

## 2016 年度 試験研究助成 一覧

2016/11/30

No	大学名	研究テーマ	研究者
1	インドネシア大学 (UNIVERSITAS INDONESIA)	Synthesis of Mesoporous CU/ZSM-5 Using secondary template CTAB and PDDA as catalyst for partial oxidation of methane  メタンの部分酸化のための触媒としての二次テンプレートCTABとPDDAを使用したメソ多孔質体 CU/ ZSM-5 の合成 ※CTAB…固定化セシル・トリメチル・アンモニウムブロミド ※PDDA…ポリ ジアリル・ジメチル・アンモニウムクロリド	Dr. Yuni Krisyuningsih Krisnandi
2		Application of Nano Copper and Fe <sub>3</sub> O <sub>4</sub> -Doped Silica Particles Prepared From Waste Material of Used Frying Oil and Rusty Iron for Adsorptive Desulfurisation of Natural Gas and Model Fuel  天然ガスとモデル燃料の吸着脱硫のために、使用済みフライ油と錆びた鉄の廃棄物から準備されるナノ銅と四酸化三鉄を添加したシリカ粒子の応用 (燃料電池への利用)	Dr. Ir. Antonius Herry Cahyana
1	バンドン工科大学 (INSTITUT TEKNOLOGI BANDUNG )	Molecularly imprinted polymers membrane (MIPsM): a functional materials for peat water treatment  分子認識高分子膜(MIPsM): 泥炭水処理のための機能性材料	Muhammad Ali Zulfikar, S.Si., M.Si., Ph.
2		Simultaneous Design of Optimal Control Structure and Model Estimation in Natural Gas Processing Plants  天然ガス処理プラントにおける最適制御構成とモデル評価の同時設計	Prof. Dr.-Ing. Ir. Yul Yunazwin, M.Sc., DIC
3		Analysis on Uranium and Thorium Fuel Cycle Utilizations in term of Fuel Sustainability in Nuclear Power Plant  原子力発電所における燃料の持続可能性の観点によるウランやトリウム燃料サイクルの利用率に関する分析	Dr. Eng. Sidik Permana, S.Si., M.Eng.
1	ボゴール農業大学 (INSTITUT PERTANIAN BOGOR)	Waste Management of ornamental fish culture with aquaponics system using chili plant  唐辛子植物を用いた観賞魚培養液のアクアポニックス・システムによる廃棄物管理 ※アクアポニックス・aquaponicsは、水産養殖(Aquaculture)と水栽培(Hydroponics)という二つの言葉を組合せた用語。 魚、植物、微生物の3要素による浄化培養システムである。	Bagus Amalrullah Utomo, S.Pi Giri Maruto Darmawangsa, S.Pi Dr. Ir. Hefni Effendi, M.Phil
2		Implementation of pyrolysis biochar system for wet waste management in Bogor Agricultural University  ボゴール農大における含水廃棄物管理のための熱分解バイオ炭システムの導入 ※バイオ炭(Biochar)とは、生物資源を材料とした、生物の活性化および環境の改善に効果のある炭化物のこと	Johanis R. Pangala, ST, MSi Prof.Dr. Armansyah Halomoan Tambunan Yudi Setiawan, Ph.D

No	大学名	研究テーマ	研究者
3		<p>Design compos digester with capability to absorb bad smell for organic fertilizer production based on eco-friendly and eco-business with community partnership surrounding Bogor Agricultural University (IPB)</p> <p>ボゴール農大(IPB)を取り巻く地域社会のパートナーシップとともに、環境に優しく、環境ビジネスを基本とした有機肥料生産のために、悪臭を吸収する能力を有する堆肥・ダイジェスター(蒸解装置)の設計</p>	<p>Dr. Zaenal Abidin, M.Agr Ayu Hapita Triawati Aisyah</p>
4		<p>Analysis of Potency and the Development of Renewable Energy Industry Based on Biomass Waste in Jambi Province</p> <p>ジャンビ州(スマトラ島南東部)におけるバイオマス廃棄物に基づいた再生可能エネルギー産業の有効性と発展の分析</p>	<p>Dr. Ir. Y. Aris Purwanto, M.Sc</p> <p>Prof.Dr. Anas M. Fauzi Wilda Harlia Devita</p>



## &lt;マレーシア&gt;2016 年度 試験研究助成テーマ一覧

3,4,11,12,13 は継続研究テーマとなった (2017.12)

No	大学名	研究テーマ	研究者
1	サラワク大学 (UNIVERSITI MALAYSIA SARAWAK)	Inspection Methodology for Bond Pad Discoloration in Wafers 半導体ウェハーにおけるボンドパッド変色の検査方法	Ir Dr David Chua Sing Ngie
2		Application of Resonant Effect in Pepper Drying Process コショウの乾燥プロセスにおける共振効果の応用	Dr Ana Sakura bt Zainal Abidin
3		Pyrolysis and Co-Combustion Characteristics of Torrefied Oil Palm Empty Fruit Bunch (EFB) for Energy Generation in Coal-Fired Combustion System 石炭火力燃焼システムにおけるエネルギー生成のための焙焼用の油ヤシ空果房 (EFB) の熱分解と混焼特性	Siti Nor Ain bt Musa
4		Fabrication of high Performance Biodegradable Cellulose Nanofiber (CNF) Composite 高性能の生分解性セルロースナノファイバー (CNF) 複合体の製作	Noor Hisyam b Noor Mohamed
5		Evaluating the Effects of Correlated Characteristics with Non-Normal Distribution in Manufacturing Quality Control 製造品質管理における非正規分布と相関特性に及ぼす影響評価	Shirley ak Johnathan Tanjong
6		The Study of Vegetable Based Cutting Fluid Performance in Milling Process 切削プロセスにおける植物油ベースの切削油の性能研究	Dr Abg Mohd Nizam Abg Kamaruddin
7		Implementation of Integrated Optical Tap Planar Lightwave Circuit (PLC) in Fiber-To-The-Home (FTTH) System ファイバーツーホーム (FTTH) システムにおける光集積タップ平面光波回路 (PLC) の導入	Nurdiani bt Zamhari
8		The Design of Microwave Sensor by Using Band Pass Filter (BPF) Application for Industrial Application 産業用用途へのバンドパス・フィルタ (BPF) を適用したマイクロ波センサの設計	Dr Dyg Norkhairunnisa bt Abang Zaidel

No	大学名	研究テーマ	
9	サラワク大学	Efficient Design and Implementation of SHA-1 Hash Function Using Verilog Code Verilog コードを使用した SHA-1 ハッシュ関数の効率的な設計と実装	Shamsiah binti Suhaili
10		Effect Nanofiller on Electrical Properties of Nanocomposite Blends as Electrical Insulator 電気絶縁体としてのナノコンポジットブレンドの電気特性に及ぼすナノフィラーの影響	Mohd Ridhuan b Mohd Sharip
11		An Investigative Study of Green Energy Assessment of Pusat Islam Tun Abang Salahuddin (PITAS) Building Pusat Islam Tun Abang Salahuddin (PITAS)ビルのグリーンエネルギー評価に関する調査研究	Mohd Hafiez Izzwan b Saad
12		Solid Waste Generation and Management in UNIMAS WEST CAMPUS サラワク大学西キャンパス内の固形廃棄物の発生と管理	Jethro Ak Henry Adam
13		The Fabrication of a Bio-Filtration Pilot Plant for Potential Domestic Waste Water Treatment 将来性のある国内廃水処理バイオろ過パイロットプラントの製作	Nur Amalina Shairah bt Abdul Samat

OSAKA GAS FOUNDATION  
OF INTERNATIONAL CULTURAL EXCHANGE  
YEAR 2016-2017

PROGRESS REPORT

**SYNTHESIS OF MESOPOROUS Cu/ZSM-5 USING  
SECONDARY TEMPLATE CTAB AND PDDA AS  
PARTIAL OXYDATION CATALYST OF METHANE**

Principal Investigator:  
Dr. Yuni Krisyuningsih Krisnandi

Co-Investigator:  
Dita Arifa Nurani S.Si., M.Si., M.Sc.

Department of Chemistry  
Faculty of Mathematics and Natural Science



Departemnt of Chemsitry  
Faculty of Mathematics and Natural Science  
Universitas Indonesia

DEPOK, 2017

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Synthesis of Mesoporous Cu/ZSM-5 Using Secondary Template CTAB and PDDA as Partial Oxydation Catalyst of Methane

Identification

**Synthesis of Mesoporous Cu/ZSM-5 using secondary template CTAB and PDDA as partial oxydation catalyst of methane**

Duration : 18 months  
Principal Investigator : Dr. Yuni K. Krisnandi  
Institution : University of Indonesia  
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Research members

1. Investigator

No.	a) Full Name b)Field of Study c) Responsibility	Degree	a) Sex b) Time alocation (Week-hours)	Institution
1	a) Yuni K. Krisnandi b) Material chemistry and catalysis c) mesoporous zeolite preparation and characterization; Catalytic gas transformation experiments; data analysis and Full Report Preparation	Dr.	a) Female b) 15	Dept. of Chemistry Faculty of Science, University of Indonesia
2.	a) Dita Arifa Nurani b) Analytical separation and speciation for trace level metals c) Basic Chemistry 1, Basic Chemistry 2, Electrochemistry and Basic of Separation Methods, Analytical Chemistry	Dr	a) Female b) 15	Same as above

## **A. Research Title**

**Synthesis of Mesoporous Cu/ZSM-5 Using Secondary Template CTAB and PDDA as Partial Oxydation Catalyst of Methane**

## **B. Abstract**

Every year the world's energy needs are always increasing. Meanwhile, the energy source that being used today primarily comes from petroleum, a non-renewable energy source. So that is a very necessary effort to reduce dependency on petroleum. One way to do it is to utilize the natural potential of more abundant but renewable sources such as methane gas that obtained by natural gas, feedstock, landfill, and biomass. And the utilization of methane has been conducting by our team since 2013.

In our work previously, direct partial oxidation of methane was conducted by mesoporous Co/ZSM-5 using PPDA as secondary template. The work showed methane gas converted to methanol and formaldehyde and the highest percent yield was methanol. However, PDDA gave disorder mesoporosity. Moreover, utilization of PDDA as secondary template and cobalt metal as active site on ZSM-5 is too expensive. So that looking for other materials are less expensive, giving high order mesoporosity and increasing active site performance to be an attractive thing. Therefore, this proposed research will be focused on replacing secondary template by CTAB and replacing cobalt metal by copper metal. Furthermore, the experiments include varying temperature and time of reaction and the amount of catalyst. When optimum condition obtained, reuse of catalyst and change in gas composition will be performed.

**Keywords:** Cu/ZSM-5, methanol, methane conversion, mesoporous zeolite

## **C. Introduction**

The conversion of methane directly into other products is one of the biggest challenges in the field of heterogeneous catalysts, because the thermodynamic constraints contained in this reaction is quite a lot. In this case, P.P. Knops-Gerrits, W.A. Goddard III [1] reported that the catalytic oxidation of methane to methanol with gas N<sub>2</sub>O catalyst Fe-ZSM-5 zeolite Fe and other systems to optimize the work of the conversion of methane. N<sub>2</sub>O is more difficult to set in the oxidation reaction of methane, compared with O<sub>2</sub> gas or even air . Therefore, the



**FINAL REPORT  
OSAKA GAS FOUNDATION  
OF INTERNATIONAL CULTURAL EXCHANGE  
Year 2016/2017**

**Application of Nano Copper and  $\text{Fe}_3\text{O}_4$ -Doped Silica Particles  
Prepared From Waste Material of Used Frying Oil and Rusty  
Iron for Adsorptive Desulfurisation of Model Fuel**

**Principal Investigator :  
Dr.Ir. Antonius Herry Cahyana  
Department of Chemistry  
Faculty of Mathematics and Natural Sciences  
University of Indonesia**



**THE CENTER FOR SCIENCE AND TECHNOLOGY RESEARCH  
(csTR)**

**UNIVERSITY OF INDONESIA  
DEPOK, JUNE 2017**

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## ABSTRACT

The presence of sulfur compounds in liquid fuels is always objectionable in the world due to their harmful effects on combustion. The various sulfur compounds generally found in diesel oil and gasoline are mercaptants, sulfides and aromatic ring structured compounds thiophenes. The removal of sulfur compounds from petroleum is increasingly important. In addition to its contribution to form particulate pollution, sulfur emission may cause some health problems. A commonly used method for the removal of sulfur-bearing species from fuel is desulphurization. However, due to the regulations required removal of sulfur to very low levels, several alternative technologies have also been reported for sulfur removal from liquids such as by adsorption has been regarded as the most promising approach. In the current research, materials of  $\text{Fe}_3\text{O}_4$  nanoparticles were synthesized from bulky waste material of used cooking oil and rusty iron, and Cu modified with silica through the co-precipitation method prepared as green heterogeneous catalysts for adsorptive desulfurization of model fuel, diesel oil and gasoline. This scenario urged the researcher to attempt synthesis of material that is likely to offer good adsorption capacity for sulfur via green process. Following protocol of sol-gel method, transition metals of Cu and Fe solution are gelled with tetraethoxysilane (TEOS; silica precursor) using glycerol as by-product waste of preparation of FAM (Fatty Acid Mixture) from hydrolysis of waste frying oil, and magnetically iron nanoparticles prepared from oxidation of rust with fatty acid mixture from waste frying oil. Batch experiments were conducted to assess the adsorptive potential of synthesized nano metal particles.

Four sets of open batch as a function of time were conducted for the selective adsorption of thiophene and 1-benzothiophene as representatives of organosulfur compounds. The percentage removal was calculated for the sulfur compounds to determine the efficacy of synthesized nano-adsorbents. In addition, as-synthesized Cu doped silica particle and  $\text{Fe}_3\text{O}_4@\text{SiO}_2$  nanoparticle were used as a magnetic adsorbent for removal of sulfur compounds from Indonesia gasoline using thiophene and 1-benzothiophene as model. The effect of reaction time, sulfur, and adsorbent concentration on the desulfurization.

**Research Report**  
**Osaka Gas Foundation of International Cultural Exchange**  
**(OGFICE)**



**Molecularly imprinted polymers membrane  
(MIPsM): a functional materials  
for peat water treatment**

Principal Investigator:  
Dr. Muhammad Ali Zulfikar

Academic Unit

Research Division : Analytical Chemistry  
Faculty/School : Mathematics and Natural Sciences

**INSTITUT TEKNOLOGI BANDUNG**  
October 2017

## I. IDENTITY PAGE

1. Title : Molecularly imprinted polymers membrane (MIPsM): a functional materials for peat water treatment
2. Topic : Water treatment
3. Research Period : November 2016 – October 2017
- 4.1. Principal Investigator :
- a. Full Name : Muhammad Ali Zulfikar
- b. Academic Rank : Dr.
- c. NIP : 197112211997021003
- d. Current Position : Associate Professor
- e. Academic Unit : Chemistry
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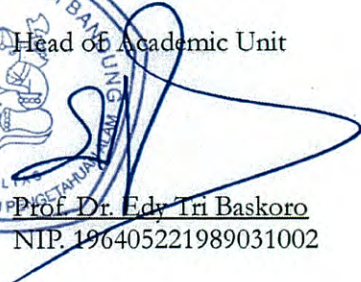
### 4.2 Members of the Team:

No	Name and Academic Rank	Field of Expertise	Institution	Allocation of Time	
				Hrs/week	Months
1	Dr. Deana Wahyuningrum	Organic Synthesis	ITB	10	10
2	Dr. Muhammad Nasir	Membrane	LIPI	10	10
3	Dr. M. Yudhistira Azis	Environmental	ITB	10	10


### 4.3 Research Assistants/Students (mention names when available):

No	Name	Departement and NIM	Alocation of Time	
			Hrs/week	Months
1.	Dikdik Mulyadi, M.Si.	Chemistry, 30514007	12	10
2.				

