the dosage tended to be constant. The adsorption quantity of Cu^{2+} is 0.029 mg/g for initial concentration for 1 ppm of the solution and it increases to 0.906 mg/g when the initial concentration of the solution is 10 ppm. The kinetic and isotherm model for this study were Pseudo first-order kinetic model and Langmuir isotherm model respectively based on the better linear plot and correlation coefficient R^2 value.

***Keywords*:** Alginate, Tannic-acid, Immobilization, Copper, Adsorption.

SIIC049

COMPARATIVE STUDY OF SURFACE MODIFICATION ON REDOX PROPERTY OF CEO_2 AND CEO_2 BASED CATALYSTS

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Abstract: Cerium oxide (CeO_2) are used in a variety industrial applications process and CeO_2 based materials have been used in environmental applications due to its potential to reverse or block environmental damage and reduce the emission of toxic pollutant. The significant influences on CeO_2 performance depend on the surface properties of materials which can develop the transition between Ce^{3+} and Ce^{4+} ions. The controllable regulation on their surface features such as surface defects is an efficient approach to intensify their catalytic activity. However, surface properties of CeO_2 are challenging to be modified as their behavior depends on the synthetic methods. The method to adjust the surface properties and improve CeO_2 catalytic performance is a multistep process involving a lot of parameters. The objective of this review study is to identify the best technique used to regulate the surface defects of CeO_2 catalysts based on its redox properties by referring several articles related such as pressure regulation and annealing temperature, chemical doping, and post-treatment. The results of measured oxygen storage capacity (OSC) from TPR and Ce^{3+} concentration from XPS analysis will be analyzed. The existence of oxygen vacancies and their transportation in the crystal cell of CeO_2 is very influential as it also led to the generation of Ce^{3+} species. Thirteen articles were used as the main references to identify the measurement of OSC and Ce^{3+} concentration produced from those techniques. Based on the previous studies, the pressure regulation and annealing temperatures has increased the OSC measurement by 67.24% and 60.25%. For chemical doping technique, it showed that Ce^{3+} surface fraction had increased by 25.8%. The post-treatment technique had also increased the Ce^{3+} surface fraction by 13% in the presence of reducing/oxidizing agents. In conclusion, the comparison on relative measured OSC or Ce^{3+} surface fraction with catalytic efficiency for each technique has been done and it showed that the performance of the catalytic activity obtained the highest efficiency with 96.5% by using post-treatment compared to other techniques. Hence, the best technique to modify the surface of CeO_2 is post-treatment in the presence of reducing/oxidizing agents.

***Keywords*:** Cerium oxide (CeO_2), OSC, Ce^{3+} concentration, XPS, TPR

SIIC050

THE EFFECT OF pH AND DOSAGE COAGULANTS TO OPTIMISE PERFORMANCE OF SELECTED NATURAL AND CHEMICAL COAGULANT IN WASTEWATER: A COMPARATIVE STUDY

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Abstract: Developing countries and third world countries are facing potable water supply problems because of inadequate financial resources. The cost of the water treatment process might be higher due to the unsuitable parameter used during the coagulation, flocculation and sedimentation process. Therefore, this study was conducted to determine the effect of pH and coagulant dosage of turbidity in wastewater and to determine the optimum pH and dosage of the selected natural and chemical coagulant. Methodology of this comparative study including the data collection, data review and data analyzed. Throughout the process, the database basically used like Science Direct and Springer. Meanwhile, source of the data comes from journal, books, thesis and website. In order to analyze the parameter, common method was identified and being use for all parameter. pH analysis was conducted by adjusting the pH value using HCI and NaOH until getting the desired pH value wheatear acidic, neutral and alkali. Dosage coagulant usually analyzed using jar test operation. As a finding for the natural coagulants, the best pH was at 7-7.5 since the better result of colloidal particle occur at neutral condition. Among seven natural coagulant, Orange Peels has a better result since its required 0.2 mg/L with removal efficiency at 97%. The optimum pH value for chemical coagulant same goes to the natural coagulant since three chemical coagulant shows the better result among the other six coagulant. It is because the colloidal particle can be further stabilized and lead to floc growth at neutral condition. Polyaluminium chloride (PAC) shows the better result for the chemical coagulant since its pH at 7, dosage coagulant required at 19 mg/L with removal efficiency at 90.5%. Higher dosage in chemical coagulant can result higher in sludge volume. Thus, PAC shows the better performance for the chemical coagulant since it optimum condition shows the better ones compared to other chemical coagulants.

***Keywords*:** pH, dosage coagulant, coagulant performance, wastewater.

SIIC051

INVESTIGATION OF MODIFIED ALUMINA FOR REMEDIATION OF CONTAMINATED OIL: A REVIEW

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Abstract: Increases in human population and industrial activity unavoidably have produced large volume of oily wastewater and increased in demand for clean water. The performance of conventional methods in wastewater treatments showing insignificant effect as its drawbacks to the environment such as large volume of sludge produced and high cost of reagents. However, adsorption by alumina have shown a promising potential to be developed as new material for wastewater treatment attributed by its modifiable surface area and high sorption capacity. Sol-gel method is highlighted as the modification route for materials' morphology and topography due to its simplicity. In this review, data for the effect and performance of modified alumina sucrose templated via sol-gel method is collected, analyzed, compared, and predicted. Review discovered that surfactants does affect material porosity and alumina templated with sucrose demonstrated to have high porosity and predicted to have better removal performance compared to non-modified alumina. A technical study for the performance of alumina sucrose templated in removing oil is suggested to be conducted in further study for more solid proof.

***Keywords*:** Alumina, Sucrose, Adsorption, Oil removal, Sol-gel method

SIIC052

A REVIEW ON THE PHYSICOCHEMICAL PROPERTIES OF PEROVSKITE AS CATALYSTS FOR WATER AND WASTEWATER TREATMENT

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Abstract: The main objective study of this report is to review the physico-chemical properties of perovskite catalyst in water and wastewater treatment by using Advanced Oxidation Process (AOP) method to treat the organic contamination effluent from industry that uses organic components or elements by generated highly oxidizing hydroxyl radicals (HO.). The general formula of perovskite catalyst is ABO_3 where A-site is a type of rare earth metal while B-site is a transition metal such as Mg and Ni respectively. The perovskite catalyst has been applied as heterogenous catalyst which help to degrade the organic effluent under dark ambient conditions. This comparative study compares the performance of catalytic activity of perovskite catalyst based on its physicochemical properties. The scope of work on overall paper determine the percentage of degradation of organic pollutants which correlated to the perovskite's physicochemical properties. The research methodology used the data collection and analyzed them in the previous study to fulfill the research on the study by putting together all notable related journals, past studies and research works done. This study explains the details and understanding of the fundamental correlation of physicochemical properties of perovskite catalyst performance on the metal compound. Therefore, the study of perovskite catalyst is analyzed by using scanning electron microscopy (SEM), Transmission Electron Micrographs (TEM), X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA) and Texture profile analysis (TPA). The perovskite catalyst gives major impact on different A-site and B-site element on the characterization results. It was found that the percentage of degradation organic pollutants by using the perovskite catalyst under dark ambient condition is more than 50% degradation. The perovskite catalyst characterization shows on previous study that it is stable under the oxidative conditions and their thermal stability was better for the possible used on organic wastewater treatment.

***Keywords*:** Perovskite catalyst, Catalyst characterization, Advanced Oxidation Process, Heterogeneous catalyst, Wastewater treatment.

SIIC053

ARTIFICIAL NEURAL NETWORK: PHYSICO-CHEMICAL AND MACRONUTRIENTS PARAMETERS IN AN AQUAPONIC SYSTEM

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Abstract: Aquaponics system which integrates conventional aquaculture and hydroponic in one closed loop system plays a significant role as an alternative way to produce very least waste effluent to the environment by recycle back the nutrients (fish waste) for plant growth. The parameter such as pH, DO, TAN and percent total sludge of Phosphorus (P) and Nitrogen (N) were investigated by taken the input and target data value from the selected research paper covering the fields of Aquaponic. In this study, Artificial Neural Network (ANN) involving Levenberg-Marquardt (LM) and Scaled Conjugate Gradient (SCG) training function was used to measure those parameters to obtain the predict value. For parameter pH, DO, TAN one layer with 4,6,8,10,12,13 neurons were studied. Meanwhile, one layer with 3,4,6,9,12 neurons were studied for total sludge (P and N). Different range neurons value was used for pH, DO, Tan and Total Sludge (P and N) due to diiferent input data found in literature. The outputs from the model of training function LM show the most optimum neuron number for each parameter of pH, DO, TAN at neuron 6. As for total sludge (Nitrogen and Phosphorus), the most optimum neuron number at neuron 3. For the training function SCG, the most optimum neuron number at neuron 4 for each parameter of pH, DO, TAN and at neuron 9 and neuron 4 were the most optimum neuron number for parameter Total Sludge (N and P). The result for the most optimum neuron number can be explained by the value of Sum Squared Error (SSE) Mean Absolute Percentage Error (MAPE%) with the lowest value. The investigated forecast parameters of the trained neural network according to correlation coefficient (R) and Mean Square Error (MSE) showned LM performed better rather than SCG.

***Keywords*:** Aquaponics; Artificial neural network; Physico-chemical parameters; Nitrogen; Phosphorus

SIIC054

A COMPARATIVE STUDY ON THE EFFECT OF TIN PRECURSOR CONCENTRATION ON THE TIN(IV) OXIDE NANOPARTICLES GROWTH AND THE PHOTOCATALYSIS PROPERTIES

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Abstract: An investigate on the effect of the tin precursor concentration on the tin(IV) oxide nanoparticles was carried out. The characterization data of tin(IV) oxide nanoparticles which was prepared via hydrothermal method was used in this study. The data ware obtained from Fourier-Transform Infrared Spectroscopy (FTIR), Field Emission Scanning Electron Microscope (FESEM), Ultraviolet-visible spectrometer (UV-Vis) and High Resolution Transmission Electron Microscopy-Selected Area Electron Diffraction (HRTEM-SAED). Based on SEM analysis show the morphology developed from cluster of irregular shape to nanorods structured from concentration 0.08M to 2.0M. Based on the data analysis tin(IV) oxide prepared with 0.12 shows the well formation of on dimensional nanostructure. The formation of SnO_2 can be confirm at the peak 619cm^{-1} and 490cm^{-1} from the FTIR analysis. The XRD data confirm that SnO_2 presence in the form of rutile tetragonal phase in nanorods shape with average size 18.17± 2.79 nm. The comparison was done with the use of surfactant as a templated. It is found the present of the surfactant will decrease the particle size compare to the free-based synthesis. The band gap energy increases as the concentration increases at 3.76eV, 3.77eV, and 3.84eV with the concentration 0.04M, 0.08M and 0.12M respectively. The best selected sample (0.12M) was tested on Methylene Blue dye (6ppm). The data analysis shows that about 84.75% degradation has achieve with only 15 minutes and 10% degradation was achieved at 105 minutes. The previous study also stated that the concentration of tin precursor can affect the morphology and performance of photocatalysis. At optimum concentration, the well ordered of the structured increase the surface to volume and the particles are in nanoscale also increase the surface area, hence the active sites increase more to catalytic rection to occur. Thus, the concentration of tin precursor can affect the morphology of the tin(IV) oxide and also the photocatalysis performance.

***Keywords*:** Hydrothermal method, Tin(IV) oxide, Photocatalysis, Concentration of precursor, Methlyene blue

SIIC055

SYNTHESIS, CHARACTERIZATION, AND TOXICITY OF SILVER NANOPARTICLES REDUCED BY ETHANOL EXTRACT OF BEIJING GRASS

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Abstract: Recently with the arising concern in regards with some of drawbacks from chemical and physical methods to synthesize silver nanoparticles (AgNPs), plant mediated of silver nanoparticles (AgNPs) have garnered such a considerable attention from many researchers due to their beneficial approach that are environmental in nature as well as the attractiveness of its cost-cutting approach in which the established method from chemical and physical synthesis of nanoparticles are pale in comparison to biological synthesis approach. In the present study, the ethanol extract of Beijing Grass will be act as bio-reducing agents for the synthesis of silver nanoparticles (AgNPs) in which setting reactions parameter such as concentrations and volume ratio will be observed in this research to find the optimized structure of silver nanoparticles (AgNPs).The optimum parameter was determined by varying the concentrations of $AgNO_3$ ranged from 0.5 mM, 1.0 mM, 2.0 mM, 3mM to 5 mM and volume ratio of AgNO3 /BeijingGrass extract from [9:1] to [5:5]. The as-synthesized AgNPs are then characterized using UV-vis Spectroscopy in the range of 400 nm-800 nm. The results shows a successfully synthesized via biological method by using two different parameter mentioned, where based on the UV-Visible absorption spectra, a distinguishable peak at 469 nm at optimized concentration of 2mM silver ion (Ag+) and volume ratio at 9:1 are observed. Furthermore, with the rapid proliferation of AgNPs aligned to exponential growth on increasing demand of AgNPs in many industrial sector, a review aimed to highlighting on *in-vitro* cytotoxicity effect on aquatic organism are done. Referring to SCOPUS database, there are still not enough documented paper to get a more tangible conclusion on the idea on its effect toward aquatic organism and the mechanism behind it but basing on the limited studies, a general conclusion showed that cytotoxicity of AgNPs are governed by factors such as size, shape, coating, dose and cell type.

***Keywords*:** Silver, Nanoparticles, In-Vitro, Cytotoxic, Aquatic

SIIC056

A COMPARATIVE STUDY ON THE EFFECT OF NICKEL DOPANT CONCENTRATION ON THE ETHANOL GAS SENSOR OF TIN(IV) OXIDE

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Abstract: In recent times, most countries have exposed to atmospheric pollution caused by human activities such as open burning, deforestation, and the use of vehicles. These activities produce greenhouse gases such as carbon dioxide, methane, and particulate matter, which can cause severe air pollution. To control the issue of gas emission, various types of gas sensors have been developed. One of them is tin oxide (SnO_2) as material for gas sensors. SnO_2 can be used to detect many gases especially ethanol (C_2H_5OH) gas. İn this study, an ethanol gas sensor was synthesized by a simple hydrothermal method at high temperature and then doped with different Nickel (Ni) concentration (0.5-5.0 mol%). To investigate the effect of Ni concentration of SnO_2 on the C_2H_5OH gas sensor, characterizations were conducted on the sample by using Fourier-Transform Infrared Spectroscopy (FTIR), High-Resolution Transmission Electron Microscopy (HRTEM), Field Emission Scanning Electron Microscopy (FESEM), Ultraviolet-Visible spectroscopy (UV-Vis), and X-Ray Diffraction (XRD). UV-Vis results show that the bandgap is decreasing as the Ni dopant concentration. Compared to other concentrations, 5.0 mol% Ni doping concentration recorded the smallest bandgap reading (3.80 eV). Meaning that the performance of sensing properties of the highest doped SnO_2 (5.0 mol%) is better compared to other concentrations. Besides that, from the FTIR characterization, the results showed that the peak for SnO_2 (498 and 647 cm^{-1}) were shifted to a higher wavelength as the concentration of Ni dopant is increasing from 0.5 to 5mol%. This is due to the concentration of Nickel increase, hence more Sn^{2+} ion will be replaced by the Ni^{2+}. This explains why the peak of SnO_2 shifted to the left.

