2020

ICBB
INTERNATIONAL CONFERENCE OF BIOMASS AND BIOENERGY 2020

E-PROGRAM BOOK
INTERNATIONAL CONFERENCE OF BIOMASS AND BIOENERGY 2020

"Advanced Technology and Digital Innovations in Biomass, Bioenergy and Agriculture"
10-11 Agustus 2020

Host :

IPB University | SBRC Surfactand and Bioenergy Research Center

Co-Host :

ISBB International Society of Biomass and Bioenergy

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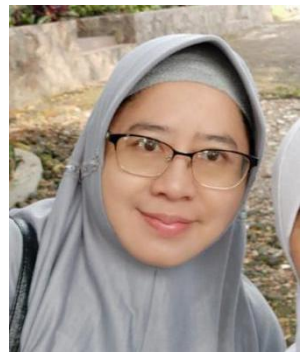
Message from Chairman of Organizing Committee



It is my pleasure and honor to welcome you all, and especially the warm welcome to prominent keynote speakers, invited speakers, and participants from domestic and abroad. Welcome to the International Conference of Biomass and Bioenergy 2020 organized by Surfactant and Bioenergy Research Center (SBRC), IPB University in collaboration with the International Society of Biomass and Bioenergy (ISBB). After the success of the previous conferences, the current conference theme is **Advanced Technology and Digital Innovations in Biomass, Bioenergy and Agriculture**.

This year, we are facing the difficulties to meet each other in the real world because of the pandemic. Now, all over the world has to consider the rules of new normal, but this also the opportunity for us to reach many new participants from regional and global countries by virtual conference. We hope that this arrangement can fulfill our goals to share technical knowledge, the latest technology developments, policy, and the initiative for collaboration within all stakeholders.

On behalf of the organizing committee, I would like to thank the steering committee, organizing committee, all supporting organizations, and special thanks also extended to our main sponsor. I hope this conference will succeed with a real contribution to our life.

Bogor, August 7th 2020

Dr. Ir. Dwi Setyaningsih, S.TP, M.Si

Milestones of ICBB

Surfactant and Bioenergy Research Center (SBRC)-IPB University has a good reputation in organizing international conferences. On 10-11th October 2016, SBRC-IPB University successfully conducted the 1st International Conference on Biomass with the theme "*Technology, Application and Sustainable Development*". On 24-25th July 2017, SBRC-IPB University successfully conducted the 2nd International Conference on Biomass with the theme "*Sustainable Development of Biomass Utilization for Industrial Applications*". On 1-2 August 2018, SBRC-IPB University in collaboration with the International Society of Biomass and Bioenergy (ISBB) successfully conducted the 3rd International Conference on Biomass with the theme "*Accelerating the Technical Development and Commercialization for Sustainable Bio-based Products and Energy*".

Furthermore, on 19-20 August 2019, SBRC-IPB University in collaboration with the ISBB successfully conducted the International Conference of Biomass and Bioenergy with the theme "*Biomass and Bioenergy: A Pathway for Sustainable Development Goals*". The papers of previous conferences were published in IOP conference series indexed by Scopus: Vol. 65, ICB 2016; Vol. 141, ICB 2017; Vol. 209, ICB 2018; and Vol. 460, ICBB 2019. The documentation of previous conferences is shown below.

Concerning the important issue of industry 4.0, in this year the International Conference of Biomass and Bioenergy 2020 (ICBB 2020) hosted by SBRC-IPB University in collaboration with the ISBB is continuously be held with the theme "*Advanced Technology and Digital Innovations in Biomass, Bioenergy and Agriculture*". Due to the COVID-19 pandemic, ICBB 2020 is held as an online conference. Nevertheless, under this big challenge, we have achieved such a milestone in the increasing of participants from ASEAN countries. In this year conference, we received submissions from Indonesia, Thailand, Vietnam, Columbia, Philippines, USA, Malaysia, and Japan.

We are enormously grateful for your kind support and contribution by participating in this year online conference. We are inviting all participants this year to the ICBB 2021 and we hope to see you all in next year conference.

SBRC-IPB University
International Society of Biomass and Bioenergy

Profile of SBRC

Surfactant and Bioenergy Research Center (SBRC) is one of the research centers under IPB University. Surfactant development research consists of processing and technology development research, followed by application of the product in various industries. Bioenergy development research contains integrated upstream to downstream research activities. These activities include processing and technology of bioenergy, role model of institutional development on bioenergy business, and sustainability assessments of Bioenergy development in Indonesia which covers environmental, social and economic aspects.

The recent promising bioenergy to develop is micro/macroalgae as the next alternative environmentally friendly biofuel feedstock. Furthermore SBRC is engaged in the field of biomass and bioproduct. Reseach and development in this field includes biomaterials technology, bioaditives, new biochemicals and green biorefinery. The last SBRC's research area is Advanced computing technology. This research area deals with the advanced digital technology including blockchain, robotics, artificial intelligence, internet of things, drone technology, as well as precision agriculture and agroindustry. The documentation of R&D activities is shown below.

During the last decade, SBRC, IPB University has extensive experiences in collaborating with international partners including collaborations with FAO Rome in 2012-2013, Central Research Institute of Electric Power Industry (CRIEPI) in 2011-2012 and 2014-2015, Research Institute of Industrial Science and Technology (RIIST-POSCO, South Korea) in 2011-2013. Other international cooperation include DFG-CRC990 with University of Goettingen, DE, DK (2012-2017), DANIDA-REDD+ with University of Copenhagen, Denmark (2014-2017), JICA-JSTSATREPS with Nagoya University, Japan (2015-2017), and RISTEKDIKTI AIC with Monash University and University of Sydney, Australia (2015-2017).

Profile of ISBB

The Founder Meetings of International Society of Biomass and Bioenergy (ISBB) was held one day before the ICB 2018 on 31 July 2018 with 18 participants, and the forum ended with a resolution that ISBB, the administrative body of the future conferences of biomass and bioenergy sciences be financially independent by Registration and Review & Publication fees, not seeking for the external funding support, but for the sustainability to keep the high scientific level of papers, as well as providing opportunities to local young generations to work in such an international environment. Current Co-chairs of ISBB are Prof. Dr. Yukihiko Matsumura (Hiroshima University, Japan) and Prof. Dr. Erliza Hambali (IPB University, Indonesia), and the Secretary is Prof. Dr. Haruhiro Fujita (Niigata University of International and Information Studies, Japan).

Figure. Founder Meetings of ISBB in 2018

Objectives of ISBB are to promote academic & industrial development in biomass (and related) fields, by providing opportunity of an international forum of operating international biomass conferences, publishing high level papers, as well as providing professional training programs; to host capacity development of young generation scientists and staff, providing opportunities to work in an international association, of implementing various projects as above.

Activities of ISBB are:

1. To have official publications of ICBB Proceedings and International Journal of Sustainable Biomass and Bioenergy (IJSBB)
2. To have strong network with biomass and bioenergy industries with the participation of their high- ranked official in the society
3. To organize conferences, training and short courses
4. To plan for mobility programs to allow participants or students to have more real-life experience in related industries.
5. To promote research attachment at established labs of its members for research capacity upgrading and expertise sharing
6. To give certain recognitions to high-achievers in biomass science and technology

Under the essential collaboration with the Surfactant and Bioenergy Research Center (SBRC) of the IPB University, the ISBB has been taking major roles in:

1. Conference/paper administration in ICB 2018, ICBB 2019 and ICBB 2020
2. Original publication of International Journal of Sustainable Biomass and Biomass, 19 papers in three editions.