5. Approved budget : US \$ 4,400

  
Head of Academic Unit  
  
Prof. Dr. Edy Tri Baskoro  
NIP. 196405221989031002

Bandung, October, 2, 2017  
Principal Investigator

  
Dr. Muhammad Ali Zulfikar  
NIP. 197112211997021003



## I. EXECUTIVE SUMMARY

1. **TITLE OF RESEARCH** : Molecularly imprinted polymers membrane (MIPsM): a functional materials for peat water treatment
2. **HEAD OF RESEARCH TEAM** : Dr. Muhammad Ali Zulfikar
3. **TEAM MEMBERS** : Dr. Deana Wahyuningrum, Dr. M. Nasir, Dr. M. Yudhistira A
4. **OFFICIAL ADDRESS** : Jl Ganesa 10 Bandung 40132

5. **EXTENDED ABSTRACT** :

One of problems that are faced by people who live in lowland and marshy area is the scarcity of available clean water. This is due to the fact that the abundant source of water in that area is peat water. Peat water is water having more than 75% humic acid content and has the character of acid. Humic acid imparts a brown or yellow color in peat water and pose a serious environmental problem, particularly in drinking water treatment because of their taste and odor. They also tend to react with a variety of oxidants and disinfectants used for the purification of drinking water forming carcinogenic disinfection byproducts (DBPs). In order to acquire clean water from peat water it is necessary to do pretreatment process to this water. At present, there are several methods used to remove humic substance, especially humic acid as main component from peat water, such as coagulation-flocculation, electro coagulation processes, oxidation, photocatalysis, biofiltration and membrane technology. However, these techniques are associated with problems such as excessive time requirements, high costs and high energy consumption. Due to its simplicity and high efficiency, adsorption treatments have been extensively applied to remove organic pollutants in aqueous environments. Activated carbon is the most widely studied and used as adsorbents for water and wastewater treatments. However, the main disadvantage of activated carbon is its high cost in manufacturing and treatment and difficult to regenerate. Therefore there is a need to continue the search and developing alternative adsorbents with high adsorptive capacity for humic acid removal.

In this research, we use of molecularly imprinted polymers membrane (MIPsM) material as an alternative adsorbent for the adsorption of humic acid (HA) from peat water in batch mode. The MIPsM and the correspondent non-imprinted polymers membrane (NIPsM) will be prepared by radical polymerization technique using methacrylate acid (MAA) as a functional monomer, humic acid (HA) as templates, divinyl benzene (DVB) as a cross-linker, 2,2-azo bis isobutyronitrile (AIBN) as an initiator, and acetonitrile as a solvent. The physical properties of the MIPsM will be characterized by Fourier transform infra-red (FT-IR) spectroscopy and scanning electron microscope (SEM) method. The effects of agitation time and pH on adsorption of HA from peat water also investigated. The kinetics of the removal process will determine using pseudo-first-order and pseudo-second-order models. The Langmuir, Freundlich, and Sips isotherm models will be used to evaluate the equilibrium adsorption data.

The results showed that the equilibrium contact time was 60 minutes. The adsorption percentage decreased with increasing peat water pH from 2 to 12. The equilibrium data fits

well for the Langmuir adsorption isotherms, with monolayer adsorption capacity of MIPsM found to be 42.45 mg/g. The results of the kinetic study show that the adsorption of HA onto MIPsM could be described by the pseudo-second order kinetic model with a rate constant in the range of 0.034 - 0.115 g.mg<sup>-1</sup>.min<sup>-1</sup>.

## 6. LIST OF RESEARCH OUTPUT

International Journal (1)

# II. TECHNICAL REPORT

## 1. INTRODUCTION

One of problems that are faced by people who live in lowland and marshy area is the scarcity of available clean water. This is due to the fact that the abundant source of water in that area is peat water. Such problem is also readily found in several remote villages in Riau Province, Indonesia. Almost 45% of Riau Province area is peat land, thereby the major source of water is peat water. Humic acid (HA) is one of the major components of peat water which is formed by the microbial degradation of biomolecules. The presence of HA in water may lead to yellowish to brown colour, taste and odour problems, and to biological instability of drinking water in distribution systems. Moreover, the high affinity of humic substances for complexation with various pollutants including heavy metals and pesticides could cause contamination of ground and surface water. They also tend to react with a variety of oxidants and disinfectants used for the purification of drinking water forming carcinogenic disinfection byproducts (DBPs) such as trihalomethanes and haloacetic acids (Ngh et al, 2011; Hamid et al, 2011; Rojas et al, 2011; Uyguner et al, 2007; Sonea et al, 2010; Tao et al, 2010). Thus, the removal of HA from surface water or wastewater is very important.

At present, there are several methods used to remove humic substance, especially HA as main component from peat water, such as coagulation-flocculation (Uyguner et al, 2007; Rojas et al, 2011), electro coagulation processes (Gheraout et al, 2009), oxidation (Uyguner et al, 2007), photocatalysis (Sonea et al, 2010), biofiltration (Hu et al, 2003) and membrane technology (Rojas et al, 2011; Hamid et al, 2011). However, these methods are not widely used due to their high costs and economic disadvantages.

Due to its simplicity and high efficiency, adsorption treatments have been extensively applied to remove organic pollutants in aqueous environments. Activated carbon is the most widely studied and used as adsorbents for water and wastewater treatments (Gupta et al, 2009). However, the main disadvantage of activated carbon is its high cost in manufacturing and treatment and difficult to regenerate (Gupta et al, 2006). Therefore there is a need to continue the search and developing alternative adsorbents with high adsorptive capacity and low cost for humic acid removal.

Molecularly-imprinted polymers membrane (MIPsM) are synthetic materials having artificially generated recognition sites able to rebind a specific target molecule. These materials are obtained by polymerizing functional and cross-linking monomers around a template molecule, leading to a highly cross-linked, three-dimensional network polymer. The

**Research Report**  
**Osaka Gas Foundation of International Cultural Exchange**  
**(OGFICE)**



***Simultaneous Design of Optimal Control and Model Estimation in  
Natural Gas Processing Plant***

Principal Investigator:  
Prof. Yul Yunazwin Nazaruddin, IPM

Academic Unit

Research Division : Instrumentation & Control Research Group  
Faculty/School : Faculty of Industrial Technology

**INSTITUT TEKNOLOGI BANDUNG**

October 2017

## I. IDENTITY PAGE

1. Title : Simultaneous design of optimal control and model estimation in natural gas processing plant
2. Topic : Control of cryogenic processes
3. Research Period : December 2016 - November 2017
- 4.1. Principal Investigator :
- a. Full Name : Yul Yunazwin Nazaruddin
- b. Academic Rank : Professor
- c. NIP : 19570715 198703 1 001
- d. Current Position : Chair of Instrumentation & Control Research Group
- e. Academic Unit : Engineering Physics Study Program, Faculty of Industrial Technology
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- g. Home Address/Phone/Fax/E-mail : Jl. Wastukencana 12, Bandung 40117/ +62 22 201 3240 / yul\_yn@yahoo.com

### 4.2 Members of the Team:

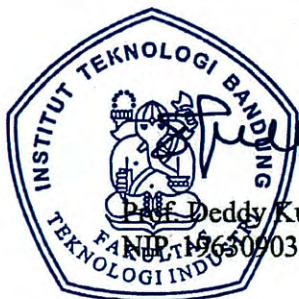
No	Name and Academic Rank	Field of Expertise	Institution	Allocation of Time	
				Hrs/week	Months
1	Tua A. Tamba, PhD	Control Systems	ITB	15	11

### 4.3 Research Assistants/Students (mention names when available):

No	Name	Departement and NIM	Alocation of Time	
			Hrs/week	Months
1.	Oki Matra Prakasa	Engineering Physics, ITB	10	11
2.				

5. Approved budget : IDR 55.839.800,-

Dean of Faculty of Industrial Technology  
Institut Teknologi Bandung



Bandung, 2 October 2017  
Principal Investigator

Prof. Yul Yunazwin Nazaruddin, IPM  
NIP. 19570715 198703 1 001

## I. EXECUTIVE SUMMARY

1. **TITLE OF RESEARCH** : Simultaneous design of optimal control and model estimation in natural gas processing plant
2. **HEAD OF RESEARCH TEAM** : Prof. Yul Yunazwin Nazaruddin, IPM
3. **TEAM MEMBERS** : - Tua Agustinus Tamba, PhD  
- Oki Matra Prakasa, ST
4. **OFFICIAL ADDRESS** : Engineering Physics Study Program, Faculty of Industrial Technology, Institut Teknologi Bandung. TP. Rachmat Building, Jl. Ganesa no. 10, Bandung 40132

5. **EXTENDED ABSTRACT** :

In this report, an optimal control design method based on a semidefinite optimization approach for a nonlinear model of a cryogenic separation process is reported. The cryogenic separation process is an air separation technology which is utilized for producing specific component of the air in gases or liquid form with high purity. This technology is frequently used in liquefied natural gas (LNG) industries, nuclear isotopes separation process and space shuttles' cryogenic fuels production. The optimal control algorithm which is developed in this research for such a process combines the state-dependent Riccati equation (SDRE) method and a semidefinite optimization method based on the sum of squares (SOS) programming technique. This research initially characterizes a stabilizing control law which is capable of minimizing a quadratic performance index of the process in an exact manner. Due to the difficulties in solving the SDRE which arises during the synthesis of such an optimal control, this research next examines the use of SOS optimization techniques for computing suboptimal control law. The effectiveness of the control strategy which is developed in this research is illustrated through the design of a controller which maximizes the fraction of a particular isotope that is produced in the cryogenic separation plant.

6. **LIST OF RESEARCH OUTPUT**

a. **Papers in International Conference Proceedings**

- [1] T.A. Tamba and Y.Y. Nazaruddin, "Optimal control of a nonlinear cryogenic separation process via SDRE Method," *Proceedings of the 5th International Conference on Instrumentation, Control and Automation*, pp. 140-145, Yogyakarta, Indonesia, August 2017.
- [2] T.A. Tamba and Y.Y. Nazaruddin, "Synthesis of a nonlinear tracking controller for a cryogenic separation process plant," *Proceedings of 11th Asian Control Conference*, Gold Coast, Australia, December, 2017.

b. **Papers in International Journal**

- [1] T.A. Tamba and Y.Y. Nazaruddin, "Nonlinear control synthesis for a cryogenic separation process based on convex optimization," *Working draft in progress (to be submitted to SCOPUS-indexed journal by the end of October, 2017)*.



## Research Report

**Osaka Gas Foundation of International Cultural Exchange**

**(OGFICE)**



### *Research Title*

**(Analysis on Uranium and Thorium Fuel Cycle Utilizations In Term of Fuel Sustainability in Nuclear Power Plant (NPP))**

Principal Investigator:

**. Dr. Eng Sidik Permana, S.Si, M. Eng**

..

Academic Unit

Research Division : Nuclear Physics and Biophysics Research Division.

Faculty/School : Faculty of Mathematic and Natural Science.

**INSTITUT TEKNOLOGI BANDUNG**

Oktober 2017

## I. IDENTITY PAGE

1. Title : Analysis on Uranium and Thorium Fuel Cycle Utilizations In Term of Fuel Sustainability in Nuclear Power Plant (NPP)..
2. Topic : ..New And Renewable Energy..
3. Research Period : ..November 2016 – November 2017.
- 4.1. Principal Investigator :
- a. Full Name : . Dr.Eng Sidik Permana, S.Si, M.Eng.
- b. Academic Rank : .Associate Professor...
- c. NIP : . 19780511200812 1 002.....
- d. Current Position : .. Lecturer and Researcher.....
- e. Academic Unit : .. Faculty of Mathematics and Natural Sciences...
- f. Office Address/Phone/Fax/E-mail : .. Jl. Ganesha 10, Gedung Fisika / Phone : +62-22-2500834/ Fax : +62-22-2506452, psidik@fi.itb.ac.id.
- g. Home Address/Phone/Fax/E-mail : . Jl. Sadang Luhur blok 13 no 28, Coblong Bandung Indonesia / psidik@gmail.com.

### 4.2 Members of the Team:

No	Name and Academic Rank	Field of Expertise	Institution	Allocation of Time	
				Hrs/week	Months
1.	Dr. Eng Asril Pramutadi	Nuclear Material, Physics	Institut Teknologi Bandung	4	16

### 4.3 Research Assistants/Students (mention names when available):

No	Name	Departement and NIM	Alocation of Time	
			Hrs/week	Months
1.	Geby Saputra	Physics and 20216025	10	40
2.				
3.				
4.				
5.				

5. Approved budget : Rp . 55.839.800.....



Bandung, 02 Oktober 2017  
Principal Investigator

Dr.Eng Sidik Permana, S.Si, M.Eng  
NIP. 197805112008121002

## I. EXECUTIVE SUMMARY

1. **TITLE OF RESEARCH** : Analysis on Uranium and Thorium Fuel Cycle Utilizations In Term of Fuel Sustainability in Nuclear Power Plant (NPP)
2. **HEAD OF RESEARCH TEAM** : Dr.Eng Sidik Permana, S.Si, M.Eng
3. **TEAM MEMBERS** : Dr. Eng Asril Pramutadi, Geby Saputra, S.Si
4. **OFFICIAL ADDRESS** : Jl. Ganesha 10, Gedung Fisika / Phone : +62-22-2500834/  
Fax : +62-22-2506452, psidik@fi.itb.ac.id
5. **EXTENDED ABSTRACT** :

Nuclear fuel sustainability is one of the important issues for extending fuel utilization factor such as by re-cycle options of spent nuclear fuel (SNF) especially from the existing light water reactor (LWR) which can be combined with nuclear proliferation aspect as a strategic program. The recycling program can be harmonized with higher fuel breeding reactors, utilization of nuclear fission as well as additional fuel resources from sea water and utilization of thorium which can be estimated to fulfill world energy demand as similar pattern as sustainable energy or renewable energy resources (Zaleski, 2006). Fuel breeding aspect as a key factor of nuclear sustainability can be enhanced with several ways and program such as designing high breeding capability reactors, effectively recycling fuel program for both nuclear fuel cycle of uranium and thorium which is naturally exist. In addition, some new fuels are produced in the reactor which can be maintained as new fuel resources and gives some fuel breeding gain to used in the next step of reactor operation. In term of recycling spent fuel from the reactor, there is a sensitive issue especially to the plutonium production and plutonium utilization which can be defined as a nuclear non-proliferation aspect and nuclear security concern intrinsically and extrinsically. Enhancing fuel breeding capability is one of the essential programs for sustainability of nuclear fuel which can be maintained by recycling process of spent nuclear fuel (SNF) and designing a reactor system which can operate with high breeding capability. Some programs have been done to increase the fuel sustainability and recycling program for reducing SNF volume as well as in line with increasing fuel breeding condition and to increase a level of nuclear non-proliferation capability of the nuclear fuels (Sidik and Zaki, 2009; Sidik et al, 2009; Choi and Downar, 1999; Edward and Weston, 2003; Taiwo et al, 2006; Saito, 2002; Meiliza et al, 2008; Sidik et al, 2011a, 2011b, 2011c, 2013).

In term of thorium utilization which has 3-4 times more larger resources than uranium. Some investigation also have been employed which shows some advantages by utilizing thorium as fuel such as high fuel breeding capability especially in thermal and epi thermal energy regions, high fuel stability, and better nuclear non-proliferation aspect (Permana et al., 2007; Kim and Downar, 2002; Michael and Otto, 1998; Turan, 2000). To evaluate the capability of nuclear fuel breeding with some fuel cycles have been also done in term of thermal and fast reactor types (Akie et al., 1991; Permana et al., 2006, 2007, 2010; Iwamura et al., 1999; Hibi et al., 2001; Hibi and Sekimoto, 2005; Takaki, 2000; Takaki et al, 2010; Iwamura, et al., 2006, 2007; Kim and Downar, 2002; Takahashi et al., 2000; Freeman et al., 1989; Nuttin et al., 2005; Akie et al., 1991; Michael and Otto, 1998; Turan, 2000; Jagannathan and Usha, 2006; IAEA, 2005). The advantages of thorium fuel also can be estimated from the safety performance capability in relation with reactivity condition of void condition which shows a negative void reactivity condition (Permana et al., 2007, 2008, 2011; Takahashi et al., 2000). In order to control the use of nuclear fuel, a proposes to reduce a use for military or weapon purposes and to increase the use of nuclear fuel only for peaceful use and civilian use have been proposed (Obama, 2009). And in the same time same proposed methodology to evaluate intrinsic proliferation resistance approach (Pellaud, 2002; Kessler, 2007; Mark, 2009, Saito, 2002; Sidik, 2011a, 2011b).