***Keywords*:** Gas sensor, tin oxide, ethanol gas, nickel doped, characterization

SIIC057

A COMPARATIVE STUDY ON HYDROTHERMAL TREATMENT FOR VALUE-ADDED PRODUCT OF VARIOUS TYPE OF BIOMASS

(TIMES NEW ROMAN, 14 FONT SIZE, BOLD, ALL CAPS, CENTERED)

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Abstract: Biomass is an abundance waste in Malaysia which comes from the plant residue, agricultural waste and forestry. İt is also known as potential feedstock that can be utilized into value-added products. However, the presence of lignin in lignocellulosic biomass must be depolymerized before cellulose and hemicellulose are converted into simple sugars. Therefore pretreatment is required to alter the structure. Different pretreatment would gives different result of composition. The objective of this study was to compare the efficiency of different pretreatment on producing value-added product from various biomass. In addition, to find a low cost, efficient and enviromentally friendly pretreatment technique in producing high yield of value-added products. Basically, in this comparative study showed that percentage of lignin and hemicellulose are reduced after pretreatment. For instance, the results of pretreated bagasse with hydrothermal treatment showed 29.2% lignin from 31% and 5.4% hemicellulose from 48%. This is due to the lignin removal and hence the hemicellulose is easily hydrolyzed. However, the cellulose composition increase after pretreatment because of the solubilization of hemicellulose enhanced the enzyme accessibility of cellulose. The composition of lignocellulosic was analyzed by using the standard procedure National Renewable Energy Laboratory (NREL). The value-added product for different pretreatment does not show much difference. Hydrothermal treatment does not require any chemical or catalyst which can save cost as well compared to chemical pretreatment. Therefore, hydrothermal treatment is the most convenient method for the conversion of valuable product.

Keywords: Hydrothermal treatment, value-added product, lignocellulosic biomass, lignin, hemicellulose

SIIC058

PREDICTION OF FRUIT RIPENING BY ARTIFICIAL NEURAL NETWORK BASED ON RELATIONSHIP BETWEEN PECTIN AND IMAGE ANALYSIS

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Abstract: This research was focuses on the prediction of fruit ripening using artificial neural network. The main purposes of this study are to correlate pectin activity (data) with image analysis (image) of figs and to investigate the compatibility of Artificial Neural Network (ANN) in speculating the figs ripening behaviors (stage). Ripening stages is the stage where the fruit are ready to be harvest. During this phase, every fruit will undergo the weakening of parenchyma cell wall and dissolution of middle lamella. As the result, the figs is sweetening as its reach the final stage of its development which is ripening phase. In order to analyze the changes happened between the figs, the laboratory experiment such as extraction yield (EY), brix of sugar and degree of esterification (DE) were come in handy. Those data represent the statistical input of pectin structure. Later, the information being correlated with the figs resemblance. Those method is quantitative-typed method where it is said to have numerous limitation which would affect the accuracy of the results obtained. The limitations would be time-consuming, expensive and lack of consistency as the volume of chemical and procedure of sampling are changeable since human error are commonly to happen from time to time. Thus, the solution to those limitations is Artificial Neural Network (ANN). The models used is MLP model with back-propagation algorithms with the help of learning function of Bayesian regularization and the transfer function is tangent hyperbolic. It is found that neuron number eight is the most accurate than the others neuron number since it has a high R value which is 0.97194 and low value of MSE, RMSE, MAE and MAPE which are 9.18E-13, 9.58123E-07, 3.04E-04 and 0.03% respectively.

***Keywords*:** Artificial Neural Network (ANN), figs, fruit ripening, pectin, image analysis.

SIIC059

A REVIEW OF ISOLATION AND IDENTIFICATION OF BIOACTIVE COMPONENTS FROM *MURDANNIA* SPECIES

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Abstract: The term of medicinal plants includes a variety of plants used in herbalism and some of these plants possessed activities suitable for the medicinal area. These medicinal plants are considered as a rich resource of compounds which can be processed for drug development and synthesis. These same plants are considered important because of their source of nutrition and as a result of that these plants recommended for their potency in treating diseases and illnesses. This study consists of the review on the the bioactive components that had been identified in the *Murdannia* species as well as the methods used to isolate and identify the these bioactive compounds by using collection of relevant information, articles, journals and books by searching in various databases such as Science Direct, Research Gate, Francis and Taylor publishes, Elsevier, Sage and others. UV-Vis spectrophotometer used on *M. bracteata* identified 10% of gallic acid equivalent of phenolic compounds. GC-MS analysis were used on the research of *M. bracteata*, *M. lanuginosa* and *M. simplex*. It able to identify α-tocopherol (16.89% of hexane extract), β-sitosterol (15.19% of hexane extract) and stigmasterol (10.58% of hexane extract) in *M. bracteata*. Bioactive compounds 2-Furanone,3,4-dihydroytetrahydro (49.84% of methanol extract), 4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6methyl (22.12% of methanol extract) 1,2,3-Propanetriol, diacetate (15.77% of methanol extract) can be found in *M. lanugnosa*. Research on *M. simplex* shows the presence of salicylaldehyde, azine (74.34% of methanol extract) and diphenylfurazan N-oxide furazan, diphenyl-, 2-oxide 3,4-diphenylfurazan 2-oxide diphenylfuroxan (10.08% of methanol extract). Caffeic acid and apigenin are found in hexane extract of *M. bracteata* determined by using UPLC analysis. Ethanolic extract of *M. loriformis* shows 77 mg of 3b-O- D-glucopyranosyl-24n-ethylcholest-5-ene and 46 mg of β-O-D-glucopyranosyl-2-(2-hydroxy-Z-6-enecosamide)-sphingosine which are determined using HPLC analysis. Standard colour test commonly used for qualitative analysis. It able to determine the presence of alkaloids and steroids in ethanolic extract of *M. loriformis*, then, tannins, saponins, alkaloids and flavonoids in methanolic extract of *M. nudiflora*, and, phytosterols, alkaloids and flavonoids in ethanolic extract of M. nudiflora.

***Keywords*:** review, *murdannia*, bioactive components, traditional medicine.

SIIC060

PHOTOCATALYTIC OXIDATION OF WASTE COOKING OIL USING ZEOLITE ZSM-5 & TiO_2 AS CATALYST: A PARAMETRIC OPTIMIZATION STUDY VIA RESPONSE SURFACE METHODOLOGY

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Abstract: Waste cooking oil (WCO) are generated large scale all over the world, hence it has devised serious problems of its waste management which contributes to water pollution. There are variety of methods in order to treat waste cooking oil, which are by esterification, transesterification, recycle process and photocatalytic oxidation (PCO) technology process. PCO process is rarely used in the industries nowadays. Among all these three processes, PCO is the least applied for water treatment. It is because this process is energy saving by using UV light. This review study explores the PCO process using zeolite ZSM-5 and TiO_2 as catalyst. The aim of this study is to review on characterization of WCO and catalyst (TiO_2 and ZSM-5). Other than that, the main aim of this study is to review the optimization of reaction conditions such as pH of solution, reaction temperature, catalyst loading and type of catalyst used (TiO_2, ZSM-5) on the removal of waste cooking oil by using Response Surface Methodology (RSM). The review study presented here are based on literatures from year 2015 until present which were retrieved from databases such as Scopus, Research Gate and Science Direct. The results showed that, harmful organic molecules such as Free Fatty Acid (FFA) are contained in WCO as reviewed from Fourier-Transform Infrared Spectroscopy (FTIR) results. Brunauer-Emmett-Teller (BET) and Thermal Gravimetric Analysis (TGA) reviewed that ZSM-5 has high surface area and thermal stability which comparable to TiO_2 and other catalyst (Pt and Ag). The reviewed of various optimization studies via RSM shows that the optimum parameters are pH of solution (6-7), reaction temperature (30°C-50°C), catalyst dosage (0.1 g $100mL^{-1}$-0.3 g $100mL^{-1}$) and type of catalyst used (ZSM-5). In addition, some researcher proved that other factors such as light intensity and irradiation time are also important in PCO to treated WCO.

***Keywords*:** photocatalytic oxidation, waste cooking oil, zeolite zsm-5 & TiO_2 catalyst, parametric optimization, response surface methodology.

SIIC061

COMPARATIVE ADSORPTION STUDIES OF ALGINATE-BASED BEADS FOR DYE REMOVAL

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Abstract: Toxic dye from textile industry contain harmful constituents that effect human and environment. It can cause lung and liver cancer also interfere the ecosystem of the aquatic life. The dye can be treated by physical method which is adsorption process. Adsorption process is defined as the process where adsorbate (dye) attached to the surface of adsorbent (alginate-based beads) for removal of dye. The adsorbent particularly in solid and the adsorbate is liquid. Many types of adsorbent used to solve the dye problem, one of it is sodium alginate based in the form of immobilized beads. The alginate-based beads are modified with the present of other component such as acid and magnetic compound in order to enhance the adsorption process. The process of adsorption is increase by the surface morphology of the beads is increased to adsorb more matter. Thus, a comparative study on adsorbent alginate-based beads of the literature was conducted. The literature data on types of dyes, process parameter, and characterization studies for the process were reviewed in this work. In addition, kinetic and isotherm model were evaluated in order to observe the activity of the adsorption process. Both removal of cationic and anionic have insignificant value of initial concentration, pH and contact time as the removal of dye due to the various modification of the alginate-based beads adsorbent. The dye removal on these effects depends on presence of binding site, charge of adsorbent and active site. The adsorption of dye removal also influences by the dye functional group and modified adsorbent increase in pore size and internal surface. The isotherm and kinetic model for adsorption process dominant on Langmuir and pseudo-second order respectively.

Keywords: Alginate Beads, Cation, Anion, Surface Morphology, Surface Chemistry, Kinetic, Isotherm

SIIC062

MODIFICATION OF ZIRCONIA FOR ENHANCEMENT OF PHOTOCATALYTIC PERFORMANCE FOR HEAVY METAL REMOVAL

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Abstract: This study covers the fabrication of zirconia nanotubes modification with other material to remove heavy metal from wastewater. Zirconia has been widely studied due to its various application, chemical and physical properties. Water pollution, which is one of the major concerned in the world have gain attention of the researchers to find methods that can reduce this pollution that contain heavy metals. As heavy metals are known to have harmful effects to human, animal and environment, therefore, it is important to remove or reduced the concentration of the compound. In this study, comparative study was made based on the synthesis of zirconia nanotubes and removal of heavy metal in wastewater. Experimental work on zirconia nanotubes is doped with iron (II) sulphate heptahydrate by anodization method. This method involves the immersing of electrode in electrolyte of constant voltage. Two method of anodization were used for synthesis of ZrO_2 nanotubes. Power of 60 V was supply for the anodization process to take place with air bubbler to mix the electrolyte. The characterizations and morphologies of the nanotubes were carried out using SEM and EDX. A ring structure on the surface of the foil confirms the formation of nanotubes for 0.5 M concentration of iron solution. The removal of heavy metals were made by comparative study. Based on previous studies, high removal of heavy metal can be achieved in doping than undoped ZrO_2. Therefore, doping of zirconia with iron compound will give high rate of removal of heavy metal, thus reduced the pollution of heavy metal in water.

***Keywords*:** Zirconia, photocatalyst, heavy metal, anodization, modification.

SIIC063

DYNAMIC SAFETY RISK ANALYSIS OF WATER CHLORINATION USING DYNAMIC BOW-TIE APPROACH

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Abstract: Chlorine is one of the hazardous materials and need to be handled carefully. In water chlorination system at water treatment plant (WTP), there was potential hazard to the workers and the population nearby the water treatment plant. To identify this hazard, risk assessment is the one of the techniques that can be used to eliminate the hazard and measure the risk other than to identify the hazard. But due to the limitation of being static of conventional risk assessment, many researchers were study to update the conventional risk assessment to the dynamic risk assessment. This paper was aimed to update the conventional bow-tie analysis to the dynamic one by mapping bow-tie (BT) into bayesian network (BN) by using Genie software. Posterior probability was used to replace the prior probability in this study to update the conventional to the dynamic. Three time interval was mapping into BN to showed the dynamic failure updating by assuming lack of maintenance. To conduct this study, Kelar water treatment plant was chosen as the case study. Failure mode effect analysis (FMEA) was used to determine the potential hazard in the water chlorination system. Chlorine leakage from drum was chosen as the worst-case accident for this study of the top event to mapping the BT and BN. Besides that, to update to the dynamic one, ALOHA modeling software was also being used to determine the area concentration of chlorine emission nearby the population of Kelar WTP if there was a chlorine leakage. The worst cases of the accident was a leaking from 5 mm hole of body drum that will be affected about 15 villages nearby the Kelar WTP. By implemented this approach, the bad accident can be prevented other than can be eliminated.