Content

Conference Program

Day-1: Monday, 10 August 2020

Opening Ceremony	**IPB University's Session**
07.30–08.30	Login and Registration
08.30–08.40	Welcome message Prof. Dr. Erliza Hambali Co-chair Steering Committee of ICBB 2020
08.40–09.00	Opening address Prof. Dr. Arif Satria, S.Pi, M.Si Rector of IPB University
09.00–09.30	Keynote Speech Eddy Abdurrachman Oil Palm Plantation Fund Management Agency-BPDPKS ***Bring Biomass Technology to Small Holder Palm Oil Farmers***
Chair **Prof. Dr. Yukihiro Matsumura**	**Plenary Session**
09.30–12.00	Prof. Dr. Kiyoshi Dowaki (Department of Industrial Administration, Graduate School of Science and Technology, Tokyo University of Science) ***A proposal of assisted bicycle with a fuel cell battery fueling Bio-H2***
	Assoc. Prof. Dr. Justinus A. Satrio (Department of Chemical Engineering, Villanova University, USA) ***Strategies for Optimizing Positive impacts of Biomass Utilization from STEEP Perspectives***
	Prof. Dr. Yandra Arkeman (Department of Agroindustrial Technology, IPB University, Indonesia) ***Application of Artificial Intelligence and Cellular Automata for Biomass and Bioenergy***
	Dr. Oki Muraza (King Fahd University of Petroleum and Minerals, Saudi Arabia) ***Biofuels from Palm Oil Industry: Between Job Creation and Energy Security***
	Prof. Dr. Ahmad Zuhairi Abdullah (School of Chemical Engineering, Universiti Sains Malaysia) ***Conversion of Oleochemical Industry Waste into Hydrocarbon Fuels by Nickel-Loaded Mesostructured Cellular Form Catalyst***
12.00 – 13.00	**Break**

Day-2: Tuesday, 11 August 2020

	Closing Session
15.45 - 16.00	Best Student Paper Award by Secretariat ICBB 2020
16.00 - 16.15	Closing Remarks by Chairperson Organizing Committee ICBB 2020
16.15 -16.30	Call for ICBB 2021, Secretary ICBB 2020 & Int. Soc. Biomass Bioenergy

Day-1: Monday, 10 August 2020 : Parallel Session

Time	Parallel 1: Biomass utilization and Bio-materials	Parallel 2: Bioenergy and AI/IT technologies in Biomass/Bioenergy/Agriculture	Parallel 3: Bio-chemicals	Parallel 4: Environment, Economic, Policy, Management/Business related to Biomass or Bioenergy
	Paper	**Paper**	**Paper**	**Paper**
	SESSION 1			
	ROOM 1	**ROOM 2**	**ROOM 3**	**ROOM 4**
	Chair : Dwi Setyaningsih	**Chair: Oki Muraza**	**Chair: Obie Farobie**	**Chair: Aris Purwanto**
13.00 - 14.00	*1A-1.4. Physical quality improvement of culled chicken meat with marinated technology using Gelugur acid (Garcinia atroviridis) biomass*	*1B-1.3. Production of Microalgae and Oil Palm Based Biodiesel: A Case Study Implementation of Extended Life Cycle Analysis in Indonesia*	*1C-1.119. Optimization Extraction of Indigofera tinctoria L. by using Ultrasound assisted Extraction*	*1D-1.7. The study on the growth, production and chemical pompound of Chlorella sp in various concentratons of palm oil waste water*
	1A-1.5. The Use of Vermicompost plus as an Organic Pond Fertilizer in a Recirculating Aquaculture System: Effects on Water Quality and Survival Rate of Catfish Fry (Clarias sp.)	*1B.1.8. Optimization of Calophyllum oil extraction and its aplication for biofuel*	*1C-1.9. An experimental biorefinery of Spirulina platensis biopigments using different extraction methods*	*1D-1.10. Damage and loss magnitudes of Eucalyptus sp. and Acacia mangium due to 2D-seismic activity in industrial plantation forest in Jambi, Indonesia*
	1A-1.20. Isotherm Moisture Sorption of Composite Desiccant Made from Rice Husk Biomass	*1B.1.53. Development of a Remote Monitoring and Control System for the Energy Self-Sufficient Bioethanol Distiller*	*1C-1.11. Spectroscopic analysis of photosynthetic pigments from three microalgae species with different solvents*	*1D-1.12. The Design of Palm Fruit Purchasing System from Independent Smallholders to Support the Biodeisel Conversion Program*
14.00 - 14.15				
	Chair: Dwi Setyaningsih	**Chair: Oki Muraza**	**Chair: Obie Farobie**	**Chair: Herdhata Agusta**
14.15 - 15.15	*1A-2.6. Marination technology using Garcinia xanthochymus biomass to improve the*	*1B-2.17. Production of High Octane Gasoline by Catalytic Cracking of Petroleum Gasoil*	*1C-2.15. The ratio of thickener on bio grease with olein epoxide of palm oil as a base*	*1D-2.26. Physical and chemical soil properties in oil palm land which is overgrown with weeds*

Time	Parallel 1: Biomass utilization and Bio-materials	Parallel 2: Bioenergy and AI/IT technologies in Biomass/Bioenergy/Agriculture	Parallel 3: Bio-chemicals	Parallel 4: Environment, Economic, Policy, Management/Business related to Biomass or Bioenergy
	Paper	**Paper**	**Paper**	**Paper**
	physical quality of culled chicken meat	*with Palm's Triglyceride and Oleic Acid*	*oil*	*in different ages*
	1A-2.13. Potential of red fruit oil (Pandanus conoideus Lam.) as an active antioxidant packaging: A review	*1B-2.29. TG-DSC investigation of co-combustion characteristics of blends sawdust and coal*	*1C-2.18. Fish Oil Fractionation of By-Products of Fish Flour Processing Industry using Supercritical CO2 Column*	*1D-2.33. Diversity of Hydrogenase Producing Microbial from Wartawan Beach Hot Spring, Lampung*
	1A-2.28. Improvement of gas membrane type biogas purifier for dairy farming areas in Japan	*1B-2.67. Design and Evaluation of a Zero Fossil Fuel Distiller for Bioethanol*	*1C-2.56. Porous Biochar Purification Method from Coconut Shell by Alkali Roasting Followed by Leaching and Its Application as a Lithium Primary Battery*	*1D-2.44. Sustainability of Biodiesel B30, B40 and B50 in Indonesia*
15.15 - 15.30				
	Chair: Aris Purwanto	**Chair: Kiyoshi Dowaki**	**Chair: Farah Fahma**	**Chair: Herdhata Agusta**
15.30 - 16.30	*1A-3.14. Innovation of Oxygen Indicators for Leakage Packaging Detector: A Review*	*1B-3.31. Using Surface Free Energy Method to evaluate the Isothermic Adsorption of Free Fatty Acid on Low-grade Coal*	*1C-3.21. Synthesis of mono-diacylglycerol from palm fatty acid distillate and glycerol*	*1D-3.45. Clustering Analysis for Production System Design of Emulsifier for Biodiesel B30 based on Digital Business Ecosystem*
	1A-3.27. Applied technology to absorb CO2, haze, dust, tiny particle, Covid-19 and to produce O2, Chlorella powder in order to increase human body immunity from COVID-19 illness	*1B-3.36. Synthesis of Oil Palm Empty Fruit Bunch Derived Magnetic Solid Acid Catalyst for Levulinate Production*	*1.C-3.22. Kinetic and Isotherm Studies of Cu(II) Adsorption by Alginate/Zeolite 4A Beads and Film Composites*	*1D-3.46. Microalgae of Sarawak, the solution from nature for the future*
	1A-3.50. Production of Edible	*1B-3.34. Bioethanol prospect*	*1C-3.24. Extraction of Palm Oil*	*1D-3.60. Value Added Products*

Time	Parallel 1: Biomass utilization and Bio-materials	Parallel 2: Bioenergy and AI/IT technologies in Biomass/Bioenergy/Agriculture	Parallel 3: Bio-chemicals	Parallel 4: Environment, Economic, Policy, Management/Business related to Biomass or Bioenergy
	Paper	**Paper**	**Paper**	**Paper**
	Film Based on Catfish (Clarias batrachus) Protein Source by Enzymatic Cross-Linking Reaction with Transglutaminase EnzymeBased on Catfish (Clarias batrachus) Protein Results of Enzymatic Cross-Linking Transglutaminase	*from agricultural crops and its biomass in Indonesia*	*Cellulose Nanocrystalline through Solid Acid Hydrolysis and Its Application in Carrageenan Biofilm*	*from Urban Organic Wastes: A Whole Systems Perspective*

