PO-01 Use of nanoparticles for improvement of seeds germination and growth rate

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There are many nanotechnology-based products related to agriculture and agro-based industries being developed by foreign and domestic companies and some of them have entered the Malaysian market Nanotechnology has the prospect to revolutionize the agricultural and food industry with new tools for the molecular treatment of diseases, rapid disease detection and enhancing the ability of plants to absorb nutrients. The engagement of nanoparticles in these fields envisions that these particles will impart some beneficial effects to the crops. The unique properties of nanoparticles (small size, high biochemical reactivity, ability to penetrate cells, and swift distribution inside organisms) make them an attractive tool for crop management techniques.
In seed industry, it has proven that the nanoparticles could improve both plant germination and growth rate of the seeds. However, reports related to understanding nanoparticle and plant interactions are still limited and sometimes contradictory. MARDI has spearheaded this research focusing on effects on germination and growth rate of selected nanoparticles on local seeds. For a start, different types of nanoparticles with different sizes were selected, namely single walled carbon nanotubes (SWCNTs), multi walled carbon nanotubes (MWCNTs), cuprum oxide and silicon nanoparticles. Local seeds such as paddy, tomato and papaya were treated with these nanoparticles and grown at optimal condition. Molecular approach also sought in understanding the behaviour of these seeds at molecular level. This finding will provide us the information regarding comparisons of different classes of nanoparticles' effects towards root development (including number of roots) of those seeds in addition to the effects on seed germination and root elongation. Although this paper demonstrates the potential of nanoparticles for agricultural applications, further investigation and research is needed to expand the application possibilities and methodologies in agriculture.

PO-02- Multi-Dimensional Model of Flame Synthesis of Carbon Nanotube

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The discovery of carbon nanotube (CNT) over two decades ago has sparked extensive investigations worldwide where various CNT synthesis methods and parameters have been experimentally explored. Flame synthesis is attractive due to its low cost and simple technique. Nevertheless, very little attention has been paid to the modelling side of flame synthesis especially on the coupled computational aspect due to the complex physics involved and due to the lack of supporting data for validation. Temperature and partial pressure are important growth parameters for CNT growth. Since both parameters are tied together in flame synthesis, the coupled effect of the two parameters should be investigated and should demonstrate the correct physics of CNT growth before a coupled computation of the particle scale and the flame scale model could be carried out. In addition, the understanding of the underlying physics of CNT growth within the flame structure is limited. This hinders the improvements of synthesis control for better CNT throughput. In the present study, a baseline multiscale model of flame synthesis in inverse diffusion flame is developed. The multiscale model consists of a coupled computation of a growth rate model and a flame model that caters to CNT growth at the particle and the flame scale respectively. At the particle scale, a previous CNT growth rate model that is based on chemical vapour deposition (CVD) studies is modified to produce a more accurate physical representation of CNT growth. The modified growth rate model is validated against CVD experimental data on CNT length and shows excellent agreement. With regards to the flame model, computation of the reacting flow field is done for an inverse diffusion flame using the compressible, nonpremixed combustion solver from the CFD toolkit OpenFOAM. A baseline model is established before extensive validation works are carried out. The validation results for the flame baseline model show good agreement with the experimental data in terms of the location of the reaction zone, the local flame temperature, and CNT growth region. The validation of CNT growth region stems from a coupled computation of the growth rate model and the flame baseline model which is the first attempt of its kind. The coupled effects of temperature and partial pressure of species on CNT terminal length and growth rate is studied using the growth rate model. A trend of increasing growth is observed at high temperature and partial pressure which confirms the expected response of CNT growth towards both parameters. Additionally, it is predicted that operating conditions below 950 K and 5 Torr of temperature and partial pressure results in unfavourable growth and should be avoided when

setting up experiments in the future. Finally, the effects of flame structure and oxygen concentration on CNT length and growth region are investigated. The results for the baseline model show that high CNT growth region falls within a fixed mixture fraction range of 0.28 to 0.50, which indicates that there is a unique range of mixture fraction that acts as an indicator of the growth region at a specified fuel to oxidizer ratio. In addition, the maximum CNT length is predicted at about 0.50 mixture fraction for all oxygen concentrations that involves small variation in stoichiometric mixture fraction. Flame structure that is based on physical space and mixture fraction space is used to present the findings for the oxygen concentration effects. Analysis on the CNT length at increasing oxygen concentration shows improvement of CNT length by 40% from 25%O_2 to 40%O_2. The results also suggest that the spatial width of growth region improves by threefold when the oxygen concentration is increased from 25%O_2 to 40%O_2.

PO-03- Time Resolved Photoluminescence of Chalcopyrite Materials CuGaSe2/CuInSe2 Single Quantum Well

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$CuGaSe_2$ and $CuInSe_2$ single quantum well layers are grown on GaAs (001) by employing the deposition sequence of migration enhanced epitaxy (MEE) using a molecular beam epitaxy system. The carrier lifetime of the quantum well is measured via time-resolved photoluminescence (TRPL). By using the single exponential fitting, the PL decay time is 21.5 ps. Carrier lifetime increases with increasing of the measurement temperature. The carrier lifetime of CGS/CIS SQW is smaller comparison to GaAs. The shorter carrier lifetime may indicate the contribution of non-radiative recombination.

Keywords: CGS/CIS single quantum well; solar cell; carrier lifetime; TRPL; Photoluminescence; MBE; MEE

PO-04- Mesoporogen-free synthesis of hierarchically porous, nano-sized ZSM-5 aggregates at low-temperature

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The molecular diffusion with zeolites is limited, especially in a specific reaction including bulky reactants and/or products due to the solely presence of micropores (<2 nm). Generation of hierarchically porous ZSM-5 with micro and mesopores (2-50 nm) has been a rational solution for overcoming this problem. The conventional method for synthesizing hierarchically porous ZSM-5 generally requires high-temperature heating (>100 °C) in the dual presence of an organic structure-directing agent (OSDA) and a mesopore-generating agent (mesoporogen). Herein, we report a new method for the synthesis of hierarchically porous ZSM-5 resulted from aggregates of ZSM-5 zeolite crystallites at low temperature (90 °C) without the presence of any mesoporogen. Catalytic test on LDPE pyrolysis shows the significant effect of mesoporosity.

Keywords: diffusion, hierarchical porosity, nano-aggregates, ZSM-5.

PO-05- Hierarchically porous MOR zeolite designed via sequential acid-base treatment and its catalytic performance on ethanol dehydration

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MOR zeolite is one of the most important catalyst for many reactions in petrochemical industries, however, it is susceptible to deactivation by cokes formation due to diffusion limitation along its one dimensional (1D) micropores. Desilication in alkaline media provide good result in introducing mesopores into zeolite crystals. Nevertheless, this method do not have a good agreement with low silica zeolite (Si/Al ratio <25) such as MOR, especially in the complete absence of OSDA (organic structure-directing agent). To overcome these problems, acid treatment can be performed prior to base treatment (sequential acid-base treatment). In this contribution, we perform an investigation into the effect of acid type on the sequential acid-base treatment with regard to mesopores formation in MOR zeolite. The used acids were HCl, HNO_3, and $H_2C_2O_4$ with *K*a of 1.3×10^{6}; 24; and 5.4×10^{-2}, respectively. The results show that the extraction of Al is strongly governed by acid strength. The extraction of Al is also proportional with amount of formed silanol groups. Thus, the sinergy between increased Si/Al ratio and fabricated silanol groups are the key of successful desilication. Catalytic test on ethanol dehydration demonstrates that sequential acid-base treatment significantly improve MOR zeolite performance, in the order of acid strength. These insight are based on the characterzation results of XRD, ^{27}Al and ^{29}Si MAS NMR, Raman dan Infrared spectroscopy, SEM, TEM, and TGA.