Keywords: FMEA, Bow-tie, Bayesian network, ALOHA, Genie Software

SIIC064

FINITE ELEMENT SIMULATION OF MAGNETIC NANOPARTICLES AUGMENTED POLYMERIC MICROCAPSULES IN ANAEROBIC DIGESTION

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Abstract: The application of magnetic nanoparticles (MNPs) in anaerobic digestion (AD) had become adverse as it can increase the performance of AD by enhancing the production of methane. Nevertheless, magnetic nanoparticles have several disadvantages such as its tendency to agglomerate and easily oxidized in acidic condition. This study was conducted to determine the role of MNPs-Polymer microcapsules in anaerobic digestion of sludge. Moreover, it was also conducted to perform the finite element simulation of magnetic nanoparticles augmented polymeric microcapsules influence to iron concentration and diffusion of palm oil mill effluent sludge (POME) in anaerobic digestion. For the experimental setup, the MNPs-Polymer microcapsules was synthesis by using phase inversion method and the effect MNPs-nanoparticle polymer microcapsules was investigated. The iron oxide (Fe3O4) nanoparticles was localized in Polyvinylidene fluoride (PVDF) for immobilization purpose. There were 3 batches anaerobic digestion setup in which all of the digesters were filled with the same amount of sludge but the Reactor 2 (R2) was added with 2g of MNPs, while Reactor 3 (R3) was added with 58.8g of MNPs-Polymer microcapsules. The result from the experimental indicates that cumulative methane production increased to 7.5% and cumulative carbon dioxide production decreased to 74.38% when magnetic nanoparticles-polymer microcapsules were introduced to the process. However, from the simulation conducted, the methane production had decrease to 1.09% and the production of carbon dioxide had reduced to only 0.59%. Moreover, the performance of the MNPs-Polymer was determined by measuring the presence of iron in AD process. It had shown that the MNPs-Polymer microcapsules had reduce the iron content by 90.6% from the experimental analysis and 77% from the simulation analysis. As for the efficiency of the MNPs-Polymer microcapsules, it can still perform well in anaerobic digestion after 14 days.

***Keywords*:** Iron Oxide Nanoparticles, Polyvinylidene Fluoride, Microcapsules, Anaerobic Digestion, Phase Inversion, Finite Element Analysis, Simulation

SIIC065

DYNAMIC RISK MODELLING OF A CHEMICAL REACTOR BY USING ASPEN PLUS

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Abstract: Risk assessment is an important step in predicting possible threats of hazards. The objectives of this research project are to identify potential risks that could possibly occur to a chemical reactor in a dynamic environment by using Fault Tree Analysis (FTA), and to simulate and evaluate the risks of a chemical reactor in a dynamic environment by using Aspen Plus and Bayesian Network. In a dynamic situation, a conventional risk assessment is lacking in providing the information needed. Aspen Plus is one of the most leading software used in the industry as it could be used to comprehend the condition of the reactor in a faulty condition. Sensitivity analysis is simulated in dynamic condition to observe the behavior of the methanol. The highest mole flow of methanol is produced when the model is deviated to 262 bars. Threats and severity of any faulty conditions such as leakage of reactor or thermal radiation from jet fire could be predicted by using Areal Location of Hazardous Atmosphere (ALOHA). From the leakage of the reactor, a small but dense flame pocket of concentration greater than 43080 ppm is detected. A threat of potentially lethal within 60 seconds is predicted as the thermal radiation from jet fire is simulated. From the point, the area of coverage for the threat is 1.38 yards off centerline and 1.72 yards downwind. A second-degree pain is possible at off centerline of 1.21 yards and 11.2 yards downwind. Fault tree analysis could be constructed based on the model simulations as the faults that caused the risk has been determined. A Bayesian Network could also be constructed as the threats from the risk also has been determined.

***Keywords*:** Dynamic risk modelling, Aspen Plus, Bayesian Network, Areal Location of Hazardous Atmosphere (ALOHA), Fault Tree Analysis (FTA).

SIIC066

AN OVERVIEW OF CO_2 METHANATION ON SUPPORTED CATALYST

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Abstract: Rapid population growth has contributed significantly to the increasing demand for natural resources consumption. An initiative that can be made in conserving the natural resources is by CO_2 methanation that converts CO_2 to the methane gas. Catalyst plays a significant role in promoting the CO_2 methanation in achieving high methane selectivity. The catalytic activity, selectivity, stability and cost must take consideration towards the selection of suitable methanation catalyst in certain reaction conditions. The methanation catalysts that had been reviewed based on their catalytic activity are noble metal such as Rhodium and Ruthenium, Nickel and Cobalt catalyst. The noble metal catalysts such as Ru and Rh are the most active metal in group VIII which possess higher methane selectivity produced at low temperature due to its high resistance for the carbon dioxide, CO_2 oxidized to the atmospheres. Supported Rh/γ-Al_2O_3 catalyst increase the CO_2 adsorption and CO_2 dissociation compared to unsupported Rh catalyst in hydrogenation of CO_2 to methane process. The increase of Rh loading from 1 wt% to 10 wt% resulted higher methane selectivity in the process. The co-precipitated of zirconia dioxide support resulted the greater CO conversion in 20 wt% Ni/ZrO_2 catalyst compared to sol-gel method. The different types of support were used in Ni catalyst such as CeO_2, ZrO_2, TiO_2, SiO_2, and Al_2O_3 to observed the most suitable support in low temperature process. The strong interaction between Ni and Ce support possess the highest catalytic activity based on the percentage of methane yield. The effect of support and metal loading for cobalt catalyst shows that 230 m^2/g of support Co/CeO_2 and increasing from 5 wt% to 10 wt % of Co/CNT catalyst produced higher CO conversion in the CO_2 methanation process. The addition of support and effect of metal loading has influenced the catalytic performance of the catalyst in the reaction.

***Keywords*:** carbon dioxide, methanation, noble metal catalyst, Ni-based catalyst,Co-based catalyst

SIIC067

EXPLORING THE PARAMETER FOR ALTERNATING CURRENT ELECTROPHORETIC DEPOSITION OF CARBON NANOTUBES-POLYANILINE: A REVIEW

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Abstract: CNTs-based materials have attracted many attentions for their outstanding chemical properties such as tensile strength and electrical conductivity. The CNTs-based materials can be deposited either using DC-EPD and AC-EPD techniques. This review specifically discusses the important parameter for alternating current electrophoretic deposition of CNTs – PANi. The information related to this review is obtained from previous studies from year 2000 to 2020. The parameter for AC-EPD can be categorized into two which are parameter related to suspension and parameter related to EPD process. Both category of parameter can affect the uniformity of the dispersion of CNTs. Based on previous studies, a uniform and homogenous CNTs dispersion can be obtained by using electric field more than 20 V/cm, voltage of 40 V, 50 mm distance between plate and 4 – 5 minutes deposition time. Square waveform with duty cycle of 80% can be used to deposit the CNTs as these properties are commonly used for AC-EPD. The frequency for deposition can be increased up to 10 MHz.

***Keywords*: Alternating current electrophoretic deposition (AC-EPD), electrophoretic deposition (EPD), carbon nanotubes (CNTs), polyaniline (PANi), AC-EPD parameters**

SIIC068

AHMAD NABIL ASYRAF BIN MAT TAHA

SIIC069

MODELLING OF ROTARY KILN INCINERATOR FOR THE DISPOSAL OF HAZARDOUS WASTE

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Abstract: Hazardous wastes are currently in the rise in Malaysia. Hazardous wastes are waste that could cause major health issues and pollution due to its properties such as clinical and industrial wastes. Rotary kiln incinerator is one of the treatment methods that has been established in Malaysia to handle these types of waste where the equipment incinerates these wastes to eliminate toxicants before landfilling. Incinerator modelling is a method introduced to promote a better approach on determining the flue gas composition released by the incinerator as the substitution to previous manual sampling on the actual release stack. Microsoft Excel modelling (Analytical Method) is modelled by inserting stoichiometric and thermodynamics' equation in the spreadsheet to form a fully functional rotary kiln system with the four (4) majors' components which are waste inlet, excess air inlet, fuel gas inlet and flue gas outlet that have the capability to manipulate wide properties in the model identical to the actual existing rotary kiln condition. The reliability of the model is compared with Kualiti Alam and Cenviro Johor data from their waste to energy (WTE) plants in Malaysia. Comparisons are done by determining the percentage error between actual and simulated data where Kualiti Alam and Cenviro Johor percentage errors with the model are 1.12% and 0.26% respectively. The model simulates less than 5% difference error between the actual data showing a particularly similar operating condition of an actual rotary kiln system. Addition data can be tested for further determination of the model's reliability.

***Keywords*:** Modelling, Incineration, Mass Balance, Rotary Kiln Incinerator, Flue Gas Emission

SIIC070

EXPLORING THE PARAMETER FOR ALTERNATING CURRENT ELECTROPHORETIC DEPOSITION OF CARBON NANOTUBES-POLYPYRROLE : A REVIEW

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Abstract: Carbon nanotubes (CNTs) is one of the most widely used carbonaceous materials aside from graphene and activated carbon. Electrophoretic deposition (EPD) of CNTs, especially in combination with polypyrrole (PPy), is receiving increasing attention from medical field and also electric and electronic feield. Objective of the research is to determine the important parameter for alternating current electrophoretic deposition of CNTs-PPy film formation and involves methods such as systematic review from previous journals to complete the research. The article presents a comprehensive review of the field of AC-EPD of CNTs-PPy composite by highlighting the field or operating parameters of EPD and AC-EPD (space between plate, wave frequency, deposition period, duty cycle, waveform and peak to peak voltage), the factors of suspension for EPD technique and brief factors affecting the suspension of CNTs-PPy (particle size, dielectric constant, conductivity and viscosity of suspension, zeta potential, stability of suspension and concentration of solid in suspension).

***Keywords*:** Alternating current electrophoretic deposition, carbon nanotubes, polypyrrole, parameter, suspension

SIIC071

A REVIEW ON UNSUPPORTED NICKEL-IRON CATALYST FOR CO_2 METHANATION

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Abstract: The population has accelerated growth as a result of larger consumption of resources now day. The energy consumption from carbon contain substance resulted in harmful effect to the atmosphere due to high in concentration of carbon dioxide (CO_2) and also greenhouse effect as carbon gasses emitted . the are action have been taken to control the CO_2 emission by converting CO_2 through methanation which is that a reaction between carbon dioxide with Hydrogen at exothermic condition. The main objective of this research project is to determine which catalyst combination shows the most excellent outcome of reaction. Review on X-ray powder Diffraction (XRD) and H_2 temperature Programmed Reduction (H_2-TPR) of nickel based catalyst on the dispersion and reduction of nickel particle when methanation occur. From the review, it shows that several of support effects the catalyst dispersion and reduction. Unsupported Ni-Fe catalyst show good response to the analysis but still supported Ni-Fe catalyst show more stable reaction and good conversion on CO_2 methanation.

***Keywords*:** CO_2 methanation , Ni-Fe Catalyst, X-ray Powder Diffraction, H_2- Temperature programmed Reduction, support and unsupported effect

SIIC072

AN OVERVIEW OF PHYSICAL AND CHEMICAL PROPERTIES METHOD FOR FRUITS AND/OR VEGETABLES

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Abstract: The paper reviews recent studies on the method of obtaining physical and chemical properties of fruits and/or vegetables which pointing out special characteristics of the fruits. Some of the authors describe the fruits as underutilized fruits because the species is unexposed to the public with its advantages and currently being handled manually. Additionally, the journal mostly highlighted the purposes of the fruits and/or vegetables to humans. This study aims to determine the best method of acquiring physical and chemical properties of fruits and/or vegetables to provide applicable details in order to contribute an improvement to practical information to ease machine design for handling and processing.

***Keywords*:** Method, Physical and chemical properties, improvement.

SIIC073

PREDICTION OF TOTAL MAXIMUM DAILY LOADS (TMDLs) OF POLLUTANTS IN RIVER BY USING ARTIFICIAL NEURAL NETWORK (ANN)

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Abstract: Total Maximum Daily Load (TMDL) studies are crucial in determining a pollutant reduction target and allocates load reductions necessary to the source(s) of the pollutant. Existing modelling approaches to simulate TMDL allocations of point source and non-point source pollutants typically consist of linking watershed model, receiving water transport model, and receiving water quality model. In this study, BOD, COD, SS, and NH_3-N loads for Muda River is predicted using artificial neural network (ANN). The model is developed based on historical monthly concentration data and discharge data from 2013 to 2018 provided by Department of Environment (DOE), Malaysia. These parameters were introduced as inputs, whereas TMDL as outputs of the three-layer feed-forward back-propagation ANN. The learning algorithm used is Bayesian Regularization with tansig transfer function at the hidden layer and purelin transfer function at the output layer. Here, the number of neurons tested to obtain the optimum number of hidden layer nodes is 5, 7, 9, 11, and 13, which run at different epochs: 1000, 2000, and 3000. Model performance was evaluated using mean absolute percent error (MAPE), coefficient of determination (R^2), root mean square error (RMSE), and model efficiency (E). The best model for TMDL of BOD is 6:13:1 at epoch 2000 with 0.0004% (MAPE), 1.0 (R^2), 0.0005 (RMSE), and 1.0 (E). Meanwhile, the best model for TMDL of COD is 6:5:1 at epoch 3000 with 0.00004% (MAPE), 1.0 (R^2), 0.0004 (RMSE), and 1.0 (E). Furthermore, the best model for TMDL of SS is 6:5:1 at epoch 3000 with 0.0038% (MAPE), 0.99 (R^2), 0.1 (RMSE) and 1.0 (E). Finally, the best model for TMDL of NH_3-N is 6:5:1 at epoch number 3000 with 0.0001% (MAPE), 1.0 (R^2), 9.47×10^{-6} (RMSE) and 1.0 (E). It can be concluded that ANN is an excellent modelling approach to substitute deterministic models for TMDL prediction.

***Keywords*:** TMDL study, artificial neural network (ANN), water quality parameters, bayesian regularization.

SIIC074

APPLICATION OF ARTIFICIAL NEURAL NETWORK ON THE PREDICTION OF MICROBIAL POPULATION AND SPECIES DURING SPONTANEOUS FERMENTATION OF GARCINIA MANGOSTANA PERICARP

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Abstract: In this study, an artificial neural network (ANN) was used to predict microbial population dynamics and species during the spontaneous fermentation of *Garcinia mangostana* pericarp. The study was conducted by collecting the experimental data from analysis of fermented *garcinia mangostana* pericarp and train the data by using neural network in MATLAB system. The model was developed based on trial and error at different neural network architecture, transfer function, and training algorithm. The input parameter consists of days of fermentation (0-100 days) and volume of fermenters (5 and 50 liters). The data set were trained by the artificial neural network using hyperbolic tangent sigmoid (tansig) transfer function and Levenberg-Marquardt (trainlm) training algorithm. Based on the results, the best neural network architecture for prediction of the microbial population were 2-7-7-3 (bacteria) and 2-7-6-1 (yeast), while for the microbial species was 2-5-4. The correlation coefficient (R-value) for the training performance for prediction of bacteria and yeast population showed R-value were 0.99299 and 0.9703 respectively, while for the bacteria species was 0.94244. Performance of neural network design was evaluated based on mean square error (MSE) and relative error. The result shown the MSE for the training performance for prediction of microbial population were 0.009557 (bacteria) and 0.01358 (yeast), while for microbial species was 0.1077. The average relative error for microbial population for bacteria and yeast was evaluated to make sure the accuracy of the predicted data. The relative error means the percentage of incorrect predicted data. Hence, the least value of the average relative error will be good for the neural network model that indicate the accuracy between experimental data and predicted data.