In this study, the effect of different nuclear fuel loading such as uranium and thorium fuel cycles to the fuel breeding capability as a fuel sustainable parameter in nuclear power plant (MPP) will be investigated. Fuel

breeding analysis will be based on the conversion ratio capability which is basically comes from reaction rate of neutron in the reactor. Research activities will be performed from compiling literature and previous research result as a basic analysis, conducting analysis and computational simulation analysis up to publication process of research activity results. In education point of view, the significant result and research activity program can be used as educational research program especially for co-researcher from post graduate student and also can be collected as a reference document for university lectures as well as can be used as reference data for utilizing uranium and thorium resources in Indonesia. International publication will be performed as paper publication in international journal and in proceeding paper of international conference.

## 6. LIST OF RESEARCH OUTPUT

1. Comparative Analysis on Fuel Breeding for Less Moderation Ratio of Water-Cooled Reactor , ASIAN PHYSICS SYMPOSIUM, Aughust 29-31, 2017, Bandung, Indonesia. [Proceeding Conference international]
2. Nuclear Fuel Sustainability Evaluation on Fast Breeder Reactor (FBR) , Draft Paper to be submitted to International journal.

## II. TECHNICAL REPORT

### Comparative Analysis on Fuel Breeding for Less Moderation Ratio of Water-Cooled Reactor

**Abstract** – Nuclear fuel breeding aspect of water-cooled reactor become one of the important issues to extend the sustainability aspect of nuclear fuel in line with fast breeder reactor program with closed fuel cycle concept. Utilization of transuranium fuel in water-cooled reactor is one of the option to optimize nuclear fuel utilization as additional resource fuel in conjunction with uranium fuel utilization. Fuel sustainability aspect of nuclear fuel will be analyzed in the present study based on a water cooled reactor with uranium and transuranium fuels as supply fuels with light and heavy water as coolants. Ratio of moderator to fuel ratio is set to be low arrangement to have more harder spectrum to enhance fuel breeding capability of water cooled. Some actinides such as plutonium are investigated to show the composition effect to fuel breeding capability which is based on plutonium vector composition. Possible fuel breeding capability can be achieved by the present water cooled reactor for both light and heavy water coolant systems. Higher possible fuel breeding capability can be achieved for less moderation ratios and some contributions from recycled fuel of spent fuel. In addition, some plutonium isotopes contribute to increase fuel breeding capability for both water coolants. Heavy water coolant has better plutonium production which achieves more fuel breeding because of harder neutron spectrum. Some transuranium recycling schemes show better fuel breeding capability as well as more plutonium isotopes production.

**Keywords:** sustainability, transuranium, water-cooled, fuel breeding, plutonium isotopes.

### Nuclear Fuel Sustainability Evaluation on Fast Breeder Reactor (FBR)

#### Abstract

Nuclear fuel sustainability aspect is one of the important issues in conjunction with fuel production in the reactor core during reactor operation, fuel cycle capability as well as fuel fabrication and its facilities. New fuel production from the reactor can be used for the reactor self or for other reactors. Reused or recycle concept will be one of the choices which will have some challenges in term of fuel cycle capability and its facilities as well as nuclear non-proliferation concern of special nuclear materials. In the present study, it will focus on different analysis approach evaluation as a comparative study based on the conversion ratio or breeding ratio concept as well as some actinide contribution to increase breeding in fast breeder reactor (FBR) type. Conversion ratio approach is depending on the reaction rate of fertile and fissile materials and it can be estimated from the initial

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**Research Grant FY 2016/2017**

## **Progress Report**

### **Waste Management of Fish Culture with Aquaponics System Using Horticulture Crops**

**1. Bagus Amalrullah Utomo**

**Center for Environmental Research**

**2. Hefni Effendi**

**Center for Environmental Research**

**3. Giri Maruto Darmawangsa**

**Aquaculture Diploma Programme**



**Submitted to:**

**Center for Environmental Research**

**Bogor Agricultural University**

**for**

**The Osaka Gas Foundation of International Cultural Exchange (OGFICE)**

**June 2017**





# The Osaka Gas Foundation of International Cultural Exchange (OGFICE) Research Grant for 2016/2017: Progress Report

Date: Juny 14, 2017

## I. Applicant Information

Name of project leader (Last name, first name)	Utomo,Bagus	Date of birth (Month, date, year)	Bogor, 26 August 1984
Institution	Center of Environmental Research	Position	Researcher
Address of institution	Lingkar Akademik Street, Bogor Agricultural Institute		
	Post code: 16001	Tel. (0251) 8621085	Fax. (0251) 8622134
	E-mail: pplh@apps.ipb.ac.id		URL: http://pplh.ipb.ac.id
Home address	Vila Ciomas Indah Blok P6 NO. 18		
	Kecamatan Ciomas, Bogor		
	Post code: 16610	Tel:	Fax.
	E-mail: bagz_suede@yahoo.co.id		Mobile number: 08568426531
Name of contact person (if other than project leader)	Hefni Effendi	Contact address (please insert ✓ for appropriate answer)	Institution <input checked="" type="checkbox"/>
			Home <input type="checkbox"/>
			Others <input type="checkbox"/>
Contact Address (if other than home or organization address)			
	Post code:	Tel.	Fax.
	E-mail:		URL:

## II. Project Arrangement

Project team Please include the project leader. If the team members are more than 5 persons, you can add extra pages				
Name	Age	Institution	Major	Role in the project
1) Bagus A. Utomo	32	Center for Environmental Research	Aquatic Resources Management	Team leader
2) Hefni Effendi	50	Center for Environmental Research	Environmental Management	Environmental Expert
3) Giri Maruto D.	32	Aquaculture Diploma Programme	Aquaculture	Fish Aquaculture Expert
4)				
5)				

### III. Project Setting

Theme: **Waste Management Model (Case Study of Bogor Agricultural University (IPB), Indonesia)**

Topic of the project For appropriate answer, please insert ✓ in the box on the right

a. Integrated and Sustainable Waste Management

✓

b. New Technology and Innovation on Waste Management Approach

#### 1. Title of the project

Waste Management of Fish Culture with Aquaponics System Using Horticulture Crops

#### 2. Summary of the project

Please explain within 600 words: why the project is necessary, objectives, location, targeted beneficiaries, and results obtained so far.

Water that has been mixed with organic waste in the process of aquaculture (food remains and feces) if not replaced will cause a decrease in water quality, consequently bring about an effect on survival of farmed fish. The existence of organic materials that do not decompose completely can produce ammonia and can reduce levels of dissolved oxygen in the water of cultivation media. The existence of high ammonia in the culture system can inhibit the growth of maintained aquatic biota. The availability of dissolved oxygen in the water is needed in the survival of cultured aquatic biota. In a farming, water quality are really crucial for the growth of aquatic biota. Therefore, it is necessary find out technology that can maintain suitable water quality for the survival of aquatic biota. Fisheries organic waste treatment technology that may be applied is aquaponics system.

The purpose of this study are to: utilize waste organic liquid derived from fish farming to growing pepper plants, the efficiency of water use in the cultivation of ornamental fish), creating fisheries organic waste management that can be applied on the home backyard that has limited land, and can add to the aesthetic value of a yard. The benefits for the general public is creating organic liquid waste treatment technology that is simple, cost-effective, easy to apply, and does not require a large area (can be applied in the yard of the house). The benefits for fish farmers (small-scale and large scale) that can minimize the usage of water, reduce the cost of business operations, the addition of the commodity business other than fish, and reduce waste discharged into the environment.

Based on research conducted for 35 days, fish treatment with chilli is  $4.67 \pm 0.11\%$ /ind/day. The rate of growth is absent in treatment without plants of  $3.83 \pm 0.08\%$ /ind/day. This suggests that the use of plants in the culture system has a positive impact on the growth rate of fish. It is also done by the efficiency of feed on each treatment that is fish treatment with chilli which has the highest efficiency of feed value  $104.41 \pm 4.69\%$ . It is composed of fish that are kept with chilli can be used as an energy source efficiently. The level of life expectancy in all treatments showed the same result that is 100%.

Laboratory analysis of physical and chemical parameters of water (inlet, outlet, fish pond) is still in the process of analysis. The water quality data shown is still in the form of temporary data.

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Research Grant FY 2016/2017**

## **Progress Report**

**Implementation of pyrolysis biochar system for wet waste management  
in  
Bogor Agricultural University.**

**1. Johanis R. Pangala**

**Center for Environmental Science Bogor Agriculture Institute (PPLH-IPB)**

**2. Armansyah H. Tambunan**

**Mechanical Engineering and Biosystem Bogor Agriculture Institute (TMB-IPB)**

**3. Yudi Setiawan**

**Center for Environmental Science Bogor Agriculture Institute (PPLH-IPB)**



**Submitted to:**

**Center for Environmental Research**

**Bogor Agricultural University**

**for**

**The Osaka Gas Foundation of International Cultural Exchange (OGFICE)**

**June 2017**



**The Osaka Gas Foundation of International Cultural Exchange (OGFICE)  
Research Grant for 2016/2017: Progress Report**

Date: 10 June , 2017

**I. Applicant Information**

Name of project leader (Last name, first name)	Pangala, Johanis	Date of birth (Month, date, year)	April, 5 <sup>th</sup> 1967
Institution	Center for Environmental Science Bogor Agriculture Institute (PPLH-IPB)	Position	Researcher
Address of institution	PPLH Building Floor 2-4 Bogor Agriculture Institute, Darmaga Campus, Lingkar Akademik Road, Bogor		
	Post code: 16680	Tel. 0251-8621085	Fax. 0251-8621262
	E-mail:		URL:
Home address	Jl. Arimbi 5/3, Perumnas Indraprasta - Bogor		
	Post code: 16153	Tel: 0251 8341445	Fax. -
	E-mail: johnpangala.dsm@gmail.com		Mobile number: 085292803412
Name of contact person (if other than project leader)	Yudi Setiawan	Contact address (please insert ✓ for appropriate answer)	Institution
			Home
			Others
Contact Address (if other than home or organization address)	PPLH Building Floor 2-4 Bogor Agriculture Institute, Darmaga Campus, Lingkar Akademik Road, Bogor		
	Post code: 16680	Tel. 0251-8621085	Fax. 0251-8621262
	E-mail: pplh_ipb@indo.net.id , pplh@ipb.ac.id		URL: <a href="http://pplh.ipb.ac.id">http://pplh.ipb.ac.id</a>

**II. Project Arrangement**

<b>Project team</b> Please include the project leader. If the team members are more than 5 persons, you can add extra pages				
Name	Age	Institution	Major	Role in the project
1) Johanis R. Pangala	49	Center for Environmental Science Bogor Agriculture Institute (PPLH-IPB)	Natural Resources and Environmental	Project leader
2) Armansyah H. Tambunan	54	Mechanical Engineering and Biosystem Bogor Agriculture Institute (TMB-IPB)	Agricultural Engineering	Member
3) Yudi Setiawan		Center for Environmental Science Bogor Agriculture Institute (PPLH-IPB)		Member

### III. Project Setting

Theme: Waste Management Model (Case Study of Bogor Agricultural University (IPB), Indonesia)

Topic of the project For appropriate answer, please insert ✓ in the box on the right

a. Integrated and Sustainable Waste Management

b. New Technology and Innovation on Waste Management Approach

✓

#### 1. Title of the project

Implementation of pyrolysis biochar system for wet waste management in Bogor Agricultural University.

#### 2. Summary of the project

Please explain within 600 words: why the project is necessary, objectives, location, targeted beneficiaries, and results obtained so far.

The purpose of this study is to process wet waste by utilizing biochar. Biochar raw material to be used is palm empty fruit bunches (EFB). The use of EFB is because previous studies (Pangala 2016) showed that EFB biochar has a large enough surface area 216.9 m<sup>2</sup>/g with a pore diameter of 20.0 to 74.6 μm. These properties indicate that biochar EFB has potential if it is applied as a medium wet waste management.

Most wet waste on campus Bogor Agricultural University (IPB) have not been handled properly. The wet waste is mostly disposed of with other waste or discarded around the campus. Most of these wastes are generated by the canteens in the campus area. If EFB biochar can be used as a compost medium for wet waste management, it will be necessary to have a significant amount of biochar, so a mode of production that is effective and efficient is needed to support this application.

Biochar production is mostly still using the batch system which is less effective and efficient. Therefore, this study intends to develop ways of biochar production with semi continuous pyrolysis technique and application of its product output as a wet waste management. The advantage of this system will create energy use, as well as making biochar and energy production more efficient and more effective. It is more efficient because it only takes trigger preheating once and heat energy is not wasted on cooling biochar is released. It is more effective because it can produce more biochar per unit time.

The output of EFB biochar production will then be destroyed, and placed in a container for mixing the wet waste with biochar EFB. Various parameters will be tested and measured in this application to obtain results of wet waste management with this EFB biochar. Mixing the final product will be tested to see various characteristics of the parameters for applications in the field of agriculture.



**The Osaka Gas Foundation of International Cultural Exchange (OGFICE)**

**Research Grant FY 2016/2017**

## **Progress Report**

Design compos digester with capability to adsorb bad smell for organic fertilizer production based on eco-friendly and eco-business with community partnership surrounding Bogor Agricultural University (IPB)

**Dr. ZAENAL ABIDIN, M.Agr**

Department of Chemistry, Faculty of Mathematics and Natural Science  
Bogor Agricultural University

**Aisyah**

Department of Chemistry, Faculty of Mathematics and Natural Science  
Bogor Agricultural University



**Submitted to:**

**Center for Environmental Research  
Bogor Agricultural University**

**for**

**The Osaka Gas Foundation of International Cultural Exchange (OGFICE)**

**June 2017**





# The Osaka Gas Foundation of International Cultural Exchange (OGFICE) Research Grant for 2016/2017: Progress Report

Date: June 15, 2017

## I. Applicant Information

Name of project leader (Last name, first name)	Dr. Zaenal Abidin, M.Agr	Date of birth (Month, date, year)	June 14, 1971
Institution	Department of Chemistry, Faculty of Science and Math, Bogor Agricultural University (IPB)	Position	Lecturer/Leader
Address of institution	Gedung Fapet Lantai 4, Jalan Meranti, Kampus IPB Darmaga, Bogor Jawa Barat, Indonesia		
	Post code: 16680    Tel. +62-251-8624-567    Fax.		
	E-mail:    URL:		
Home address	Komplek Kehutanan Selakopi Blok D-18 Pasir Mulya, Bogor Barat, Bogor City West of Java, Indonesia		
	Post code: 16188    Tel: +62-251-8639-770    Fax.		
	E-mail:    Mobile number:		
Name of contact person (if other than project leader)		Contact address (please insert ✓ for appropriate answer)	Institution
			Home
			Others
Contact Address (if other than home or organization address)			
	Post code:    Tel.    Fax.		
	E-mail:    URL:		

## II. Project Arrangement

Project team Please include the project leader. If the team members are more than 2 persons, you can add extra pages				
Name	Age	Institution	Major	Role in the project
1) Dr. Zaenal Abidin, M.Agr	45	Department of Chemistry	Nano-aluminosilicate material	Leader
2) Aisyah	23	Department of Chemistry		Member

### III. Project Setting

Theme: University Waste Management Model: Case Study of Bogor Agricultural University (IPB), Indonesia

a. Integrated and Sustainable Waste Management

b. New Technology and Innovation on Waste Management Approach



#### 1. Title of the project

Design compos digester with capability to adsorb bad smell for organic fertilizer production based on eco-friendly and eco-business with community partnership surrounding Bogor Agricultural University (IPB).

#### 2. Summary of the project

*Please explain within 300 words: why the project is necessary, objectives, location, targeted beneficiaries, expected results*

In the early 2000, Bogor Agricultural University (IPB) decided that all of education activities has to be centered at IPB Dramaga campus and resulted in an increment of student population in the campus and surrounding areas at that time. This regulate has to been implemented immediately and effected on several aspects in the campus and surrounding areas. One of aspects is to the declining of environment quality of these areas rapidly without holistic improvement by involving the community around the campus IPB. Some effort has been initiated to manage organic waste in IPB campus such as waste separation. They classified into two kind of waste for separation i.e. Inorganic and organic types. Inorganic waste such PET bottle, papers, cans, glass bottle is sold to recycle cooperation. On the other hand, organic waste is mainly restaurants and households around IPB campus and flown out to the waterways without any treatments.