Keywords: MOR zeolite, hierarchically porous, sequential acid-base treatment, ethanol dehydration

PO-06- Magnetically Recoverable Chitosan Supported Biosynthesized Gold Nanocatalyst For Reduction Of 4-Nitrophenol

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Application of metal nanoparticles as catalysts has attracted great interest due to their high catalytic activity and improved selectivity. However, the isolation and recovery of these metal nanocatalysts is problematic. Biosynthesis of metal nanoparticles using plant extracts as an environmentally benign compound has received increasing attention due to high yields, environmental friendliness, elimination of organic solvents and easy work up. In this research, a novel magnetically recoverable magnetic chitosan supported biosynthesized Au nanoparticles (Au NPs) is prepared through simple adsorption-reduction of the Au(III) ions on the chitosan coated magnetite support. Au NPs were well loaded on the surface of the magnetic support due to the presence of hydroxyl (-OH) and amino ($-NH_2$) groups in chitosan molecules that provided the driving force for the complexation reaction with the Au(III) ions. Complete reduction of the Au(III) to Au(0) is achieved by using *Melicope ptelefolia* aqueous leaf extract. The synthesized magnetic chitosan supported biosynthesized Au nanocatalyst was characterized using FT-IR, TEM, XRD and CHN analysis. FTIR spectrum of magnetic chitosan shows peaks at 1570 cm^{-1} indicative of N-H bending vibration and 577 cm^{-1} which designates the Fe-O bond. TEM analysis shows amorphous layer around the magnetite core which supported the coating of chitosan on the magnetite surface. XRD analysis shows six characteristics peaks for magnetite corresponding to (220), (311), (400), (422), (511) and (440) in both the magnetite and magnetic chitosan samples (JCPDS file, PDF No. 65-3107). CHN analytical data further supported the coating of chitosan onto the magnetite. The as-synthesized magnetically recoverable Au nanocatalyst catalytic performance was evaluated in the reduction of 4-nitrophenol (4-NP) to 4-aminophenol (4-AP) in the presence of formic acid.

Keywords: Magnetic chitosan, Gold nanoparticles, Biosynthesis, *Melicope ptelefolia*, 4-nitrophenol

PO-07- Neuroprotection and Reactive Oxygen Species Effect of Functionalized CNT on SH-SY5Y Cells

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Carbon nanotubes (CNTs) have unique physical and chemical properties for applications in biological systems especially used for drug carrier. However, more concern should be high light on the safety use to human. The present study was undertaken to determine the biocompatibility of CNT onto SH-SY5Y cell lines based on the toxicity test *in vitro*. The cells were cultured with CNT and functionalized CNT (f-CNT). The CNT was functionalized with polyethylene bis-amine (PEG-NH_2). The percentage of viable cells was determined and compared with previous reactive oxygen species (ROS) produced when exposed to CNTs and f-CNT. Our results demonstrate that the CNT induces cytotoxicity and increased ROS in SH-SY5Y cells at relatively high concentrations (above 10 µg/ml) compared to low concentration (below 100 µg/ml). The f-CNT showed high cells viability (98%) at 10 µg/ml.

Keywords: CNTs; polyethylene bis-amine; SH-SY5Y cells; ROS; biocompatibility.

PO-08- Effect of various Ultrasonic waves Amplitude on Synthesis of Silver Nanoparticles in κ-carrageenan and their Antibacterial Activity

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Silver nanoparticles (Ag-NPs) are being increasingly used exclusive in medical applications such as antibacterial agent. Chemical methods have been used for the synthesis of Ag-NPs, but these methods have a lot of disadvantages because most of the chemical that have been used for synthesis the nanoparticles are too expensive and toxic, which are responsible for various biological risks. Hence, the sonochemical method as green methods has been developed for preparing Ag-NPs in κ-carrageenan at different ultrasonic amplitude. The κ-carrageenan used as an eco-friendly stabilizer and ultrasonic irradiation as a green reducing agent. While increases of ultrasonic amplitude, the number of Ag-NPs increased, formations of Ag/κ-carrageenan were determined by UV–visible spectroscopy where surface plasmon absorption maxima observed in 401– 409 nm. TEM images showed the good distribution of Ag-NPs with average particle size less than 2 nm. SEM images showed the spherical shape of the Ag-NPs. The antibacterial result proved the AgNPs that synthesis by ultrasonic irradiation at different amplitude are well as an antibacterial agent. The use of photo irradiation provides green and economic features of this work.

Keywords: Antibacterial, green methods, silver nanoparticles, κ-carrageenan, ultrasonic amplitude

PO-09- Highly Crystalline, Stable Mesoporous SSZ-13 Obtained via Controlled Post-Synthetic Treatments

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SSZ-13 zeolite has typical pore architecture arranged by a large ellipsoidal cage (CHA) and double six-membered ring (d6r). This material has shown remarkable catalytic activity in MTO (methanol-to-olefin) reaction and selective catalytic reduction of NOx (NH_3-SCR) due to their high selectivity toward reactant and product molecules. However, SSZ-13 is susceptible to faster deactivation because of diffusion hindrance in micropore channel. The rapid deactivation in zeolite can be suppressed by the addition of mesopores. Desilication has been used to introduce mesopores within zeolite structure but the results often lead to loss of crystallinity due to uncontrol desilication rate. By varying the amount of OSDA within the zeolite framework, the desilication rate can be controlled since OSDA may prevent the hydroxyl ions attack to siloxane bonds. In this case, we performed an investigation into the effect OSDA content to produce highly-stable crystallinity of mesoporous SSZ-13 zeolite and its hydrothermal stability compared to that of purely microporous parent SSZ-13. The result shows, zeolite with OSDA content within the framework tends to not further affected by alkaline treatment. Based on X-rays diffractograms, the typical peaks of SSZ-13 zeolite appear in AT-AS-C550 and C250-AT-C550 samples. The

decreasing of OSDA content at the C450-AT-C550 and C550-AT-C550 leads to the disappear of typical peaks that shown amorphous behavior. Additional characterizations such as IR-ATR, RAMAN, SEM, TEM, XRF, ^{29}Si and ^{27}Al MAS NMR were used to support the XRD data. Hydrothermal stability test on samples demonstrate that mesoporous SSZ-13 zeolite has relative high stability.

Keywords: SSZ-13, partial detemplation, hydrothermal stability, MTO, desilication.

P0-10- Encapsulated Tamoxifen in PLLA from Supercritical Anti Solvent (SAS) Process: In-vitro drug release and kinetic modelling

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Pharmaceutical industry are focusing on nanoparticle production by using environmental friendly process, such as using supercritical carbon dioxide. In this paper, evaluation on drug release of encapsulated Tamoxifen; an anti-cancer drug in a biodegradable polymer in Phosphate Buffered Solution were carried out. Encapsulated Tamoxifen used in this work was the optimized particle from our previous study which is synthesis of encapsulation Tamoxifen in PLLA using supercritical Anti-Solvent (SAS) process. Particle size, morphology and crystallinity profile of Tamoxifen and processed Tamoxifen were obtained to compare Tamoxifen behavior; before and after SAS process. Based on the in-vitro release profile, 5 different kinetic models were used to find the best fit of encapsulated Tamoxifen. Kinetics models which are commonly used to study drug release from polymeric shell such as Zero-order, first order, Higuchi. Korsmeyer-Peppas and Hixson Crowell model are chosen. From the cumulative drug released, it was observed that encapsulated Tamoxifen has higher solubility compared unprocessed Tamoxifen, which suggested that encapsulated Tamoxifen are more attractive to be used. From the kinetic models, Higuchi model gives the highest R^2 value; which proves that Higuchi model is the best fit for release of Tamoxifen in PLLA.

Keywords: Nanoparticles, Drug Encapsulation, Supercritical Carbon Dioxide, Drug release kinetics, Tamoxifen.

