EDITORIAL: FUNDAMENTAL INTERDISCIPLINARY PATHWAYS TO FUTURE SUSTAINABILITY

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Introduction

School of Fundamental Science (PPSA) Universiti Malaysia Terengganu (UMT) delighted to organise our first ever postgraduates' colloquium recognised as 'PPSA Postgraduate Colloquium 2015' since its establishment as a result from UMT academic transformation in 2013. Nearly after two years of the formation of our school, PPSA feels deeply honoured to organise this colloquium specifically for our postgraduates. *'Fundamental Interdisciplinary Pathway to Future Sustainability'*, the theme of this postgraduate colloquium is fitting well with the initial aim of the formation of PPSA. We are established to focus, project and enrich our mission towards gaining and digesting the knowledge of fundamental science in the respect of teaching and learning activities. The focus is also on the research and innovation in this area which occasionally have not been well appreciated, as the world today seems to focusing more into applied knowledge. The way this colloquium was set up utterly unique in our point of view. It involvement comprised different background, primarily focusing on young talents, involvement in research who are the postgraduates with firm contributions from our renowned and reputable academicians with numerous experiences within our school. Well-focused scientific programme were also designed which catered the area of biomaterials, chemical sciences as well as material sciences and physics.

Highlights of Research

The colloquium were aimed to highlight current research in fundamental science towards sustainable future, we also intend to give initial expose and firm grasps to our postgraduates with scientific conferences at international level. Due to wide ranges of research focuses which actively been carried in our school, we want to have an ideal platform for us to communicate the research outcomes from interdisciplinary fields among participants.

As the smallest school in UMT surprisingly, we to date, a number of 70 active postgraduates and around 40 academics carrying out different research focus and in most cases, interdisciplinary with emphasising on fundamental knowledge of science. Therefore, with this motivation, it has boosted our confident that this first time ever postgraduate colloquium would certainly further strengthen our fundamental knowledge and latest findings which apparently involved interdisciplinary areas of research especially for our postgraduates and our active, progressive academicians here at PPSA.

There are emerging challenges to integrate the fundamental science knowledge from interdisciplinary perspective in order to solve the complex issue of future sustainability, such as waste treatment and renewable energy (Scholz *et al.*, 2009). In this special issue, dynamic interaction from the integration between chemistry, physics and biology were presented, which covers from the basic knowledge in science towards applications in various field.

Four articles cover issues on sustainable bio-based polymers. Cellulose, as one of most abundant natural polymer (Chai & Isa, 2013), has been studied as potential conductive thin films to replace petroleum-based non-renewable polymer. These articles proved the outstanding conductive ability of solid bio-polymer electrolyte (SBE) when integrated with dopants via solution casting

techniques (Hafiza *et al.,* 2014). The effects of dopant concentrations on the ionic conductivity of various systems were presented. The SBEs exhibited room temperature conductivity in the magnitude of 10^{-3} – 10^{-5} S/cm which is comparable to other non-biopolymer system (Samsudin *et al.,* 2012). Furthermore, the studies revealed that the temperature dependence of ionic conductivity of the SBEs follow Arrhenius empirical relation. In these articles, the criteria of an ideal SBE for electrochemical device applications have been discussed. The cellulose based solid polymer electrolytes provide high electrochemical performance at ambient and elevated temperature and can act as a new invention in the fabrication of low current density application devices.

Oral drug delivery system provides a simple mechanism and more convenient approach (Amidon *et al.,* 2015) towards colon cancer treatment, yet, it faced with limitation on passing through in the gastrointestinal tract (GIT) before reaching the targeted area. A contribution in this special issue has helped to resolve the drawback. In the presented article, two types of materials; hydrocarbon (eicosane and docosane) and fatty acid (C12 and C16) were coated via dip coating process on gellan gum hydrogel to increase the treatment efficiency in oral administration colon cancer treatment. Single and mixed coating materials tested showed hydrocarbon with a weight ratio of 40:60 of eicosane and docosane (E:D) is the best coating materials for the studied system.

