ICFCHT2015

5th INTERNATIONAL CONFERENCE ON FUEL CELL & HYDROGEN TECHNOLOGY

1 –3 September 2015

BOOK OF ABSTRACT

PULLMAN KUALA LUMPUR CITY CENTER HOTEL & RESIDENCE.

Organizer:

UTM UNIVERSITI TEKNOLOGI MALAYSIA RESEARCH UNIVERSITY

UNIVERSITI KEBANGSAAN MALAYSIA *The National University of Malaysia*

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FOREWORD

In the name of Allah, Most Gracious, Most Merciful.

It is a true pleasure for me to welcome you to the Fifth International Conference on Fuel Cell and Hydrogen Technology (ICFCHT2015). In particular, I would like to express our gratitude to all plenary and keynote speakers for your participation in this conference. For those from abroad, I would like to extend our warm welcome to Malaysia.

ICFCHT is a continued effort of encouraging research and development works on hydrogen energy. These include hydrogen production from multiple sources, energy utilization that has strong emphasis fuel cell systems in addition to direct combustion of hydrogen, energy storage, and energy management, which in itself is a broad subject covering safety, transmission and transport, smart microgrid system and lifecycle analysis. I believe every single one of us here understood the importance of energy sustainability, and this will not be a reality without the advent of these technologies. To have a solution that is more widely applicable, we need to be innovative in managing differing demand-response scenarios, which introduce dynamic challenges in energy supply and storage.

The interest of the international scientific community in hydrogen energy is very clear. This has resulted in many conferences focusing in hydrogen energy specifically, or those that include it as one of the key themes, being organized in various parts of the world. The opportunity to contribute knowledge and to highlight research findings from our works is therefore plentiful.

This year, we bring the ICFCHT to Kuala Lumpur. Having the aura of being more of a regional conference, ICFCHT has historically attracted a larger portion of participants from the host country. This has positively spawned interests among researchers in this region.

This year, ICFCHT has attracted participants from 16 countries. We will hear 77 oral presentations, and have the opportunity to see 37 poster presentations. The subjects range from fundamental works on new products and methodologies, as well as applied research and case studies. I am sure that these contributions will provide you with a wealth of knowledge and opportunities for discussions.

Finally, on behalf of the organizing committee and the co-organizers, which is Universiti Teknologi Malaysia, Universiti Kebangsaan Malaysia and The Agency for the Assessment and Application of Technology (BPPT), Indonesia, I would like to thank everybody for all the hard works in making this conference eventful. We look forward to seeing you again in future ICFCHT's.

Prof. Dr. Arshad Ahmad
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	Carbonate as Composite Cathode for Low-Temperature Solid Oxide Fuel Cells	*ananas comosus leaf for thermal application*	*gasification in fluidized bed reactor using Aspen Plus*
12.00 – 12.20	M.V. Nomnqa and D. Ikhu-Omoregbe* *Effects of fuel processor combustion parameters on the performance of a 1kWel HT-PEM fuel cell based CHP system*	N. Ngadi, F. Ismail, M.R. Taib, S. Haron and N. Ali *Production of Biodiesel from Palm Oil using Magnesium Oxide supported on Activated Carbon Catalyst*	R. Gill*, S. Batool, and S.S. Qureshi and M. Rafique *Nanofabrication of multilayer composite assemblies using epoxy components with amino modified clay*
12.20 – 12.40	M.H.M. Nor, M.F.M. Mubarak, H. Yusuf, B.H. Han, N. Ibrahim, M. F.A. Wahab, Z. Ibrahim *Simultaneous Bioelectricity Generation and Treatment of Real Textile Wastewater using Lysinibacillus Fusiformis ZB2 in Microbial Fuell Cell*	Olagoke Oladokun, Arshad Ahmad*, Tuan A.T. Abdullah *Prediction of Hydrogen production from Imperata cylindrica using Stoichiometric and Thermodynamic Model*	A.N. Rahimi, M.F. Mustafa, M.Z. Zaine, N. Ibrahim, K.A. Ibrahim, N. Yusoff, E.M. Al-Mutairi, M.K.A. Hamid *Optimal Synthesis of Energy Efficiency Improvement for Natural Gas Liquids Indirect Direct Sequence Fractionation Unit*
12.40 – 13.00	S.M. Jamil, M.H.D. Othman*, M.A. Rahman, J. Jaafar, A.F. Ismail *Anode supported MT-SOFC fabricated with mix particle size CGO electrolyte via phase-inversion technique*	P. Lertthahan, S. Yongprapat, A. Therdthianwong*, and S. Therdthianwong *Pt-modified Au/C catalysts for direct glycerol electro-oxidation in an alkaline medium*	M.Z. Zaine, M.F. Mustafa, K.A. Ibrahim, N. Ibrahim, M.K.A. Hamid* *Sustainability Improvement for Hydrocarbon Mixtures Direct Sequence Separation Process*