P1-01- Conversion of cellulose to short chain polyols over metal loaded on KCC-1 catalyst

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The production of short chain polyols from cellulose over metal (Ce, Ni, or Ru) loaded on fibrous mesoporous silica KCC-1 catalysts was studied at temperature range of 150-240°C. The KCC-1 was prepared by microwave assisted hydrothermal method. Then it was modified with Ce, Ni or Ru by incipient wetness impregnation method. The KCC-1, Ce/KCC-1, Ni/KCC-1 and Ru/KCC-1 were characterized with XRD, FESEM, FTIR and nitrogenphysisorption analyzer. The XRD analysis showed that the introduction of metals did not change much of the XRD pattern for KCC-1. The FESEM and EDX results showed the presence of Ce, Ni and Ru metals on the uniform spherical shape of fibrous silica particle. The surface area of KCC-1, Ce/KCC-1, Ni/KCC-1 and Ru/KCC-1 was 393.81, 371.56, 314.22 and 351.97 m2/g, respectively. At 220 °C, 5 bars of nitrogen, and 2 h of reaction, the conversion of cellulose reached 95 % over Ce/KCC-1 with the product distribution of 3-buten-1-ol (S=63.30%), diisopropyl ether (S=2.86%) and cyclopropane carboxylic acid (S=33.70%). While, bare KCC1, Ni/KCC-1 and Ru/KCC-1 showed less activity than that of Ce/KCC-1. The high activity of Ce/KCC-1 may be due to the presence of Ce metal and fibrous silica which provided large surface area and average pore diameter.

Keywords: Cellulose, Cerium, Ruthenium, Nickel, KCC-1

P1-02- Pilot-Scale Catalytic Fast-Pyrolysis Process of Producing Bio-Oil from Empty Fruit Bunch Biomass

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The search of alternative energy in response to the world energy security supply dependency on ever depleted fossil fuel has increase rapidly over the decades. Agricultural and other lignocellulosic biomass such palm oil empty fruit bunch (EFB) is identified with high potential to be processed as renewable energy due to its right characteristic and abundance locally. Pyrolysis process, among other processes of transforming biomass into bio-oil, has been recognized as one of most viable process. In this study, catalytic fast pyrolysis process of transforming EFB into bio-oil in a pilot-scale reactor plant is reported. The pilot-scale reactor was designed and built to achieve conversion percentage of greater than 50% as well as simulates actual bio-oil production line. Introduction of predetermined amount of catalyst in the material mixture reduced the typical acquired temperature of non-catalytic reaction to 320 ºC. Two types of nano-catalyst were compared to deduce the best out of Zeolite NaA and NaX to be used in the process. Modified zeolite NaA evidently is more cost effective, catalytically more active and selective.

Keywords: empty fruit bunch, zeolite, fast-pyrolysis, pilot-scale, renewable energy

P1-03- Radio frequency magnetron sputtered YSZ thin film: Impact of oxygen ratio

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Yttrium stabilized zirconia (YSZ) thin films were deposited using RF magnetron sputtering technique to achieve an electrolyte effective for low-temperature solid oxide fuel cells (LT-SOFCs). Influence of varying oxygen ratio (0, 25, and 50 sccm) on the growth morphology and structure of such thin films was determined. Samples were characterized using various analytical techniques. The structural and electrical properties of single cell were evaluated. Present findings may contribute towards the development of YSZ based electrolyte useful for LT-SOFC operation.

Keywords: YSZ, thin film, reactive RF magnetron sputtering, oxygen ratio.

P1-04- The Effect of Calcination Temperature on the Structure and Photocatalytic Activity of Carbon-Doped Titanium Dioxide Prepared via Sol-Gel Route

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A simple and low-cost sol-gel route based on the self-assembly technique using polyoxyethylenesorbitan monooleate (Tween 80) as a carbon source and calcined at 300-600 ºC for preparing C-doped TiO_2 photocatalyst was carried out. The powder obtained was characterized by attenuated total reflectance spectra Fourier transform infrared spectroscopy (ATR-FTIR), diffuse reflectance ultraviolet-visible spectroscopy (DR UV-Vis), X-ray diffraction (XRD), scanning electron microscopy (SEM), photoluminescence (PL), and ultraviolet-visible spectrophotometry (UV-Vis). The use of C-TiO_2 particles for photocatalytic environment remediation was demonstrated by the degradation of phenolphthalein (PHP) under UV and visible light irradiation. C-TiO_2

photocatalyst calcined at 400 ^{o}C was the most effective with an ideal amount of carbon, the presence of hydroxyl group, better crystallinity of amorphous-anatase mixture, and the existence of sub-band which reduces the band gap energy. Thus, exhibits high degradation percentage of PHP under UV and visible light irradiations, leading to as much as 3.70 and 11.89 %, respectively. As a result, carbon doping modification is an appropriate strategy to enhance the photocatalytic activity by improving visible-light absorption and e^{-}/h^{+} separation.

Keywords: Titanium dioxide, C-doped TiO_2, Phenolphthalein, Photocatalysis, Photocatalyst

P1-05- Low temperature synthesis and characterization of compact, mesoporous TiO2 film

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In order to realize the use of organometallic light absorber, the TiO_2 thin film with thickness less than 100 nm have become a requirement. It needs to be compacted to block the HTM electron recombination at n-type layer. In this study, reactive sputtering with various O_2 partial pressure were used to develop TiO_2 thin films at room temperature. Diluted hydrothermal TiO_2 were used as mesoporous thin films developed via optimized spin coating method. Both combined method able to produce overall less than 300 nm TiO_2 thin film.

Keywords: TiO_2 thin film, reactive sputtering, TiO_2 film phase

P1-06- Characterizations of Solvent Extracted Aloe Vera Gel for Electrolyte Application

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Aloe Vera was choosen as the component required to improved the conductivity of the gel polymer electrolyte in photoelectrochemical cell of dye solar cell. The study started with the solvent extraction of gel from Aloe Vera (Aloe Barbadensis Miller) which involved the separation of compounds based on their relative solubility in two different immiscible liquids such as water and an organic solvent. The extraction process was carried out in a series of solvents namely hexane and ethanol. Both organic solvents will extract different compounds in Aloe Vera gel based on their polarity. The yield of extracted gel from hexane was 7.72 wt% while ethanol was 5.78 wt%, lower than hexane. The samples were than characterized using several analytical tools such as Fourier Transform Infrared spectroscopy (FTIR), Thermogravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC).

Keywords: Solvent extraction; Aloe Vera gel; organic solvents; electrolyte

P1-07- Insertion of Molybdenum Disulfide as active layer for Perovskite Solar Cells: Further Performance Enhancement Perspective from Device Simulation

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Organo-halide Perovskite Solar Cells (PSC) have been reported to achieve remarkably high power conversion efficiency (PCE). A through understanding the role of each component in solar cells and their effect as a whole is still required for further improvement in PCE. In this work, the effect of Molybdenum Disulfide (MoS_2) in PSC with mesoporous structure configuration was analyzed using Solar Cell Capacitance Simulator (SCAPS). With the MoS_2 layer which having twofold function, acting as a protective layer, by preventing the formation of shunt contacts between perovskite and Au electrode, and as a hole transport material (HTM) from the perovskite to the Spiro-OMETAD. As simulated, PSC demonstrates a PCE, η of 13.1%, along with stability compared to typical structure of PSC without MoS_2 ($\Delta\eta/\eta$ =-9% vs. $\Delta\eta/\eta$ =-6%). The results pave the way towards the implementation of MoS_2 as a material able to boost shelf life which very useful for new material choice and optimization of HTMs.

Keywords: Solar Cells, Perovskite, MoS_2, active layer, Device Simulation.