Day-2: Tuesday 11 August 2020: Parallel Session

Time	Parallel 1: Biomass utilization and Bio-materials	Parallel 2: Bioenergy and AI/IT technologies in Biomass/Bioenergy/Agriculture	Parallel 3: Bio-chemicals	Parallel 4: Environment, Economic, Policy, Management/Business related to Biomass or Bioenergy
	Paper	**Paper**	**Paper**	**Paper**
	SESSION 1			
	ROOM 1	**ROOM 2**	**ROOM 3**	**ROOM 4**
	Chair: Assoc. Prof. Justinus Satrio	**Chair: Haznan Abimanyu**	**Chair: Farah Fahma**	**Chair: Herdhata Agusta**
08.00 - 09.00	*2A-1.37. Effect of indigenous cellulolytic fungi enhancement on organic carbon and soybean production on peat soil*	*2B-1.38. A system analysis of the biomass integrated gasification solid oxide fuel cell*	*2C-1.25. Natural Volatile Organic Compounds from Streptomyces sp. against Oil Palm Pathogen Ganoderma boninense*	*2D-1.65. Techno-economic analysis for furfural production using oil palm empty fruit bunches with various pretreatment substrate*
	2A-1.40. Utilization of Plant Waste as Botanical Pesticide for Citrus Pest Control	*2B-1.41. Green Prosperity: A Natural Solution for Rural Electrification in Indonesia*	*2C-1.30. A transient analysis and LCA analysis of impurity adsorption using Kanuma clay and HAS-Clay in a Bio-H2 production system*	*2D-1.70. Development of Self Sufficient Energy in Tapioca Industry*
	2A-1.54. Natural dyes extracted from longan and inthanin bok leaves as light-harvesting units for dye-sensitized solar cells	*2B-1.57. Biochar production investigation from pyrolysis of lamtoro wood as a coal blends for fuel substitution in steam power plants*	*2C-1.91. Colomn CO_2 Fractionation method from oil fish to omega-3, 6 and 9*	*2D-1.105. Environmental performances on the adsorbents of HAS-Clay, Kanuma-Clay and coffee residue for Bio-H2 purification.*
09.00 - 09.15				
	Chair: Assoc. Prof. Justinus Satrio	**Chair: Obie Farobie**	**Chair: Farah Fahma**	**Chair:Kiyoshi Dowaki**
09.15 - 10.15	*2A-2.47. Utilization of*	*2B-2.120. The characteristics of*	*2C-2.43. Stannous Chloride*	*2D-2.102. Growth performance*

	Cellulose Nanocrystal (CNC) as a filler for chitosan based films for cayenne pepper packaging	*graphene-like materials derived from biomass wastes and its electrical conductivity*	*(SnCl2) and Stannous Sulfate (SnSO4) Synthesis from Tin Powderization Waste*	*of bioenergy plantation in Bukit Soeharto Research Forests, East Kalimantan*
	2A-2.48. Biorefinery of Genetically Modified Soybean as Biodiesel with Sustainable Production System in Indonesia: A Review	*2B-2.49. Fuel Properties of Two Types High Speed Diesel Blending with Palm Oil Biodiesel in Indonesia*	*2C-2.51. The parameters study in essential oil extraction from black pepper seeds using microwave hydrodistillation by modeling*	*2D-2.103. Potency and prospect of various raw materials for bioethanol productionn in Indonesia: A review*
	2A-2.55. Comparison of Pyrogallol Derivative Performance using Methyl Linoleate from Sunflower Oil and Corn Oil as Biodiesel Antioxidant Additives	*2B-2.88. Performance Analysis of Microalgae Cultivation in Photobioreactors with IOTs (Internet of Things)*	*2C-2.52. RNA-seq derived identification of coronatine-regulated genes putatively involved in terpenoid biosynthetic pathway in the rubber tree Hevea brasiliensis*	*2D-2.104. Study on Environmental Impact of Electricity Production from Biomass Power Plant System Through Life Cycle Assessment (LCA) Method in Aceh Province Indonesia*
10.15 - 10.30				
	Chair: Haznan Abimanyu	**Chair: Endang Warsiki**	**Chair: Kiyoshi Dowaki**	**Chair: Oki Muraza**
10.30 - 12.00	*2A-3.59. Oil palm empty fruit bunch ash as a potassium source in the synthesis of npk fertilizer*	*2B-3.79. Synthesis of biodiesel from kesambi oil (Schleichera oleosa L.) using carbon nanotube-supported zinc oxide heterogeneous catalyst*	*2C-3.64. Characterization of pyrolysis products derived from palm oil empty fruit bunches*	*2D-3.80. Impact Of B30, B40 And B50 Policies On The Economy Of Indonesia*
	2A-3.81. Using two dosages of biochar from shorea to improve the growth of Paraserianthes falcataria seedlings	*2B-3.61. Characteristics of biochar produced from the harvesting wastes of meranti (Shorea sp.) and oil palm (Elaeis guineensis) empty fruit bunches*	*2C-3.69. Potential of polypropylene Nanocomposite Reinforced with Cellulose Nanofiber from Oil Palm Empty Fruit Bunch as Sustainable Industrial Packaging: A Review*	*2D-3.93. Genetic Diversity Assessment of Indonesian Sorghum Germplasm Based on Agro-morphological Traits*
	2A-3.82. Investigation of Rotary Dryer Performance Fueled by Wood Pellets for Biomass Processing	*2B-3.66. Potential evaluation of anaerobic mono-digestion on dry water primrose for biogas production*	*2C-3.97. Performance evaluation of the levulinic acid production using calendula (Calendula Officinalis) as*	*2D-3.72. Economic Technology Analysis of Furfural Purification Process From Hydrothermal Hydraulic Products from Empty*

			potential feedstock.	*Palm Flow Distilation and Extraction Methods*
	*2A-3.*58. Solid Alcohol Formulation as a Lighters in Bio-Briquettes of Agricultural Biomass	*2B-3.*112. Development of Smart Algae Pond System for Microalgae Biomass Production	*2C-3.*121. AC-Fe Catalyst Modification on SS Cathode Affects Hydrogen Production in Microbial Electrolysis Cell	*2D-3.*115. The Role of Planting Media in the Growth of Antigonon leptopus as beneficial plant on Oil Palm Plantation
12.00 - 13.00				
	Chair: Dwi Setyaningsih	**Chair: Endang Warsiki**	**Chair: Yukihiro Matsumura**	**Chair: Ahmad Zuhairi Abdullah (Parallel 3: Bio-chemicals)**
13.00 - 14.00	*2A-4.100. Characterization of physiological properties of bacteria isolates TM4 and BNT8 in biopesticide formulas*	*2B-4.95. Performance and emission effects of b30 usage in PLTD and PLTMG*	*2C-4.42. Synthesis of Pyrogallol Derivative as Antioxidant Additive for Biodiesel Using Methyl Linoleate from Sunflower Oil*	*2D-4.116. Catalytic Reactions of 5-Hydroxy Methylfurfural in Zeolite*
	2A-4.106. Washing Metals in Rice Straw to Improve Combustion Properties	*2B-4.101. An effect of Distilled Palm Methyl Esther as a blend fuel on precipitation and vehicle performance*	*2C-4.84. Study on utilization of essential oil as an additive for Pure Plant Oil (PPO) in single cylinder diesel engine*	*2D-4.117. Magnetic Properties of Silicon Dioxide from Rice Straw*
	2A-4.99. Biodegradable foams based on extracted fractions from sorghum by-products	*2B-4.118. Potential of Renewable Energy from Animal Waste and Napier Grass*	*2C-4.86. Optimizing chemical and physical pretreatment conditions to enhance sugar recovery from tobacco stalks biomass for bioethanol production*	*2D-4.71. Release property of red ginger essential oil in silica-cellulose nanocomposite based sachet*
14.00 - 14.15				
	Parallel 3: Bio-chemicals			
	Chair: Endang Warsiki	**Chair: Haznan Abimanyu**	**Chair: Yukihiro Matsumura**	**Chair: Aris Purwanto**
14.15 - 15.15	*2A-5.110. Application of mag (monoacyl glycerol) as emulsifier with red palm oil in body cream product*	*2B-5.96. Technical assessment of the xylitol production process using thyme (Thymus vulgaris) as raw material.*	*2C-5.87. Catalytic Co-pyrolysis of Crude Palm Oil and Polypropylene in a Stirred Tank Reactor to Produce Non-*	*2D-5.73. Physical pretreatment and algal enzymes hydrolysis of dried low-grade and waste longan fruits to enhance its*

			Oxygenated Bio-oil	*fermentable sugar production*
	2A-5.111. Evaluation of M-DAG purification process in increasing m-dag yield value	*2B-5.107. Effect of Pyrolysis Operating Conditions on The Biomass Shrinkage Process of Leaf Waste and the formation of Oxygenate and Non-Oxygenate compound Products in Bio-Oil Using ZSM-5 and YSZ Catalysts*	*2C-5.89. Characteristic of Bio-Briquettes from Kemiri Sunan (Reutealis trisperma) shell at several adhesive ratios*	*2D-5.74. Design and cost estimation of a process on levulinic acid production from glucose in choline chloride aqueous solution*
	2A-5.114. Formulation of mono-diacylglyserol from palm fatty acid distillate and glycerol as antistatic agents on plastics	*2B-5.109. The Characterization of Hydrocarbon Compounds in Bio-Oil produced by Pyrolysis of Biomass from the Essential Oil Distilled Residue Using ZSM-5 and YSZ Catalysts.*	*2C-5.90. Formula Optimization of Foaming Agent Using Mixture D-Optimal Method and Application in Peat Fire Suppression*	*2D-5.78. Torrefaction to Improve Biomass Pellet Made of Oil Palm Empty Fruit Bunch*
15.15 - 15.45	**Break - Closing preparation**			

