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(Bioprocess Engineering and Environmental Biotechnology)

Professor Dr. Suraini Abd-Aziz 8
(Biochemical Engineering and Enzyme Technology)

Dr. Hidayah Ariffin 10
(Bioprocess Engineering and Environmental Biotechnology)

Dr. Mohd Rafein Zakaria 12
(Environmental Biotechnology)

Dr. Norhayati Ramli 22
(Microbial Biotechnology)

Dr. Mohamad Faizal Ibrahim 24
(Enzyme Technology)

Dr. Mohd Zulkhairi Mohd Yusoff 26
(Environmental Biotechnology and Microbial Biotechnology)

Dr. Ezyana Kamal Bahrin 27
(Environmental Biotechnology)

Dr. Ahmad Muhaimin Roslan 42
(Environmental Biotechnology)

MESSAGE FROM THE EB GROUP LEADER

PROFESSOR DR. MOHD ALI HASSAN

In The Name of ALLAH, Most Gracious, Most Merciful.

AlhamduLillah, praise to ALLAH for His generous favours and blessings on us all. As the Leader of Environmental Biotechnology Research Group (EB) at Universiti Putra Malaysia, I am glad to share with you our research report for 2016.

- We have two sub-groups; comprising of EB1 - Biomass and Biorefinery, and EB2 – Bioenergy and Biobased Chemicals.
- We have 9 academic staff members, 1 post-doctorate researcher and associate researchers.
- Our current student enrolment are PhD, MS and undergraduate students. In addition we also have students on the PhD Double-Degree and students on the Split-PhD program with Kyushu Institute of Technology, Japan.
- In 2016, PhD students and MS students graduated from our laboratory.

"We continue to operate the Biorefinery@UPM Complex, comprising of the Biomass Technology Laboratory and the Pilot Plant for Biocompost, Biochar, Biodiesel and Biogas under the Serdang Biomass Town project, in collaboration with The Ministry of Housing and Local Government (KPKT, Malaysia), The Ministry of Agriculture, Forestry and Fisheries (MAFF, Japan), Malaysia Agricultural Research and Development Institute (MARDI) and The Subang Jaya Municipal Council (MPSJ)."

- We managed to secure the JICA-JST SATREPS International Grant for the period 2013-2017, with a matching grant from The Ministry of Education Malaysia, to set up an integrated zero-emission showcase pilot plant at Keningau Palm Oil Mill in Sabah. Under the JICA-JST SATREPS project, we continue to strengthen the academic and research collaboration with Professor Yoshihito Shirai and co-workers from Kyushu Institute of Technology, Dr. Satoshi Hirata and co-workers from Advanced Institute of Science and Technology (AIST) Japan, Professor Dr. Kenji Sakai and co-workers from Kyushu University and Professor Dr. Charles Vairappan and co-workers from Universiti Malaysia Sabah.
- We conduct collaborative research projects with the industry, namely Indah Water Konsortium (IWK) on sewage sludge pellets, and with CJ BioMalaysia Sdn. Bhd on sludge and spent activated carbon. We also conduct a consultancy project with Mitsubishi Heavy Industry Asia Pacific on fuel pellets from oil palm biomass.
- In terms of output, we successfully published research papers in 2016, with in Quartile 1 (Q1) and 9 in Quartile 2 (Q2), with a total of Impact Factors.

I appreciate the hard work from all EB members in maintaining our high-performance culture. May ALLAH give us the strength to continue the good work and contribute to the development of university, the ummah and the nation.

Thank you. Wassalam.

Professor Dr. Mohd Ali Hassan

PROFESSOR DR. MOHD ALI HASSAN

Specialization:
Bioprocess Engineering and Environmental Biotechnology

Current research interest:
Treatment and utilization of biomass for the production of bio-based products, bioremediation and reduction of greenhouse gases

h-index: 23

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(f) Post-graduate Diploma (Islamic Studies), University Kebangsaan Malaysia (1985)

Selected Publications:

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PUBLISHED

Impact Factor = 4.917 (Q1)

Dr. Mohd Rafein Zakaria

Group Researcher

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Soluble inhibitors generated during hydrothermal pretreatment of oil palm mesocarp fiber suppressed the catalytic activity of Acremonium cellulase

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highlights

- Oil palm mesocarp fiber was pretreated at isothermal and non-isothermal conditions.
- Enzymatic hydrolysis of both pretreated slurry and solids were performed.
- Inhibitors generated from hydrothermal pretreatment of OPMF were identified.
- Xylooligosaccharide and tannic acid are the most severe inhibitors to cellulase.
- Activated carbon from OPMF is suitable adsorbent for tannic acid removal.