P2-02- Critical Physicochemical Attributes of Chitosan Nanoparticles in Pulmonary Drug Delivery

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Nanoparticulate delivery system receives a widespread interest for use to deliver therapeutics for treatment of different diseases such as cancer and infection. Nanomaterials enable therapeutic agents to be delivered in a targeted fashion. Nanoparticles improve drug solubility, extend drug half-life, improve therapeutic index, and reduce drug immunogenicity. The nanoparticles can penetrate the mucus barrier and biological interface to raise the drug bioavailability.

With reference to lung cancer, delivering nanoparticles via the lung gains much interests as nano-size particles can cross the cellular barrier. However, nanoparticles have the disadvantages of being exhaled from lungs after pulmonary administration. The inhaled particles should have an aerodynamic diameter between 1 and 5 µm in order to enable the drugs being deposited in the deep lungs. Several approaches have been developed to form nanoparticles with suitable aerodynamic diameters for lung delivery, namely nanoagglomeration, nanocomposite formation and microencapsulation. The current approaches of producing inhalable nanoparticles have several drawbacks. Firstly, they require meticulous efforts in the formulation steps. Each formulation is only likely to be applicable to a specific nanoparticle type. The microscale particles are known to face issues of poor flowability and dispersibility in association with their cohesive nature. The microencapsulated dosage forms run the risks of inadequate nanoparticle release. The nanoparticle size can change during the microencapsulation process, suggesting the size-dependent biological performances of nanoparticles can be affected by nano-to-micro scale transformation. This presentation highlights physical blending using microcarrier (lactose-polyethylene glycol (PEG) 3000 microparticles) as the alternative approach to deliver chitosan nanoparticles via the pulmonary route. The critical physicochemical parameters of nanoparticles that are required for pulmonary inhalation are identified.

P2-03- Conjugation of hydrophobic oleic acid with chitosan for use as a lung–specific nanoparticulate drug carrier.

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Lately, hydrophobically modified polysaccharides have leading–edge in the fields of nanotechnology and pharmaceutical research. Amphiphilic polymers consist of hydrophilic and hydrophobic fragments can form nano-sized conjugates through intramolecular and/or intermolecular hydrophobic interaction in aqueous media, where hydrophobic fragments are separated from the aqueous exterior by entropic gain to form an inner core surrounded with a hydrophilic shell. Additionally, the hydrophobic hub gives stability to the conjugates in aqueous media by hydrophobic interactions which will then function as a reservoir for active hydrophobic molecules. Whereas, the hydrophilic shield guards the hydrophobic drugs from the surroundings, providing stability to the conjugates, and can increase the biocompatibility through surface modifications.

Keywords: Chitosan; oleic acid; conjugation; hydrophobic; degree of substitution.

P2-04- Development of Nanocolloidal Carrier Loaded with Curcumin Aimed for Pulmonary Delivery in Targeting Lung Cancer

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Curcumin (CUR) has demonstrated extraordinary antitumour effects on lung cancer. However, lack of optimal bioavailability of CUR due to poor solubility, low stability and high toxicity at its therapeutic dose were identified as the main problems for the development and clinical use of this antitumour compound. Hence, attention has been focused on the development of aerosolized lipid-based nanocolloidal carrier system to deliver CUR via pulmonary route. The selection of biocompatible components including oils, surfactants and co-surfactants along with their optimum concentration is crucial to get stable and clinically acceptable carrier system. In this work, the solubility of CUR in the oils (palm kernel oil esters (PKOEs), safflower seed, soybean, coconut and olive), surfactants and co-surfactants in single and mixed ratios were taken as criteria for selection. It was found that, PKOEs with safflower seed oil gave the highest effect in solubilizing CUR. The particle size was directly proportional to the amount of oils but inversely proportional to the amount of surfactants and co-surfactants. The optimal nanocolloidal carrier composition was stable under centrifugal force and the measured droplet size was <200nm. The nanocolloidal carrier formulation could be a promising carrier system for CUR in targeting lung cancer through pulmonary route.

Keywords: nanocolloidal carrier, curcumin, lung cancer, pulmonary delivery

P2-05- Top 10 smoking cessation mobile apps : Apps feature review

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The past few years the world had been introduced with various methods and alternatives to curb smoking. Smoking trend had changed drastically as nowadays smoking start as early as in adolescents stage. Due to this change in smoking trend a mobile apps had been introduced as new alternative to discourage the use of tobacco products. This alternative method is in line with the current trend worldwide of using mobile apps and internet as a way of living. The objective of this research is to review apps feature among ten most popular mobile app based interventions to facilitate smoking cessation. Furthermore, this study involved review of each apps feature from ten selected mobile apps using android and iOS mobile operating system. This study also help to develop a complete and effective feature apps of intervention for smoking cessation.

Keywords: mobile apps, smoking cessation, apps feature, intervention, smoking trend

P2-06- Pilot Study: Second Hand Smoke Exposure among employees working in smoking banned area

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Health effect of secondhand smoke have been established more than two decades. This has led to ratification of Framework Convention of Tobacco Control leading by World Health Organization (WHO) which have been followed by many countries to fight against tobacco industry. Legislation of smoke free zones is one of the solution applied by many countries. Many studies show significant improvement of secondhand smoke exposure after the implementation of smoke free policy. However, there is still cases reported exposure within the smoke free area. So this study aims to investigate the impact of working at smoking banned area (workplace) towards the risk of secondhand smoke exposure among the employees and its associated factors. A pilot study was performed in a subsample of 30 employees from Pusat Perubatan Universiti Malaya (PPUM). Exhaled carbon monoxide level were measured and face to face interviewed using Global Adult Tobacco Survey- Malay version were used. Out of 30 employees, 21 were nonsmokers and 6 were smokers. Among female's employees (n=8), four (4) of them

reported their partners are smoker. While six (6) participants reported exposure of secondhand smoke at the workplace. Secondhand smoke exposure at the workplace reported higher among employees working farther from the main hospital setting. Although the policy and warning signboard is available within the workplace, lack of comprehensive enforcement may contribute to the existing of lighting cigarettes within the smoking ban area.

Keywords: Secondhand smoke; Environmental Tobacco Smoke, Global Adult Tobacco Survey; Smokerlyzer; Exhaled carbon monoxide

P2-07- Cytotoxicity of Docetaxel loaded Poly-εCaprolactone Nanoparticles Evaluated by MTT-Cell Culture Assay

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Current approaches to encapsulate and deliver therapeutic compounds had focused on developing biodegradable polymeric nanoparticles (NPs), resulting in clinically approved therapeutics such as Doxil/Caelyx and Genexol-PM, respectively. Our group recently reported the development of poly-ε-caprolactone (PCL) biodegradable NP systems that combined the beneficial properties of polymeric NPs for controlled drug delivery. Nanoparticles developed in this research using PCL biodegradable polymer as nanocarrier and encapsulated with a model chemotherapy drug, docetaxel for treatment of lung cancer. Finally, we tested the cytotoxicity of different processing preparation method for PCL NPs formulation with and without purification using MTT assays on two model cell lines; human fibroblast normal lung cell line (ccd-19lu) and lung cancer cell line (NCL-H460). Our data suggested that PCL nanoparticles in this study could be successful nanocarrier for lung cancer drug such as docetaxel to be used as pulmonary delivery system nanocarrier for lung cancer treatment.

Keywords: Poly-ε-caprolactone nanoparticles, nanocarrier, pulmonary delivery system, cytotoxicity, lung cancer.

P3-01- Detection of Ganoderma Boninense (*G.boninense*) with Silicon Nanowires (SiNWs) based Gold Nanoparticles (AuNPs)

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Recently, the discovery of SiNWs had been anticipated due to the remarkable properties including for biomolecules detection. In this experiment, the 95 nm of SiNWs is characterized with the current-voltage (I-V) measurement to show the relationship of Ohm's Law of the device's potential. Thus, the detection of Ganoderma Boninense (*G.boninense*), a fungal pathogen that had been infected oil palm in Malaysia with SiNWs had been carried out. The presence of gold nanoparticles (AuNPs) as surface functionalization also gives the great benefit with the biomolecules detection.