The real action on integrated waste management at IPB campus is needed to improve its environment quality at the present time. Because the large amount of organic waste is produced by restaurants and households activities around campus IPB, they have to involve in and active participate on the waste management. Organic waste from restaurants and households can be used as raw materials for production of biogas and compos as organic fertilizer. Biogas is a clean and renewable form of energy and could be produce from organic waste. The quality of biogas is lower than commercial natural gas such as LPG or CNG.

On the other hand, compos can be produced by fermentation process and the product can be used as organic fertilizer. However, some problems are come out during production of compos from restaurants and households waste. Fermentation process results bad smell and need long time biochemical process for decomposition. This difficulty make many people is not motivated to treat organic waste to be compos. Therefore they just throw away the organic waste into environments.

The important keys to make compos is how to reduce bad smell, effectivity of starting materials for fermentation process and also simple process. Here in this study, we will focus on the design of compos digester models, development of starting materials for optimization of the fermentation process, enrichment quality of compos product. Here, we will develop adsorbent materials base on nanomaterials for adsorb bad smell and also can increase time for the fermentation process. This results study is expected to be a model for community based for integrated waste management at IPB campus.

**The Osaka Gas Foundation of International Cultural Exchange (OGFICE)**

**Research Grant FY 2016/2017**

## **Progress Report**

### **Analysis of Potency and the Development of Renewable Energy Industry Based on Biomass Waste in Jambi Province**

**Dr. Y. Aris Purwanto**  
Center for Environmental Research, IPB

**Prof. Dr. Anas M. Fauzi, MSc.**  
Department of Industrial Technology IPB

**Wilda, STP**  
Department of Industrial Technology IPB



**Submitted to:**

**Center for Environmental Research**  
**Bogor Agricultural University**

**for**

**The Osaka Gas Foundation of International Cultural Exchange (OGFICE)**

**June 2017**



**The Osaka Gas Foundation of International Cultural Exchange (OGFICE)  
Research Grant for 2016/2017: Progress Report**

Date: June 19, 2017

**I. Applicant Information**

Name of project leader (Last name, first name)	Dr. Y. Aris Purwanto	Date of birth (Month, date, year)	March 7, 1964
Institution	Center for Environmental Research Bogor Agricultural University	Position	Researcher
Address of institution	PPLH IPB, Gedung PPLH Jl. Lingkar Akademik, Kampus IPB Darmaga, Bogor		
	Post code: 16880	Tel. +62-251-8621262	Fax. +62-251-8622134
	E-mail: pplh@ipb.ac.id		URL: http://www.pplh.ipb.ac.id
Home address	Jl. Sutiragen 4 no 4 Indraprasta, Bantarjati, Bogor		
	Post code: 16153	Tel: +62-251-8346859	Fax. -
	E-mail: arispurwanto@ipb.ac.id		Mobile number: +62-8128818258
Name of contact person (if other than project leader)	-	Contact address (please insert ✓ for appropriate answer)	Institution
			Home
			Others
Contact Address (if other than home or organization address)			
	Post code:	Tel.	Fax.
	E-mail:		URL:

**II. Project Arrangement**

Project team <i>Please include the project leader. If the team members are more than 5 persons, you can add extra pages</i>				
Name	Age	Institution	Major	Role in the project
1) Dr. Y. Aris Purwanto	53	Center for Environmental Research (PPLH-IPB)	Agricultural Engineering	Project leader
2) Prof. Dr. Anas M. Fauzi	56	Dept. of Industrial Technology IPB	Industrial Technology	Researcher member
3) Wilda, STP	24	Dept. of Industrial Technology IPB	Industrial Technology	Researcher member

Please do not change the page layout and add pages, unless directed to so.

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### III. Project Setting

Theme: **Renewable Energy**

1. Topic of the project *For appropriate answer, please insert ✓ in the box on the right*

a. Integrated and Sustainable Waste Management

✓

b. New Technology and Innovation on Waste Management Approach

✓

2. Title of the project

Analysis of Potency and the Development of Renewable Energy Industry Based on Biomass Waste in Jambi Province

3. Summary of the project

*Please explain within 600 words: why the project is necessary, objectives, location, targeted beneficiaries, and results obtained so far.*

Indonesia is currently facing problems related to energy. The electricity ratio in some areas is still less than 100%; this means that some households in some areas do not have access to electricity. Currently, biomass is considered as one of the primary sources of energy for both developed and developing countries. Indonesia with a large amount of biomass waste as a source of electricity generation is considered as one of the potential countries in this field. It is estimated that Indonesia produces 146.7 million tons of biomass per year, equivalent to about 470 GJ/y. The source of biomass energy is scattered all over the country. Jambi province is one of the provinces which has the significant potential for biomass waste. The source of biomass waste in Jambi Province are mainly from palm oil mill, agricultural, and estate plantation. The objectives of this research project were to analyze the potency of biomass waste energy in Jambi Province and to review the possibility to develop the industry of renewable energy based on biomass waste in Jambi Province.





**RINGKASAN LAPORAN AKHIR**  
**GERAN PENYELIDIKAN OSAKA GAS**  
*END OF OSAKA GAS*  
*GRANT REPORT SUMMARY*

<b>A. Tajuk Projek</b> <i>Project Title</i>	: Inspection Methodology for Bond Pad Discoloration in Wafers
<b>Ketua Penyelidik</b> <i>Project Leader</i>	: Ir Dr. David Chua Sing Ngie
<b>Fakulti/Institut</b> <i>Faculty/Institute</i>	: Faculty of Engineering
<b>Ahli Kumpulan Penyelidik</b> <i>Research Team Members</i>	: Assoc. Prof Dr. Abdullah Hj Yassin Dr. Shahrol bin Mohamaddan Ir Dr Lim Soh Fong
<b>B. Tarikh Geran Diluluskan</b> <i>Grant Approval Date</i>	: 6 December 2016
<b>Tempoh Projek</b> <i>Project Duration</i>	: 1 year
<b>Peruntukan Yg. Diluluskan</b> <i>Budget Approved</i>	: RM5000
<b>Perbelanjaan Terkini</b> <i>Expenditure To-Date</i>	: RM4394.20
<b>C. Pencapaian Keseluruhan</b> <i>Overall Achievement</i>	<p>Huraikan pencapaian berbanding objektif, hipotesis serta permasalahan asal yang diselidiki..  <i>Describe the achievements in relation to the original objectives, hypothesis and research problems.</i></p> <p>Deployment of an automatic visual inspection system in semiconductor industry has become increasingly popular than ever not only due to its relatively high value as a yield analysis tool of outgoing products but more importantly for the prevention of defect escapee. A lot of studies are</p>



done on the application of in-line defect scan but the application of outgoing wafer inspection at post-fab environment has been very limited and rarely found in literature. With rapid growth of automotive application in worldwide industry, the importance of quality of the wafer at die level has never been so critical. This project has established an inspection methodology for bond pad discoloration induced by polyimide process and also, evaluated the method used for bond pads discoloration inspection over conventional inspection method. A method for detection of bond pad discolorations at outgoing quality check especially in semiconductor industry is proposed. An effective method for detection of the bond pad discolorations was proposed. The advantages and disadvantages of the detection method are discussed. Factors that are affecting the performances of the detection method are also described and analyzed.

#### **D. Pencapaian Utama** ***Key Findings***

A method for detection of bond pad discoloration was proposed. In order to overcome the inherent deficiencies of the conventional method (method A) in detection of different severities of bond pad discolorations, PMI inspection pass is of utmost important and necessary to reduce defect escapees. The PMI inspection pass uses the averages of grey scale values of each pixel within the defined region to represent the entire unit of the bond pad as a single entity. The threshold can then be set to determine pass or fail by inspectors easily. Unlike the conventional method which uses the concept of pixel to pixel comparison method. This is useful to detect localised defects but not feasible for the detection of bond pad discoloration as a whole especially very mild bond pads discoloration.

#### **E, Hasil Penyelidikan** ***Deliverables***

Sila tandakan item yang berkaitan pada senarai berikut:

*Please tick the relevant items below:*

	Item	Bilangan/Number
	Kertas teknikal/bersiri dalaman <i>Internal technical/serial papers</i>	
	Tesis/disertasi pelajar sarjana <i>Student's Masters thesis/dissertation</i>	
	Tesis pelajar PhD <i>Student's PhD thesis</i>	
	Kertas persidangan tempatan <i>Local conference papers</i>	
	Kertas persidangan antarabangsa <i>International conference papers</i>	
	Makalah dalam jurnal tempatan <i>Local journal papers</i>	
√	Makalah dalam jurnal antarabangsa <i>International journal papers</i>	1
	Monograf atau buku <i>Book/monograph</i>	

Lain-lain/others (sila nyatakan/please specify)

Sila senaraikan maklumat (pengarang, tahun, tajuk, jurnal/penerbit, jilid, halaman) bagi penerbitan/tesis yang dihasilkan (jika ada).

*Please specify the publications (authors, year, title, journal/publisher, volume, page nos.) (if any)*

David Chua, S.N., Mohamaddan, S., Tanjong, S.J., Yassin, A., Lim, S.F. "Detection of Bond Pad Discolorations at Outgoing Wafer Inspections," IEEE Transactions on Semiconductor Manufacturing, Vol 1(1), 2017.

#### F. Pengecaman Output Output Identification

Sila tandakan penerangan yang berkaitan pada senarai berikut:

*Please tick the relevant description as given below:*

<input type="checkbox"/>	Suatu sumbangan besar kepada bidang ilmu yang berkaitan <i>A major contribution to knowledge (new knowledge) in the respective discipline</i>
<input type="checkbox"/>	Suatu sumbangan kecil tetapi bermakna kepada bidang ilmu yang berkaitan <i>A minor but important contribution to knowledge in the respective discipline</i>
<input checked="" type="checkbox"/>	Suatu sumbangan besar kepada teknologi/ciptaan/algoritma dalam bidang yang berkaitan <i>A major contribution to technology/invention/algorithm or a tangible product</i>
<input type="checkbox"/>	Suatu sumbangan kecil tetapi bermakna kepada teknologi/ciptaan/algoritma berkaitan <i>A minor but important contribution to relevant technology/invention/algorithm</i>
<input type="checkbox"/>	Terdapat potensi yang baik untuk kajian lanjutan ke arah pemasaran <i>There is a good potential for further R &amp; D and commercialization</i>
<input type="checkbox"/>	Suatu sumbangan besar kepada kerangka polisi pengurusan/garis panduan <i>A major contribution to management policy framework/guidelines (in relevant areas)</i>
<input type="checkbox"/>	Suatu sumbangan kecil tetapi bermakna kepada kerangka polisi pengurusan/garis panduan <i>A minor contribution to management policy framework/guidelines (in relevant areas)</i>
<input type="checkbox"/>	Sesuai untuk dijadikan bahan pengajaran/case study atau bahan latihan <i>The finding is suitable for use as a complementary teaching/training material (a case study)</i>
<input type="checkbox"/>	Suatu output yang baik dan berpotensi untuk memenangi hadiah penyelidikan <i>A quality output that has a potential for winning a research award</i>
<input type="checkbox"/>	Suatu bahan yang baik/sesuai untuk hebahan atau pameran <i>A good/suitable material for showcasing/publicizing/exhibition</i>

Lain-lain/*Others* (Sila nyatakan/*Please specify*)

**G. Sinopsis Hasil Penyelidikan bagi Tujuan Promosi**

***Synopsis for Promotional Purposes***

(Beri huraian ringkas yang tidak melebihi 400 perkataan dan dalam bahasa yang mudah, bagi maksud hebahan hasil penyelidikan ini melalui media massa dan 'Unimas Research Update')

*(Please provide a synopsis not exceeding 400 words, in a not-too-technical language, for the purpose of promoting this research findings through the mass media and Unimas Research Update).*

The deployment of Automatic Visual Inspection (AVI) system in the semiconductor manufacturing industry has become increasingly popular than ever not only due to its relatively high value as a yield analysis tool of outgoing products but more importantly the prevention of defect escapee. It is well-known that the current trend of electronic devices is heading towards the idea of the smaller the better. Researchers and manufacturers are vying to produce small and smaller die feature size with shrinking circuitries. As a result, the requirements for the integrated circuitry (IC) processing and packaging in all facets are getting higher and more stringent as well. Producing a die that is able to meet its functionality is simply not good enough as the cost of production can be extremely high due to prevalence of screening tests that need to be set up and performed. One of the ways to reduce the cost is to introduce inspections on the wafer. Inspection is one of the important criterion to ensure the quality of the device, at the same time it helps to prevent faulty parts being delivered to customers which is very important for wafer fabrication manufacturers. This research has shown a useful method of screening bond pad discoloration at outgoing process in semiconductor industry.

**Catatan Penting/Important Notes**

Penyelidik diminta mengemukakan kepada Pusat Penyelidikan:

- Borang ini dalam kedua-dua bentuk bercetak dan elektronik
- Researchers are required to submit to the Research Centre:*
- *This form in both hard- and soft-copies*

.....  
**Tandatangan (Penyelidik Utama)**  
Signature (Principal Researcher)

.....  
**Tarikh**  
Date



**RINGKASAN LAPORAN AKHIR**  
**GERAN PENYELIDIKAN OSAKA GAS**  
*END OF OSAKA GAS*  
*GRANT REPORT SUMMARY*

<b>A. Tajuk Projek</b> <i>Project Title</i>	:	<b>Application of Resonant Effect in Pepper Drying Process</b>
<b>Ketua Penyelidik</b> <i>Project Leader</i>	:	Dr. Ana Sakura Binti Zainal Abidin
<b>Fakulti/Institut</b> <i>Faculty/Institute</i>	:	Department of Mechanical Manufacturing Engineering, Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak.
<b>Ahli Kumpulan Penyelidik</b> <i>Research Team Members</i>	:	Prof Sinin Hamdan  Mr Rasli Bin Muslimen  Dr Raudhah Ahmadi
<b>B. Tarikh Geran Diluluskan</b> <i>Grant Approval Date</i>	:	1 January 2017
<b>Tempoh Projek</b> <i>Project Duration</i>	:	1 year
<b>Peruntukan Yg. Diluluskan</b> <i>Budget Approved</i>	:	RM 3,000.00
<b>Perbelanjaan Terkini</b> <i>Expenditure To-Date</i>	:	RM 2,999.00
<b>C. Pencapaian Keseluruhan</b> <i>Overall Achievement</i>		<p>Huraikan pencapaian berbanding objektif, hipotesis serta permasalahan asal yang diselidiki..  <i>Describe the achievements in relation to the original objectives, hypothesis and research problems.</i></p> <p>The main objective of this research project is to improve the pepper berries drying rate through application of resonant principle. The project begins with gathering important information about</p>

the properties of the pepper berries, processes and different methods of drying conducted all around the world. Market study of available dryer in market as well as pattern for similar mechanisms have been studied too. Development of dryer applied Engineering Design process that begin with problem definition, followed by conceptual design, embodiment design and finally detail design. The list of functions have been defined carefully at the beginning of the design process. Important parameters were also considered during the development process namely natural frequency of the pepper berries, physical properties of berries, motor speed, material of drum, safety factor and manufacturability of the developed drum. Number of experiments have been conducted to confirm on important information before the design of the dryer can be finalized. Once completed, the design drawing was sent to fabricator for fabrication. Qualified fabricator will be appointed to ensure the quality and safety of the designed dryer. Once ready, the fabricated dryer continues with simple testing to ensure the dryer is fit to be used. However, validation with actual application is unable to run due to budget and time constraint.

#### **D. Pencapaian Utama**

##### ***Key Findings***

There are number of pepper species in Sarawak. Different species have different characteristics and chemical properties that consequently contribute to significant different of pepper berries natural frequency. Number of specimens from different pepper species have been tested and range of natural frequencies were gathered from 44 Hz to 100 Hz.

A compact drum dryer has been designed and fabricated. The drum can accommodate up to 3 kg fresh pepper berries. The overall size of the dryer inclusive of the support structure is 1m (length) × 0.5m (wide) × 0.7m (height). The drum speed is also adjustable depending on the pepper natural frequencies. The maximum speed can reach up to 5500 rpm. The material used for the prototype is complied with the international food standard. The development also addressed the safety features as the rotating drum is protected by the drum cover outside and both of the drums have its own lock. The base structure was design to be fitted to the floor in order to stabilized the structure as well as to absorb the vibration of the high drum rotation.