13.00 – 14.00	**Lunch Break**

Parallel Session 4

	AO17-AO21 Venue : Pullman 7 Chairperson : Dr. Kamarizan Kidam	**AO22-AO26** Venue : Pullman 10 Chairperson : Dr. Jarot Raharjo	**DO11-DO15** Venue : Pullman 11 Chairperson : Dr. Norzita Ngadi
14.00 – 14.20	A.F.M. Adnan, S.K.M. Jamari, A.N. Idris, T. Winie, A.K. Arof *A Microbial Fuel Cell Using Phthaloylchitosan/Polyamide Membrane*	M. Asghary, J. B. Raoof*, M. Rahimnejad, and R. Ojani *Use of CNTPE modified by Nano-Gold particles as anode electrode in microbial fuel cells for current and power density enhancement*	H. Uthman and H. Saidi *Grafting kinetics of 1-vinylimidazole and 1-vinyl-2-pyrrolidone onto EB-preirradiated poly (ethylene-alt-tetrafluoroethylene), ETFE, films*
14.20 – 14.40	A.A.M. Hassan, M.H.D. Othman*, M.H. Puteh, A.F. Ismail, M.A. Rahman, J. Jaafar *Fabrication of Pva-Based Membranes As Electrolytes For Microbial Fuel Cell*	M. Mashkour, M. Rahimnejad*, M. Mashkour *Improving Microbial Fuel Cell Performance by Titanium Dioxide and Graphene Oxide Modified Cathode*	W.F.M. Lee, K.H. Ng, L.J. Minggu, H. Kasai and M.B. Kassim *Bis(bipyridyl)-Ru(II)-1-Benzoyl-3-(pyridine-2-yl)-1H-pyrazole as Photocatalyst: Experimental and DFT Theoretical Studies*
14.40 – 15.00	M.H. Zainal*, O.H. Hassan, S.A.S. Mohamad, H.M. Ameran, N.K.A. Kamalruzaman, T.I.T. Kudin, A.M.M. Ali, M.Z.A. Yahya *Freeze Dry Pre-treated Chlorella Vulgaris Biomass using Microbial Fuel Cell for Bioelectricity Generation*	D. Panuh, M.S. Masdar, A.M. Zainoodin, S.K. Kamarudin, W.R. W. Daud *Fabrication and Testing of a Single Cell and 6-Cell Stack: Performance and Stability of Passive Direct Methanol Fuel Cells (DMFCS)*	P. Parpainainar, N. Sudachom, C. Warakulwit, T. Witoon, M. Chareonpanich, J. Limtrakul *Effect of different carbon supports of Pt-Ru-Ni electrocatalysts on ethanol oxidation reaction*
15.00 – 15.20	S.N. Kardi, N. Ibrahim*, G. Najafpour, and N.A.A. Rashid *Using Surfactant-Modified-Clinoptiolite On Aluminum Mesh Carbon Cloth Anode In Simultaneous Decolorization And Bio-electricity Generation In Microbial Fuell Cell*	N. Pittayaporn, A. Therdthianwong* and S. Therdthianwong *Transient two-phase model for liquid feed direct ethanol fuel cells*	M.T. Salleh, J. Jaafar, N.A.M. Norddin, A.F. Ismail, M.H.D. Othman, M.A. Rahman, N. Yusof and W.N.W. Salleh *Durability of SPEEK/Cloisite/TAP membrane under Fenton Reagent Accelerated Stress Test*
15.20 – 15.40	B.H. Lim*, E.H. Majlan, W.R.W. Daud, T. Husaini and M.I. Rosli *Numerical analysis of modified parallel flow field design for fuel cells*	S. Hajimolana, M.A. Hussain*, M.A. Hashim, S.R. Nabavi, S. Tonekabonimoghadam, R. Farah and P.V. Aravind *Modelling and advanced Optimization of SOFC/GT Power Plant*	A.A. Jais*, M.R. Somalu and A. Muchtar *Characterization of SOFC cermet anode powders synthesized by microwave-assisted glycine nitrate combustion process (MW-GNP) technique*