Keywords: Oil palm, G.boninense, Biosensor, Silicon nanowires (SiNWs), Gold Nanoparticles (AuNPs).

P3-02- Application of GC-MS Based Metabolomics for Metabolite Variations in Healthy and *Ganoderma boninense* Infected Oil Palm Leaf

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An approach to metabolomics profiling of healthy and *Ganoderma boninense* (*G. boninense)* infected oil palm leaf crude extracts that utilizes gas chromatography-mass spectrometer (GC-MS) and multivariate statistics of principal component analysis (PCA) have been tested. This combination has provided a rapid approach in investigating the changes in the metabolite variations of healthy and *G. boninense* infected oil palm leaf at 60 days post-infection. The extracts of healthy and *G. boninense* infected leaf were prepared by using 80% (v/v) of methanol. In identifying the metabolites responsible for each differentiation, PCA model was generated in loading bi-plot. 5-hydroxymethylfurfural and 1-propylpiperidine contents were higher in healthy samples than infected samples. 4*H*-pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-, 2,4 (1H, 3H)-pyrimidinedione,5-amino, coumaran, 2-amino-4-methylpyrrole-3-carbonitrile,dl-α-tocopherol, stigmasterol and stigmast-5-en-3-ol, (3*β*) were more abundant in infected samples. Up and down regulation of metabolites during infection indicates their roles in plant stress/disease signaling. The present study highlights the GC-MS-metabolomics approach as an additional discrimination method in identifying the metabolite variations of healthy and *G. boninense* infected oil palm leaf.

Keywords: *Ganoderma boninense*, oil palm, leaf, metabolomics, GC-MS

P3-03- Synthesis and Characterizations of Fungicides Intercalated Zinc–Aluminium Layered Double Hydroxides

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Two fungicides; hexaconazole and dazomet were first encapsulated into micelles derived from an anionic surfactant, sodium dodecyl benzenesulfonate (SDBS), and then were subsequently intercalated into the intergallery of Zn/Al layered double hydroxide (ZALDH) using ion exchange method. Due to the intercalation of the fungicides, the basal spacing of the ZALDH was expanded from 8.7 Å to 28.8 Å and 29.6 Å for hexaconazole-intercalated ZALDH (HZALDH) and dazomet-intercalated ZALDH (DZALDH), respectively. Fourier transform infrared (FTIR) study shows that the absorption band of the resulting nanocomposite is composed of both features of both fungicides which further confirmed the intercalation episode which subsequently enhanced the thermal stability of the fungicides compared to their counterparts. This study was conducted in order to develop a new generation of safer and environmental friendly agronanochemicals.

Keywords: Nanocomposite, layered double hydroxide, hexaconazole, dazomet, agronanochemical.

P3-04- Study of Penetration Forces by Drilling on Oil Palm Trees

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Ganoderma boninense is a major pathogen causes a devastating oil palm disease called as basal stem rot (BSR). This disease leads oil palm trees rotting on palm bole and eventual death. Applying chemical treatment such as hexaconazol to the infected palms is one of current methods in order to control and minimize the losses due to this disease and is applied through injecting by drilling to the trunk. The method of drilling need to be optimized as it may wounds the trunk and causes other infection or attract some dangerous insects. This paper presents the study and analysis of penetration forces by drilling on the oil palm trunk. This study can be used in designing a new drilling method and mechanism for better efficient drilling.

P3-05- Basal Stem Rot Disease Detection at Oil Palm Tree Using Soil Electrical Resistance – Preliminary Study

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Basal stem rot (BSR) caused by *Ganoderma boninense* is a major disease attacking the oil palm plantation in Malaysia and incur big losses in palm oil industries. The disease is spread mostly by root i.e. either through spore availability in soil or roots contacts. Soil properties were reported to have significant influence on the growth of fungi. YL-69 soil moisture sensor was used to collect soil electrical resistance (ER) data at eight positions surrounding the basal stem of oil palm trees. The sensor was embedded approximately 4.7 cm deep in the soil. The results showed that ER readings at healthy oil palm trees significantly higher than ER readings at unhealthy oil palm trees. More specifically, ER readings at points where no symptoms (i.e. fruiting bodies and/or hollow) appear were significantly higher compared with ER readings at points where symptoms appear even though the points of measurements are at the same palm. Hence, soil electrical resistance can contribute to *Ganoderma*-infected detection in oil palms.

Keywords: *Ganoderma boninense*, basal stem rot, soil electrical resistance, moisture sensor, oil palm

P3-06- Detection of Quinoline in *G. boninense*-Infected Plants Using Functionalized Multi-Walled Carbon Nanotubes: A Field Study

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Carbon nanotubes (CNTs) reinforced with gold nanoparticles (AuNPs) and chitosan nanoparticles (CTSNPs) were anchored on a screen-printed electrode to fabricate a multi-walled structure for the detection of quinoline. The surface morphology of the nanocomposites and the modified electrode was examined by an ultra-high resolution field emission scanning electron microscope (FESEM), and Fourier-transform infrared (FT-IR) spectroscopy was used to confirm the presence of specific functional groups on the multi-walled carbon nanotubes MWCNTs. Cyclic voltammetry (CV) and linear sweep voltammetry (LSV) were used to monitor the layer-by-layer assembly of ultra-thin films of nanocomposites on the surface of the electrode and other electrochemical characterizations. Under optimized conditions, the novel sensor displayed outstanding electrochemical reactivity towards the electro-oxidation of quinoline. The linear range was fixed between 0.0004 and 1.0 μM, with a limit of detection (LOD) of 3.75 nM. The fabricated electrode exhibited high stability with excellent sensitivity and selectivity, specifically attributable to the salient characteristics of AuNPs, CTSNPs, and MWCNTs and the synergistic inter-relationship between them. The newly developed electrode was tested in the field. The Ipa increased with an increase in the amount of quinoline solution added, and the peak potential deviated minimally, depicting the real capability of the newly fabricated electrode.

P3-07- Preparation of Fungicide-Chitosan Nanoparticles for Antifungal Activity against *Ganoderma boninense*

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A golden crop and economically important tree of Malaysia, oil palm has now faces the threat of a devastating disease which particularly caused by a pathogenic fungus, *Ganoderma boninense*. For better management of the disease, we have synthesized fungicide nanodelivery formulations onto biodegradable chitosan nanoparticles (CEN) as their host matrix. Three types of nanoparticles have been synthesized namely chitosan-hexaconazole (CHEN), chitosan-dazomet (CDEN) and chitosan-hexaconazole-dazomet (CHDEN) nanoparticles. The chemical structure of the synthesized nanoparticles was evaluated using the Fourier transform infrared spectroscopy (FTIR), x-ray diffraction (XRD), and thermogravimetric analysis (TGA). High resolution transmission electron microscopy (HRTEM) shows a sphere shape of CEN with mean diameter of 1.5 nm, compared to 18.1, 6.7 and 5.3 nm for CHEN, CDEN and CHDEN, respectively. Moreover, the hydrodynamic particle size distribution measured using DLS zeta sizer of CEN, CHEN, CDEN and CHDEN were found to be around 1.3, 10.1, 3.6, 11.7 nm, respectively. Furthermore, *in vitro* anti-fungal studies of the synthesized nanoparticles against *Ganoderma boninense* shows better inhibition and lower EC_{50} compared to the bare fungicide. The EC_{50} of bare dazomet and bare hexaconazole was found to be 133 ± 23 and 21 ± 5 ppb, respectively. When the fungicides were incorporated onto the nanoparticles, CHDEN gave the lowest EC_{50} value with 4 ± 1 ppb, followed by CHEN and CDEN with 8 ± 2 and 14 ± 2 ppb, respectively.