***Keywords*:** Artificial Neural Network, Fermentation, *Garcinia Mangostana* Pericarp, Bacteria, Species

SIIC075

LIGHT POWERED MICROMOTOR: SYNTHESIS, MOTION BEHAVIOUR AND APPLICATION

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Abstract: Photocatalytic micromotors or light powered micromotors have been studied intensively for the past few years for several applications such as environmental remediation, biomedicine and micropumps. In water remediation, conventional wastewater treatment has been known for its economically infeasible. Therefore, a different approach by using micromotor as the possible substitute for water remediation has been focused on. Throughout the years, a substantial number of researches has been done in the synthesis of these light-powered micromotors which revolves around its materials used, motion behavior and its applications. Hence, this paper focus on the progress of light-powered micromotors which will focus on the synthesis method, motion behavior and its applications.

***Keywords*:** light-powered, micromotor, synthesis, motion behaviour, application.

SIIC076

APPLICATION OF ARTIFICIAL NEURAL NETWORK ON PREDICTION OF MICROBIAL POPULATION AND SPECIES DURING SPONTANEOUS FERMENTATION OF CARICA PAPAYA LEAF

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Abstract: Microbial population and species during spontaneous fermentation process of *Carica Papaya* leaf was unpredictable. Therefore, the Artificial Neural Networks (ANNs) method was used in this research because of the non-linearity pattern of the experimental data obtain. The parameter involve are the day of fermentation (1-100) days and the volume of water sample used (5L and 50L) as the input. The suitable of transfer function were used which are Levenberg Marquardt (trainlm) as training function and hyperbolic tangent sigmoid (tansig) as activation function to get the best performance model. The number of hidden layers to use was maximize into two hidden layers (multiple hidden layer) and the number of neurons was specified as seven neurons where can achieved the optimum model with using of the feedforward algorithm. The parameter of the output layer as the experiment data was the microbial population and the species of the C. Papaya leaf. Lastly, determining the best performance model were referring to their lower relative error percentage with correlation coefficient (R value) approach to one and the least number of Mean Square Error (MSE).

Keywords: Artificial Neural Network, Levenberg Marquardt, Hyperbolic Tangent Sigmoid, Correlation Coefficient (R value), Mean Square Error (MSE)

SIIC077

OPTIMIZATION OF PROCESS PARAMETER IN CATALYTIC TRANSESTERIFICATION OF BIODIESEL PRODUCTION : A COMPARATIVE STUDY

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Abstract: Biodiesel is a low emission diesel substitute fuel made from renewable resources. The most common ways to produce biodiesel is by using transesterification process. The process of transesterification with the reaction of triglyceride and methanol to form the biodiesel with the aid of catalysts. The aim of this review paper is to compare the optimize reaction conditions in biodiesel production for various feedstocks and to compare the optimize of biodiesel production by using different mixed oxide catalysts. The feedstocks use in this review paper is be differentiate by two types which are edible and non-edible oil hence the comparison with biodiesel will be conducted. For the second objectives, the heterogenous catalysts are used because of their advantages that can be reused, non-corrosive and non- toxic. The heterogenous catalysts contain of two different types which are mixed oxide and mixed metal oxide catalysts. This review paper is conduct by doing a research from the previous article to analyse and get the information. The calcium oxide is the most common catalyst that use in the reaction of biodiesel. The reaction parameters used in this review paper is the reaction time, methanol:oil ratio and the reaction time. From the reaction parameters, the optimize result of biodiesel yield is be compared. The edible oil contain highest result of optimization of biodiesel compare to the non-edible. The mixed metal oxide will get better optimization compare to the mixed oxide catalyst because of the doped of metal in the mixed oxide will increase the yield of the process.

***Keywords*:** Biodiesel, Feedstocks, Heterogenous Catalysts, Tranesterification, Optimization

SIIC078

EPOXIDATION OF PALM OLEIC ACID BY USING PERACID MECHANISM AND KINETIC STUDY

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Abstract: Elaeis guineensis is a scientific name for palm oil (PO) tree is a wild plant grow that has been introduced for planting commercial plant in 1917 for economy purpose. PO consumption has been increased rapidly in the past several years as this type of oil has higher amount of saturated fat compared to other vegetable oil. The extraction of palm fruit produce epoxidized palm oil (EPO) through the chemical reaction called epoxidation. EPO has been widely used as intermediate product such stabilizer and plasticizer of polyvinylchloride, while also used as solvent to replace volatile organic solvent in paint and EPO can be classes as biodegradable as it obtained from fruit. This study is conducted since there only a few researches related to the kinetic study on organic catalyst toward palm oleic acid as palm oil exist redundantly in Malaysia. The study also can be compared to existing reseach to make a better result. This reseach paper was conducted to determine the effect of hydrogen peroxide (H_2O_2) which is 30-32%, 35% and 50% toward epoxidation palm oleic acid by organic catalyst, to determine the physico-chemical properties of epoxidation palm oleic acid and to determine reaction kinetic epoxidation palm oleic acid based on different molar ratio of hydrogen peroxide (H_2O_2) and temperature by organic catalyst. Experiment is conducted in FKK laboratory, molar ratio selected is 1:1:1 for FA:H_2O_2:OA. Performic acid is prepared *in situ* at fixed temperature and reaction time which is 60^{o}C and 35 minutes. Analitycal data need to be concern is the relative conversion to oxirane (RCO). Product chracterization conducted by using pycnometer to determine densities, while Fourier-Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD) and Nuclear Magnetic Resonance (NMR) spectroscopy to determine functional group. All the spectroscopy spectrum result verified and proved that samples contain epoxy functional group which is the important properties in the product sample. The kinetic modelling conducted using MATLAB to determine reaction rate, k the optimum condition for reaction. Overall, sample of 30-32% H_2O_2 shows the highest RCO and other characterization shows positive outcome. Further study need to be conducted in future to expand the research.

Keywords: Palm oil, Epoxidation, Concentration, Characterization, Kinetic modelling.

SIIC079

DYNAMIC RISK ANALYSIS OF CHEMICAL REACTOR USING DYNAMIC BOW-TIE APPROACH

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Abstract: Chemical reactors have been designed accordingly to the complexity of a chemical plant to support the demand of the production. Thus, a risk analysis and assessment are necessary to estimate the probability of accident to occur. A bow-tie (BT) model is used in many risks analysis studies as it covers the accident estimation including the causes and consequences. However, bow-tie model has a static characteristic hence, limiting its application in real time monitoring and risk updating. Thus, a combination of bow-tie model and Bayesian network (BN) is focused for constructing a dynamic risk analysis of chemical reactor using dynamic bow-tie approach. This study is conducted to develop dynamic bow-tie approach for dynamic risk analysis of chemical reactor by using Bayesian approach for three-bed ammonia reactor based on Uhde process dual-pressure ammonia synthesis and to compare the risk analysis method between the conventional risk analysis and the dynamic risk analysis. In this study, HAZOP is used for identifying hazard revolving around the chemical reactor. Bow-tie approach constructed the causes and consequences modelling of the reactor and Bayesian network is used for risks updating of the dynamic risk analysis through real time failure rate data. Thus, potential accident probabilities and associated risks are updated and used for risks assessment. The results of the study showed that the most likely causes of rapid increase of pressure in reactor are due to human failure, process control failure and heat exchanger failure which lead to rapid increase of reactor temperature. Once the reactor overpressure occurred, it will most likely to result in reactor shutdown and the worst-case scenario resulted in reactor rupture which could lead to explosion. Thus, priority would be given to the most probable root events and main contribution factors, which have been identified in the study, in order to reduce the occurrence probability of the worst consequences.

***Keywords*:** dynamic risks analysis, bow-tie approach, Bayesian network, chemical reactor.

SIIC080

TORREFACTION OF EMPTY FRUIT BUNCH IN A FIXED BED REACTOR

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Abstract: In Malaysia, due to the agricultures activities and some area still in natural forest had produced a largest biomass resource. Not only that, Malaysia also produced a lot of solid waste from rice husk and empty fruit bunch of palm oil because Malaysia is the second top producer of palm oil. In this study, the biomass is used empty fruit bunch as the biomass because of the abundant resources. Biomass also has a higher moisture content and lower calorific value than coal. In response the issues related to environment pollution and renewable energy such as biomass has been recognized as a solution to overcome the problem related to degradation of natural resources. In this study, torrefaction process had been introduced to increase the calorific value, lower the moisture content and also to produce a better fuel quality. Therefore, the purposed of this study are to study the effect of torrefaction temperature and holding time on the mass yield of torrefied EFB and to assess the activation energy, Ea of torrefaction process by using the Coats-Redfern method. The torrefaction of EFB was performed in a fixed-bed reactor with the particle size of EFB was varied from 250 – 500 μm and nitrogen gas act as an inert gas in the reactor and run at a ramp 50ml/min. The effect various of torrefaction temperature at 200 , 220, 240, 260, 280 and 300 ^{o}C and holding time of 20, 40 and 60 minutes on the mass yield of EFB was investigated. The results showed that temperature significantly influenced the mass yield of EFB during torrefaction. It was determined that from the mass yield decreased upon increasing torrefaction temperature. The activation energy values for EFB was 37.09 kJ/mol, 33.677 kJ/mol and 33.02 kJ/mol based on holding time of 20, 40 and 40 minutes, respectively. The torrefaction process in this study was proven that it improvise the characteristic of biomass and it was potential as solid fuel for future thermal applications.

Keywords:, Empty fruit bunch, renewable energy, torrefaction, fixed bed reactor, activation energy .

SIIC081

COMPARATIVE STUDY ON FABRICATION OF COATED MESH FOR OIL WATER SEPARATION

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Abstract: Oil pollution has become a major global issue that can cause harm to the environment. There are many conventional methods such as oil skimming, dispersant, in situ burning, however, these methods proposed certain drawbacks such as secondary pollution, expensive equipment, and time-consuming. In response to this problem, super-wetting material is introduced as an alternative. Pristine stainless steel mesh has an amphiphilic characteristic whereby it unable to separate oil/water mixture effectively. The objectives for this study are to determine the effect of different fabrication methods, towards the modification stainless-steel mesh and to evaluate the surface characteristics of superhydrophobic and superoleophilic stainless steel mesh using different characterization methods. In the review process, the main library databases cover most of the papers are Science Direct, Scopus, and Google Scholar. The types of method that have been reviewed in this comparative study are dip/immersion and spray coating method. The characterization involves in this study are surface morphology, surface composition analyses, and surface wettability. In addition, oil/water separation efficiency was conducted by using gravity-driven filtration. It is found that dip/immersion and spray coating method conducted on stainless steel meshes has a significant and distinctive result on the surface morphologies. Nanoscaled architecture with certain surface roughness on the meshes surface is produced due to the nanoparticle introduced. In the surface composition analysis, different absorption peaks can be observed due to the different functional groups introduced on coating material. Functional groups of the substance can be qualitatively analyzed and semi-quantitatively analyzed based on peak intensity, peak shape, and other parameters occurring in the infrared spectrum. In the surface wettability analysis, it is found that the coated meshes exhibit high water contact angle and low oil contact angle. Other than that, these coated meshes also have high oil/water separation efficiency as superhydrophobic and superoleophilic characteristics are employed.

***Keywords*:** Oil/Water separation, Superhydrophobic, Superoleophilic, Surface wettability, Stainless steel.

SIIC082

EFFECT OF B-SITE SUBSTITUTIONS ON THE CATALYTIC ACTIVITY OF PEROVSKITES COMPOUNDS: A REVIEW

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Abstract: The objective of research are to review the B-site loading or composition on the catalytic activity of perovskite compound and to compare the performance of organic pollutants' degradation using perovskite compounds at different B-site loading or composition. Methodology of research consist of identification of problem, study of literature, data collection, data analysis and conclusion. The combination of qualitative and quantative data analysis conducted from the data collection obtained from online based literature such as Science Direct, Springer, Sage and ASCE. Data analysis with graphical representations is carried out in this research study. The graphical results are obtained from the catalytic performances and characterization analysis such as XRD, FE-SEM, EDX, BET and UV-vis spectrophotometer. $LaFeO_3$ scored the highest intensity at $2\theta = 32.2°$ crystallite size by using XRD pattern analysis. Photocatalytic activity of $LaMnO_3$ with Fe_3O_4 nano composite evaluated for 2 hour by using Hitachi UH5300 UV- visible spectrophotometer. According to Sun et al, the sample of the LaCoO3-x perovskite catalyst samples analysed by FTIR spectra with FTIR-Nexus-670 spectrometer (400–4000 cm^{-1}). Moreover, LaFeO3 was highlighted as active degradation of Methylene Blue (MB) dyes and exhibited strong visible-light photocatalytic active. LaCoO3 Photocatalytic properties especially in the degradation of the MB, Methyl oranges and neutral red dyes after 100 min reaction. LaFeO3 perovskites catalyst required time to achieve 90% degradation for 180 min with the catalyst loading of $2gL^{-1}$. $LaNiO^3$ perovskites catalyst required 5 hours and considered less efficient compared to Fe and Co B-sites perovskites. The substitution of Ni as B-site to Co element can affect the surface area of the catalyst exhibiting maximum at x=0.5. The analysis of the degradation rate of the organic pollutant by using Fe B-site element obtain 97 percent in 4 hr duration time. Meanwhile, the lowest degradation rate of organic pollutant achieved 80 percent in 6hr duration time by using BaTiO3 perovskite. The required time to achieved 90% followed by LaCoO3 (85%) and $LaNiO_3$ (74.5%).

***Keywords*:** Organic pollutant, Catalyst, Perovskites, Dyes, Degradation

SIIC083

PRODUCTION OF BIODIESEL FROM PALM FATTY ACID DISTILLATE: KINETIC STUDY

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Abstract: As the fossil fuels are depleting and eventually will be gone forever, the studies and research have been conducted to find the alternative for the fossil fuels. The most suitable alternative for fossil fuels are biodiesel. Biodiesel or known as fatty acid methyl esters (FAME) usually obtained from green resources such as plant oil, animal fats or even waste cooking oils. Next, Palm Fatty Acid Distillate (PFAD) which is by-product of Palm Oil will be used as the main material as it contains high concentration of free fatty acid (FFA). In this study, a mathematical kinetic model of esterification will develop by using a software named MATLAB. Rate constant will also be determined by the end of this study by using rate law. Rate of reaction or known as rate constant (k) is vital in process because it will determine the time taken for the process to complete. From the rate constant for both forward and backward reaction obtained, values of activation energy and the pre-exponential factor values for both reactions at can be determined with plotting Arrhenius plot. A general kinetic model and parametric study of the kinetics of the reaction involved in the production of biodiesel developed in this project through use of MATLAB Sequential Quadratic Programming and ODE45 have shown promising results. The objective of this project is achieved.