#### **E, Hasil Penyelidikan**

##### ***Deliverables***

Sila tandakan item yang berkaitan pada senarai berikut:

*Please tick the relevant items below:*

	Item	Bilangan/Number
	Kertas teknikal/bersiri dalaman <i>Internal technical/serial papers</i>	
	Tesis/disertasi pelajar sarjana <i>Student's Masters thesis/dissertation</i>	
	Tesis pelajar PhD <i>Student's PhD thesis</i>	
	Kertas persidangan tempatan <i>Local conference papers</i>	



	Kertas persidangan antarabangsa <i>International conference papers</i>	
	Makalah dalam jurnal tempatan <i>Local journal papers</i>	
	Makalah dalam jurnal antarabangsa <i>International journal papers</i>	
	Monograf atau buku <i>Book/monograph</i>	

Lain-lain/others (sila nyatakan/*please specify*)

**3 final year project students:**

1. Creating the resonant effect towards improving the black pepper drying rate by Mohd Zaiful Safri bin Zulkifli.
2. Development of natural frequency pepper drying machine by Dylan Smith Tawir.
3. Application of rotary drum dryer to improve the black pepper drying rate by Melissa Michelle Rolland (on going).

**Fabrication of pepper drum dryer prototype.**

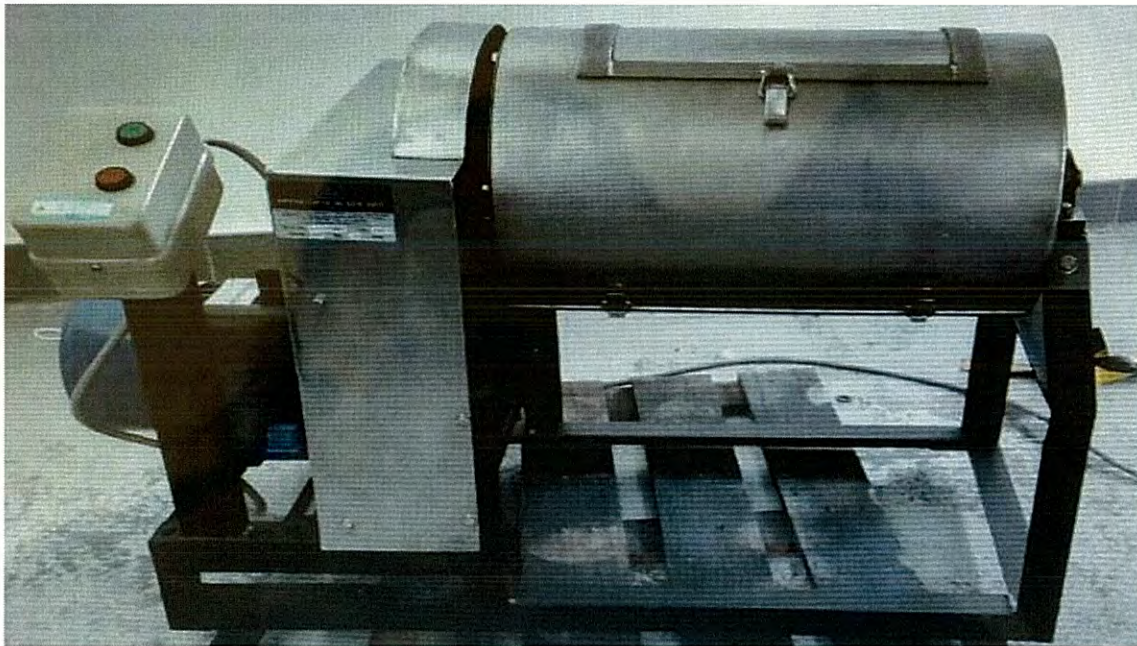


Figure 1: Prototype of efficient pepper dryer.

Sila senaraikan maklumat (pengarang, tahun, tajuk, jurnal/penerbit, jilid, halaman) bagi penerbitan/tesis yang dihasilkan (jika ada).

*Please specify the publications (authors, year, title, journal/publisher, volume, page nos.) (if any)*



**F. Pengecaman Output**  
**Output Identification**

Sila tandakan penerangan yang berkaitan pada senarai berikut:

*Please tick the relevant description as given below:*

	Suatu sumbangan besar kepada bidang ilmu yang berkaitan <i>A major contribution to knowledge (new knowledge) in the respective discipline</i>
X	Suatu sumbangan kecil tetapi bermakna kepada bidang ilmu yang berkaitan <i>A minor but important contribution to knowledge in the respective discipline</i>
	Suatu sumbangan besar kepada teknologi/ciptaan/algoritma dalam bidang yang berkaitan <i>A major contribution to technology/invention/algorithm or a tangible product</i>
X	Suatu sumbangan kecil tetapi bermakna kepada teknologi/ciptaan/algoritma berkaitan <i>A minor but important contribution to relevant technology/invention/algorithm</i>
X	Terdapat potensi yang baik untuk kajian lanjutan ke arah pemasaran <i>There is a good potential for further R &amp; D and commercialization</i>
	Suatu sumbangan besar kepada kerangka polisi pengurusan/garis panduan <i>A major contribution to management policy framework/guidelines (in relevant areas)</i>
	Suatu sumbangan kecil tetapi bermakna kepada kerangka polisi pengurusan/garis panduan <i>A minor contribution to management policy framework/guidelines (in relevant areas)</i>
X	Sesuai untuk dijadikan bahan pengajaran/case study atau bahan latihan <i>The finding is suitable for use as a complementary teaching/training material (a case study)</i>
	Suatu output yang baik dan berpotensi untuk memenangi hadiah penyelidikan <i>A quality output that has a potential for winning a research award</i>
X	Suatu bahan yang baik/sesuai untuk hebahan atau pameran <i>A good/suitable material for showcasing/publicizing/exhibition</i>

Lain-lain/Others (Sila nyatakan/Please specify)

-nil-

**G. Sinopsis Hasil Penyelidikan bagi Tujuan Promosi**

**Synopsis for Promotional Purposes**

(Beri huraian ringkas yang tidak melebihi 400 perkataan dan dalam bahasa yang mudah, bagi maksud hebahan hasil penyelidikan ini melalui media massa dan 'Unimas Research Update')

*(Please provide a synopsis not exceeding 400 words, in a not-too-technical language, for the purpose of promoting this research findings through the mass media and Unimas Research Update).*

The drum dryer has good potential to be commercialized as the drum can improve the pepper drying rate. The design has considered safety of the user as the dryer has two drums; rotating drum and drum cover. Both have its own lock. It is very easy to insert and take out the dried peppers with the shared functions of the drum door. The drum is equipped with fin to ensure the pepper berries can dry evenly. The compact design is just suitable for the small planters daily harvesting volume. At the same time, the compact size (1m × 0.5m × 0.7m) enables the dryer to be stored in house. The most important is the cost of the dryer is reasonable and affordable by all pepper planters. By having the dryer, pepper planters are no longer depending on the weather to the dry the pepper. They can plant and harvest the pepper throughout the year that consequently increase their income.

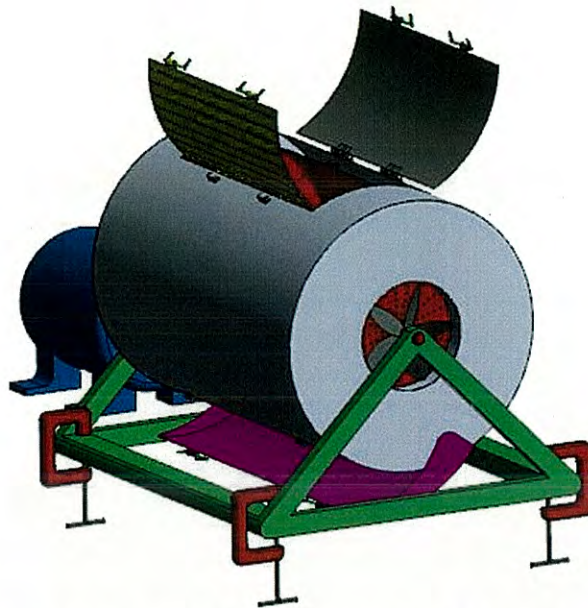


Figure 2: Compact design of efficient pepper dryer.

**Catatan Penting/Important Notes**

Penyelidik diminta mengemukakan kepada Pusat Penyelidikan:

- Borang ini dalam kedua-dua bentuk bercetak dan elektronik
- Researchers are required to submit to the Research Centre:*
- *This form in both hard- and soft-copies*

.....  
**Tandatangan (Penyelidik Utama)**  
 Signature (Principal Researcher)

.....  
**Tarikh**  
 Date



**RINGKASAN LAPORAN AKHIR**  
**GERAN PENYELIDIKAN OSAKA GAS**  
*END OF OSAKA GAS*  
*GRANT REPORT SUMMARY*

<b>A. Tajuk Projek</b> <i>Project Title</i>	: Evaluating the effects of correlated characteristics with non-normal distribution in manufacturing quality control.
<b>Ketua Penyelidik</b> <i>Project Leader</i>	: Dr. Shirley Johnathan Tanjong
<b>Fakulti/Institut</b> <i>Faculty/Institute</i>	: Faculty of Engineering
<b>Ahli Kumpulan Penyelidik</b> <i>Research Team Members</i>	: Dr. Magdalene ak Andrew Munot Ir. Dr. David Chua Sing Ngie Dr. Shahrol Mohamaddan Assoc. Prof. Dr. Abdullah Yassin
<b>B. Tarikh Geran Diluluskan</b> <i>Grant Approval Date</i>	: 06 December 2016
<b>Tempoh Projek</b> <i>Project Duration</i>	: 12 months
<b>Peruntukan Yg. Diluluskan</b> <i>Budget Approved</i>	: RM4,500
<b>Perbelanjaan Terkini</b> <i>Expenditure To-Date</i>	: RM3,300 (remaining RM1,200 for payment of USJC publication for charges with > 7 pages)
<b>C. Pencapaian Keseluruhan</b> <i>Overall Achievement</i>	<p>Huraikan pencapaian berbanding objektif, hipotesis serta permasalahan asal yang diselidiki..  <i>Describe the achievements in relation to the original objectives, hypothesis and research problems.</i></p> <p>This research was conducted based on a set of data collected from an actual manufacturing industry. The data comprises of a measurement of 3 variables which were collected during the</p>

outgoing quality control stage. The initial objectives of the research were (i) to evaluate the effects of correlation in quality characteristics on manufacturing quality control, and (ii) to propose a method for assessing the quality of multivariate products. In relation to the first stated objective, it was found that two of the variables demonstrate high positive correlation. The collected measurements were well within the desired tolerance and specification limits, hence in this study, we cannot conclude the effect of correlation in determining product quality. Nevertheless, what-if scenarios were simulated and studied to demonstrate the achievement of the first objective. In relation to the second objective, an approach based on the modified tolerance region has been proposed and it has been shown to be effective in highlighting potential out-of-specification in the case of bivariate correlated data.

#### **D. Pencapaian Utama** **Key Findings**

1. It was found that the case study company demonstrates common practices of manufacturing quality control/analysis in industry where correlation in measurements is not taken into consideration.
2. It was shown that ignoring correlation in evaluating process performance can provide misjudgment about the process.

#### **E, Hasil Penyelidikan** **Deliverables**

Sila tandakan item yang berkaitan pada senarai berikut:

*Please tick the relevant items below:*

	Item	Bilangan/Number
	Kertas teknikal/bersiri dalaman <i>Internal technical/serial papers</i>	
	Tesis/disertasi pelajar sarjana <i>Student's Masters thesis/dissertation</i>	
	Tesis pelajar PhD <i>Student's PhD thesis</i>	
√	Kertas persidangan tempatan <i>Local conference papers</i>	1
	Kertas persidangan antarabangsa <i>International conference papers</i>	
	Makalah dalam jurnal tempatan <i>Local journal papers</i>	
	Makalah dalam jurnal antarabangsa <i>International journal papers</i>	
	Monograf atau buku <i>Book/monograph</i>	

Lain-lain/others (sila nyatakan/*please specify*)

Sila senaraikan maklumat (pengarang, tahun, tajuk, jurnal/penerbit, jilid, halaman) bagi penerbitan/tesis yang dihasilkan (jika ada).

*Please specify the publications (authors, year, title, journal/publisher, volume, page nos.) (if any)*

Pending publication of conference paper titled 'Estimating non-conformance using the modified tolerance region method and the target distance method' presented in UNIMAS Silver Jubilee on 18-20 October 2017.

#### F. Pengecaman Output Output Identification

Sila tandakan penerangan yang berkaitan pada senarai berikut:

*Please tick the relevant description as given below:*

	Suatu sumbangan besar kepada bidang ilmu yang berkaitan <i>A major contribution to knowledge (new knowledge) in the respective discipline</i>
√	Suatu sumbangan kecil tetapi bermakna kepada bidang ilmu yang berkaitan <i>A minor but important contribution to knowledge in the respective discipline</i>
	Suatu sumbangan besar kepada teknologi/ciptaan/algoritma dalam bidang yang berkaitan <i>A major contribution to technology/invention/algorithm or a tangible product</i>
	Suatu sumbangan kecil tetapi bermakna kepada teknologi/ciptaan/algoritma berkaitan <i>A minor but important contribution to relevant technology/invention/algorithm</i>
	Terdapat potensi yang baik untuk kajian lanjutan ke arah pemasaran <i>There is a good potential for further R &amp; D and commercialization</i>
	Suatu sumbangan besar kepada kerangka polisi pengurusan/garis panduan <i>A major contribution to management policy framework/guidelines (in relevant areas)</i>
√	Suatu sumbangan kecil tetapi bermakna kepada kerangka polisi pengurusan/garis panduan <i>A minor contribution to management policy framework/guidelines (in relevant areas)</i>
√	Sesuai untuk dijadikan bahan pengajaran/case study atau bahan latihan <i>The finding is suitable for use as a complementary teaching/training material (a case study)</i>
	Suatu output yang baik dan berpotensi untuk memenangi hadiah penyelidikan <i>A quality output that has a potential for winning a research award</i>
√	Suatu bahan yang baik/sesuai untuk hebahan atau pameran <i>A good/suitable material for showcasing/publicizing/exhibition</i>

Lain-lain/Others (Sila nyatakan/Please specify)

### **Sinopsis Hasil Penyelidikan bagi Tujuan Promosi**

#### **G. Synopsis for Promotional Purposes**

(Beri huraian ringkas yang tidak melebihi 400 perkataan dan dalam bahasa yang mudah, bagi maksud hebahan hasil penyelidikan ini melalui media massa dan 'Unimas Research Update')

*(Please provide a synopsis not exceeding 400 words, in a not-too-technical language, for the purpose of promoting this research findings through the mass media and Unimas Research Update).*

In today's advanced modern technology, most products quality are defined by more than one quality characteristics. Although measurements are often assumed to be normally distributed, in the real-world quality characteristics are in fact represented by non-normal distributions and this is no exception in many manufacturing processes. Application of traditional process capability methods to non-normal data can mislead decision-making process due to underestimation or overestimation of process performance. From this study, it was noted that most manufacturers still adopt the common methods of univariate quality analysis to assess multivariate process, which are inefficient and may provide inaccurate conclusion about the process, especially when correlation exists. It was observed that several limitations arise when assessing process capability for multivariate non-normal data. Principal component analysis (PCA) explains the variance-covariance structure of a set of variables through a number of linear combinations of these variables. Although the application of PCA does not require the assumption of joint multivariate normal data, most of the methods that employ PCA estimates the multivariate process capability assuming that the quality characteristics are normally distributed. Secondly, most works that use the distance method and the PCA techniques failed to consider correlation among the variables when defining the new specification limits. Alternative method such as the distance method can be used to evaluate non-normal multivariate data however it does not provide the convenience of data visualization. Finally, when considering multivariate non-normal data, methods of transformation often diminishes the visual interpretation of the original measurements with respect to the original specification limits. In this study, an approach for analyzing multivariate data in the application of manufacturing quality control has been proposed. This approach can be appealing to the manufacturers in which the modified tolerance region method can be effective in identifying the mean and variation of the correlated quality characteristics against the combined specifications.