Abstract of Papers

[1A-1.4] Physical quality improvement of culled chicken meat with marinated technology using Gelugur acid (Garcinia atroviridis) biomass

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Abstract. Chicken meat is perishable food, so it is very susceptible to damage. Culled chicken meat have a tough texture, so they are less liked by consumers. Improving the quality of meat is needed to overcome the problem, one of which uses inexpensive and abundant spices, namely Gelugur acid (Garcinia atroviridis). This study aimed to determine the gelugur acid marination formulation, which was effective to improve the physical quality of culled chicken meat. This study used a completely randomized design with 4 treatments and 3 replications. The treatments consisted of P0: without marination using gelugur acid, marinating in 50 grams of gelugur acid + 1000 mL distilled water (P1); 750 mL distilled water (P2) and 500 mL distilled water (P3). It was concluded that the level of marinating using gelugur acid to the physical quality of culled chicken meat had a very significant effect ($P<0.01$) on the physical quality of chicken meat, namely the pH value, cooking loss and tenderness. However, there was no significant effect ($P>0.05$) on drip loss and colour of meat. Marinated chicken meat using 50 grams of gelugur acid and 1000 mL distilled water (P1) was an effective level to improve the physical quality of culled chicken meat.

[1A-1.5] Use of vermicompost as organic pond fertilizer in recirculating aquaculture system: effect on water quality and survival rate of catfish fry (Clarias sp.)

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Abstract. The main objective in this study was to determine whether vermicompost can be used as an organic pond fertilizer to improve water quality and survival rate of catfish fry (Clarias sp.). Vermicompost is an organic fertilizer produced from the degradation of organic waste with the help of earthworms, containing macro and micro nutrients, vitamins, enzymes, antibiotics, hormones, microorganisms, humic acid and minerals. Vermicompost is broken down by bacteria into organic materials to stimulate the growth of phytoplankton and zooplankton populations so as to increase the availability of natural foods that contain natural proteins. The feasibility of vermicompost affected water quality and fish growth which was conducted in a lab scale in a static aquaculture tank and also in scale up (1:10) recirculating aquaculture system (RAS) using catfish fry (Clarias sp.). The water quality of Clarias gariepinus culture in both systems complied with the requirements for the freshwater aquaculture. Vermicompost has potential to be used as a fish pond fertilizer. From the results, vermicompost gave the higher fish growth and fish survival compared to the control. In conclusion, vermicompost as a pH corrector maintained the water quality at standard acceptable level for fish culture and increased the fish growth.

Keywords: vermicompost, pond fertilizer, water quality, catfish fry

[1A-1.20] Isotherm moisture sorption of composite desiccant made from rice husk biomass

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Abstract. The behavior of isotherm moisture sorption form rice husk-CaCl2 composite desiccants was studied in this paper. The desiccant composites in various treatments was tested its isotherm sorption using gravimetric method. Saturated solution of LiCl, CH3COOK, MgCl, K2CO3, NaBr, NaNO2, NaCl, KCl, and K2SO4 were used to condition the moisture of 11%, 22%, 32%, 44%, 56%, 64%, 75%, 84% and 97%. Water activity produced from these saturated salt solutions was measured using aw meters. The equilibrium moisture data was then fitted into several isothermal equation models that have been used and tested in several literatures. This rice husk composite desiccant have exposed a type III of isothermic sorption curve with a boundary zone in the range of aw 0.24 with B limit was aw 0.64. Based on the isothermic absorption curve, the Oswin equation model was able to predict the results of research with the smallest RMSE values, ranging between 0.09-0.107. This rice hush desiccant was able to absorb water vapor at low RH, with composite desiccant water content of 1.69% bk. It means that this desiccant is promising to be used for low water content or hygroscopic product of such as flour based product, food flavor powder, chili powder, palm sugar and etcetera.

Keywords: Rice husk, desiccant composite, CaCl2, isotherm moisture sorption

[1A-2.6] Marination technology using Garcinia xanthochymus biomass to improve the physical quality of culled chicken meat

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Abstract. Kandis acid (Garcinia xanthochymus) is a fruit usually dried with a sour taste and used as a spice in Indonesian cuisine. Aside from being flavoring and enhancer of flavor images in dishes, Kandis acid is also thought to be able to preserve fish. This study aimed to test the effectiveness of Kandis acid in improving the quality of culled chicken meat. This study used a complete randomized design with 4 treatments and 4 replications. The treatment was marination of culled chicken meat in Kandis acid solution consisting of 4 different concentrations, namely 0% or without Kandis acid as a control (P0), 50 grams Kandis acid + 500 mL distilled water (P1), 50 grams Kandis acid + 750 mL distilled water (P2), and 50 grams Kandis acid + 1000 mL distilled water (P3). The results obtained revealed that the physical quality of the culled chicken meat was affected by the acid kandis marination especially in the pH variable, which was relatively similar in the drip loss, cooking loss and tenderness variables. It is recommended that marination using Kandis acid with a concentration of 50 grams in 750 mL distilled water can effectively maintain the quality of culled chicken meat.

[1A-2.13] Potential of red fruit oil (Pandanus conoideus Lam.) as an active antioxidant packaging: A review

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Abstract. The active packaging system is a food packaging system that is continuously developing to produce safe, healthy and quality food products to consumers. The addition of antioxidants in packaging is one of the innovations in active packaging technology. Active packaging that contains synthetic antioxidants has now been avoiding as natural antioxidan from natural products produces has been already a growing trend to replace synthetic substances. The use of red fruit oil on the packaging is expected to act as a natural antioxidant. Red fruit (Pandanus conoideus Lam.) is a plant that is often found in Papua. By local people, red fruit oil is usually used as medicine. The main compounds of red fruit oil are β-carotene and tocopherol which have potential as natural antioxidants. Red fruit extract does not contain heavy metals and harmful microorganisms, so it is safe when applied to food products. Besides being easily found in Indonesia, red fruit oil also has a more economic value compared to the use of antioxidants from other essential oils such as rosemary oil, sunflower oil, and cinnamon oil. This paper will discuss about the potential of the red fruit oil to be used for active packaging to protect and prolong the shelf life of the food product.

Keywords: Red fruit (Pandanus conoideus Lam.), antioxidant active packaging, food packaging

[1A-2.28] Improvement of a Membrane-separation-type Biogas Refining-compression-filling (RCF) Facility for Dairy-farming Areas in Japan

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Abstract. A method of directly using biogas as gas energy source was investigated. Utilizing that method, a prototype "refining-compression-filling (RCF) facility" for biogas, which uses membrane separation, was developed. The facility forms the core of a system for supplying dairy farms and facilities in the suburbs by filling gas cylinders with biogas reformed to high calorific value. However, the recovery rate of methane from biogas achieved by this prototype is about 80%. From the viewpoint of mass production of equipment, the officials and manufacturers of the municipalities that introduced the facility have therefore requested for further improvement in methane-purification efficiency of the RCF facility. Accordingly, the purpose of this study was to clarify the optimal arrangement of the membrane module unit for improving the methane-purification efficiency of the biogas-dedicated purification RCF facility. According to the results of this study, a combination of three membrane modules arranged in series (called "three-stage-module in-series type") was found to effectively increase methane concentration to about 99%. Moreover, to further increase methane-recovery rate, a module configuration that combines the series and parallel arrangements of modules ("three-stage-module composite type") was found to effectively increase methane recovery rate increased to approximately 95%.

[1A-3.16] Innovation of Oxygen Indicators for Leakage Packaging Detector: A Review

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Abstract. Oxygen is one of the factors that cause damage to food products and modified atmosphere packaging (MAP) becomes an effective solution offered. However, there is always a risk of leakage on the packaging which are the packaging process, distribution process and damage due to insects or rodents. Therefore, oxygen indicators are made that can facilitate retailers and consumers to find out leaks and prevent to buy a leaky product. The principle works is by showing the color changes that reflect the gas composition changes. The use of oxygen indicators is not only beneficial for the consumers but also the producers of packaged products that use oxygen indicators to interact loyal consumers and increasing the level of consumer trust in their products. Furthermore, advances in technology encourage researchers to improve some important aspects of oxygen indicators such as safety application for food products, reducing the production costs, easy to manufacture and environmentally friendly. This article reviews the development of oxygen indicators, the advantages and disadvantages of each type of oxygen indicators and provides guidance for researchers and the MAP industry which encourage oxygen indicators to be developed in the future.