***Keywords*:** PFAD, Rate constant, Esterification, Kinetic modelling, .

SIIC084

A COMPARATIVE STUDY ON THE EFFECT OF PALLADIUM DOPANT CONCENTRATION ON THE PHOTOCATALYTIC PROPERTIES OF TIN(IV) OXIDE

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Abstract: Several type of semiconductor photocatalysts such as TiO_2, ZnO and SnO_2 have been applied in treating dye containing wastewater. However, the application of SnO_2 metal oxides as photocatalysts still remain limited despite the potential of the material to oxidize and degrade pollutant materials in wastewater. In this work, SnO_2 with different concentration of palladium dopant (0.5, 1, 3 and 5 mol%) were successfully analysed. The characterization data from X-ray diffraction (XRD), Fourier-Transform infrared spectroscopy (FTIR), high-resolution transmission electron microscopy with selected area electron diffraction (HRTEM-SAED), field emission scanning electron microscopy (FESEM) and UV-vis spectroscopy were carefully analysed and compared with previous studies. From XRD analysis, the results showed strong evidence of SnO_2 nanoparticles formation. Whereas the FTIR peaks further confirmed the presence of the Sn-O bonds. The UV-vis result revealed the band gap of Sn-O considerably decreased with increasing Pd concentration. The selected 5 mol% Pd doped SnO_2 was tested on photocatalyst reaction with methylene blue. In addition, the image of Pd doped SnO_2 from HRTEM-SAED demonstrated the SnO_2 nanoparticles existed in short nanorods in a closely packed structure. The comparison with literature review shows that Pd doping improve the photocatalytic properties of SnO_2.

Keywords: SnO_2, Pd doped, nanorods, photocatalyst, concentration

SIIC085

ELECTROCHEMICAL PROPERTIES OF ELECTRIC ARC FURNACE SLAG FOR DEGRADATION OF ACID ORANGE II

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Abstract: Electrochemical properties of electric arc furnace slag for degradation of acid orange II in which this study is to analyze the potential of the EAFS as electrode. The objectives are to study the oxidation and reduction process of EAFS through electro-Fenton reaction process using cyclic voltammetry and to analyze the potential of EAFS for degradation of acid orange II through cyclic voltammetry profile. This research project is conduct to analyze two types of electrode which were IO electrode and EAFS electrode using CV. IO and EAFS that been mix with binder to become solutions was dropped carefully using dropper on the circle spot (working electrode) of the screen printed electrode (SPE). Meanwhile, acid orange II was used as the model dye pollutant. For CV analysis, the scan rate for each sample were varies (10, 20, 30, 40, 50, and 60 mV/s). From results obtained, effect of various scan rate on IO and EAFS electrode is observed for the CV pattern. EAFS electrode show great rate capability along with efficient pseudocapacitive performance. The occurrence of oxidation and slight reduction occur in EAFS electrode prove the potential of the electrode. Due to non-active electrode like the Raw-EAFS use in this study is less efficient for indirect electro oxidation with the active solution. So, it is recommended to use active EAFS electrode for further study of the electrochemical properties of EAFS electrode using the CV technique.

Keywords: Electric Arc Furnace Slag, Iron Oxides, Cyclic Voltammetry, Dye Pollutant

SIIC086

THE TIME SERIES STUDY ON THE TEMPERATURE EFFECT OVER PENANG ISLAND USING GIOVANNI

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Abstract: NASA GIOVANNI is an advanced technology of remote sensing system. It is able to provide with Earth Science information within only a few minutes. The focus of this study is to obtain a reliable information via NASA GIOVANNI regarding the temperature trend in Penang Island, Malaysia, from year 2016 to 2018 and also to verify the validity and reliability of the data obtained from NASA GIOVANNI and therefore being able to replace with the conventional method of using AccuWeather. From the system, MODIS Aqua is selected as it is the most suitable satellite among other to capture the temperature reading at the desired area. The data obtained from AccuWeather are mostly accurate and clear even though there are several limitations regarding the parameter involved as it is quite general. Meanwhile the temperature data obtained from NASA GIOVANNI are more specific and detailed as it consists of several parameters. For example, NASA GIOVANNI is capable of accessing the sea surface and land surface temperature for the desired location. Apart from that, NASA GIOVANNI also able to separate between daytime and nighttime temperature data. After obtaining both data from NASA GIOVANNI and AccuWeather, an effective comparison is made via cross validation or to be exact, linear regression. From the graph of linear regression, R-Squared value can be calculated and hence can determine the correlation of both data. From the R-Squared calculations, the values calculated are 0.75 for year 2016, 0.65 for year 2017 and 0.71 for year 2018. According to the R-Squared value, it is concluded that the temperature data from NASA GIOVANNI is having a positive and strong correlation with AccuWeather as the values are exceeding 0.5 for each year. Therefore, the temperature data via NASA GIOVANNI is possible to obtained and also the obtained temperature data are almost as accurate as AccuWeather

***Keywords*:** NASA GIOVANNI, AccuWeather, time series study, linear regression, MODIS Aqua

SIIC087

CO-PYROLYSIS OF BIOMASS AND PLASTIC: EFFECT OF OPERATING CONDITION, PLASTIC AND REACTOR TYPE ON PRODUCTION OF BIO-OIL

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Abstract: The exhaustion of fossil-based oil, gas and coal reserves has urged the planners and policy makers to discovered a new alternative renewable source. Therefore, bio-oil derived from biomass alone has the potential to substituted the depletion of non-renewable fossil fuels energy sources. Conversely, the pyrolysis oil required to be upgraded since it has high content of oxygen, low calorific value and instability. Co-pyrolysis has attracted numerous researchers as the most efficient upgrading thermochemical conversion to generated high-grade yield of bio-oil. In addition, the use of this techniques also promoted the characteristic of the liquid oil, e.g. increment of bio-oil yield, high caloric value, reduction of moisture and oxygen content. Therefore, an extensive research of the well-recognized publishers was carried out in main database such as Scopus, Science Direct, Springer Link and others. This article mainly reviewed on the previous studies of the co-pyrolysis of lignocellulosic biomass and synthetic polymers in the production of bio-oil. This studies also overviews the types of plastic and reactors, effect of operating parameters including the pyrolysis temperature, retention time, blending ratio and feedstock composition on co-pyrolysis quantity and quality. Besides, the synergistic mechanism in co-pyrolysis is also presented in this article. This critical review revealed that the co-pyrolysis of biomass and plastic is more beneficial compared to individual biomass pyrolysis in terms of economic, simplicity and effectiveness in enhancing the quality of liquid oil.

***Keywords*:** Co-pyrolysis, Bio-oil, Biomass, Plastic, Reactor.

SIIC088

THE TIME SERIES STUDY OF THE RAINFALL INTENSITY OVER PENANG USING GIOVANNI

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Abstract: Just like most parts of Malaysia, Penang gets a tropical climate throughout the year. This means it is warm and humid through the year with little to no variations in weather conditions. In this research, Penang is being selected as a research area. On September and November it is the wettest months with about 21 to 25 days of rainfall recorded in Penang. There are many bad effect if intensity of rainfall too high or too low such as flooding, landslide or insufficient water. GIOVANNI system is utilized to get the information from satellite where to empower Web-based visualization and investigation of satellite remotely detected meteorological, oceanographic, and hydrologic information sets, without users having to download data. By using GIOVANNI system method, the prediction for future event can be plot through the time series of rainfall where TOVAS is used as a sensor to measure the intensity of rainfall. The time series of rainfall can be plotted in daily, monthly or yearly depend on the study area and parameter has been chose. The main purpose of this research is to verify the reliability of the NASA GIOVANNI system to ensure the data has strong relation with real data from world weather. The result from GIOVANNI system is compared with world weather data in order to find out the resemblance of the data. Inequality of data between GIOVANNI and TOVAS are analyses by doing cross validation using regression analysis where R-square as an indicator to determine whether the relationship between both data are strong or weak. A high R-square of above 0.60 is required for studies in the research study for engineering field can be reasonably predicted to some degree of accuracy research. Then normally, R-square at lower value generally accepted for studies in the field of arts, humanities and social sciences because human behaviour cannot be accurately predicted, therefore, a low R-square is often not a problem in studies in the arts, humanities and social science field.

***Keywords*:** GIOVANNI system, rain intensity, regression analysis, cross validation, TOVAS

SIIC089

TOXICITY LEVEL OF BEIJING GRASS MEDIATED SILVER NANOPARTICLES IN MULTICELLULAR CELL

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Abstract: Silver nanoparticles are the nanoparticles of silver which have the typical size between 1 nm and 100 nm. Silver nanoparticles have a unique structure which helps in antimicrobial action, environmental control, in therapist as well as device that are used in medical. There is a various type of synthesis silver nanoparticles which commonly known as physical method, chemical method and green synthesis. Physical and chemical methods have many disadvantages compared to advantages such as it required big capital and have a safety issue. Therefore, green synthesis with plant extract is the simple, cheap, safe and famous method among the researcher. In this study, Beijing grass leave extract used to reduce and stabilize the silver ion in the formation of silver nanoparticles. the UV-Vis spectrophotometer was used to observe the formation of silver nanoparticles based on their wavelength and absorption band. The effect of Beijing grass extract concentration, the effect of volume ratio silver nitrate to Beijing grass extract in silver nanoparticle and toxicity effect of silver nanoparticles were the main focus in this study. 100 % concentration of Beijing grass and 5:5 volume ratio silver nitrate to Beijing grass extract in silver nanoparticles were the optimum value in the synthesis of silver nanoparticles. Every multicellular cell has a different effect based on the dosage consumption on silver nanoparticles. The human cell obviously can deal with high concentration of silver nanoparticles compared to the marine invertebrate cell.

***Keywords*:** Silver Nanoparticles, Silver Nitrate, Beijing Grass Extract, Toxicity, UV-Vis

SIIC090

THE EFFECT OF VARIOUS NATURAL COAGULANTS ON POLLUTANT REMOVAL OF WASTEWATER

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Abstract: . Natural coagulants have been increasingly popular past few years due to its benefits and the fact that it resolves most of associated problems when using synthetic coagulants. In this review paper the removal of pollutant on wastewater by using different natural coagulants will be researched. This review investigates the efficiency of natural coagulants in the removal of pollutant in wastewater. The objective of this paper is to review the effect of various natural coagulants and determine the effective natural coagulant on pollutant removal of wastewater. The method uses in this review paper is Microsoft Excel and Multi Criteria Decision Making (MCDM). Advantages and disadvantages of natural coagulants is identify. The efficiency of natural coagulants performance such as Moringa oleifera, roselle seeds, banana pith and many more. The parameter result of natural coagulants such as turbidity, suspended solids, pH and conductivity shows in the finding.

***Keywords*:** Natural coagulant, synthetic coagulant, wastewater

SIIC091

THE GREEN SYNTHESIS OF NANOPARTICLE ZINC OXIDE (ZNO) USING ALOE VERA LEAF EXTRACT: STRUCTURAL AND OPTICAL CHARACTERIZATION REVIEWS

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Abstract: Zinc oxide (ZnO) is a wide and direct semiconductor with a wurtzite crystal structure. Nano-scaled ZnO as today has been synthesized through green synthesis using natural plant extract as an effective 'reducing agent' of metal precursor, has been reported to be a cleaner and environment-friendly alternative to the physical and chemical methods. The Final Year Report is based on the green synthesis and the main physical optical properties of pure ZnO nanoparticles synthesized by a completely green chemistry process using the natural extract of Aloe Barbadensis Miller (Aloe Vera) Leaf Extract to bio-reduce the zinc acetate precursor, Zinc Acetate Dihydrate ($Zn(CH_3COO)_2 \cdot 2H_2O$). The concentration of Zinc Acetate Dihydrate ($Zn(CH_3COO)_2 \cdot 2H_2O$) is known to affect particle size as well as on the optical properties such as surface morphology, porosity, particle size and polymeric properties of ZnO nanoparticles. The obtained ZnO nanopowdered samples will be obtained with different concentration of the precursor at 0.01M, 0.1M and 1.0M at constant pH 10 and temperature 60°C. Investigation of the optical properties and surface morphology of ZnO nanoparticles structure with different concentration of Zinc acetate dihydrate carried out by using Photoluminesence spectra, Raman Spectra, XRD, FE-SEM and optical microscope. The green synthesis of NPs ZnO use is much better and affordable because the process provide more ecofriendly, economical, free toxic, and easy to compose rather than chemical and physical methods. The objective of this study are to determine the effect of Zinc Acetate Dihydrate ($Zn(CH_3COO)_2 \cdot 2H_2O$) concentration on particle size as well as on the optical properties such as surface morphology, porosity, particle size and polymeric properties of ZnO nanoparticles also to characterize the surface morphology and optical properties of ZnO Nanoparticles formed by Zinc acetate dihydrate ($Zn(CH_3COO)_2 \cdot 2H_2O$) at different concentration at constant time and pH by using different analysis equipment such X-Ray Diffraction (XRD) Analysis, Field Emission Scanning Electron Microscopy (FE-SEM), Fourier Transform Raman (FT-Raman), Photoluminesence Spectra (PL).