#### **Catatan Penting/Important Notes**

Penyelidik diminta mengemukakan kepada Pusat Penyelidikan:

- Borang ini dalam kedua-dua bentuk bercetak dan elektronik

*Researchers are required to submit to the Research Centre:*

- *This form in both hard- and soft-copies*

09 Feb 2018

.....  
**Tandatangan (Penyelidik Utama)**  
Signature (Principal Researcher)

.....  
**Tarikh**  
Date





**RINGKASAN LAPORAN AKHIR**  
**GERAN PENYELIDIKAN OSAKA GAS**  
*END OF OSAKA GAS*  
**GRANT REPORT SUMMARY**

<b>A. Tajuk Projek</b> <i>Project Title</i>	:	The Study of Vegetable Based Cutting Fluid Performance in Milling Process
<b>Ketua Penyelidik</b> <i>Project Leader</i>	:	Dr Abang Mohammad Nizam Abang Kamaruddin
<b>Fakulti/Institut</b> <i>Faculty/Institute</i>	:	Faculty of Engineering
<b>Ahli Kumpulan Penyelidik</b> <i>Research Team Members</i>	:	1. Prof Madya Dr Abdullah b. Haji Yassin 2. Dr Shahrol b Mohamaddan 3. Prof Madya Dr Syed Tarmizi Syed Shazali
<b>B. Tarikh Geran Diluluskan</b> <i>Grant Approval Date</i>	:	06 December 2016
<b>Tempoh Projek</b> <i>Project Duration</i>	:	01 January 2017 to 31 December 2017
<b>Peruntukan Yg. Diluluskan</b> <i>Budget Approved</i>	:	RM4500
<b>Perbelanjaan Terkini</b> <i>Expenditure To-Date</i>	:	RM0
<b>C. Pencapaian Keseluruhan</b> <i>Overall Achievement</i>	<p>Huraikan pencapaian berbanding objektif, hipotesis serta permasalahan asal yang diselidiki.  <i>Describe the achievements in relation to the original objectives, hypothesis and research problems.</i></p> <p>The experiment shown that MQL vegetable oil reduced slight tool wear up to 1800m whereby at this cutting length, the tool wear progression seems to be reaching the same level as dry cutting. Meanwhile, the cutting force of the MQL assisted cutting is also a bit higher than wet cutting. This relation have to be explain later in the future. Note that some of the dry cutting data have been included in unpublished journal (waiting for acceptance from publisher).</p>	

The data from MQL the experiment is insufficient at this moment due to the time limitation faces FYP student. Full controlled experiment with better result is expected be done by student in mid-2018. Hopefully, complete data could be presented in EnCon 2018.

#### D. Pencapaian Utama

##### *Key Findings*

Cutting force is greatly reduce and comparable to wetting cutting. Meanwhile, tool wear is slightly higher than wet cutting. MQL with vegetable oil seems to performed slightly better in comparison wet cutting in cutting finish as the surface roughness values are noticeably lower.

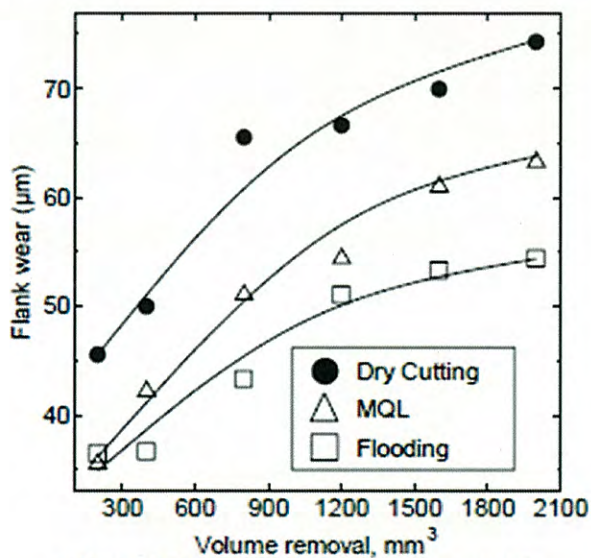


Figure 1 Flank wear vs volume removal



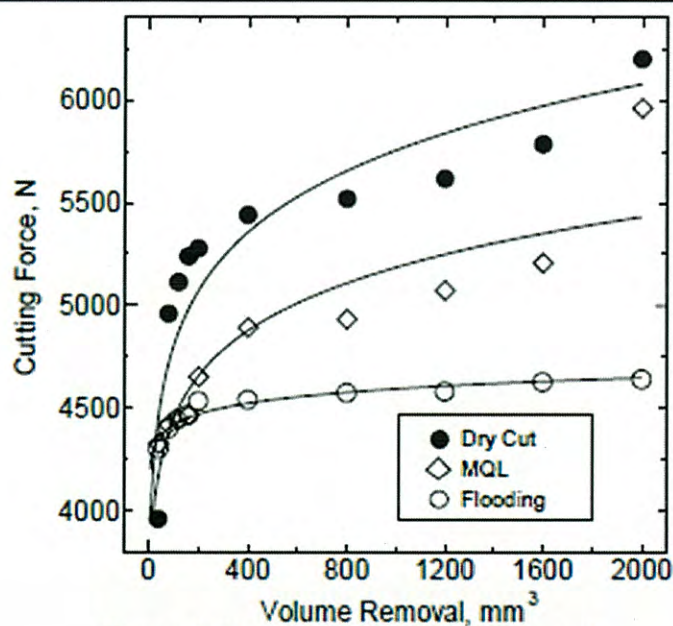


Figure 2 Flank wear vs volume removal

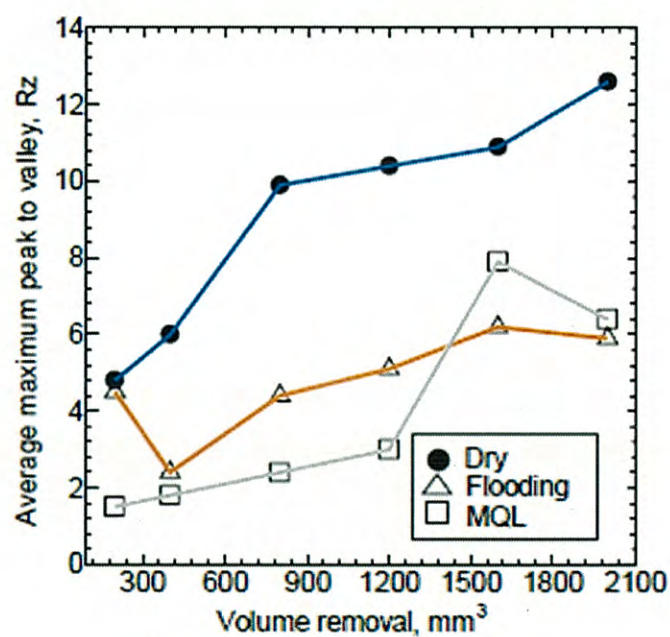


Figure 3 Surface Roughness

**E, Hasil Penyelidikan**  
**Deliverables**

Sila tandakan item yang berkaitan pada senarai berikut:  
Please tick the relevant items below:

Item	Bilangan/Number
Kertas teknikal/bersiri dalaman <i>Internal technical/serial papers</i>	
Tesis/disertasi pelajar sarjana <i>Student's Masters thesis/dissertation</i>	
Tesis pelajar PhD <i>Student's PhD thesis</i>	
Kertas persidangan tempatan <i>Local conference papers</i>	
Kertas persidangan antarabangsa <i>International conference papers</i>	
Makalah dalam jurnal tempatan <i>Local journal papers</i>	1
Makalah dalam jurnal antarabangsa <i>International journal papers</i>	
Monograf atau buku <i>Book/monograph</i>	

Lain-lain/others (sila nyatakan/please specify)

Final year project report.

Sila senaraikan maklumat (pengarang, tahun, tajuk, jurnal/penerbit, jilid, halaman) bagi penerbitan/tesis yang dihasilkan (jika ada).

*Please specify the publications (authors, year, title, journal/publisher, volume, page nos.) (if any)*

1. M. A. Kiprawi, A. Yassin, A. M. N. A. Kamaruddin, S. T. S. Shazali, M. S. Islam and M. A. M. Said, Development Of A Cutting Edge Temperature Measurement Of End Mill Tool By Using Infrared Radiation Technique, *JMES Journal*. (submitted, 2017)

#### F. Pengesanan Output Output Identification

Sila tandakan penerangan yang berkaitan pada senarai berikut:

*Please tick the relevant description as given below:*

<input type="checkbox"/>	Suatu sumbangan besar kepada bidang ilmu yang berkaitan <i>A major contribution to knowledge (new knowledge) in the respective discipline</i>
<input type="checkbox"/>	Suatu sumbangan kecil tetapi bermakna kepada bidang ilmu yang berkaitan <i>A minor but important contribution to knowledge in the respective discipline</i>
<input type="checkbox"/>	Suatu sumbangan besar kepada teknologi/ciptaan/algoritma dalam bidang yang berkaitan <i>A major contribution to technology/invention/algorithm or a tangible product</i>
<input type="checkbox"/>	Suatu sumbangan kecil tetapi bermakna kepada teknologi/ciptaan/algoritma berkaitan <i>A minor but important contribution to relevant technology/invention/algorithm</i>
<input type="checkbox"/>	Terdapat potensi yang baik untuk kajian lanjutan ke arah pemasaran



	<i>There is a good potential for further R &amp; D and commercialization</i>
	Suatu sumbangan besar kepada kerangka polisi pengurusan/garis panduan <i>A major contribution to management policy framework/guidelines (in relevant areas)</i>
	Suatu sumbangan kecil tetapi bermakna kepada kerangka polisi pengurusan/garis panduan <i>A minor contribution to management policy framework/guidelines (in relevant areas)</i>
✓	Sesuai untuk dijadikan bahan pengajaran/case study atau bahan latihan <i>The finding is suitable for use as a complementary teaching/training material (a case study)</i>
	Suatu output yang baik dan berpotensi untuk memenangi hadiah penyelidikan <i>A quality output that has a potential for winning a research award</i>
	Suatu bahan yang baik/sesuai untuk hebahan atau pameran <i>A good/suitable material for showcasing/publicizing/exhibition</i>

Lain-lain/Others (Sila nyatakan/Please specify)

#### G. Sinopsis Hasil Penyelidikan bagi Tujuan Promosi

##### *Synopsis for Promotional Purposes*

(Beri huraian ringkas yang tidak melebihi 400 perkataan dan dalam bahasa yang mudah, bagi maksud hebahan hasil penyelidikan ini melalui media massa dan 'Unimas Research Update')

*(Please provide a synopsis not exceeding 400 words, in a not-too-technical language, for the purpose of promoting this research findings through the mass media and Unimas Research Update).*

The usage of sustainable environmental friendly substitute of lubricant in material removal manufacturing method has been the aim for a lot of manufacturer. From the conception of minimum quantity lubrication, the masses have not being able to appreciate this new technology as the setup is too expensive to be installed in small and medium enterprise operations. This research main objective is to introduce a cheaper alternative of setup with cheaper resources to be install in these aforementioned operation with an accepted production quality.

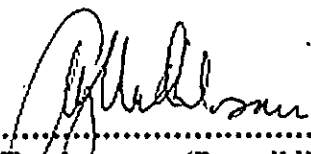
The experiment conducted has shown promising result of improvement on machine surface in palm oil MQL assisted cutting although the tool wear is slightly higher in comparison to wet cutting. The usage of palm oil also seem to reduce the problem of disposal. Longer experiment is planned to discover prolong effect on performance and environment.

The result of this research is expected to encourage usage of local produce as cutting oil substitute and a greener approach of material removal process.

**Catatan Penting/Important Notes**

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.....  
**Tandatangan (Penyelidik Utama)**  
**Signature (Principal Researcher)**

  
.....  
**Tarikh**  
**Date**





**RINGKASAN LAPORAN AKHIR**  
**GERAN PENYELIDIKAN OSAKA GAS**  
*END OF OSAKA GAS*  
*GRANT REPORT SUMMARY*

<b>A. Tajuk Projek</b> <i>Project Title</i>	: IMPLEMENTATION OF INTEGRATED OPTICAL TAP PLANAR LIGHTWAVE CIRCUIT (PLC) IN FIBER-TO-THE-HOME (FTTH) SYSTEM
<b>Ketua Penyelidik</b> <i>Project Leader</i>	: NURDIANI BINTI ZAMHARI
<b>Fakulti/Institut</b> <i>Faculty/Institute</i>	: FACULTY OF ENGINEERING, UNIVERSITY MALAYSIA SARAWAK 94300 KOTA SAMARAHAN, SARAWAK.
<b>Ahli Kumpulan Penyelidik</b> <i>Research Team Members</i>	: DR. ABDUL RAHMAN BIN KRAM, DR. ABANG ANNUAR EHSAN & PROF. MOHD SYUHAIMI AB RAHMAN.
<b>B. Tarikh Geran Diluluskan</b> <i>Grant Approval Date</i>	: 6 December 2016
<b>Tempoh Projek</b> <i>Project Duration</i>	: 12 Months
<b>Peruntukan Yg. Diluluskan</b> <i>Budget Approved</i>	: RM3000
<b>Perbelanjaan Terkini</b> <i>Expenditure To-Date</i>	: Journal IJECE = RM1014.12 Travelling (Approved) March = RM156.88 June = Rm358.28 Travelling (Recommended) - claim has not been paid. April = RM197.16 Nov = RM342.76 Total = <b>RM2069.20</b>

**C. Pencapaian Keseluruhan*****Overall Achievement***

Huraikan pencapaian berbanding objektif, hipotesis serta permasalahan asal yang diselidiki.  
*Describe the achievements in relation to the original objectives, hypothesis and research problems.*

The objective of this research has been achieved where integrated optical tap PLC based on SOI LCRW has successfully implemented into PON FTTH optical access network as in-line monitoring device. The device can be monitor up to 128 ONU with the main signal output power -18.52 dBm for both downstream signals (1480 nm and 1550 nm) with maximum distance of 20 km. This device can be install simultaneously or separately at the main line and distribution line of FTTH network.

**D. Pencapaian Utama*****Key Findings***

New in-line monitoring device based on silicon-on-insulator large cross-section rib waveguide.

**E. Hasil Penyelidikan*****Deliverables***

Sila tandakan item yang berkaitan pada senarai berikut:

*Please tick the relevant items below:*

	Item	Bilangan/Number
	Kertas teknikal/bersiri dalaman <i>Internal technical/serial papers</i>	
	Tesis/disertasi pelajar sarjana <i>Student's Masters thesis/dissertation</i>	
	Tesis pelajar PhD <i>Student's PhD thesis</i>	
	Kertas persidangan tempatan <i>Local conference papers</i>	
	Kertas persidangan antarabangsa <i>International conference papers</i>	
	Makalah dalam jurnal tempatan <i>Local journal papers</i>	

√	Makalah dalam jurnal antarabangsa <i>International journal papers</i>	1
	Monograf atau buku <i>Book/monograph</i>	

Lain-lain/others (sila nyatakan/*please specify*)

Sila senaraikan maklumat (pengarang, tahun, tajuk, jurnal/penerbit, jilid, halaman) bagi penerbitan/tesis yang dihasilkan (jika ada).