Keywords: oxygen indicator, smart packaging, modified atmosphere packaging.

[1A-3.27] Applied technology to absorb CO2, haze, dust, tiny particle, Covid-19 and to produce O2, Chlorella powder in order to increase human body immunity from COVID-19 illness

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Abstract. The COVID-19 was first confirmed in Indonesia on 2 March 2020, when a dance instructor and her mother were infection from a Japanese national. The pandemic has spread to 34 provinces in country with Jakarta, West Java, and East Java being the worst-hit. So far, Indonesia has 13.112 cases, the second highest in Southeast Asia behind Singapore. In terms of death numbers, Indonesia fifth in Asia with 943 deaths. It ts fatality rate is also one of highest in the world at around 7 %. So it is very important to increase human body immunity by absorb CO2, haze, dust, tiny particle, covid-19 and to produce O2 surrounding area and Chlorella Powder as supplement food to prevent fatality of human being by Covid-19 illness.
Dahril Bottle is a place to culture micro algae Chlorella sp in closed room in order to absorb CO2, haze, dust, tiny particle, covid-19 and to produce O2 in surrounding area and Chlorella Powder that can be used as supplement food to increase immunity of human body from Covid-19 illness.
Based on the result of this study indicated that Chlorella with Chlorophil-a in side can grow well in Dahril Bottle to absorb CO2 and to produce O2, with chemical reaction as follow,6 CO2 + 6 H2O -> C6H12O6 + 6 O2. The high concentration of cells density was found 1.2 x 10'7 cell/ml. Chlorophil-a concentration of 184.09 ug/l, Chlorella powder 1.25 g/l and CO2 decreased from 18.36 mg/l to 1.24 mg/l or 93.34, O2 increased from from 3.76 mg/l to 6.21 mg/l or 65.15 %. The chemical compound of Chlorella powder were also high with protein level of 45.09 %, lipid 10.85 % and carbohydrate 12.77 %. They also contained vitamin E, mineral, beta carotene and anti oxidant. Chlorella powder that found in this study could be used as supplement food to increase immunity of human body to prevent Covid-19 illness. (see: https://youtu.be/79_Hq_UOGBE and https://yoytu.be/GGDGylotpHg.)

Key word: Dahril Bottle, CO_2, O_2, Chlorella powder, Covid-19 illness.

[1A-3.50] Production of Edible Film Based on Catfish (Clarias batrachus) Protein Results of Enzymatic Cross-Linking Transglutaminase

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Abstract: The existence of many kinds of plastics are useful for various kinds of packaging purposes in our whole activities. However, it takes around 500 years to decompose because these plastics are made from petroleum, thus the production of plastic is high dependency on oil stock. Due to this problem, edible film can be an alternative packaging because it is more biodegradable. Protein is the most potential biopolymer to be an edible film, but still needs an improvement. Enzymatic crosslinking reaction can be selected as a good method to improve mechanical properties of protein-based edible film. In this study, catfish meat (Clarias batrachus) was used as protein source to produce an edible film through enzymatic crosslinking reaction with Transglutaminase enzyme (TG-ase). The results of protein-based edible film showed the improvement in thickness where TG-05 is the thickest film. The solubility decreases from 42.86 % to 20 %. Tensile Strength (TS) and Elongation at Break (EAB) results have range value from 1.630 ± 0,19-10.032 ± 1,316 MPa and 10.733 ± 0.6798-31.9 ± 6.531 %, respectively. FTIR analysis showed the change in Amide II. Biodegradable test showed that edible film could degrade in 6 days.

[1B-1.3] Production of Microalgae and Oil Palm Based Biodiesel: A Case Study Implementation of Extended Life Cycle Analysis in Indonesia

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Abstract. This paper will introduce a research regarding microalgae biomass as an environmentally and sustainably alternative biodiesel raw material. The purpose of the research is to compare all production cost variables between microalgae and oil palm biodiesel using production process cycle analysis system of extended life cycle analysis (extended LCA). The use of extended LCA system could possibly accommodate all environmental commodity variables on biodiesel production so that the potensial microalgae biomass which is a renewable, low land use and environmentally sustainable product could be promoted. Values of environmental commodity variables are estimated by employing a willingness to pay (WTP) approach that is referred to the calculation of Environmental Priority Strategy (EPS) Software. The research shows that there is an increase of biodiesel production cost of microalgae and oil palm after the inclusion of their externality variables cost. The biggest biodiesel production cost comes from the stage of fresh fruit bunch biomass production of palm that reaches 49% - 64% of the total cost. Extended LCA analysis concludes that the increase of microalgae and palm biodiesel production cost is about 3% and 18%; respectively. From profitability analysis indicates that biomass input for the production of biodiesel from microalgae is more environmentally sustainable than from oil palm because both technical and non-technical constraints during microalgae biomass production are easier to be taken care. In addition, it is predicted that microalgae will have a significant contribution in the green house gases (GHGs) mitigation by replacing fossil fuel in the future through its role as a biodiesel.

Keywords: microalgae, palm oil, biodiesel, environmental commodity, extended life cycle analysis (extended LCA)

[1B-1.8] Optimization of Calophyllum oil extraction and its aplication for biofuel

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Abstract. The utilization of a binary solvent, i.e. n-hexane-methanol mixture, for Calophyllum oil extraction and resin separation in a direct stage was optimized in this research. Optimum oil yield and separated resin percentage were determined using response surface method with optimizing of extraction time and stirring speed. Biofuel production was conducted using thermal cracking at 475-575ºC of oil obtained from optimum extraction conditions. The oil yield was optimized to suit using second order polynomial. Extraction time affected oil yield more significantly than stirring speed. Oil yield improved when extraction time and stirring speed augmented, and the optimum oil yield (65.2%) was predited to be reached at 5.2 h and 405 rpm. Beside, the separated resin percentage was predicted to be constant (19.4%) with increasing extraction time and stirring speed so there was no optimum separated resin percentage. The oil obtained from optimum extraction conditions showed good quality at 0.862 g/cm3 of density, 27.5 mPa.s of viscosity (40ºC), 56.0 mg KOH/g of acid value, 88.8 g/100 g of iodine value, 229.9 mg KOH/g of saponification value, trace water and sedimet content, and zero ash content. The thermal cracking of oil produced 5-79wt.% liquid product (biofuel). Biofuel yield improved as temperature increased from 475 to 575ºC, and so highest biofuel yield (79 wt.%) was obtained at 575ºC. The GC-MS analysis result of liquid product showed that the biofuel was composed of 32.2 wt.% gasoline fraction (C5-C12), 36.8 wt.% diesel fuel fraction (C16-C19), and 9.4 wt.% non-hydrocarbon fraction.

Keywords: Biogasoline, *Calophyllum* seeds, Oil extraction, Optimization, Thermal cracking

[1B-1.53] Development of a Remote Monitoring and Control System for the Energy Self-Sufficient Bioethanol Distiller

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Abstract. Mariano Marcos State University (MMSU) started the Bioethanol industry way back in 2008 and produced the first fuel-grade Hydrous Ethanol (95%) in the Philippines in 2012. Developments went on until the team developed Village-scale fuelwood fired 150L and 850L capacity Multi-Feedstock Bioethanol Distiller. Recently, the Village-Scale Bioethanol Industry established in Pamplona, Cagayan, produced more than 4000L of 95% Ethanol from Nipa Sap last year. The output of the team was remarkable. Challenges encountered in monitoring operation protocols resulted in low efficiency, mainly so that the distillers are situated about 4hrs away from the University. With a meager ethanol yield of 5-6 percent during the production last year, the team was challenged to develop a Remote Monitoring and Control System for the Distillers deployed in Cagayan. This study aims to automate the Bioethanol distiller to increase the ethanol yield. Implementing IoT via web application for real-time monitoring and control and integrating Photovoltaic cells for an energy self-sufficient Bioethanol Distiller. Results showed that it is functional and effective in controlling the kettle temperature, water pump, and the energy usage of the Bioethanol distiller wirelessly and remotely through the MMSU i4.0 platform. It was observed that the ethanol yield is up to 8.39%. Furthermore, a better quality of the front and tail ethanol yield was achieved by implementing PID control.