15.40 – 17.00	**Coffee Break & Poster Session 2**
17.00– 20.30	**Break**
20.30 – 22.00	**Dinner** (Attire – Smart Casual)

3 September 2015

Keynote Lecture

09.00-10.45	**Keynote Lecture 1** **Professor Dr. Abu Bakar Mohamed** **Title:** Potential of Graphene Oxide based Composite Membrane for Medium Temperature PEM in Fuel Cell Application	**Keynote Lecture 4** **Professor Dr. Nor Aishah Saidina Amin** **Title :** Hydrogen Production from Catalytic Steam Reforming of Clycerol Over Various Supported Nickel Catalysts

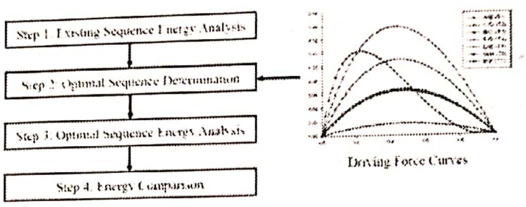

Figure 1 Energy efficient distillation columns sequence methodology [2].

Components	Feed conditions Mass flow (kg/h)		Mole fractions (%)
Methane	931.66		0.86
Ethane	87179.69		40.45
Propane	87268.17		27.81
i Butane	26803.59		6.43
n Butane	57180.35		13.72
i Pentane	20649.83		3.99
n Pentane	14600.65		2.83
n Hexane	17359.16		2.84
n Heptane	9099.66		1.27
Temperature (°C)		66.85	
Pressure (bar)		31.37	

Table 1 Feed conditions of the mixture [3]

is tested in designing minimum energy distillation column sequence for NGLs fractionation process, which consists of nine compounds (methane, ethane, propane, *i*-butane, *n*-butane, *i*-pentane, *n*-pentane, *n*-hexane, *n*-heptane) with eight indirect-direct sequence of distillation columns. The feed composition, temperature and pressure are described in Table 1. The results show that the maximum of 42.5% energy reduction was able to achieve by changing the sequence suggested by the driving force method. It can be concluded that, the sequence determined by the driving force method is able to reduce energy used for NGLs fractionation process. All of this findings show that the methodology is able to design minimum energy distillation column sequence for NGLs fractionation process in an easy, practical and systematic manner.

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DO 10

Sustainability Improvement for Hydrocarbon Mixtures Direct Sequence Separation Process

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The energy efficient distillation columns technologies has been developed which it is aim to reduce energy required for chemical separation process without having major plant modifications. However, this energy efficient methodology was only considered the energy saving technologies without taking sustainability aspects in chemical process design. Therefore, the objective of this paper is to present new improvement of existing methodology by including a sustainability analysis to design an optimal sequence of energy efficient distillation columns. Accordingly, the methodology is divided into four hierarchical sequential stages: i) existing sequence sustainability analysis, ii) optimal sequence determination, iii) optimal sequence sustainability analysis, and iv) sustainability comparison and economic analysis. In the first stage, a simple and reliable short-cut method is used to simulate a base (existing) sequence. The sustainability index of the base sequence is calculated and taken as a reference for the next stage. In the second stage, an optimal sequence is determined by using driving force method. All individual driving force curves is plotted and the optimal sequence is determined based on the plotted driving force curves. Then, by using a short-cut method, the new optimal sequence is simulated and the new sustainability index is calculated in the third stage. Lastly, in the fourth stage, the sustainability index for both sequences (base and optimal) is compared. The capability of this methodology is tested in designing an optimal sustainable energy efficient distillation columns sequence of hydrocarbon mixtures separation unit. The existing hydrocarbon mixtures separation unit consists of eleven compounds (propane, i-butane, n-butane, i-pentane, n-pentane, n-hexane, benzene, cyclohexane, n-heptane, toluene, and n-decane) with ten indirect sequence distillation columns is simulated using a simple and reliable short-cut method within Aspen HYSYS® simulation environment. As results, energy analysis is performed and prove that the optimal sequence using driving force method has better energy reduction with 4.64 % energy savings compare to existing sequence, In addition, the sustainability analysis also shows the sustainability reduction of 4.78 % based on existing sequence. It can be concluded that, the sequence determined by the driving force method is not only capable in reducing energy consumption, but also has better sustainability index for hydrocarbon mixtures separation unit.