Keywords: chitosan; dazomet; hexaconazole; fungicide; antifungal; Ganoderma

P3-08- Detection of Secondary Metabolites in Oil Palm Trees using ZnO-NPs/rGO/SPCE Modified-Screen Printed Electrode

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There is a current need to extensively improve the detection of oil palm disease in oil palm tree. Secondary metabolite has been identified as one of the potential marker to detect the infection of oil palm disease in oil palm tree. In this work electrochemical technique sensor has been developed to detect the marker. Electrodeposition of zinc oxide nanoparticles (ZnO-NPs) were performed directly onto reduced graphene oxide (rGO) for modification of SPCE at simple and less time consuming technique in order to enhance the performance of electrochemical properties for detection of the secondary metabolites. The combination of physical and electrochemical characterization of graphene oxide (GO) before and after reduction together with zinc oxide nanoparticles (ZnO-NPs) were studied by field emission scanning electron microscopy (FESEM), energy dispersive x-ray (EDX) and cyclic voltammetry (CV) revealed the successful fabrication of ZnO-NPs/rGO/SPCE. Most significantly, ZnO-NPs/rGO/SPCE demonstrated as a good sensing performance as it was performed a valuable signal in the detection of secondary metabolites. Consequently, the outstanding outcome for sensing performance based on ZnONPs/rGO/SPCE in detection of secondary metabolites can be applied to control oil palm disease.

Keywords: Reduced graphene oxide; zinc oxide nanoparticles; electrodeposition; secondary metabolites; oil palm.

P3-09- Synthesis, Characterization and Toxicity of Nanomaterials for Gene Therapy Applications.

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Gene therapy has becomes increasingly popular over this decade due to its massive potentials for the treatment of disease that previously untreatable using conventional schemes. Double stranded RNAmediated interference

(RNAi) inhibits cancer gene expression at the stage of translation or by hindering the transcription of specific cancer gene. Various types of nano-delivery systems have been developed to increase the efficiency in gene targeting. Magnetic nanoparticles (Fe_3O_4) posses superparamagnetic properties, which is widely known for its application as a contrast agent in MRI and as nanocarrier in targeted drug delivery. Semiconductor quantum dots (CdSe-ZnS) posses fluorescent properties and have extensive application in photovoltaic cells, sensor, and biomedical applications. Current work are focusing on synthesis and characterization of biocompatible magnetic nanoparticles and fluorescence quantum dots, as well as toxicity of the nanomaterials for the biomedical application and gene therapy specifically. Magnetic nanoparticles (Fe_3O_4) and semiconductor quantum dots (CdSe-ZnS) are both synthesized using co-precipitation method and microwave irradiation technique respectively. The synthesized nanoparticles were characterized with X-Ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), Transmission Electron Microscopy (TEM), and Vibrating Sample Magnetometry (VSM). The toxicity of both type of nanoparticles were tested on 2 different cell line; A549 human lung carcinoma and MRC5 human lung fibroblast using MTT assay. This research explores the potentials of incorporating nanomaterials in gene delivery in order to provide efficient, multifunctional and nontoxic non-viral delivery in cancer therapy.

Keywords: gene therapy, nanocarriers, magnetic nanoparticle, quantum dots.

P3-10- Development of Automated Controller for Irrigation

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Water has been one of the global issues nowadays especially when facing the drought season. The efficiency and precise water usage is important when we are facing water global problem. The need of water in everyday life is important as we need the oxygen. In term of agriculture sector, irrigation and drainage application has widely used and expanded to fulfill the water needed by agriculture production in order to support our food consumption. Irrigation and drainage has varied technique and method which help in saving the water by precision usage application. However, the problem arises as the different crop production require different water consumption which hardly controllable by one source of water tank especially when using soil media. Thus, automated irrigation has been introduced to provided better precision of water supply.

P3-11- Preliminary Study on Development of Nano-porous Pipe for Irrigation and Drainage

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Porous pipe application has been used to delivered water for agriculture purposes. Porous pipe is categorized in surface and subsurface application. Most of the market available porous pipe that widely used is corrugated pipe and soaker hose. Both has high marketability to help with minimizing of water usage in agriculture application. Some also been applied in backyard rainwater harvesting and filtering. However, the problem arises with these two systems is the clogging inside the pipe since the water quality used for agricultural sector is low thus degraded the pipe performance. Besides that, the clogging of soil material causes the system to be changed regularly and resulted on high maintained cost. The broad expands of nanomaterial application is an opportunity to be used in nano-porous pipe development because of its nanoporous structure that has been prove as an excellent filter. The study had been done on the super-absorbent polymer (SAP) as one of the material development for the pipe.

P3-12- DNA Extraction for Label-free Detection of Pathogenic Fungus *Ganoderma boninense*

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The conventional detection method such as tissue culture and PCR based analyses are expensive, time-consuming that takes up usually to two weeks, and are labor-intensive. In comparison to conventional methods, the use of Lab-on-A-Chip (LOC) biosensing system can allow for a rapid identification within possibility of 1-2 hours for

confirmation, inexpensive, at a very low amount of concentration. This study outlines an intelligible and unelaborated design for DNA extraction on chip for label-free detection *Ganoderma boninense,* the pathogenic fungus that has been identified to be the major pathogen for palm oil plantation in several countries, especially in Malaysia. Methods of DNA extraction were applied for yield comparison using conventional CTAB method and AP1 method for DNA lysis. Results were analyzed using UV-Vis spectroscopy, and DNA profile showed the best using AP1 buffer with higher DNA peaks detected at 290nm. Subsequent optimization of DNA extraction can be further devised for the applicability of LOC devices.

Keywords: DNA extraction, microfluidics, Ganoderma boninense, DNA, Lab-On-A-Chip

P3-13- Rapid Detection of Ganoderma boninense: Expression Monitoring for Hybridization Time

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Emergence of biosensors has brought on many advantages to researchers worldwide especially in interdisciplinary fields such as pharmaceuticals, medical, horticulture, agriculture, food technology and many more. The obvious advantage is that biosensors can give rapid results compared to the conventional laboratory method. Therefore, in this study, an Interdigitated Electrode (IDE) based electrochemical biosensor is proposed for the early detection of *Ganoderma boninense* DNA. Present work has justified the performance of IDE coupled with gold nanoparticles whereby the timeframe for hybridization varied from 30 minutes, 1 hour and 2 hours. The electrical measurements validate that early detection is possible with functionalized IDE.

Keywords: biosensor, Interdigitated Electrode, Ganoderma boninense, gold nanoparticle, early detection.

P4-01- Facile preparation of graphene thin film from exfoliated graphene dispersion via dip coating method

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The development of an approach for producing graphene sheets with simple and green technique is essential for highly conductive graphene thin film preparation. This work describes the preparation of graphene thin film through dip coating technique from aqueous processed graphene dispersion. Graphene was initially dispersed with water and re-dispersed in n-butyl acetate prior to film deposition. The procedure of simple dip coating method is elucidated and the thin layer of conductive graphene films are deposited onto cleaned substrates such as glass and quartz. The prepared graphene thin film demonstrated good conductivity and high transparency for more than 90 % in the visible region at 550 nm.

P4-02- The Study of Fluid Dynamics for the Atmospheric Pressure Chemical Vapor Deposition (APCVD) of Graphene.

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In this paper, fluid dynamic properties within a CVD reactor for graphene synthesis was studied. Fluid dynamics plays a vital role for the uniform and efficient deposition of graphene. The gas flow regime within the reactor for an atmospheric pressure CVD (APCVD) using a mixture of methane, CH_4; hydrogen, H_2; and argon, Ar gases

with Cu as the substrate was analyzed. Additional analysis of Reynolds number from other literature were also made and observations on the current trends for graphene deposition were noted.

Keywords: Graphene, chemical vapor deposition, fluid dynamics, copper, Reynolds number.