Keywords: IoT, Bioethanol Distiller, MMSU i4.0 platform, web application

[1B-2.17] Production of High Octane Gasoline by Catalytic Cracking of Petroleum Gasoil with Palm's Triglyceride and Oleic Acid

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Abstract. Gasoline is primary liquid fuel needed for internal combustion of spark-ignition engines. The necessary of gasoline fuel in Indonesia currently has exceeded the existing production unit capacity. Most of gasoline coming from petroleum industry was produced by fluid catalytic cracking process that utilized heavy oil fractions like vacuum gasoil and residue using zeolitic catalysts.
Alongside product yield, the quality of gasoline especially octane number is an important factor to determine and control the ignition quality and resistance of fuel to knock. Some typical methods to upgrade gasoline yield and quality included proper catalyst selection and process optimization. This research work was aimed to verify a new pathway of catalytic cracking process for improving gasoline octane quality by means of feedstock modification using vacuum gasoil added with palm's triglyceride and oleic acid.
The cracking reaction was performed in fluid-bed reactor of ACE unit using REY zeolite catalysts at temperature of 530oC and catalyst-oil ratio of 5.5 g/g. The gasoline yield was separated from liquid fraction using simulated distillation of gas chromatography and analyzed further by gas chromatogragh of detailed hydrocarbon to obtain hydrocarbon group composition and calculated research octane number.
From the research, it was found that feed combination from vacuum gasoil added with 5% of refined bleached deodorized palm oil and oleic acid (9:1) was able to boost the octane number of gasoline from 91.8 to 98.2. The enhancement of gasoline octane quality was contributed mainly from increase of iso-paraffins, olefins and aromatics formed during cracking reaction of longer molecules of hydrocarbon oils containing triglycerides and double-bond of fatty acids supported by acid nature of catalyst. The least feed line addition in the catalytic cracking process diagram was proposed as an alternative method to upgrade gasoline quality.

Keywords: Fluid catalytic cracking, vacuum gasoil, gasoline octane, palm triglyceride, oleic acid

[1B-2.29] TG-DSC investigation of co-combustion characteristics of blends sawdust and coal

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Abstract. Co-combustion of biomass and coal in coal fired power plant could reduce CO2 emissions and utilize renewable energy resources. To understand the co-combustion characteristics of biomass and coal blends, thermogravimetry-differential scanning calorimetry (TG-DSC) analysis as well as proximate, ultimate and heating value have been conducted. TG-DSC measures both weight changes (TG) and heat flow (DSC) in a material as a function of temperature or time in a controlled atmosphere. The combustion profiles can be used to study a certain combustion properties of fuels and fuel blends. The biomass that used in this study was sawdust in its origin and torrefied sawdust which blend with a low rank coal. The composition of the biomasses and coal is 1:3; 1:1 and 3:1 in weight ratio. Results indicate that the blend of coal and torrefied sawdust in weight ratio of 1:3 shows the best combustion performance compared to the other composition, indicated by the highest of ignition temperature (Tig), maximum combustion rate (Rmax) and heating value.

[1B-2.67] Design and Evaluation of a Zero Fossil Fuel Distiller for Bioethanol

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Abstract. The study developed a Zero Fossil Fuel Distiller (ZFFD) to address environmental issues on the production of bioethanol from Nipa Sap. The Mariano Marcos State University had developed a bioethanol distiller which can produce 95% fuel grade bioethanol powered by fuelwood for Village-Scale Bioethanol Industry. While burning woods provides good source of heat most especially for industry village-scale level productions the byproducts of this activity- ash, smoke and soot, are not good for the environment. The scarcity of fuelwood will also be a problem in the future due to its large demand hence, this study. The study aims to develop an Energy Self-sufficient distillation facility to come up a ZFFD and incorporate the Internet of Things (IoT) technologies for improved performance and real time monitoring. A 10kWp Hybrid Solar Photovoltaic System with battery backup was designed to power a 150L capacity Bioethanol Distiller. The power system is capable of storing excess harnessed energy to a battery and a grid for future use, as well as managing and monitoring the inflow and outflow of electricity on site or remotely via IoT. Results show an average harnessed energy of 47.11kWh to supply a 33.99kWh required energy to distill 133L of feedstock daily. The excess energy of 13.12kWh is stored to the grid for future use. The developed ZFFD shows an improved performance of Kettle temperature, Column temperature and Cooling System water flow regulation, resulting to a 8.90% v/v ethanol yield.

Keywords: ZFFD, Solar Energy, Bioethanol Distiller, IoT

[1B-3.31] Using Surface Free Energy Method to evaluate the Isothermic Adsorption of Free Fatty Acid on Low-grade Coal

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Abstract. Surface free energy analysis on low-grade coal has been done. This research shows the interaction between oil and coal which improve the quality of low-grade coal by coating process. Sample coal has a total surface free energy of 22.3 mJ/m2 with 17.51 % polar ratio. The interfacial energy between coal and free fatty acid (FFA) is 9.1 mJ/m2 with adhesive energy by 53.4 mJ/m2 under van der Waals effects.

[1B-3.36] Synthesis of Oil Palm Empty Fruit Bunch Derived Magnetic Solid Acid Catalyst for Levulinate Production

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Abstract. Ethyl levulinate is widely known as a fuel additive, flavour, and fragrance components. In this study, the biomass-derived magnetic catalyst was synthesised, and its efficiency was evaluated in the esterification reaction. Oil palm empty fruit bunch (EFB) was used in the preparation of the solid magnetic catalyst. The synthesised catalyst was analysed by scanning electron microscope (SEM), electron dispersive X-ray spectroscopy (EDX), vibrating sample magnetometer (VSM) analyses, and acidic test. The magnetisation value of 24.97 emu/g for EFB fiber-MAC was reported that the catalyst has excellent magnetic properties and a strong acid density of 2.4 mmol/g. The catalytic performance was evaluated via the esterification of levulinic acid. The highest ethyl levulinate conversion of 66.78 mol% and yield of 84.87 mol% were recorded corresponding to 10 wt% catalyst loading and 10:1 ethanol to levulinic acid molar ratio with reaction temperature of 70oC for 5 hours. FTIR and GC-FID analysis confirmed the appearance of the ester group after the esterification reaction. Finally, the magnetically separable catalyst can be easily separated, and it shows a potential solution to the utilisation of heterogeneous catalysts in the esterification reaction.

Keywords: Levulinate; esterification; oil palm empty fruit bunch; magnetic; catalyst

[1B-3.34] Bioethanol prospect from agricultural crops and its biomass in Indonesia

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Abstract. Contradiction between the surplus domestic bioethanol supply and the failure to fulfill the bioethanol E2 biofuel program in 2020 because the fuel grade ethanol price is still more expensive than gasoline. Indonesia's fuel consumption needs, especially gasoline increased from 37.49 million kL in 2020 to 43.59 million kL in 2025. There is still a deficit that is met with gasoline imports. Although bioethanol production is still in surplus, the remainder is exported, still unable to supply the E2 bioethanol program and the import of non-fuel-grade ethanol is carried out. The abundance of mollase is not only the main raw material for bioethanol, but it is in competition with other industries such as MSG, and the decline in sugar cane land will reduce the availability of mollase in the future. In 2015, world bioethanol produce 1,390 million liter from 2G bioethanol, still in TRL4~TRL8 status, yet to commercial. To maintain ethanol supply security, biomass potential and waste-crops, there are quite a lot available, scoring elections that are not in contact with food needs, technological aspects, productivity, availability, and other aspects, biomass commodities need to continue to be developed with more intensive collaboration between institutions (academic, government, private). This study assesses the greatest potential of non-food biomass, including 2nd-generation bioethanol (giant king grass, corn pulp, palm oil tank, sugarcane bagasse, milk waste and its derivatives), 3rdGeneration (algae), and the biggest challenge now is in the readiness and maturity of the technology and its economic feasibility.