*Please specify the publications (authors, year, title, journal/publisher, volume, page nos.) (if any)*

#### F. Pengecaman Output *Output Identification*

Sila tandakan penerangan yang berkaitan pada senarai berikut:

*Please tick the relevant description as given below:*

	Suatu sumbangan besar kepada bidang ilmu yang berkaitan <i>A major contribution to knowledge (new knowledge) in the respective discipline</i>
	Suatu sumbangan kecil tetapi bermakna kepada bidang ilmu yang berkaitan <i>A minor but important contribution to knowledge in the respective discipline</i>
	Suatu sumbangan besar kepada teknologi/ciptaan/algoritma dalam bidang yang berkaitan <i>A major contribution to technology/invention/algorithm or a tangible product</i>
√	Suatu sumbangan kecil tetapi bermakna kepada teknologi/ciptaan/algoritma berkaitan <i>A minor but important contribution to relevant technology/invention/algorithm</i>
√	Terdapat potensi yang baik untuk kajian lanjutan ke arah pemasaran <i>There is a good potential for further R &amp; D and commercialization</i>
	Suatu sumbangan besar kepada kerangka polisi pengurusan/garis panduan <i>A major contribution to management policy framework/guidelines (in relevant areas)</i>
	Suatu sumbangan kecil tetapi bermakna kepada kerangka polisi pengurusan/garis panduan <i>A minor contribution to management policy framework/guidelines (in relevant areas)</i>
	Sesuai untuk dijadikan bahan pengajaran/ <i>case study</i> atau bahan latihan <i>The finding is suitable for use as a complementary teaching/training material (a case study)</i>
	Suatu output yang baik dan berpotensi untuk memenangi hadiah penyelidikan <i>A quality output that has a potential for winning a research award</i>
	Suatu bahan yang baik/sesuai untuk hebahan atau pameran <i>A good/suitable material for showcasing/publicizing/exhibition</i>

Lain-lain/Others (Sila nyatakan/Please specify)

**G. Sinopsis Hasil Penyelidikan bagi Tujuan Promosi**

***Synopsis for Promotional Purposes***

(Beri huraian ringkas yang tidak melebihi 400 perkataan dan dalam bahasa yang mudah, bagi maksud hebahan hasil penyelidikan ini melalui media massa dan 'Unimas Research Update')

*(Please provide a synopsis not exceeding 400 words, in a not-too-technical language, for the purpose of promoting this research findings through the mass media and Unimas Research Update).*

Integrated optical tap planar lightwave circuit (PLC) based on silicon-on-insulator (SOI) large cross-section rib waveguide (LCRW) for fiber-to-the-home (FTTH) passive optical network (PON) in-line monitoring system has successfully designed and implemented in the FTTH network. In-line monitoring system has the advantage as service provider are able to know the damage and location of the fiber break on the transmission line directly. This allows technicians to repair or correct the affected line without interrupting other lines or other user. Besides, this also can reduce the time to detect the location of the damage and at the same time the damage can be fixed immediately which can reduce the operation cost. The selection of SOI as a material in this device is due to its transparency and low loss at the communication wavelength and fabrication compatibility with CMOS technology on SOI platform. The monitoring device can be install in all branch within FTTH network with up to 128 users without interrupt the performance and quality of the data and video. This device can be install simultaneously or separately at the main line and distribution line of FTTH network. The main signal output power of -18.52 dBm for both downstream signals (1480 nm and 1550 nm) with maximum distance of 20 km has been obtained where this value of output power is exceeding the 802.3ah IEEE EPON standards.

**Catatan Penting/Important Notes**

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Signature (Principal Researcher)

.....  
**Tarikh**  
Date



**RINGKASAN LAPORAN AKHIR**  
**GERAN PENYELIDIKAN OSAKA GAS**  
*END OF OSAKA GAS*  
*GRANT REPORT SUMMARY*

<b>A. Tajuk Projek</b> <i>Project Title</i>	<b>: THE DESIGN OF MICROWAVE SENSOR BY USING BAND PASS FILTER (BPF) APPLICATION FOR INDUSTRIAL APPLICATION</b>
<b>Ketua Penyelidik</b> <i>Project Leader</i>	<b>: DYG NORKHAIRUNNISA BINTI ABANG ZAIDEL</b>
<b>Fakulti/Institut</b> <i>Faculty/Institute</i>	<b>: FACULTY OF ENGINEERING</b>
<b>Ahli Kumpulan Penyelidik</b> <i>Research Team Members</i>	<b>: 1. Dr. Dyg Azra Awang Mat 2. Mohd Ridhuan Mohd sharip 3. Dr Dayang Norulfairuz Abang Zaidel</b>
<b>B. Tarikh Geran Diluluskan</b> <i>Grant Approval Date</i>	<b>: 1<sup>st</sup> January 2017</b>
<b>Tempoh Projek</b> <i>Project Duration</i>	<b>: 1 year</b>
<b>Peruntukan Yg. Diluluskan</b> <i>Budget Approved</i>	<b>: RM 3,500.00</b>
<b>Perbelanjaan Terkini</b> <i>Expenditure To-Date</i>	<b>: RM 0</b>
<b>C. Pencapaian Keseluruhan</b> <b><i>Overall Achievement</i></b> Huraikan pencapaian berbanding objektif, hipotesis serta permasalahan asal yang diselidiki.. <i>Describe the achievements in relation to the original objectives, hypothesis and research problems.</i>  The objective for this research are, The objectives of this study are:  i. To study and design band pass filter that operated at 2.45 GHz frequency range using different materials which are Rogers RO4003C and RT/Duroid 6202. ii. To simulate and optimize the band pass filter that have been analysed and designed.  For the first objective of this research, a study on literature has been made to compare on both materials; Rogers RO4003C and RT/Duroid 6202. In terms of performance both show slightly difference. However, to achieve the second objective, material Rogers RO4003C has been chosen to be analyzed and designed. In terms of cost, Rogers RO4003C holds advantages as it is	

cheaper compare to RT/Duroid.

The designed and fabricated filter can be used widely in the industrial application especially in rice industry that can act as a microwave sensor where it can detect the quality of the rice.

In terms of publication, one conference paper has been presented. Later, one journal will be published in national journal (Scopus index).

#### **D. Pencapaian Utama**

##### ***Key Findings***

The designed and fabricated filter can be used widely in the industrial application especially in rice industry that can act as a microwave sensor where it can detect the quality of the rice. This band pass filter is low in cost and very easy to fabricate.

#### **E, Hasil Penyelidikan**

##### ***Deliverables***

Sila tandakan item yang berkaitan pada senarai berikut:

*Please tick the relevant items below:*

	Item	Bilangan/Number
	Kertas teknikal/bersiri dalaman <i>Internal technical/serial papers</i>	
	Tesis/disertasi pelajar sarjana <i>Student's Masters thesis/dissertation</i>	
	Tesis pelajar PhD <i>Student's PhD thesis</i>	
	Kertas persidangan tempatan <i>Local conference papers</i>	1
	Kertas persidangan antarabangsa <i>International conference papers</i>	
	Makalah dalam jurnal tempatan <i>Local journal papers</i>	1 (Scopus index)
	Makalah dalam jurnal antarabangsa <i>International journal papers</i>	
	Monograf atau buku <i>Book/monograph</i>	

Lain-lain/others (sila nyatakan/*please specify*)

- Intex 2017
- Student undergraduate FYP Report

Sila senaraikan maklumat (pengarang, tahun, tajuk, jurnal/penerbit, jilid, halaman) bagi penerbitan/tesis yang dihasilkan (jika ada).



*Please specify the publications (authors, year, title, journal/publisher, volume, page nos.) (if any)*

In process of publication at Journal of Telecommunication, Electronic and Computer Engineering (International UNIMAS STEM Engineering Conference 2017)

#### **F. Pengecaman Output Output Identification**

Sila tandakan penerangan yang berkaitan pada senarai berikut:

*Please tick the relevant description as given below:*

<input type="checkbox"/>	Suatu sumbangan besar kepada bidang ilmu yang berkaitan <i>A major contribution to knowledge (new knowledge) in the respective discipline</i>
<input type="checkbox"/>	Suatu sumbangan kecil tetapi bermakna kepada bidang ilmu yang berkaitan <i>A minor but important contribution to knowledge in the respective discipline</i>
<input type="checkbox"/>	Suatu sumbangan besar kepada teknologi/ciptaan/algoritma dalam bidang yang berkaitan <i>A major contribution to technology/invention/algorithm or a tangible product</i>
<input type="checkbox"/>	Suatu sumbangan kecil tetapi bermakna kepada teknologi/ciptaan/algoritma berkaitan <i>A minor but important contribution to relevant technology/invention/algorithm</i>
<input type="checkbox"/>	Terdapat potensi yang baik untuk kajian lanjutan ke arah pemasaran <i>There is a good potential for further R &amp; D and commercialization</i>
<input type="checkbox"/>	Suatu sumbangan besar kepada kerangka polisi pengurusan/garis panduan <i>A major contribution to management policy framework/guidelines (in relevant areas)</i>
<input type="checkbox"/>	Suatu sumbangan kecil tetapi bermakna kepada kerangka polisi pengurusan/garis panduan <i>A minor contribution to management policy framework/guidelines (in relevant areas)</i>
<input type="checkbox"/>	Sesuai untuk dijadikan bahan pengajaran/case study atau bahan latihan <i>The finding is suitable for use as a complementary teaching/training material (a case study)</i>
<input type="checkbox"/>	Suatu output yang baik dan berpotensi untuk memenangi hadiah penyelidikan <i>A quality output that has a potential for winning a research award</i>
<input type="checkbox"/>	Suatu bahan yang baik/sesuai untuk hebahan atau pameran <i>A good/suitable material for showcasing/publicizing/exhibition</i>

Lain-lain/Others (Sila nyatakan/Please specify) : -

#### **G. Sinopsis Hasil Penyelidikan bagi Tujuan Promosi**

##### ***Synopsis for Promotional Purposes***

(Beri huraian ringkas yang tidak melebihi 400 perkataan dan dalam bahasa yang mudah, bagi maksud hebahan hasil penyelidikan ini melalui media massa dan 'Unimas Research Update')

*(Please provide a synopsis not exceeding 400 words, in a not-too-technical language, for the purpose of promoting this research findings through the mass media and Unimas Research Update).*

The applications of microwave sensors are wide. Microwave sensors, or known as radar or radio frequency (RF) operate at frequencies ranging from 300 MHz to terahertz. They are commonly used in industry due to their effectiveness in sensing and not sensitive to the environment. One of their great advantages is their ability in sensing task in wide capacity. This great advantage leads the communication between the sensor and the Material Under Test (MUT) to become non-invasive, non-ionizing and contact-less manner, which by then allows the information of the MUT to be extracted further. Thus, the test subject information could be extracted without affecting the quality and material's condition of the test subject.

Microwave sensors can be divided into several types such as radiometer sensors, transmission sensors and last but not least the most popular among all, resonator sensor. The easiest way to develop the resonator sensors is by applying the principle of microstrip filter. The microstrip filter response greatly on the frequency shift and broaden the curve compared to free space when filled with a test subject.

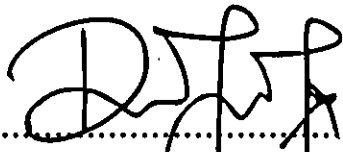
Microstrip wideband bandpass filter (BPF) is one of the mostly used devices as the microwave sensors. In recent years, the development of the wideband BPF have shown rapid increment and variety of different wideband BPF has been reported.

This research focus on the design of slotted ring wideband bandpass filter design. Broadside-coupled microstrip-slot technique has been implied. This technique can produce tight coupling filter with a wideband frequency range performance where the slotline in the bottom layer will be coupled to the two open-circuited stubs on the upper layer of the patch. Meanwhile, Rogers RO4003C substrate with thickness of 0.508 mm is used to maintain the low manufacturing cost. The designed wideband BPF possess good performance and suitable to be used as a microwave sensors to measure the rice quality.

#### Catatan Penting/Important Notes

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Signature (Principal Researcher)

7<sup>th</sup> February 2018

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Tarikh  
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*END OF OSAKA GAS*  
*GRANT REPORT SUMMARY*

<b>A. Tajuk Projek</b> <i>Project Title</i>	: Efficient Design and Implementation of SHA-1 Hash Function using Verilog Code
<b>Ketua Penyelidik</b> <i>Project Leader</i>	: Shamsiah binti Suhaili
<b>Fakulti/Institut</b> <i>Faculty/Institute</i>	: Faculty of Engineering
<b>Ahli Kumpulan Penyelidik</b> <i>Research Team Members</i>	: Norhuzaimin Julai
<b>B. Tarikh Geran Diluluskan</b> <i>Grant Approval Date</i>	: 6 December 2016
<b>Tempoh Projek</b> <i>Project Duration</i>	: 1 Year
<b>Peruntukan Yg. Diluluskan</b> <i>Budget Approved</i>	: RM4,500
<b>Perbelanjaan Terkini</b> <i>Expenditure To-Date</i>	: RM4330
<b>C. Pencapaian Keseluruhan</b> <b>Overall Achievement</b> Huraikan pencapaian berbanding objektif, hipotesis serta permasalahan asal yang diselidiki.. <i>Describe the achievements in relation to the original objectives, hypothesis and research problems.</i>  High performance of hash function design is important to improve the throughput of the design since nowadays all the system required fast implementation. Efficient implementation of	

cryptographic hash function on reconfigurable hardware is one of the problems that need to be solved. Therefore, the high speed designs are required in order to improve the maximum frequency of the design. Besides, the area implementation needs to be reduced as well as power consumption of the design. Cryptographic hash function or known as message digest algorithms, are algorithm that translates a random string of characters into hash code output.

The objective of this project is to design and implement the cryptographic hash function on reconfigurable hardware based on timing, power and area implementation. Furthermore, in order to increase the speed of the design, a study on how to improve the maximum frequency is performed. In this project, FPGA is used as reconfigurable hardware because it is flexible and appropriate platform to implement the design. Besides, the process of placement and route is important where the architecture of FPGA family device need to be considered for converting HDL code into gate level.

High performances of SHA-1 and SHA-256 hash function were obtained based on pipelining and unfolding transformation technique. Both designs provided high throughput by using new implementation techniques of hash function algorithm on reconfigurable hardware.

#### **D. Pencapaian Utama** *Key Findings*

The key findings of this project are high performance design based on pipelining and unfolding transformation technique.

#### **E, Hasil Penyelidikan** *Deliverables*

Sila tandakan item yang berkaitan pada senarai berikut:

*Please tick the relevant items below:*

	Item	Bilangan/Number
	Kertas teknikal/bersiri dalaman <i>Internal technical/serial papers</i>	
	Tesis/disertasi pelajar sarjana <i>Student's Masters thesis/dissertation</i>	
	Tesis pelajar PhD <i>Student's PhD thesis</i>	
	Kertas persidangan tempatan <i>Local conference papers</i>	
	Kertas persidangan antarabangsa <i>International conference papers</i>	1
	Makalah dalam jurnal tempatan <i>Local journal papers</i>	1
	Makalah dalam jurnal antarabangsa <i>International journal papers</i>	

	Monograf atau buku <i>Book/monograph</i>	
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Lain-lain/others (sila nyatakan/*please specify*)

Sila senaraikan maklumat (pengarang, tahun, tajuk, jurnal/penerbit, jilid, halaman) bagi penerbitan/tesis yang dihasilkan (jika ada).

*Please specify the publications (authors, year, title, journal/publisher, volume, page nos.) (if any)*

1. Shamsiah binti Suhaili, Takahiro Watanabe, Norhuzaimin Julai, (2017), High speed and throughput evaluation of SHA-1 hash function design with pipelining and unfolding transformation techniques, Journal of Telecommunication, Electronics and Computer Engineering (JTEC), Vol. 9, No.3-10, pp. 19-22.
2. Shamsiah binti Suhaili, Takahiro Watanabe, (2017), Design of High-Throughput SHA-256 Hash Function based on FPGA, The 6th International Conference on Electrical Engineering and Informatics 2017 (ICEEI2017), Resort World Langkawi, Kedah, Malaysia on 25 - 27 November.