Additionally, there are two articles focusing on waste treatment. Currently, natural organic sorbents were used in oil adsorption processes because of their adsorption capacities, higher biodegradability and cost effectiveness (da Silva Jr. *et al.,* 2003; Wang *et al.,* 2010). The improved ability of a hydrophilic lignocellulosic material – modified oil palm mesocarp fiber (OPMF), in adsorbing oil from synthetic oily wastewater via modification using alkali and acetylation treatments is also presented in this special issue. Highest adsorption capacity of 95% oil absorbance for Acetylated-OPMF compared to 63% and 58% alkali-treated and untreated OPMFs respectively is reported. The kinetic data obtained for all OPMFs was fitted well with the pseudo-second-order kinetic model. In similar interest to treat the water pollution, another article presented different approach by highlighting the role of active materials in polluted water assessment. Multi-walled carbon nanotube (MWNTs) was investigated as the adsorbent material for selected dye such as methyl orange in which 98% of methyl orange was effectively removed by MWNTs, thus indicating the potential of MWNTs to be used as dye adsorbent material. Polymer modifications can lead to numerous applications due to their unique behaviour and characteristics and might answer the readers' question why modification of polymer is needed.

On the similar materials type i.e. polymer, an article presents the effects of different surfactant concentrations towards the particles size of polymer nanoparticles. The study involved a series of hydrophilic polymer nanoparticles composed of methyl methacrylate (MMA), methacrylic acid (MAA) and 2-hydroxyethyl methacrylate (HEMA) monomers. Poly methyl methacrylate (PMMA) nanoparticles were found to partially soluble after dissolving with aqueous solution, while, PMAA nanoparticles show the ability to be dissolved in aqueous medium. In contrast, PHEMA nanoparticles were not completely dissolved in water where the polymer tends to absorb and swollen in water producing hydrogels.

The only physical science article in this special issue reported the use of nanostructured rare-earth oxides, $Gd_2O_3:Eu^{3+}$ as optoelectronic devices and biomolecule labelling. The unique properties of this material enable them to become the prominent replacement for currently available fluorescent probes used in the fluorescent displays and magnetic resonance imaging (MRI). The excellent chemical stability characteristics of enable them to be adopted into the *in vivo* and *in vitro* biological labelling studies. The researchers also indicated the biocompatibility of $Gd_2O_3:Eu^{3+}$ where there is no significant cytotoxic effect happen inside the biological cells in long term and can be effectively removed by the wastewater treatment plants.

In contrast to the all articles compiled in this special issue, the last two articles described their approach in utilizing computational chemistry as their preliminary study to understand the behaviour of molecules, as this method is fast and involved low cost. The used of computational chemistry to identify the suitable configuration of dithiocarbazate to bind with metal ion, such as mercury. The compounds, benzyl 3-[(*E,E*)-3-phenylprop- 2-enylidene]dithiocarbazate (BPED) has the most stable configuration of BPED molecules is in *trans-cis* arrangement with the lowest band gap energy (2.90 eV). Hence, the molecules is predicted to be in *trans-cis* arrangement with less steric hindrance and capable to coordinate with metal ion efficiently. Similar approach is attempted by investigating the effect of methyl substituents on the pyridine groups towards carbonylthiourea configurations was investigated using Gaussian 09W at B3LYP/6-3 11 G(d,p) level of theory. The study revealed that the methyl substituents directs the molecules into *trans-cis* configuration which stabilized by strong intramolecular hydrogen bonding.

Conclusion

In conclusion, we would like to attract readers' attentions on this Journal of Sustainability Science and Management special issue 、 to sample each of the article portrayed and learn new, cutting edge and outstanding findings by PPSA academics especially our very own postgraduates. They have put so much efforts on their research and write-up which in our view, up to the global standard. Knowledge in fundamental science are dynamics and evolve rapidly nowadays, we at PPSA are aligning ourselves to these knowledge enrichment and aiming for the very best. We do hope and guarantee that by reading all articles in our special issue, you will be amazed and mesmerized by our contribution of knowledge in the aspect of fundamental sciences.

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