Keywords: Bioethanol, biomass, technology, economy

[1C-1.119] Optimization Extraction of Indigofera tinctoria L. by using Ultrasound assisted Extraction

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Abstract. Indigosol is commonly used as a synthetic dye to generate blue color. However, synthetic dyes are detrimental health and environment because the contain heavy metals. Nila plant (Indigofera tinctoria L.) contains indicant glucoside which produces indoxyl exotic blue gold color and known as indigo. Indigo produce the dull-colored, when applied to cotton material. This study aims to get the optimize extraction method and standard dyeing of nila as cotton material matural dye, in order to generate sharper blue color. This study aims to investigate indigo extraction by using ultrasound assisted extraction method, rasio of CaO to feed (1:10), rasio of feed to solvent (1:50 – 1:10), temperature extraction (50 – 60oC), and extraction time (50 – 90 minutes). The experiment was carried out in atmospheric pressure with the following operating variables: rasio of CaO to feed, rasio of feed to solvent, temperature extraction and extraction time, respectively. Prior to running the experiment, the response surface methodology using Box-Behnken Design exhibit a high degree of confirmation with the actual yield from experiment, suggesting that the optimization methodology carried out has made the experiment more effective and effisient by focusing only on certain specific parameters in order to get the best results, in terms of both quality and quantity.

Keywords: Box-Behnken Design, Indigofera tinctorial L., Ultrasound assisted extraction, Indigo

[1C-1.9] An experimental biorefinery of Spirulina platensis biopigments using different extraction methods

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Abstract. The use of microalga Spirulina plantesis is developing rapidly in the industrial world. Spirulina plantesis biomass is widely used in the pharmaceutical and cosmeceutical industry because it is rich in biochemicals and antioxidants that are beneficial to the human body. Biopigment of Spirulina plantesis is one of the promising secondary metabolites that is widely utilized. Spirulina plantesis contains chlorophyll, carotenoids and phycocyanin biopigments that act as light harvesting pigments and antioxidants which prevent free radicals. This study aimed to examine an experimental biorefinery and simultaneous extraction of the three biopigments of Spirulina plantesis to maximize the biomass utilization. The chlorophyll content was ppm extracted using soxhlet extraction and ppm using maceration methods. Total carotenoids content was pmm extracted using soxhlet extraction and ppm using maceration methods. Phycocyanin content extracted using modified freeze thawing was ppm. Simultaneous extraction of chlorophyll and crude carotenoids was successfully applied in this study, while the addition of phycocyanin extraction should be further developed.

Keywords: Spirulina platensis, biopigments, biorefinery

[1C-1.11] Spectroscopic analysis of photosynthetic pigments from three microalgae species with different solvents

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Abstract. This study is intended to investigate the comparison of photosynthetic pigment content in the extracts of microalgae Nannochloropsis, Chlorella and Spirulina with different solvents. Pigment calculations were performed spectrophotometrically with Linchenter and Porra equations. Pigment withdrawal is done by solid-liquid extraction with methanol, acetone and ethanol as solvents. The results showed that the results of the study showed that there was an influence of the formation of the solvent on the concentration of photosynthetic pigments produced. In Nannochloropsis sp. the highest pigment concentration was obtained by extraction with methanol as solvent where chlorophyll a was obtained at 5.64 + 0.4 ug / gfw; chlorophyll b 2.54 + 0.32 ug / gfw and carotenoid 9.31 + 0.25 ug / gfw. Whereas in Spirullina sp. The highest concentration of chlorophyll a and b pigments obtained by extraction with methanol and chlorophyll a solvent was 31.26 + 1.35 and chlorophyll b 13.23 + 1.60 while the highest carotenoid concentration was obtained with ethanol solvent which was 4.06 + 29 ug / gfw. In Chlorella sp. the concentration of chlorophyll pigment obtained in the extraction with ethanol solvent which obtained chlorophyll a was 14.31 + 0.88 ug / gfw; chlorophyll b 7.09 + 0.26 ug / gfw and carotenoid 1.08 + 0.13 ug / gfw.

Keywords: Photosynthetic pigments, Nannochloropsis, Chlorella, Spirullina, solvents

[1C-2.15] The ratio of thickener on bio grease with olein epoxide of palm oil as a base oil

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Abstract. Bio grease or also known as gemuk is one type of semi-solid or thick liquid lubricant made from a mixture of base oil and thickener. It is used to reduce friction, minimize heat, and protect engine components from wear. This research aims to obtain bio grease with the most optimal thickener ratio composition and to test the resulting bio grease. Epoxidized RBDPO in a ratio of olein:acetic acid:H2O2 of 1:4:9 is used as base oil, while the thickener chosen for making bio grease is a complex type of calcium thickener of a mixture of main soap and complexing soap with a ratio of 1:3, 1:5, and 1:7. The main soap used is stearic acid with Ca (OH)2 while the complexing soap used is acetic acid with Ca (OH)2. The making of bio grease is performed in a series of a three-neck flask that is heated and stirred. After the process is complete, the mixture is blended using a mixer until it is homogeneous. Tests carried out for olein epoxide before being used as a base oil are iodine and oxygen number tests. The result of the iodine number of olein epoxide was 33.096 and the oxidant number was 0.994. Based on the test carried out previously on bio grease with a ratio of 1: 5, the best results are 232oC dropping points with a composition of 83% w/w base oil and 17% w/w thickener with NLGI 2.

Keywords: bio grease, RBDPO, olein epoxide, complex calcium soap

[1C-2.18] Fish Oil Fractionation of By-Products of Fish Flour Processing Industry using Supercritical CO2 Column

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Abstract. Fish oil is a by-product of fish flour production which can be a potential substance through further processing. Fish oil from the processing of fish meal contains a lot of omega-3 fatty acids, especially EPA (Eicosapentaenoic acid) and DHA (Docosahexaenoic acid). Before it is ready to be consumed, several purification processes are needed to remove undesirable components and stabilize the characteristic of oil. This study aims to determine the optimum condition of fish oil fractionation using the supercritical CO2 column. Purification is carried out by synthesis of triglyceride in fish oil in to methyl esters through transesterification reaction using 15-20% methanol as reactants. 1% KOH catalyst is added to obtain optimum results. The transesterification process is carried out for 1 hour at 60 ℃ with stirring. The process results in the formation of two layers which are methyl ester in the upper layer and glycerol in the lower layer.

The high amount of unsaturated fatty acids is the main cause of the level of damage to fish oil. Isolation to obtain omega-3 fatty acids for quality improvement can be done through supercritical CO2 extraction technology. In this study, fish is extracted under varying conditions of pressure, temperature, and extraction time. The extract obtained will be analyzed using a UV-Vis spectrophotometer. The effects of separation parameters, such as temperature, pressure, CO2 flow rate, and particle size on the process rate of the oil extraction rate were observed. Based on the previous study, supercritical CO2 extraction will obtain the highest yield at 318 K temperature and 15MPa pressure.

Keywords: Extractions, Carbon Dioxide, Fish Oil, Omega-3 6 9 Fatty Acids, Supercritical

[1C-2.56] Porous Biochar Purification Method from Coconut Shell by Alkali Roasting Followed by Leaching and Its Application as a Lithium Primary Battery

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Abstract. Electrochemical performance of coconut shells biochar can be improved as a Lithium primary battery by increasing its purity. Biochar was synthesized by pyrolysis under N2 atmospheric conditions at a temperature of 500oC for 5 hours. Using methods to purify biochar was the alkaline roasting method to reduce silica content and the leaching method at room temperature using 10% w/w H2SO4 to reduce metal oxide content. The used alkaline substance was 45% NaOH under process temperature which varied between 200-350oC. Energy dispersive X-ray results show that the purity of it increased from 90.18% w/w to 97.41% w/w at alkaline roasting temperature of 300oC. The surface area of it is also increased from 782,112 m2 /gram to 1218,646 m2 /gram at the same temperature. Electro Impedance Spectroscopy test shows charge transfer and semiinfinite diffusion which can be explained by the diffusion of Li+ ions from LiClO4 solution to purified biochar at the cathode. Charge transfer resistance value in purified biochar is less than biochar that has not been purified. Discharge performance test shows that the capacity of lithium primary batteries increases along with the increase of biochar purity. The highest capacity of biochar is 126.21 mAh/gram at 300oC.

[1C-3.21] Synthesis of mono-diacylglycerol from palm fatty acid distillate and glycerol

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Abstract. MDAG (mono-diacylglycerol) is nonionic surfactant which has biodegradable properties and non irritant. Palm fatty acid distillate (PFAD), a byproduct of palm oil refinery, is a potential raw material for MDAG synthesis. This study aimed to determine the best temperature and reaction time for the synthesis of MDAG and characterize the crude and purified MDAG. MDAG was produced through chemical synthesis by reacting PFAD and glycerol through an esterification process at molar ratio PFAD to glycerol of 1:6 and 2:1, and para-toluenesulfonic acid (pTSA) as catalyst. Synthesis was carried out under various conditions of temperature (100 °C, 120 °C, and 150 °C) and reaction time (90 minutes and 120 minutes). The best conditions of synthesis reaction at molar ratio of 1:6 were at temperature of 150 °C, and 90 minutes reaction time. The yield of MDAG was 14.33%, pH value of 5, hydroxyl value 344.01 mg KOH/g and consist of 93.29% MAG, and 6.71% DAG. The MDAG obtained from synthesis was white, dry texture, and odorless. The purified MDAG has met the standard because the minimum standard of MAG content at commercial product is 91%.