P4-03- The Study of Flame Deposition for the Synthesis of Graphene Thin Film.

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We present flame deposition chemical vapor deposition as an alternate form of graphene synthesis. While plasma enhanced chemical vapor deposition (PECVD) has gained widespread used in the synthesis of large-area high-quality graphene, flame deposition also holds similar potential for the development of an efficient and economical process to produce graphene. Here, we report on the setup and optimizations done towards the flame deposition CVD.

Keywords: Graphene, chemical vapor depostion, flame depositon, plasma, sheet resistance.

P4-04- Effects of Hydrogen-annealing on the quality of CVD grown graphene.

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In this account, the quality of graphene on copper and palladium substrates as a function of various hydrogen concentrations during annealing as well as different annealing times is studied. Copper and palladium substrates are chosen due to their difference in carbon/hydrogen diffusivity and solubility. Raman analysis showed that upon annealing under higher hydrogen concentration, the graphene grown is defective and of multiple layers. On the other hand, prolonged annealing time is detrimental to the quality of both substrates. We postulate that the presence of defects and multilayer graphene are caused by the hydrogen trapping phenomenon inside the substrates' vacancies. Graphical representations of the relationship between hydrogen concentration and annealing time towards graphene quality were plotted to suggest the optimized parameters in producing pristine graphene.

Keywords: Graphene, chemical vapor depostion, hydrogen-annealing, diffusivity, Raman spectroscopy

P4-05- Fabrication of NEMS Graphene Diaphragm Capacitive Nanophone

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Capacitive microphone is a device used to convert the acoustic signal into electrical signal. With regards, this research focuses on the fabrication of acoustic holes for the NEMS capacitive nanophone. The fabrication process involved substrate cleaning, spin coating, UV exposure, developing, baking and finally Deep Reactive Ion Etching (Deep RIE). Many factors need to be optimized during the fabrication process such as exposure time, developing time and so on. The sample then undergoes inspection to ensure the desired dimension and condition. After all, gold will be deposited as an electrode and graphene will be located as a diaphragm before the device testing.

Keywords: capacitive microphone, fabrication, Deep RIE, graphene.

P4-06- Modelling of field-effect transistor using graphene as active layer.

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We report the performance of graphene field effect transistor (GFET). This paper presents numerical approach of graphene as devices active area on a substrate with metal electrode and silicon as back gate to observe the electrical properties of the devices. The result shows GFET is suitable to be utilized for optoelectronic devices.
Keywords: graphene, transistor, electrical properties

P4-07- Tailoring Graphene Quality through Study of the Gases Flow

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Recently, CVD technique is known to have the capability to mass produce graphene at a reasonable cost. However, due to the complexity of the CVD process which needed a full control of several parameters, the production of high quality graphene is still a challenge. Reaction parameters such as partial pressure of methane, CH_4 and temperature have been known to contribute a lot on the graphene quality. Since graphene synthesis in CVD involved several gases used such as methane (CH_4), hydrogen (H_2) and argon (Ar), the study on the effects of gases total flow rate seems to be overlooked all these years. This paper thus intends to study the influences of gases total flow rate on the quality of the graphene produced in ambient pressure CVD. The graphene was synthesized on a polycrystalline copper (Cu) at 1000 ˚C for 30 minutes with the presence of Ar, H_2 and CH_4 at 0.2:0.2:0.6 gases ratio. The Raman results revealed that higher total flow rate of 100 mL/min could produce a better quality graphene with ID/IG and I2D/IG of 0.37 and 0.85, respectively. This finding thus could be beneficial to select the most suitable total flow rates used for the synthesis of large scale high quality graphene in the future.
Keywords: graphene, total flow rate, synthesis, CVD, ambient pressure

P4-08- Structural and Electrical Characteristic of Graphene based MEMS Supercapacitor with Solid Gel Electrolyte

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This paper presents graphene based MEMS supercapacitor with interdigital electrodes and combination of Polyvinyl Alcohol (PVA) and sulphuric acid (H_2SO_4) as solid gel electrolyte. The structural of graphene growth on the interdigital electrodes was characterized via Raman Spectrometer and the electrical characteristic has been investigated via Keithley 4200SCS analyzer at different scan rates. It is observed that galvanostatic charge discharges curves are close to triangular shape indicating a balance charge and good contact between graphene electrodes and PVA/H_2SO_4 solid gel electrolyte.
Keywords: MEMS supercapacitor, interdigital electrodes, graphene growth, solid gel electrolyte, galvanostatic charge discharge

P4-09- Narrow Microchannels Fabrication using Silicon DRIE with Different Etching Mask

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In this work, the DRIE process was performed in sulfur hexafluoride/oxygen (SF6/O2) plasma at room temperature and at cryogenic temperature to create an array of parallel microchannel on silicon substrate. The inductively coupled plasma etching process was successfully fabricate an array of parallel microchannel with nearly one aspect ratio structure in each channel using different photoresist etch mask. The microchannel geometries and structure have been examined for 60 s etch time using the plasma reactive ion etching. The photoresist and silicon etch rates were studied by analyzing their thickness before and after 60 s of DRIE. Then, the selectivity was analyzed for both etching temperature condition. The silicon substrate with both photoresist etching mask produced a good microchannel structure with uniform channel gap to another and channel width at room temperature DRIE. But, microchannel with AZ1500 etch mask had a severe undercut at cryogenic temperature DRIE. The microchannel with S1805 photoresist mask gave a better selectivity in DRIE process at both room and cryogenic temperature. All results have been verified using optical microscope and SEM micrograph.

Keywords: DRIE; microchannel; etch mask; photoresist; selectivity

P4-10- Electrical Characterization of Carbon based Nanocomposite Flexible Generator Prepared by Suspension and Colloidal Mixtures

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Intriguing of nanocomposite flexible ferroelectric polymer materials fascinated the attention in nowadays research activity which promises the sustaining on larger strains in harvesting energy from stimuli of mechanical stress. Here in, 2 cm X 1.5 cm piezoelectric thin film generator made via $BaTiO_3$/PVDF/GQD as nanocomposite active element layer have been investigated to see the influence of electrical characterization on colloidal and suspension heterogeneous mixture by two fingers tense will be versify. The output range recorded from Vp-p is 1.4~2.65 V, 0.54~1.59 V commencing by Vamp and 70~130 mV Vrms on open circuit measurement device that fabricated with stable colloid solution on -24.6 mV of Zeta Potential with $-1.91x10^{-4}$ Electrophoretic Mobility.

Keywords: GQD, $BaTiO_3$, suspension, colloidal, percolation effect

P5-01- The Progress of Catalyst Preparation Method in the Carbon Dioxide Reforming of Methane

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Carbon dioxide reforming of methane (CDRM) has gained much attention for the production of syngas, which is important for a wide range of chemical products by means of Fischer-Tropsch synthesis. Abundance of metal-based catalysts such as Ni, Co, Ce, Zr, Mg, and Fe has been proven to give a good performance in CDRM activity. However, the deactivation of the catalyst caused by carbon deposition is one of the major problems over CDRM process where the active sites of the catalyst were blocked by the accumulation of carbon. As the reaction is endothermic and occurs at high temperature, the metal catalyst suffers from the sintering problem and reoxidation of active metal during the reaction. Therefore, selection and modification of catalyst is very crucial to overcome the problems occurring during CDRM reactions to maintain the optimum performance of the catalyst. Moreover, it is imperative to understand the elementary steps involved in CDRM process with respect to the conversion of CH_4 and CO_2 in order to minimize the deactivation of the catalyst. This paper is an attempt to convey the recent development on the CDRM over catalyst dependency. Although a number of reviews have been done on the topics related to the catalyst development, there is still an urge to summarize the recent development and preparation of the catalysts as an addition to the prevail data.