***Keywords*:** nanotechnology, zinc oxide, green synthesis, morphology, aloe vera

SIIC092

MONOMETALLIC AND BIMETALLIC OXIDE CATALYST FOR CO_2 METHANATION: A REVIEW

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Abstract: Rapid industrialization occurred during the 19th century caused a large quantity of CO_2 to be emitted from different sources into the atmosphere. In order to reduce CO_2 emission across the globe, various kind of discoveries have been reported by researchers to convert CO_2 into less hazardous substances by using different combination of metal and support materials. Therefore, this paper aims to provide informative review regarding the role of metals, supports, reaction conditions and addition of secondary metal (promoters) to produce high-performance CO_2 methanation metal catalyst. A specific emphasis is placed on the role of metals as well as on the role of supports as these are the most important factors which could contribute in the enhancement of CO_2 methanation metal catalyst. In this paper, recent findings within related scope from various researchers are thoroughly reviewed and the important data gathered are presented in the form of tables. Next, any significant trends obtained from the data are explained with reasonable scientific justifications. From the research conducted, Ni was chosen as the best material mainly due to its high methanation activity, wide usage in commercial applications and exhibit a high prospect for catalytic improvement. Next, the addition of secondary metal to existing metal catalyst especially Ce not only modify and reconstruct the catalyst structure but promote the reducibility of active species thus producing new catalyst with enhanced catalytic properties. From the findings, it can be clearly seen that the bimetallic catalyst has much higher catalytic performance compared to the monometallic catalyst because of the benefits offered by the second metal. From this research, conventional metal oxide support (Al_2O_3 & CeO_2) and carbon support (CNT) was determined to exhibit better catalytic performance compared to other support materials due to its high specific surface area and high hydrogen storage ability. In addition, low temperature and high pressure condition was determined as the favourable conditions for better CO_2 methanation process. Even so, more research needs to be conducted to determine the suitable H_2/CO_2 reactant gas ratio which would give highest CO_2 conversion.

***Keywords*:** Monomettalic, Bimetallic, Supports, Conditions, Promoters

SIIC093

SYNTHESIS OF SILVER NANOPARTICLE USING DIFFERENT METHODS

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Abstract: Silver nanoparticle has been a subject of interest for decades for the valuable and unique properties and are used for a wide range of commercial reasons to restrict microbial growth. Each methods used to synthesize silver nanoparticle will fabricate different physiochemical properties of the nanoparticle. Therefore, comparison between physiochemical properties of each methods will be reviewed in this study. This review present an overview of silver nanoparticle by using chemical approach, physical approach and biological approach. Each approach has their own merits and demerits . The drawbacks for chemical approach and physical approach are the process often involve highly toxic and not enviromentally friendly subtance. The biological approach has become a new option in chemistry, consisting of reduction and elimination of dangerous subtance for the design of the product in the enviroment.

***Keywords*:** Physiochemical properties, Silver nanoparticle, Chemical approach, Physical approach, Biological approach

SIIC094

ELECTRODE REVERSIBILITY STUDY OF ELECTRIC ARC FURNACE SLAG FOR DEGRADATION OF ACID ORANGE II

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Abstract: In this study, Electric Arc Furnace Slag (EAFS) is a type of waste was used as an electrode for degradation of acid orange II (AOII). AOII is an example of dye that produce from the textile industry. The objective EAFS and iron oxide electrode were analyzed to study the electrochemical properties specifically on the reversible reaction for the degradation of AOII using the cyclic voltammetry (CV) and investigate the current and potential of EAFS electrode. CV is mostly technique used in electrochemical process to obtain the information regarding the reaction involved such as redox reaction that occur in the process. The powdered EAFS and iron oxide mixed with resin solution before place on top of the screen-printed electrode (SPE). The dye solution, AOII mixed with 0.5M sodium chloride (NaCl) was added to the SPE. Then, the SPE was connected to the potentiostat then tested for 3 complete cycles using the software NOVA 1.10. In this work, the additional of oxidizing agent which is hydrogen peroxide was used in the dye solution. The CV analysis showed both electrodes have quasi-reversible reaction. However, EAFS electrode showed the peak to peak current ratio that could have unity by increasing the scan rate more than 60mV/s which means the reversible reaction may occur. Then, the reversible reaction occurred as the potential current for anodic and cathodic were in unity. Based on the work done, the peak current was not in similarity which resulted in quasi-reversible reaction. To conclude, the EAFS electrode had higher efficiency for degradation of AOII compared to the iron electrode as the pattern of graph showed the higher tendency towards the reversible reaction compared to the iron electrode.

***Keywords*:** EAFS, acid orange II, reversible, degradation, cyclic voltammetry

SIIC095

A REVIEW ON THE MINERALIZATION STUDY OF ORGANIC POLLUTANTS USING PEROVSKITE CATALYST

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Abstract: This study aspires to have an improvement of Advance Oxidation Process (AOPs) to degrade organic pollutants. Currently, AOPs need chemical additives and additional energy that is not economically. Perovskite catalyst have been introduced to degrade existing organic pollutants preferred to economic saving and feasible operation. This study therefore aims to review the mineralization of organic pollutants using perovskite catalyst by Total Organic Compound (TOC) analysis and to review the intermediate compound presence during catalysis by High Performance Liquid Chromatograph (HPLC). Methodology of research review including identify the problem, literature review, data collection, data verification, data analysis and conclusion. Throughout these processes, online database essentially like Website, Science Direct, Google Scholar and Scholarcy including conference and published paper will be used as the data collection sources. Zinc Oxide (ZnO) perovskite catalyst used to degrade 4 types of dyes solution which are yellow 145 dye, black 5 dye, Red 4 dye, and Blue 21 for initial time, 30 minutes and 2 hours for mineralization process. Graphical presentation of the study shows that the longer the time taken for mineralization process, the higher the mineralization rate. The present study demonstrates that the ZnO type of perovskite catalyst is an efficient and feasible method to treat textile wastewater, not only for color removal but also for dye mineralization purposes. TOC removal in degradation of azo II dye solution using calcium strontium copper (CSC) based catalyst under dark condition without any ozone or peroxide has been studied. The content of Ca and Sr in the A-site of the perovskite structure was varied whilst the B-site was Cu rich. CSC compounds with higher Ca content in the A-site were slightly more effective at degrading OII. In order to understand further the by-product formation during the catalytic activity, the HPLC analysis carried out for OII dye solutions degradation from 0 to 120 minutes. Carbon(C), Hydrogen(H), Oxygen(O), Sulphur(S), and Nitrogen(N) found exist during the catalytic process. The highest intermediate compound that exist in the reaction are at mass-to-charge ratio of 327.04 m/z which is $C_{10}H_{11}N_2O_4S$. As for the contact time increase, more reactant adsorbed on the catalyst surface.

Keywords: *Perovskite catalyst, HPLC, Organic pollutant, Mineralization, Advance Oxidation Process (AOPs)*

SIIC096

KINETIC MODELLING OF DIHYDROXYSTEARIC ACID (DHSA) PRODUCTION FROM PALM KERNEL OIL-BASED OLEIC ACID

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Dihydroxystearic Acid (DHSA) is a chemical compound that belongs in the hydroxy fatty acid group which is mainly used in cosmetic industries. DHSA usually produced by the process of *in-situ* epoxidation of oleic acid, followed by the hydrolysis of the epoxidized oleic acid. This study focuses on the kinetic modelling of the production of DHSA. The purpose of this study is to establish a kinetic model of one-pot synthesis of DHSA via continuous *in-situ* epoxidation and hydrolysis process and to fit the kinetic model with the experimental data to obtain the reaction rate constants (*k*) and activation energy (*Ea*). Assumptions was made which then applied to the reaction scheme in order to develop a new reaction scheme for the kinetic model. MATLAB was the software used for developing the model where ODE45 function in MATLAB were used to solve the ordinary differential equation (ODE) by applying fourth-order Runge-Kutta method. From the model, reaction rate constants (*k*) were determined. The reaction rate constants (*k*) determined were then used to obtain the activation energy (E_a) of the reaction by constructing the Arrhenius plot for the reaction at temperature 55°C and 75°C.

***Keywords*:** Dihydroxystearic Acid (DHSA), epoxidation, kinetic modelling, reaction kinetics, activation energy .

SIIC097

EXPLORING THE PARAMETER FOR ALTERNATING CURRENT ELECTROPHORETIC DEPOSITION OF CARBON NANOTUBES-CONDUCTING POLYMER : A REVIEW

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Abstract: Electrophoretic deposition (EPD) has been gaining interest due to its great versatility in process parameters for carbon nanotubes (CNTs) and nanocomposite film deposition. The main objective of this paper is to study the parameters effecting formation of CNTs-conducting polymer films using alternating current electrophoretic deposition (AC-EPD) technique. Systematic review have been conducted to accomplish the objective of the study. The thickness, morphology and density of the film can be adjusted desirably by controlling the two major factors which were the factors related to the suspension and factors related to the AC-EPD operation. The factor related to the suspension are medium of suspension, dispersant and chemical treatment while the factor related to AC-EPD operation are applied voltage, frequency, waveform and period of deposition. In the meantime, this work reviews about applications of AC-EPD other than films or coatings making industries as well. AC-EPD technique can be applied in other fields such as biomedical and electric and electronics. The film obtained from AC-EPD of CNTs can be used as light weight sensors, supercapacitors, filters, electron field emitters and solar cells.

***Keywords*:** alternating current electrophoretic deposition, carbon nanotubes, conducting polymers, parameters.

SIIC098

A REVIEW ON THE ROLE OF SURFACTANT IN TAILORING OF SILICA PROPERTIES IN OILY WASTEWATER

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Abstract: The surface of silica nanoparticles has been modified with various surfactants such as cetyltrimethylammonium bromide (CTAB), Cetyltrimethylammonium chloride (CTAC), Cetylpyridinium chloride (CPC) and Cetylpyridinium bromide (CPB) and various experimental conditions including surfactant quantity have been studied. Studies shows that the efficiency can be increased with the presence of porous materials. The pore structure of the materials is very important to determine the ability to perform adsorption. The main objectives of this research are to analyze the effect of various types of surfactant modified on porous silica adsorbent for oily wastewater application together with the effect of porosity of surfactant-templated silica on oily wastewater application. Optimum conditions and possible surface modification mechanism for silica nanoparticles have been discussed. The thermogravimetric analysis (TGA) was used to measure hydroxyl groups quantitatively on the silica particles. In addition, most researcher use Brunauer Emmett Teller (BET) and Fourier transform-infrared (FT-IR) procedure to investigate the specific surface area and the functional groups on the silica nanoparticle. In conclusion, the addition of surfactant in the silica matrix affects the porosity of porous silica by increasing the surface area and pore volume

***Keywords*:** Oily wastewater, Adsorption, Surfactants, Silica and Porosity

SIIC099

A STUDY ON THE IMPORTANCE OF PERSONAL PROTECTIVE EQUIPMENT (PPE) USE IN OCCUPATIONAL RADIATION PROTECTION

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Abstract: Radiation safety and precaution become a responsibility for everyone to produce a safe radiation environment and to guarantee no human injuries and exposure occur. It should be a common-sense for every individual who works under a radiation environment to fully implement the usage of PPE to prevent the risk of being exposed accidentally to primary radiation or scattered radiation. However, it was found that there are several studies had discussed on the PPE among radiation workers happened to have lack of knowledge and awareness on the importance of PPE. Therefore, a study on the importance of PPE in occupational radiation protection is conducted by accumulating information and findings from the past study, as a systematic review. A case study was also conducted where a set of questionnaires of 29 designated question was distributed to 81 respondents working under a radiation-related environment. As a result, 82 articles were retrieved from seven databases. Of these, only 16 articles were eligible and included. From review towards radiation safety and awareness among workers, it can be seen that most of the studies have an average response with respondent not fully aware of it. In contrast, results from the case study show that the respondents were more aware of the radiation safety in their work-place with 96.3 % understands the radiation safety procedures when performing work. Furthermore, 78.3% know that there have been appropriate safety measures taken in their work-place to protect the worker from exposure. The significant percentage of 83.9% respondents are confident that the provided PPE are able to protect themselves. Therefore, awareness among workers should be emphasized more, and it is recommended that there should be more program like safety campaign and safety talk to be implemented to stress on the importance of personal protective equipment (PPE) in occupational radiation protection.

***Keywords*:** Radiology, radiation protection, radiation risk, ALARA, PPE.

SIIC0100

COMPARATIVE STUDY ON THE EFFECT OF ALKALI PRETREATMENT TECHNIQUE ON REMOVAL OF LIGNIN AND REDUCING SUGAR PRODUCTION FROM DIFFERENT BIOMASS

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Abstract: In Malaysia, biomass is generated every year via wastes from agriculture mainly via harvesting and is available in abundance. Rice husks are an example of biomass which are considered as wastes are disposed of improperly as the husks were burned by farmers which resulted in environmental pollution. To address this issue, several researches are continuously carried out to harness the potential of biomass as one of the alternative sources of energy and as a low-cost biosorbent and many more. Generally, biomass is made up of complex lignocellulosic structure comprising of cellulose, hemicellulose and lignin. Prior to accessing cellulose in biomass, it is imperative that lignin is broken down and removed. Thus, there is a need for biomass to undergo chemical pretreatment. There are two most commonly used modes of pretreatment used for delignification of lignocellulosic biomass. The modes of pretreatment are acidic pretreatment and alkali pretreatment. Commonly, analysis of reducing sugars utilizes the Dinitrosalicyclic acid (DNS) method developed by Miller (1959). The treated samples of black liquor from the experiment were analyzed using UV-vis spectrophotometer. This research will evaluate the effectiveness of alkali pretreatment on lignin removal from several biomass using sodium hydroxide and calcium hydroxide. Removal of lignin and reducing sugar production is evaluated from collection of data of several studies. NaOH was found to be the best alkali for alkaline pretreatment because it works at decreased temperatures and also exhibits a remarkable capacity of delignification in relation to its severity.

Keywords: Sodium hydroxide, Calcium hydroxide, Alkali pretreatment.

SIIC0101

A STUDY ON THE PERSONAL PROTECTIVE EQUIPMENT (PPE) USED IN OCCUPATIONAL RADIATION PROTECTION

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Abstract: The use of personal protective equipment is compulsory as a personal protection and control measure from radiation hazard. The hazard can be a high exposure of primary radiation or could be a low dose of the scattered radiation from the patients' body. Therefore, the workers must wear proper and the best quality of PPE to mitigate the radiation harmful. There are a lot of PPE available in the market with a particular based material, such as lead aprons, latex gloves, thyroid shield, and glasses. All these PPE have their property in terms of design, radiation characteristic, based-materials and others. Therefore, this study is conducted to gather information and findings from the previous study as a systematic review. A case study was also conducted to identify awareness among radiation workers toward the hazard. As a result, 82 articles were retrieved from seven databases and screened out their eligibility. Of these, only 18 articles were eligible and included. Three of them discussed on theoretical such as survey and ten discussed on experimentally study. For the case study, a total of 81 respondents took part in the survey with 29 designed questions. Of these, only 14 questions were selected to discuss further. It can be said that the lead-based provide maximum protection to the workers. This agreement is supported with 86.4% respondents agreed (and strongly agreed) that the lead able to shield and protect workers adequately. Moreover, 74 % respondents agreed the lead is the best material for PPE. Anyhow, more than 6 % disagreed on it. This might be due to 88.9 % agreed that an ideal design of PPE is it must have no ergonomic problems. This agreement was significance with the review, where the lead PPE is about 1-7 kg in weighing with a minimum thickness of 0.25 mm. However, lead-based material is found to be dangerous to health because of its toxicity and the dust particles that formed on the surfaces of lead objects.Therefore, futher study is needed to identify lead equivalent material to overcome the lacking on the lead-based.