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abstract

Oil palm mesocarp fiber was subjected to hydrothermal pretreatment under isothermal and non-isothermal conditions. The pretreated slurries were separated by filtration, pretreated liquids and solids were characterized. An enzymatic digestibility study was performed for both pretreated slurries and solids to understand the effect of soluble inhibitors generated during the pretreatment process. The highest glucose yield obtained from pretreated slurries was 70.1%, and gradually decreased with higher pretreatment severities. The highest glucose yield obtained in pretreated solids was 100%, after pretreatment at 210 °C for 20 min. In order to study the inhibitory effects of compounds generated during pretreatment with cellulase, technical grade solutions that mimic the pretreated liquid were prepared and their effect on Acremonium cellulase activity was monitored using Avicel. Xylo-oligomers and tannic acid were identified as powerful inhibitors of Acremonium cellulase, and the lowest hydrolysis rate of Avicel of 0.18 g/g-glucose released/L/h was obtained from tannic acid.

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Group Researcher

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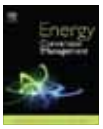

Case study: Preliminary assessment of integrated palm biomass biorefinery for bioethanol production utilizing non-food sugars from oil palm frond petiole

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abstract

In this case study, a preliminary assessment on the bioethanol production from oil palm frond (OPF) petiole sugars within an integrated palm biomass biorefinery was carried out. Based on the case study of 4 neighbouring palm oil mills, approximately 55,600 t/y off ermentable sugars could be obtained from OPF petiole. The integrated biorefinery will be located at one of the 4 mills. The mill has potential excess energy comprising 3.64 GW h/y of electricity and 177,000 t/y of steam which are sufficient to run the biorefinery. With 33.9 million litres/y of bioethanol production, the specific production cost of bioethanol is estimated at $ 0.52/l bioethanol, compared to $ 0.31–0.34/l bioethanol produced from sugarcane and $ 0.49–0.60/l bioethanol from other lignocellulosics. The net energy ratio of 7.48 for bioethanol production from OPF provides a promising alternative for OPF utilization as a non-food sugar feedstock.

PHD STUDENT

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Co-composting oil palm empty fruit bunch and anaerobic sludge palm oil mill effluent with enrichment of urea

The findings of literature review in the mathematical model type, in composting. It shows the current status of research and several gap automatically proposed research suitable to execute. Examples of gap available are validation for the mathematical model was not thoroughly done and tested, and lack of important process parameters in modeling. Experiment has to be made to fulfill the parameter data required in the modeling for estimation and rate coefficient sensitivity.

Enrichment of urea in co-composting of oil palm empty fruit bunch and sludge palm oil mill effluent has been deploying. High lignocellulosic material slows down rate of degradation. Low level and inconsistent of aging sludge and different method of mill operations also contribute to inefficient compost process. A study of quantify microbes and lignocellulosic degradation able to determine detail of compost stage process. Several process factor commonly included in compost mathematical model have known. There are about six common process factor has been applied in. Most popular is a deterministic model example substrate degradation limiting process to imitate limitation of actual process. Knowledge of process factor limiting fusion (incorporated into a single model) and direct inclusion of the possible interactions between the process factors as part of the model's structure could comprehend composting process. Composting is most dynamic type of process hence incorporation factor limiting modeling could gain new insight which compensates vague understanding and flexibility to first principle mathematical model (deterministic). This study could introduce practicality in modeling for dynamic behavior such as composting.

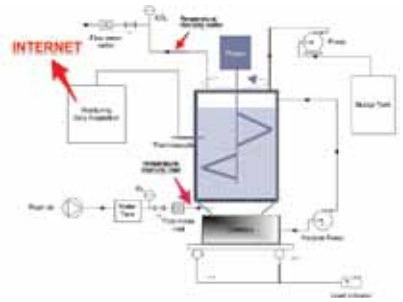

Figure 1. Composter Schematic Diagram

Figure 2. Composter

Figure 3. Temperature and Humidity Sensor with Datalogger

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Design of Functionalized Polyester from Long-Chain Fatty Acids

Bio-based polymers have received increasing attention from industrial sector and researchers. These polymers or their monomers are derived from renewable resources. Plant oil is one of the interesting renewable resources, particularly palm oil as it is abundantly can be found in Malaysia. Therefore, in this study, in order to provide greener materials with high potentials, we propose and design the reaction method and combination with useful counterparts for higher efficient green products using fatty acids from plant oil. The synthesis of greener polyester using dicarboxylic acid monomer derived from metathesis of unsaturated fatty acids, was tested by condensation polymerization with aliphatic and aromatic diol in the presence of Lipase N435 and isopropyl titanate. Subsequently, in order to introduce a new reactive group and useful properties and wide use in a variety of applications, a simple and efficient method of chemical modification called olefin epoxidation was applied in the original monomers and resulted polymeric material. Characteristics of the polyester produced can be varied depending on the type of precursors used during polymerization, thus allowing further modification for improvement of the properties. Last but not least, the functionality of the polyester will be determined by chemical modification. Further evaluation and combination of the characteristics of greener and hybrid polyester will be needed in order to clarify the potential as practical useful material.

Figure 1. Polyester from lipase-catalyzed of dicarboxylic acids and diols

Figure 2. Metathesis of fatty acids by second generation Grubbs catalyst

Figure 3. Unsaturated dicarboxylic acids from metahesis of oleic acid