DO 11

Grafting kinetics of 1-vinylimidazole and 1-vinyl-2-pyrrolidone onto EB-preirradiated poly (ethylene-*alt*-tetrafluoroethylene), ETFE, films

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Grafting kinetics of nitrogenous and heterocyclic 1-vinylimidazole (1-VIm) and 1-vinyl-2-pyrrolidone (1-V-2-P) onto electron beam (EB)-irradiated poly (ethylene-*alt*-tetrafluoroethylene), ETFE films was investigated in conjunction with reaction parameters namely: crosslinker concentration, monomer concentration, reaction temperature and absorbed dose. This was achieved by the determination of the three kinetic parameters namely: initial polymerization rate (r_{p0}), characteristic radical recombination rate (γ) and delay time (t_0) respectively. The variation of the r_{p0} with absorbed dose [D] and monomer concentration [M] allows the determination of the order of dependence of the grafting rate (R_g) on the [D] which was found to be equal to 2.23, R_g dependence on [M] was found to be equal to 3.39 respectively. Activation energy (E_a) was determined and temperature effect in the range of 50-70°C was investigated. Fourier transform infrared spectrometer (FTIR) was used to confirm and monitor the grafting of poly (1-VIm/1-V-2-P) grafts and chemical changes that followed their grafting onto ETFE films. From the present results it was observed that by controlling and optimizing reaction parameters, a quantitative kinetics for co-grafting of 1-VIm/1-V-2-P onto ETFE film can be established and the degree of grafting [DG(%)] can be easily tuned.

Keywords: Kinetic investigation, radiation induced grafting, 1-vinylimidazole, 1-vinyl-2-pyrrolidone, ETFE film.

References

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Bis(bipyridyl)-Ru(II)-1-Benzoyl-3-(pyridine-2-yl)-1H-pyrazole as Photocatalyst: Experimental and DFT Theoretical Studies

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A new derivative of pyridyl-pyrazole (pypz) compound with benzoyl substituent [1] was developed by varying the benzoyl moieties. Three new complexes $[Ru(bpy)_2(R\text{-}bzpypz)](PF_6)_2]$ (bpy = bipyridyl and *R*-bzpypz = 1-benzoyl-3-(pyridine-2-yl)-1H-pyrazole) ligands were synthesized. The complexes were characterized by theoretical modeling and spectroscopic methods namely, infrared, UV-Vis, nuclear magnetic resonance (NMR) and mass spectroscopy. We utilize density functional theory (DFT) with B3LYP exchange-correlation functional and 6-31G(d,p) basis-set (for hydrogen, carbon, nitrogen, oxygen and chlorine) and LAN2LDZ basis set as effective core potential (for Ru). Cyclic voltammetry technique was used to measure the redox potentials and the energy band. The optical band gap measured for these complexes are ca. 2.2-2.5 eV. The highest-occupied molecular orbital (HOMO) is localised at the Ru center, while the lowest-unoccupied molecular orbital (LUMO) spreads across the bpy and pypz moieties. A photocatalytic degradation of bromothymol blue (BTB) by $[Ru(bpy)_2(R\text{-}bzpypz)](PF_6)_2]$ was investigated in KOH aqueous medium at pH 12. The photocatalytic performance test for the Ru(II) complexes were done in two concentrations of BTB (2.5×10^{-5} and 10.0×10^{-5} M) and the BTB was found to degrade appreciably in the presence of photocatalyst $[Ru(bpy)_2(R\text{-}bzpypz)](PF_6)_2]$.

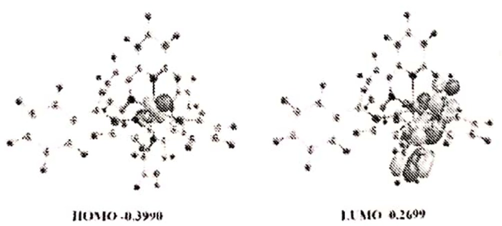

Figure 1: HOMO and LUMO orbital energies of $[Ru(bpy)_2(R\text{-}bzpypz)](PF_6)_2]$.

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