#### F. Pengecaman Output *Output Identification*

Sila tandakan penerangan yang berkaitan pada senarai berikut:

*Please tick the relevant description as given below:*

	Suatu sumbangan besar kepada bidang ilmu yang berkaitan <i>A major contribution to knowledge (new knowledge) in the respective discipline</i>
√	Suatu sumbangan kecil tetapi bermakna kepada bidang ilmu yang berkaitan <i>A minor but important contribution to knowledge in the respective discipline</i>
	Suatu sumbangan besar kepada teknologi/ciptaan/algoritma dalam bidang yang berkaitan <i>A major contribution to technology/invention/algorithm or a tangible product</i>
√	Suatu sumbangan kecil tetapi bermakna kepada teknologi/ciptaan/algoritma berkaitan <i>A minor but important contribution to relevant technology/invention/algorithm</i>
	Terdapat potensi yang baik untuk kajian lanjutan ke arah pemasaran <i>There is a good potential for further R &amp; D and commercialization</i>
	Suatu sumbangan besar kepada kerangka polisi pengurusan/garis panduan <i>A major contribution to management policy framework/guidelines (in relevant areas)</i>
	Suatu sumbangan kecil tetapi bermakna kepada kerangka polisi pengurusan/garis panduan <i>A minor contribution to management policy framework/guidelines (in relevant areas)</i>
	Sesuai untuk dijadikan bahan pengajaran/ <i>case study</i> atau bahan latihan <i>The finding is suitable for use as a complementary teaching/training material (a case study)</i>
	Suatu output yang baik dan berpotensi untuk memenangi hadiah penyelidikan <i>A quality output that has a potential for winning a research award</i>
	Suatu bahan yang baik/sesuai untuk hebahan atau pameran <i>A good/suitable material for showcasing/publicizing/exhibition</i>

Lain-lain/Others (Sila nyatakan/Please specify)

-

**G. Sinopsis Hasil Penyelidikan bagi Tujuan Promosi**

***Synopsis for Promotional Purposes***

(Beri huraian ringkas yang tidak melebihi 400 perkataan dan dalam bahasa yang mudah, bagi maksud hebahan hasil penyelidikan ini melalui media massa dan 'Unimas Research Update')

*(Please provide a synopsis not exceeding 400 words, in a not-too-technical language, for the purpose of promoting this research findings through the mass media and Unimas Research Update).*

Nowadays, security has become an important topic of interest to researchers. Different types of cryptography algorithms have been developed in order to improve the performance of these information protecting procedures. A hash function is a cryptography algorithm without a key such as MD5, RIPEMD160, and SHA-1. In recent years, designing of SHA-1 and SHA-256 hash function become popular because it were important in security design application. One of the applications of hash function was HMAC where the architecture of hash function needed to be improved in terms of speed and throughput in order to obtain the high performance design. The objective of this project was to design high speed and throughput evaluation of SHA-1 and SHA-256 hash function based on combination between pipelining and unfolding techniques. By using both techniques in designing the architecture of SHA-1 design, the speed of SHA-1 hash function can be increased significantly as well as throughput of the design. In this paper, five proposed SHA-1 architectures were designed with different stages of pipelining such as 1, 4 and 40 stages. The results showed high speed design of SHA-1 design can be obtained by using 40 stages pipelining with unfolding factor two. Furthermore, SHA-256 design and SHA-256 unfolding design based on reconfigurable hardware have been successfully completed using Verilog code. These designs were simulated and verified using ModelSim. The results showed that the proposed SHA-1 and SHA-256 unfolding design gave better performance on Arria II GX in terms of throughput. Thus, high speed design of hash functions were successfully obtained which can give benefit to society especially in security system data transmission and other types of hash functions in terms of methodology in order to obtain the high performance design of hash function in the future.

**Catatan Penting/Important Notes**

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.....6 Feb 2018.....  
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**GERAN PENYELIDIKAN OSAKA GAS**  
*END OF OSAKA GAS*  
*GRANT REPORT SUMMARY*

<b>A. Tajuk Projek</b> <i>Project Title</i>	<b>: EFFECT NANOFILLER ON ELECTRICAL PROPERTIES OF NANOCOMPOSITE BLENDS AS ELECTRICAL INSULATOR</b>
<b>Ketua Penyelidik</b> <i>Project Leader</i>	<b>: MOHD RIDHUAN BIN MOHD SHARIP</b>
<b>Fakulti/Institut</b> <i>Faculty/Institute</i>	<b>: FACULTY OF ENGINEERING</b>
<b>Ahli Kumpulan Penyelidik</b> <i>Research Team Members</i>	<b>: 1. Dr. Dyg Norkhairunnisa bin Abg Zaidel</b> <b>2. Mohd Hafiez Izzwan bin Saad</b> <b>3. Azfar Satari bin Abdullah</b> <b>4. Nurul Izzati binti Hashim</b>
<b>B. Tarikh Geran Diluluskan</b> <i>Grant Approval Date</i>	<b>: 1 January 2017</b>
<b>Tempoh Projek</b> <i>Project Duration</i>	<b>: 1 year</b>
<b>Peruntukan Yg. Diluluskan</b> <i>Budget Approved</i>	<b>: RM 4,500.00</b>
<b>Perbelanjaan Terkini</b> <i>Expenditure To-Date</i>	<b>: RM 4,500.00</b>
<b>C. Pencapaian Keseluruhan</b> <b><i>Overall Achievement</i></b> Huraikan pencapaian berbanding objektif, hipotesis serta permasalahan asal yang diselidiki.. <i>Describe the achievements in relation to the original objectives, hypothesis and research problems.</i>  The first objective of this research was achieved by presenting the design of nanofiller in the polymer matrix, thus representing the nanocomposite model. In the design, a nanocomposite	

system contains nanofiller under electrical stress was modeled and analyzed using Finite Element Magnetics Method 4.2 (FEMM 4.2). By analyzing the electric field distribution, the presence of nanofiller in the polymer matrix was found to significantly affect the electric field distribution around the nanoparticles. The presence of the nanofiller affected the dielectric strength within the nanocomposites.

Based on the literature review, we decided to consider one-dimensional (1-D) nanofiller also known as platelet in this project. The second objective has been accomplished by modeling the interphase structures surrounding the nanoparticles and neighboring nanofiller within the nanocomposites. In order to investigate the effect of the presence interphase region on the electric field distribution within the nanocomposites, the permittivity value of the interphase region for both models were varies. The electric field distribution in nanocomposites (e.g. polyethylene with clay nanofiller) varies with the presence of the nanofiller interphase due to the different values of the interphase permittivity. Meanwhile, the effect of the presence neighboring nanofiller on the electric field distribution within the nanocomposites also have been reported in this project by varying the distance between two nanofiller. The model was predicted that the electric field intensity reduces when the distance between neighboring nanoparticles in the nanocomposite increases. These factors can affect the measured breakdown strength in the resulting nanocomposites.

#### **D. Pencapaian Utama**

##### ***Key Findings***

The presence of the nanofiller affected the dielectric strength within the nanocomposites.

The electric field distribution in nanocomposites (e.g. polyethylene with clay nanofiller) varies with the presence of the nanofiller interphase due to the different values of the interphase permittivity.

The electric field intensity reduces when the distance between neighboring nanofiller in the nanocomposite increases

**E, Hasil Penyelidikan  
Deliverables**

Sila tandakan item yang berkaitan pada senarai berikut:

*Please tick the relevant items below:*

	Item	Bilangan/Number
	Kertas teknikal/bersiri dalaman <i>Internal technical/serial papers</i>	
	Tesis/disertasi pelajar sarjana <i>Student's Masters thesis/dissertation</i>	
	Tesis pelajar PhD <i>Student's PhD thesis</i>	
	Kertas persidangan tempatan <i>Local conference papers</i>	
	Kertas persidangan antarabangsa <i>International conference papers</i>	
	Makalah dalam jurnal tempatan <i>Local journal papers</i>	1 (Scopus)
	Makalah dalam jurnal antarabangsa <i>International journal papers</i>	
	Monograf atau buku <i>Book/monograph</i>	

Lain-lain/others (sila nyatakan/*please specify*)

Sila senaraikan maklumat (pengarang, tahun, tajuk, jurnal/penerbit, jilid, halaman) bagi penerbitan/tesis yang dihasilkan (jika ada).

*Please specify the publications (authors, year, title, journal/publisher, volume, page nos.) (if any)*

In process of publication at Journal of Telecommunication, Electronic and Computer Engineering (International UNIMAS STEM Engineering Conference 2017)

## F. Pengecaman Output Output Identification

Sila tandakan penerangan yang berkaitan pada senarai berikut:

*Please tick the relevant description as given below:*

<input type="checkbox"/>	Suatu sumbangan besar kepada bidang ilmu yang berkaitan <i>A major contribution to knowledge (new knowledge) in the respective discipline</i>
<input type="checkbox"/>	Suatu sumbangan kecil tetapi bermakna kepada bidang ilmu yang berkaitan <i>A minor but important contribution to knowledge in the respective discipline</i>
<input type="checkbox"/>	Suatu sumbangan besar kepada teknologi/ciptaan/algoritma dalam bidang yang berkaitan <i>A major contribution to technology/invention/algorithm or a tangible product</i>
<input type="checkbox"/>	Suatu sumbangan kecil tetapi bermakna kepada teknologi/ciptaan/algoritma berkaitan <i>A minor but important contribution to relevant technology/invention/algorithm</i>
<input type="checkbox"/>	Terdapat potensi yang baik untuk kajian lanjutan ke arah pemasaran <i>There is a good potential for further R &amp; D and commercialization</i>
<input type="checkbox"/>	Suatu sumbangan besar kepada kerangka polisi pengurusan/garis panduan <i>A major contribution to management policy framework/guidelines (in relevant areas)</i>
<input type="checkbox"/>	Suatu sumbangan kecil tetapi bermakna kepada kerangka polisi pengurusan/garis panduan <i>A minor contribution to management policy framework/guidelines (in relevant areas)</i>
<input type="checkbox"/>	Sesuai untuk dijadikan bahan pengajaran/ <i>case study</i> atau bahan latihan <i>The finding is suitable for use as a complementary teaching/training material (a case study)</i>
<input type="checkbox"/>	Suatu output yang baik dan berpotensi untuk memenangi hadiah penyelidikan <i>A quality output that has a potential for winning a research award</i>
<input type="checkbox"/>	Suatu bahan yang baik/sesuai untuk hebahan atau pameran <i>A good/suitable material for showcasing/publicizing/exhibition</i>

Lain-lain/*Others* (Sila nyatakan/*Please specify*) : -

## G. Sinopsis Hasil Penyelidikan bagi Tujuan Promosi

### *Synopsis for Promotional Purposes*

(Beri huraian ringkas yang tidak melebihi 400 perkataan dan dalam bahasa yang mudah, bagi maksud hebahan hasil penyelidikan ini melalui media massa dan 'Unimas Research Update')

*(Please provide a synopsis not exceeding 400 words, in a not-too-technical language, for the purpose of promoting this research findings through the mass media and Unimas Research Update).*

Recent works show that the presence of the interphase surrounding nanoparticles can improve the dielectric properties of nanocomposites. Also, neighboring particles in the nanocomposites affect the electric field distribution. By model and analyze the effect of one-dimensional (1D) nanofillers towards the electric field distribution when the interphase and neighboring are taken into account inside the nanocomposite system. Finite Element Method Magnetics (FEMM) 4.2 as software tools for modeling of nanocomposites system consists of polymer matrix, nanoparticle filler with interphase and neighboring particles is modeled under the electrostatic problem module. Electric field intensity is observed with different distance between adjacent nanoparticles and interphase region permittivity values. The result obtained show that the presence of the interphase with various permittivity value will result in distorted electric field intensity surrounding a nanoparticle. Furthermore, the electric field intensity also affected when adjacent nanoparticles displaced between each other within nanocomposites. Therefore, the presence of nanofiller and its interphase plays an important role in determining the electric field intensity within nanocomposite systems.

**Catatan Penting/Important Notes**

Penyelidik diminta mengemukakan kepada Pusat Penyelidikan:

- Borang ini dalam kedua-dua bentuk bercetak dan elektronik
- Researchers are required to submit to the Research Centre:*
- *This form in both hard- and soft-copies*

.....  
**Tandatangan (Penyelidik Utama)**  
Signature (Principal Researcher)

.....  
**Tarikh**  
Date



APPLICATION OF OSAKA GAS FOUNDATION OF INTERNATIONAL CULTURAL EXCHANGE (OGFICE) RESEARCH GRANT SCHEME 2016/2017

NO.	LEADER	CO-RESEARCHER	TITLE
1	Ir Dr David Chua Sing Ngie	Assoc Prof Dr Abdullah b. Yassin, Dr Shahrol b Mohamaddan, Dr Lim Soh Fong	INSPECTION METHODOLOGY FOR BOND PAD DISCOLORATION IN WAFERS
2	Dr Ana Sakura bt Zainal Abidin	Prof Dr Sinin Hamdan, Rasli Muslimen, Dr Raudhah bt Ahmadi	APPLICATION OF RESONANT EFFECT IN PEPPER DRYING PROCESS
3	Shirley ak Johnathan Tanjong	Dr Magdalene ak Andrew Munot, Ir Dr David Chua Sing Ngie, Dr Shahrol b Mohamaddan, Assoc Prof Dr Abdullah b. Yassin	EVALUATING THE EFFECTS OF CORRELATED CHARACTERISTICS WITH NON-NORMAL DISTRIBUTION IN MANUFACTURING QUALITY CONTROL
4	Dr Abg Mohd Nizam b Abg Kamaruddin	Assoc Prof Dr Abdullah b. Yassin, Dr Shahrol b Mohamaddan, Assoc Prof Dr Syed Tarmizi Syed Shazali	THE STUDY OF VEGETABLE BASED CUTTING FLUID PERFORMANCE IN MILLING PROCESS
5	Nurdiani bt Zamhari	Dr Abdul Rahman b Kram, Dr Abang Annuar Ehsan, Prof Mohd Syuhaimi Ab Rahman	IMPLEMENTATION OF INTEGRATED OPTICAL TAP PLANAR LIGHTWAVE CIRCUIT (PLC) IN FIBER-TO-THE-HOME (FTTH) SYSTEM
6	Dr Dyg Norkhairunnisa bt Abang Zaidel	Dr Dyg Azra bt Awg Mat, Mohd Ridhuan b Mohd Sharip, Dr Dayang Norulfairuz bt Abang Zaidel	THE DESIGN OF MICROWAVE SENSOR BY USING BAND PASS FILTER (BPF) APPLICATION FOR INDUSTRIAL APPLICATION
7	Shamsiah bt Suhaili	Dr Norhuzaimin Julai	EFFICIENT DESIGN AND IMPLEMENTATION OF SHA-1 HASH FUNCTION USING VERILOG CODE
8	Mohd Ridhuan b Mohd Sharip	Dr Dyg Norkhairunnisa bt Abang Zaidel, Mohd Hafiez Izzwan b Saad, Azfar Satari b Abdullah, Nurul 'Izzati bt Hashim	EFFECT NANOFILLER ON ELECTRICAL PROPERTIES OF NANOCOMPOSITE BLENDS AS ELECTRICAL INSULATOR



APPLICATION FOR EXTENSION OF OSAKA GAS FOUNDATION OF INTERNATIONAL CULTURAL EXCHANGE (OGFICE) RESEARCH GRANT SCHEME 2016/2017

NO.	LEADER	CO-RESEARCHER	TITLE	REMARKS
1	Siti Nor Ain bt Musa	Noor Aliah bt Abd Majid, Mahshuri Yusof	PYROLISIS AND CO-COMBUSTION CHARACTERISTICS OF TORREFIED OIL PALM EMPTY FRUIT BUNCH (EFB) FOR ENERGY GENERATION IN COAL-FIRED COMBUSTION SYSTEM	Extension for 3 months. Expired 31st May 2018
2	Noor Hisyam b Noor Mohamed	Prof Dr Sinin Hamdan, Dr Md Rezaur Rahman, Dr Shahrol b Mohamaddan, Assoc Prof Dr Syed Tarmizi Syed Shazali, Assoc Prof Dr Abdullah b. Yassin	FABRICATION OF HIGH PERFORMANCE BIODEGRADABLE CELLULOSE NANOFIBER (CNF) COMPOSITE	Extension for 6 months. Expired on 30 June 2018
3	Mohd Hafiez Izzwan b Saad	Dr Yanuar Z. Arief, Mohd Ridhuan b Mohd Sharip, Shirley ak Rufus, Azfar Satari b Abdullah, Nurul 'Izzati bt Hashim,	AN INVESTIGATIVE STUDY OF GREEN ENERGY ASSESSMENT OF PUSAT ISLAM TUN ABANG SALAHUDDIN (PITAS) BUILDING	Extension for 3 months. Expired on 1st Apr 2018
4	Jethro Ak Henry Adam	Rohaida bt Affandi, Nor Azalina bt Rosli, Assoc Prof Dr Siti Halipah bt Ibrahim	SOLID WASTE GENERATION AND MANAGEMENT IN UNIMAS WEST CAMPUS	Extension for 3 months. Expired 31st May 2018
5	Nur Amalina Shairah bt Abdul Samat	Dr Onni Suhaiza bt Selaman, Assoc Prof Dr Rubiyah Hj Bani, Dr Md Rezaur Rahman	THE FABRICATION OF A BIO-FILTRATION PILOT PLANT FOR POTENTIAL DOMESTIC WASTE WATER TREATMENT	Extension for 3 months. Expired on 1st Apr 2018