***Keywords*:** Radiology, radiation protection, radiation risk, ALARA, PPE.

SIIC0102

EVALUATION OF DRYING MODELLING ON COMMON HERBS LEAVES: APPLICATION TO HIBISCUS ROSA-SINENSIS

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Abstract: *Hibiscus rosa-sinensis* is a medicinal plants, where the leaves contain of beneficial biological activity such as anti-inflammatory, anti-infectious, antifungal, antimicrobial, anti-diarrheic, antioxidant, and antipyretic activity. The medicinal plants are high in value and the post-harvest causes losses due to the reduction quality of product. The plant can be less disposed to the damage from other microbial degradation and become manageable in storage and transport by reducing the content of moisture through drying. Drying leaves must ensure the required final moisture content that maintains the original high nutrient level as that of fresh leaves. The present review work focus on valuating the parameters associate with modelling of moisture contents and drying time for the drying method. The drying method selected are sun drying, tray drying, oven drying and microwave drying. By making the comparison study on previous article, the parameter can be evaluated by drying rate constant which is k value from the best fit drying model. The effect of the parameters of drying are temperature of drying air, relative humidity, thickess of spread, water activity and properties of different types of leaves. Also, evaluation of suitable drying model applied to *Hibiscus rosa-sinensis* leaves needed to understanding the drying process by selecting the most best fit model. The most suitable drying model applied are Page , Midilli et al., Diffusion approach, Logarithm and Two term model.

Keywords: Leaf drying, drying methods, drying kinetics, mathematical modelling, drying rate constant

SIIC0103

TORREFACTION OF PALM PRESSED FIBRE IN A FIXED BED REACTOR

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Abstract: The accumulation of the palm pressed fibres which are waste and by-product from the palm oil milling industry and the palm pressed fibre can be reused and utilized as a potential biofuel, becoming an alternative energy to replace the conventional fossil fuel. However, the direct usage of raw biomass as a source of biofuel is not efficient due to its high moisture content and low energy density value. Hence, the pre-treatment of biomass via torrefaction is required before the biomass is used as biofuel since torrefaction can increase the energy value of the biomass and reduces the moisture content of biomass. Torrefaction of palm pressed fibre was performed under inert environment in a fixed-bed reactor. The effects of two process parameters such as torrefaction temperature (200˚-300˚C) and holding times (20, 40, 60 minutes) were investigated towards the mass yields. The kinetics parameters for the torrefaction process at different holding times were analyzed by using the Coats-Redfern method. The values of activation energy for the reaction at 20, 40 and 60 minutes were 29.418, 25.732, 22.079 kJ/mol with Ln A values of 1.5781, 0.736 and -0.2342 respectively. The reaction follows the first order reaction. From the FTIR analysis, it was founded out that degradation of the hemicellulose, cellulose and lignin occurred during the torrefaction and chemical compounds such as O-H, C-H and C=C was founded from the analysis.

***Keywords*:** Torrefaction, Palm Pressed Fibre, Activation Energy, Coats-Redfern, FTIR.

SIIC0104

A REVIEW OF THE USE OF NATURAL AND CHEMICAL COAGULANTS IN TURBIDITY REMOVAL OF WASTEWATER

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Abstract: The introduction of natural materials into the coagulation-flocculation process need to be practiced as common as possible. The previous literature indicated that utilization of natural material is worth to be developed and if possible, into the commercial one. However, the application of natural coagulants itself as the primary treatment is not enough, due to the rise in constraints which limited its performance. Alternatively, the natural-based coagulants are commonly used as coagulant aids alongside chemical coagulants, which have created a highlight in water research. This review covers the comparison of type of coagulants used in the coagulation-flocculation of wastewater treatment in the usage of natural-based coagulants and chemical coagulants. This review paper also outlines the prospects of natural materials as aids and its potential as sustainable composite coagulants. The main objective of this study is to review the performance of contaminant removal between chemical and natural coagulants in wastewater treatment. The objectives are to determine the effectiveness of coagulation and flocculation process in wastewater treatment between synthetic coagulants and chemical coagulants by determining the advantages and disadvantages. This comparative study was conducted to collect articles in well-known journals that provide important insights for researchers and practitioners who study Wastewater Engineering and Wastewater studies. A collection of relevant papers from important databases with appropriate search indicators Studies on Chemical Coagulation and Natural Coagulation for Wastewater Treatment Process across multiple criteria. In this way, we do extensive searches in the titles, abstracts, and keywords of scientific papers. In the process of reviewing, the following major library. Conference proceedings, book chapters, theses, and unpublished papers are excluded from the review. Natural material is relatively environmentally friendly, making it an attractive substance in the wastewater treatment process. Natural or bio-flocculent used in the treatment of wastewater are isolated from various natural sources. These are economical and used as alternative coagulant. Despite the drawbacks of some chemical coagulants and the limited ability of natural materials to work at their best, the formation of coagulants from both materials could be the next great solution.

Keywords: Coagulant, Wastewater, Coagulation, Flocculation, Chemical

SIIC0105

A REVIEW ON CO-PYROLYSIS OF BIOMASS AND PLASTIC: INSIGHT INTO SYNERGISTIC EFFECT AND OPERATING CONDITION

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Abstract: Biomass and plastics are considered to have a better potential to be used as a renewable energy source to substitute fossil fuels. The production of oil from biomass and plastics can be achieved by pyrolysis process. However, the pyrolysis oil from pyrolysis contains high oxygenated compound which leads to low caloric value and corrosion problems. Many researchers have discussed an alternative technique to enhance the quality and quantity of oil by using co-pyrolysis process. A comparison between co-pyrolysis of biomass and plastics is established in the present work. It was found that production of bio-oil yield depends on biomass feedstock and type of plastics use and compositions such as moisture content, volatile matter, carbon (C), oxygen (O), nitrogen (N), ash and the presence of lignocellulose. This study discussed a comprehensive review on the co-pyrolysis of biomass and plastics influences the bio-oil yield through several point of views, including operating variables such as temperature, heating rate, blending ratio and synergistic effect and characteristics of byproducts as well. This article also focused on several studies based on published articles, patterns, figures and data.

***Keywords*:** Co-pyrolysis, Pyrolysis, Biomass, Plastics and synergistic effect

SIIC0106

NUR ZULAIHA ABAS

SIIC0107

EVALUATION OF SINGLE MISSING VALUE IMPUTATION APPROACHES FOR INCOMPLETE AIR POLLUTION DATA IN MALAYSIA

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Abstract: This research is mainly focus on environmental scope which is air pollution. It is about evaluation of single missing value imputation approaches for incomplete air pollution data in Malaysia. Single missing value imputation means the replacement of blank space in monitoring dataset from chosen DOE monitoring station with calculated value from the best method for long gap hours. The variable that mainly being monitor is PM_{10}. This variable is the main source of air pollution release from industrial and transportation of everyday activities. Single imputation method focused in this research is mean imputation method. Furthermore, this method will be tested on the dataset from Tanjung Malim monitoring station by fitting with several performance indicator such as MAE, RSME, R^2, PA and IA. The result will be compared with previous study whether it is the best used for long gap hour data. There are four stages need to be followed in order to complete this research. The steps are data acquisitions, characteristic analyzing of missing value, single imputation approach and lastly, verification of approach and suggestion of the best method. The five existing imputation method for missing data implemented in this research are series mean method, mean of nearby points, median, linear trend and linear interpolation. The finding from this research shows that interpolation method is the best method to be applied for particulate matter missing data replacement with least mean absolute error and the better in performance accuracy.

***Keywords*:** imputation, air pollution, performance indicator.

SIIC0108

SONOCATALYTIC DEGRADATION OF CAFFEINE USING CERIUM OXIDE: REACTION KINETIC STUDIES

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Abstract: Two kinetic models were proposed which are apparent first order model and Langmuir-Hinshelwood model. The rate constant, k obtained for Langmuir Hinshelwood equation for sonocatalytic degradtion of caffeine using cerium oxide without oxidant is 0.089 mg/L.min and with oxidant is 0.469 mg/L.min, while the apparent rate constant, k app apparent first order model for sonocatalytic degradation of caffeine using cerium oxide without oxidant is 0.0117 min^{-1} and with oxidant is 0.0203 min^{-1}. Both model shows increase in rate constant with the addition of oxidant. The regression line obtained for Langmuir Hinshelwood model for sonocatalytic degradtion of caffeine using cerium oxide without oxidant is 0.7823 and with oxidant is 0.9867, while the apparent rate constant, k app for apparent first order model for sonocatalytic degradation of caffeine using cerium oxide without oxidant is 0.9263 and with oxidant is 0.9934. The coefficient of determination (R^2) values for each experiment conditions shows that the sonocatalytic degradation of caffeine followed more to apparent first order model since the regression value is closer to 1.

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***Keywords*:** Sonocatalytic, apparent first order, Langmuir-Hinshelwood, kinetic, rate constant.

SIIC0109

BIOLOGICAL ACTIVITIES OF MURDANNIA SPECIES

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Abstract: Plant have been generally utilized as traditional medicine, particularly in most Asian nations. In India, traditional medicine such as Ayurveda which is the ancient medicine system of the Indian is used in treating, healing illness because of their biological activity, naturally occurring bioactive compound that exist in the plant. Numerous studies have recently revealed that the genus *Murdannia* is well-known for its biological activities that gives them the potential use as cure for certain diseases. Biological activities of the genus *Murdannia* is evaluated through the contributing factor of bioactive compound that exist in the genus itself. A review and comparison study of the related literature to the biological activities of Murdannia species has been conducted in this study. The papers were gathered using online database search (Science Direct, Springer, ResearchGate, Scopus, Wiley, Taylor & Francis and others) and classified by their publication year, author, published journal, parameters, and methods. In vitro study of *M. Bracteata* crude extracte revealed to have anti-oxidant, cytotoxic, hepatoprotective and α-glucosidase activity. Roots extract of *M. Lanuginosa* has been identified to posses anti-microbial, anti-inflammatory and anti-proliferative activity. *M. Simplex* roots extract revealed fungicidal activity due to the presence of protamine. Crude extract of *M. Nudiflora* demonstrated analgesic, anti-inflmmatory, anti-oxidant, and cytotoxic activity due to the presence of major phenolic compounds. *M. Loriformis* possess anti-inflammatory, anti-oxidant antimutagenicity, anti-ulcerogenic analgesic, DT-diaphrose and antipyretic activity which influenced by chemical constituents such as alkaloids, amino acids, flavonoids, and polyphenols that exist in the plant extract.

***Keywords*:** Murdannia, biological activity, Commelinaceae, bioactive compound, literature review.

SIIC0110

ZEOLITE SYNTHESIS FROM INDUSTRIAL WASTE FOR BIO-OIL PRODUCTION

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Abstract: In recent years, due to the escalation in global energy consumption, the impact of the conversion biomass-to-fuel processes have attracted the attention of scholars and policy makers. In this perspective, the production of bio-oil via pyrolysis process is an attractive method to achieve certain qualities of bio-oil. However, pyrolysis oil is less desirable due to high oxygen content, low calorific value and high water content, therefore, catalytic co-pyrolysis is introduced due to its numerous advantages. Although various catalytic systems have been evaluated for its production, the recent interest have indicate a shift towards industrial waste as another approach to improve the qualities of catalytic co-pyrolysis. The review therefore comprehensively explored the role of utilizing coal fly ash, woody biomass ash, palm oil mill fly ash, and sugarcane bagasse fly ash as heterogeneous catalyst for bio-oil production. In zeolite synthesis, concentration of alkaline source, temperature, reaction time, liquid/solid ratio and type of waste determine the structural properties, Si/Al ratio and its applications. The main characteristics and the applications of these synthesized waste zeolites are also reported. The paper further discussed the progress in terms of process mechanism and identification of active sites.

***Keywords*:** Bio-oil, Industrial wastes, catalytic co-pyrolysis, zeolite synthesis, pyrolysis process.

SIIC0111

COMPARATIVE KINETIC STUDY OF NON-EDIBLE FEEDSTOCK FOR TRANSESTERIFICATION PROCESS ON BIODIESEL PRODUCTION

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Abstract: The inclination of world energy consumption lead to the researcher grew their study to the biodiesel production. Transesterification is the common process for produce biodiesel. Edible feedstock for biodiesel production bring to depletion for food stock. Therefore, many studies were focused on the non-edible feedstock since biodiesel is a promising alternative fuel for replace fossil fuel and it is less environmental impact. For establish of process transesterification a kinetic study needs to perform for a optimize the process reaction. In this study, a quantitative research article was collected to compare the extraction, factors affect to transesterification reaction and the kinetic study of the paper. The highest yield of non-edible feedstock is Jatropha curcas where the yield reach 45% with n-hexane solvent and distillation separation extraction method. Besides the factor affected to the reaction was consider several parameters which is feedstock, temperature, molar ratio, and catalyst typically the optimum temperature was below than 65 degree C but it was depend on the process implementation and the best molar ratio is 4:1 of alcohol : bio-oil. Lastly, most of the article develop the kinetic model of the transesterification using pseudo first order model because it was less complex rather than Langmuir-Hinshelwood-Hougen-Watson (LHHW) and Eley-Rideal (ER) kinetic model but the model was depend on the reliability of the reaction mechanism and from the model the kinetic constant will generated to determine the optimum condition. In conclusion, this comparison study give assistance for kinetic study in transesterification process for non-edible feedstocks.

***Keywords*:** Transesterification, Biodiesel, Kinetic study, Non-edible Feedstock, Quantitative study.

SIIC0112

AN OVERVIEW OF ELECTROCHEMICAL APPLICATIONS TO ORGANIC DYES IN WASTEWATER

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Abstract: Major environmental pollution in the world comes from variety of industries that contain undesirable dye effluents. The impact not only affect the environment but the human being as well from the carcinogens produce from the reaction with disinfectant constituents. The introduction of powerful treatment to neutralize the contaminants of dye has been investigate in recent years to advance the traditional technologies (physical, physicochemical and biological) application. This paper review the electrochemical methods from scattered information connect with modern technologies applied to wastewater. The foundation of electrochemical conventional treatment consist of electrocoagulation, electrochemical reduction and oxidation, and photoassisted electrochemical. The advantages and limitations of electrocoagulation from aluminium or iron anode is discussed. The variety of electrode in electrochemical reduction and oxidation by electrolysis is collected. Recent method of photoassisted electrochemical treatment is also reported.