Keywords: CO_2, Methane Reforming, Catalyst Preparation, Carbon Deposition, Sintering

P5-02- Self-Reduced NiO/Dol Catalyst for H_2 Production via Dry Reforming of CH_4 with CO_2

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Development of novel NiO/Dol catalyst with self-reduction properties has been successfully synthesized. The catalyst was prepared by wet impregnation method to aim suitable catalyst for syngas production via dry reforming of methane (DRM) with carbon dioxide process. Catalytic DRM helps to reducing CO_2 and CH_4 which is abundant compound especially from POME treatment. The physicochemical properties of synthesized catalyst were determined by various methods including XRD, H_2-TPR, TPD-CO_2 and BET. Ni/Dol catalyst shows good performance in catalytic activity of CH_4/CO_2 % conversion is about ±98%. Self-reduction NiO/Dol catalyst improved DRM process due to self reduced properties without involving catalyst reduction step.

Keywords: Self-reduced, NiO-Dol catalyst, H_2 Production, Dry Reforming, CH_4, CO_2 and biogas

P5-03- Photocatalytic CO_2 and CH_4 Conversion to Fuels over Ag-loaded g-C_3N_4 Nanocatalyst

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Carbon dioxide (CO_2) conversion to chemicals and fuels has gained significant attention in sustainable energy research. Catalytic CO_2 reforming of methane (CH_4) or dry reforming is a promising alternative for recycling greenhouse gases. However, dry reforming of CH_4 is endothermic, which increases operating cost due to the immense heat input. In this study, synthesis and characterization of silver modified graphitic carbon nitride (Ag/g-C_3N_4) for photocatalytic CO_2 reduction with CH_4 has been investigated. The g-C_3N_4 catalyst was synthesized by melamine pyrolysis at 550 ^oC and impregnated with silver nanoparticles. The nanocatalysts were characterized by X-ray diffraction (XRD) and Scanning Electron Microscopy (SEM). The performance of nanocatalysts was conducted in a batch photoreactor operated under simulated solar energy. The products obtained were mainly CO, followed by H_2 and smaller amount of C_2H_6. Pure g-C_3N_4 was favorable for CO evolution, while Ag-loaded g-C_3N_4 samples promoted H_2 formation. The g-C_3N_4 loaded with 1 wt. % Ag gave highest amount of CO, while 2% Ag/g-C_3N_4 conferred the maximum yield of H_2 at CO_2/CH_4 feed ratio = 1.0 and irradiation time= 2 h. The enhanced photocatalytic performance can be attributed to hindered charge recombination rate in the presence of Ag-metal. The finding of this work would be attractive for development of solar energy system for CO_2 and CH_4 reforming to renewable fuels.

Keywords: Photo-catalysis, CO_2-CH_4 reduction, g-C_3N_4, Ag-loading

P5-04- Cobalt/Dolomite Catalysts for H_2 Production by Dry Reforming of Methane with Carbon Dioxide

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In this study, cobalt-dolomite based catalysts were synthesized by varying the metal loadings of cobalt (Co) at 5%-20%. The catalysts were prepared by impregnation method to develop catalysts suitable for H_2 production via dry reforming of methane (DRM) process. The synthesized catalysts were characterized by various methods including XRD, H_2-TPR, and TPD-CO_2 to determine their physicochemical properties. The best catalyst is 20 Co/Dol, due to better Co dispersion and the ability of the catalyst to reduce in the dry reforming atmosphere.

Keywords: Catalysts, Dolomite, Dry reforming of methane, H_2 production, Impregnation

P5-05- Evaluation of cobalt supported on alumina-cobalt aluminate grown in situ by redox exsolution for dry reforming of methane

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The production of syngas from dry reforming of methane is enhanced through the advancement in catalyst development. In this study, cobalt supported on alumina and cobalt aluminate were synthesized through exsolution method for dry reforming of methane. It was aimed to increase the stability of the catalyst for long hours' reaction while reducing the carbon deposition. The development of cobalt supported on alumina and cobalt aluminate and effect of cobalt content (10% to 30%) were evaluated. The redox exsolution temperature was optimized at 750ºC for the formation of cobalt crystal supported by alumina and cobalt aluminate. Study on the effect of cobalt content on catalysts in dry reforming reaction revealed that 10%-Co experienced catalytic deactivation while 15%-Co and 20%-Co recorded a stable CH_4 and CO_2 conversion up to 6 h of reaction time. 50 h stability test on 15%-Co catalyst revealed that this catalyst could achieve a constant average of 68% and 79% conversion for CH_4 and CO_2, respectively. The rate of carbon deposition was measured to be at 0.426 $mg \cdot g_{cat}^{-1} \cdot h^{-1}$. Compared with the thermodynamic equilibrium of dry reforming reaction, CH_4 conversion of 15%-Co was lowered by 17%. However, the carbon formation rate was lowered by more than 5000 times. The synergistic effect between cobalt, alumina and cobalt aluminate present the possibility to prevent the deactivation of cobalt while eliminating carbon deposition.

Keywords: dry reforming; cobalt; cobalt aluminate; alumina; exsolution

P5-06- Zn-Rich Catalyst for Low-Temperature Methanol Production via Direct CO_2 Hydrogenation

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Methanol production from direct CO_2 hydrogenation is a useful strategy to utilize CO_2 and a practical approach to sustainable development. In this study, Zn-rich catalyst was synthesized and tested for direct CO_2 hydrogenation to methanol. The synthesized catalyst was found to be more active than commercial methanol catalyst (Cu-rich). The superior catalytic performance of the synthesized catalyst was mainly due to its higher ZnO content which promotes CO_2 activation and conversion. The Zn-rich catalyst is also characterized by larger surface area, higher porosity and higher reducibility compared to the commercial catalyst.

Keywords: Zn-rich, methanol, CO_2 hydrogenation, low-temperature

P5-07- Synthesis and Characterizations of Carbon Doped TiO_2 for Photoreduction of CO_2

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In this study, carbon doped TiO_2 composite (glucose/TiO_2) was synthesized by hydrothermal method for selective photocatalytic reduction of CO_2 to methanol fuel under UV/Vis light irradiation. The synthesized catalysts were characterized by X-ray diffraction, DRUV- Vis spectroscopy and FESEM. The product identification and yield were determined using a GC with FID. The results of characterization were compared between pure TiO_2 and glucose/TiO_2. It was obvious that composite glucose/TiO2 conferred the longest wavelength to visible region and also has narrow band gap compared to pure TiO_2. The efficiency was studied by comparing the methanol yield among catalysts. It was indicated that yield of methanol while using 6 wt% of glucose, was found to be the highest at 19.5 mmol gcat-1 h-1, a two-fold increment compared to pure TiO_2. The improvement in the yield of methanol can be explained by the role of glucose as hole trapper and electron generator, and subsequently reduced the rate of recombination between electron and hole in semiconductor TiO_2.

Keywords: CO_2 reduction, photocatalysis, hydrothermal method, TiO_2 composite, glucose.

P5-08- Surface Defect Engineered Bi_2WO_6 for Photocatalytic CO_2 Reduction over Full Solar Spectrum

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Photocatalytic reduction of CO_2 has received tremendous interest from worldwide researchers owing to its ability of transforming undesirable CO_2 molecules into energy-rich hydrocarbon fuels through harnessing the clean and infinite solar energy. In this study, bismuth tungstate with abundant surface oxygen vacancy defects (Bi_2WO_6-OV) was demonstrated to possess superior photoactivity under UV and visible light irradiation. More importantly, the photoresponsiveness of Bi_2WO_6-OV was successfully extended to the low-energy NIR region. Hence, the asdeveloped Bi_2WO_6-OV was capable to harvest the full solar spectrum, ranging from UV to NIR region.

Keywords: Bismuth tungstate, surface defects, photocatalysis, CO_2 reduction, full solar spectrum.