***Keywords*:** Dye Removal, Degradation, Decolourisation, Electrochemical Technology.

SIIC0113

EFFECT OF PARAMETER CONDITIONS ON OXIDATIVE DEGRADATION OF DYES USING PEROVSKITE CATALYST: A REVIEW

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Abstract: A review was conducted regarding the effect of parameter conditions on oxidative degradation of dyes using perovskite catalyst. Four parameters were studied which are effect of dye initial concentration, pH of solution, the amount of catalyst dosage and the temperature of the solution. This study also covers the literature review regarding the dye effluent, organic pollutant, Advanced Oxidation Process (AOP), perovskite catalyst and effect of the four stated parameter condition using perovskite catalyst. Research methodology were also studied to identify suitable methods to conduct the review, within the allowable actions permitted by the respective authorities given to the current situation in the country. The process flow of the procedure was listed and elaborated. Flow chart for the methodology were prepared. The data obtained on the four parameters which affecting the oxidative degradation of dyes using perovskite catalyst was lined up and elaborated in a short but informative manner. The data obtained from various type of research paper. However, the amount of data obtained was only the one related to the perovskite catalyst influence in dye degradation only. This review concluded that in the initial dye concentration section, the higher concentration would lead to a lower efficiency of the dye degradation. High concentration of dyes would lead to the inability of the perovskite catalyst to process it efficiently. Results of the reviewed paper also shows that excessive amount of initial dye concentration leads to the inability of the degradation process to degrade the dyes at all. The presence of the catalyst highly influences the efficiency of the degradation process when compared to the one where the catalyst is absent. Next, the result obtained from reviewed paper also shows that the most suitable pH solution for degradation of dye process is in alkaline solution, between the range of 1-3 specifically. Most of the high efficiency and high degradation rate occurs in the range below pH value of 4. The study shows that alkaline solution would result in the lower performance of perovskite catalyst and the degradation efficiency. The higher the amount of catalyst dosage would lead to an increased efficiency of the degradation of dye. The higher the amount of the catalyst dosage would lead to increased rate and ability to degrade the dye solution. Finally, this review also found that a higher temperature is more preferable for the process of dye degradation. A temperature ranges from 40-60 ºC is the most suitable temperature for degradation process to perform at the maximum limit.

Keywords: Perovskite catalyst, Advanced Oxidation Process, Oxidative degradation , Heterogeneous catalyst, Dye treatment.

SIIC0114

COMPARATIVE STUDY ON TREATMENT OF WASTEWATER USING NATURAL AND CHEMICAL COAGULANT

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Abstract: The community are facing a serious issue regarding water scarcity due to the exponential population growth. There are various type of wastewater treatment technologies have been developed to ensure plenty of water supply and to meet the demand of clean water for moving towards sustainable development. Coagulation and flocculation processes are the commonly used in a wide range of water treatment processes due to its simplicity and cost-effective approach. Chemical coagulants are commonly applied in the coagulation process for turbidity removal. However, it may leads to negative impacts toward health issues instead of natural coagulants. Generally, natural coagulants considered to be more environmentally friendly due to its biodegradability, renewability, non-toxicity and relative cost-effectiveness. This review paper was conducted to compare the effectiveness of natural coagulant versus chemical coagulant and to determine the mixing condition and settling time of the coagulant. This review paper conducted based on systematic literature review (SLR) by applying SALSA method which helps to assess both quantitative and qualitative content analysis. This paper highlights the effectiveness of natural and chemical coagulants applied in different type of wastewater. The FTIR analysis proves the potential of natural coagulants in wastewater treatment due to presence of functional group such as carboxyl and hydroxyl group which could help in coagulation process. Based on this review paper, each of the application of coagulants in different type of wastewater have different type of mixing conditions. Based on the evaluation, most of the mixing condition is around 100 rpm. The settling time for coagulation and flocculation show variation due to the different type of coagulants and wastewater. In general, it shows that the turbidity removal increases as the settling time increases. Based on the review, it can concluded the application of natural coagulants are feasible and reliable towards sustainable development.

***Keywords*:** Wastewater, Coagulant, Settling time, Coagulation, Flocculation

SIIC0115

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SIIC0116

SYNTHESIS ZIRCONIA (ZrO_2) AND IRON DOPED ZIRCONIA (Fe/ZrO_2) PHOTOCATALYST FOR HEAVY METAL REMOVAL

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***Abstract*:** Zirconia modified with iron (III) nitrate nonahydrate were synthesized by using anodization method as photocatalyst. Irridation of UV light is needed to ZrO_2 photocatalyst for photo degradation of pollutant such as Chromium (Cr(VI)). Removal of Hexavalent chromium (Cr(VI)) is essential because this pollutant classified as carcinogen in group 1 by means it triggers cancer development. UV light is uitilise in photocatalytic process because ZrO_2 has large band gap which is around 3.37 eV to 5.0 eV. Doping method has been used and considered for improving the photoactivity of ZrO_2 and reducing band gap. Doping process was done by using anodization method with different iron (III) nitrate nonahydrate concentration (0.1 M, 0.5 M and 1 M). The results of morphologies and characterization that carried out by using EDX and FESEM shows that 0.5 M of Fe-doped ZrO_2 contain high Fe weight % compared to the other concentration used (0.1 M and 1 M). Comparative studies had been made on the morphologies and characterization between the doped photocatalyst and un-doped photocatalyst from literature survey. Also, comparative studies for this paper includes the application of the modified photocatalyst in the wastewater. From the comparative study, metal-doped photocatalyst nano-size particle such as Ag, Fe, Mo and Cu can enhance the photocatalytic activity. Also, by using Fe doping, band gap of the ZrO_2 nanoparticles were reduced from 4.97 to to 1.77 eV. Study shows that 95 % Cr(VI) removal was observed on ZrO_2 after 5 hours. Degradation performance of Cr(VI) might be increase by using Fe-doped ZrO_2 compare to pure ZrO_2 as the properties of the Fe-doped ZrO_2 can be enhanced in dopant ions.

***Keywords*:** Fe-doped ZrO_2, anodization, photocatalyst, hexavalent chromium

SIIC0117

THE STUDY OF DENSITY FUNCTIONAL THEORY ON SELECTED FUNCTIONALIZED MWCNTs AS ADSORBENT OF METHYLENE BLUE

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Abstract: Methylene blue is a common dye that is found in wastewater dyeing and highly toxic to the environment. In order to remove MB, the adsorption by the MWCNTs membrane is required as it is an effective way to remove dyes. To study the elelctronic properties, mechanism and selectivity interaction between MWCNTs and MB, a DFT method will be performed. The study will be done in the Gaussian 03W software package. By using the DFT method, B3LYP with 6-31G(d) will be used as a basis set for geometry optimizations. The functional group that will be introduce are hydroxyl (-OH), carboxylic acid (-COOH) and acyl chloride (-COCl). The B3LYP method with 6-31+G(d) basis set is used for energy calculations. The electronic properties of MB with MWCNTs-OH, MWCNTs-COOH and MWCNTs-COCl were mostly electrostatic attraction and hydrogen bonding. The mechanism of the MB with MWCNTs-OH, MWCNTs-COOH and MWCNTs-COCl were depend on the functional group that was introduces to the surface of MWCNTs. The energy value shows acyl chloride functional group has the lowest energy value followed by carboxylic acid and hydroxyl. However, the most polarity functional group was carboxylic acid. The selective interaction between MB with MWCNTs-OH, MWCNTs-COOH and MWCNTs-COCl were at the distance where larger energy value occurred. The distance for MB with MWCNTs-OH, MWCNTs-COOH and MWCNTs-COCl were 1.36 Å, 2.0 Å and 2.377 Å respectively. The more negative the energy value, the stronger the interaction between MB and selected functionalized MWCTs.

***Keywords*:** DFT, MWCNTs, Methylene Blue, Adsorption

SIIC0118

AN OVERVIEW OF NICO/SIO_2 FOR CO_2 METHANATION: EFFECT OF CALCINATION TEMPERATURE

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Abstract: The studies is made to review and identify the previous researches on $NiCo/SiO_2$ catalyst for CO_2 methanation with the effect of calcination temperature. CO_2 methanation is the process to reduce the emission of anthropogenic gas which is carbon dioxide by the combination with hydrogen to produce methane gas. Total CO_2 concentration in atmosphere is rapidly increase which can lead to global warming and climate change such as melting of ice, increase of sea level, ozone depletion and extreme weather changes. The review had been made based on the previous research on nickel-based catalyst, nickel-cobalt catalyst and the effect of calcination temperature on the catalyst. Most of the research stated that the catalyst was prepared by impregnation. After the preparation of catalyst, some of researches tested the catalyst first. The characterization of the catalyst had been made N_2 adsorption – desorption isotherms using BET, X-ray powder diffraction (XRD), temperature programmed reduction (TPR), temperature programmed desorption of H_2 (H_2-TPD), and CO_2 (CO_2-TPD). For nickel-based catalyst, the result obtained from the researches involve the nickel content in the catalyst. The amount of nickel content can affect the specific surface area, crystalline size, pore size distributions and CH_4 selectivity. The performance of the particle also increased. The better selection of the catalyst is the catalyst must have a good reducibility of catalyst, large specific surface area and high CO_2 conversion and CH_4 selectivity. The bigger pores can allow the easier diffusion of water and air molecules. The research will undergo the process at the different reaction temperature in order to study the effect of calcination temperature. The most common calcination temperature that used in the research is between 250℃ to 900℃. The catalyst at different calcination temperature resulting in different characteristics and performance of the catalyst. Nickel based catalyst is the commonly used catalyst due to its performance and low cost. The metal loading in catalyst can affect the catalytic performance. The catalyst activity and characteristics also can be affected by reaction temperature and composition. The propose to increase the stability of the catalyst is by adding some catalyst addictive.

***Keywords*:** Carbon dioxide, CO_2 methanation, nickel-based catalyst, calcination temperature.

SIIC0119

REDUCIBILITY ANALYSIS OF CU-ZN BASED CATALYSTS FOR METHANOL SYNTHESIS VIA CO_2 HYDROGENATION REACTION

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Abstract: Greenhouse effect has always been a major concern in environment. One of the factors greenhouse effect is global warming. The rapid rate of global warming can raise the level of temperature in the atmosphere, thus producing gases which eventually would be a harmful substance for world's ecosystem. Carbon dioxide (CO2) hydrogenation for methanol synthesis is one of the common methods to reduce the emission. Therefore, the objective of this study is to prepare and characterize a various formulation of Cu-Zn based catalysts. In addition to that, investigation of reducibility behavior of Cu-Zn based catalysts and its relation towards methanol synthesis via CO_2 hydrogenation reaction. In this process, co –precipitation method are being applied to prepare the catalyst formulation. Three different types of catalyst which is CZZ, CZA and CZAZ are used in this experiment with same ratio of Cu-Zn and various ratios for promoters in each formulation. BET analysis is performed alongside in order to study the characteristic of surface area and pore distribution of the catalyst. As a result, CZAZ has higher BET surface area while resulted in lowest in pore volume and pore size. Normally, the reduction analysis is performed by using temperature programmed reduction (TPR). This method used to analyses and highlights the reduction profile of various formulation of catalyst. Based on the results shown, all catalyst used has performed an accurate result which is one peak of broad reduction profile with H_2 consumption quantity at maximum temperature. Hence, the addition of promoters such as Al, Zr affected the Cu dispersion in the catalyst thus reduction behavior of the catalysts was observed. CZAZ resulted to be the most effective catalysts observed in TPR analysis with lower maximum temperature 194.48^{o}C and higher quantity of H_2 consumption for 4.63%. Consequently, it also produced most CO_2 conversion and CH_3OH selectivity in the process reaction simultaneously generating higher yield compares to others proposed samples. It is believed that the improved performance of methanol synthesis are largely affected by the active site that available in the catalyst which enable Cu reduce more for exhibits the best yield in the process reaction.

***Keywords*:** CO_2 hydrogenation, co-precipitation, methanol synthesis, reducibility, Cu-Zn-Al-Zr catalyst.

List of PLATINUM Awards

SIIC 086
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SIIC 097	SILVER	AHMAD BIN FAHMI
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SIIC 057	SILVER	AIDA NADIAH BINTI HAZELI
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SIIC 102	SILVER	KHAIRUNNISA NABILAH BINTI FAIRUL AZAHAR
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SIIC 041	BRONZE	NURUL IZZATUL NADIA BINTI ADNAN
SIIC 105	BRONZE	NAZRIYATUL NAZIHAH ROSLAN
SIIC 049	BRONZE	NUR MASYITAH AZ-ZAHRA BINTI ROSMAN
SIIC 061	BRONZE	MAISARAH BINTI AHMAD
SIIC 080	BRONZE	WILSON TUNGKU ANAK SAWANG
SIIC 006	BRONZE	SITI UMI BINTI ABD RANI
SIIC 027	BRONZE	NURFARZANA BINTI MOHD NOOR
SIIC 044	BRONZE	MOHAMAD HANAFI BIN HAMZAH
SIIC 028	BRONZE	NURFAZHILAH BINTI MOHD JOHAN
SIIC 067	BRONZE	AFFYCILLA ADRIES
SIIC 021	BRONZE	NORSYAHIRAH BT SHAMSUL KAMAL
SIIC 051	BRONZE	NURUL NAJWA ZAM BERE
SIIC 033	BRONZE	NABILAH HANUM BINTI MOHD.AKHIR

SIIC 065	BRONZE	SHARIFAH NUR HADZLIN BINTI WAN MADEHI
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SIIC 002	BRONZE	NAFISAH BINTI BUSTAMAN
SIIC 039	BRONZE	NUR SHAQIRA BINTI SHAMSOL KAMAL
SIIC 081	BRONZE	AFFANDY BIN RAHIM
SIIC 037	BRONZE	NUR IFFAH NABIHAH BINTI MUHAMMAD ANUAR
SIIC 014	BRONZE	MOHAMAD HELMI MOHD ASBI
SIIC 094	BRONZE	NUR ZULAIKHA BINTI ZAINUDIN
SIIC 112	BRONZE	MUHAMMAD BUDRIZ BIN MOHD AMIN
SIIC 111	BRONZE	MUHAMMAD AIZUDDIN ROSLAN
SIIC 032	BRONZE	MIMI AYUNI BINTI MAZLAN