Keywords: esterification, mono-diacylglycerol, surfactant

[1C-3.22] Kinetic and Isotherm Studies of Cu(II) Adsorption by Beads and film of alginate/zeolite 4A composites

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Abstract. Beads and film of alginate/zeolite 4A composites were synthesized to adsorb Cu(II) from aqueous solution. Furthermore, the kinetic and isotherm modelling of the adsorption experiment data were investigated. The adsorption equilibrium of 0.5 mM Cu(II) by beads and film of alginate/zeolite 4A composites was achieved at 24 h and 60 min, respectively. The removal efficiencies at equilibrium adsorption time were 88.31% for beads and 99.69% for film. Subsequently, the linear form of pseudo-first-order and pseudo-second-order models were used to study the adsorption kinetics. Pseudo-second-order model was the fittest model to described the adsorption kinetics for both beads (R2 =0.999) and film (R2 =0.998). Furthermore, the linear form of Langmuir and Freundlich isotherm models were used to investigate the adsorption equilibria data. Langmuir was the fittest isotherm model for both beads (R2 =0.9992) and film (R2 =0.9977), with the value of monolayer coverage capacity of 0.9929 mmol/g and 1.2773 mmol/g, respectively. The results indicated that alginate/zeolite 4A film had better adsorption rate and capacity compared to alginate/zeolite 4A beads.

Keywords: adsorption, alginate, zeolite, kinetic, isotherm

[1C-3.24] Extraction of Palm Oil Cellulose Nanocrystalline through Solid Acid Hydrolysis and Its Application in Carrageenan Biofilm

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Abstract. Oil palm empty fruit bunches (OPEFB) are solid waste from CPO processing with high cellulose content which can be converted to cellulose nanocrystalline (CNC). The aim of this study was to extract CNC from OPEFB fibers through solid acid hydrolysis with Phosphotungstic Acid (PTA). The CNC was then applied to the carrageenan biofilm and evaluated its mechanical and water vapor transmission rate (WVTR) properties. PTA hydrolysis conducted with acid concentrations of 55, 65, 75% w/v and the hydrolysis time of 15, 30 and 45 hours. The selected conditions were 65% PTA concentration and 15-hours hydrolysis time where CNC had a crystallinity index of 81.23 ± 0.30%, L* value of 92.14 ± 2.28%, decomposed at 285.1°C, and a rod-like particle with diameter of 15-79 nm and length of 88-411 nm based on TEM analysis. Carrageenan biofilm were made by adding CNC at a concentration of 0 – 0.5 %. The addition of 0.1% CNC was able to improve tensile strength and elongation, although the difference was not significant. It was also able to reduce WVTR, with the lowest WVTR values obtained from the addition of 0.3 % CNC, with 7.28 % reduction in WVTR compared to controls without CNC.

Keywords: : cellulose nanocrystal, OPEFB, phosphotungstic acid, solid acid hydrolysis

[1D-1.7] The study on the growth, production and chemical pompound of Chlorella sp in various concentratons of palm oil waste water

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Abstract. The study on the growth production and chemical compound of Chlorella sp in various concentrations of palm oil wastewater was conducted from June to November 2019 in Palm Oil Industry, Sei Galuh, Kampar. Five concentrations of palm oil wastewater, namely 15 %, 20 %, 25 %, 30 % and 0.0 % were used as control.
Result of this study indicated that palm oil wastewater can promote the growth, production and chemical compounds of Chlorella sp. The best growth of Chlorella sp was found at the concentration of 25 % of palm oil wastewater with cell density reached 8.500.000 cell/ml and biomass 0.77 g/l at 13 days culture periods. The chemical compound of Chlorella was also highest at the concentration of 25 % with protein level reached 45.09 %, fat 19.85 % and carbohydrate 12.77 %.
The concentrations of nitrate, and phosphates in all cultures medium were decrease. The best decreased of nitrate were found at the concentration of 25 % from 12.78 to 2.11 mg/l and phosphate decreased from 1.63 mg/l to 0.23 mg/l at the end of this study. Chlorella biomass that found in this study can be used as supplement food for animal husbandry (calves) in Riau Province.

[1D-1.10] Damage and loss magnitudes of Eucalyptus sp. and Acacia mangium due to 2D-seismic activity in industrial plantation forest in Jambi, Indonesia

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Abstract. 2D-seismic activity for oil and gas exploration was conducted in Jambi, Indonesia in 2014-2015. The seismic lines passed through the area of HTI (Industrial Plants Forest), Oil Palm Estate, and people's plantation as well. The 2D-seismic activity was conducted in such a careful way, that any negative impact had to be avoided, minimized, managed, and monitored. However, any damage and loss of the other party occurred. Inventory of cultivated plants or trees damage was conducted for loss compensation purposes. In the fact from totally 1376 shot points of the 2D-seismic activity in the HTI-plants traversing about 183,008 plants, which each shot point represented 133 growing plants, involved 286 damaged plant categorized in slight, medium and heavy damage. Plant age was categorized in juvenile, very young, young, and higher plants. The damaged plants were found only equivalent to 0.00001% of the total growing plants. The total economic loss of timber Plantation due to the 2D-seismic activity consisted of Loss of Expected Value, Loss of Expected Benefit Value, Loss of the Damage of Installation, and Infrastructure of timber plantation and Loss due to Inefficiency Value as well was estimated less than USD 0.01 per ha.

Keywords: plant damage, loss assessment, plant vulnerability, timber plant, industrial plant forest

[1D-1.12] The Design of Fresh Fruit Bunch Palm Oil Purchase System from Independent Smallholders to Support the Biodiesel Development Program

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Abstract. Miniplants established by secondary cooperative is one of the efforts to escape from monopsony market and mill. By the existence of miniplants, Fresh Fruit Bunch (FFB) sales channel will not only end at mill, but also at the miniplant despite in limited scale. Each channel of FFB sales should be supported by the credible price information and the integrated purchase system. To fulfil the need of real-time & transparent price information and the integrated FFB purchase system can be realized by making mobile application of FFB's purchase based on cloud service (SaaS). The method to develop the mobile application uses system approach following the stages in SDLC (System Development Life Cycle) starting from the ideas, user requirements, system requirements, designing, deployment and maintenance. This study is restricted until the stage of planning and generating Business Process Diagram, Use Case Diagram, Data Conceptual Model and Mock up only. Both diagram and model generated in this study aids develop FFB purchase mobile application. The large number of independent smallholders has the opportunity to get a large number of mobile application users. The application will generate a large amount of data. These data can be used to develop various tools as part of the FFB e-procurement system to ensure the supply of independent smallholder' FFB can be used for biodiesel development programs as the government wishes.

Keywords: Palm Fruit, Purchasing System, Independent Smaalholder, biodiesel

[1D-2.26] Physical and chemical soil properties in oil palm land which is overgrown with weeds in different ages

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Abstract. In large estates such as oil palm, there is always a variety of weeds grown over land. There are several types of weeds whose existence can function as a ground cover. Soil samples were taken using Simple Random Sampling on various types of ground cover weeds, namely Asystasia intrusa, Eleusine indica, Cyperus kyllingia Endl and Cyrtococcum oxyphyllum Stapf, in 7 year old oil palm stands. Also, Asystasia intrusa, Cyperus kyllingia Endl, Cyrtococcum oxyphyllum Stapf and Cyperus rotundus, in 6 year old oil palm stands. Soil samples were taken from each replicate plot at a depth of 0-20 cm (layer 1) and 20-50 cm (layer 2) at 5 random points. Variables of soil chemical properties observed in this study include levels of total N-soil, available P, total K-soil, soil C-organic and soil pH. While the physical properties of soil observed were soil water content (%) and bulk density using the gravimetric method. The results showed that the presence of weeds under oil palm stands in plantation areas did not always have a negative effect on the growing environment. In this study, the existence of 4 (four) weed species found under oil palm stands aged 6 and 7 years old and classified as dominant existences, instead, have a positive influence on the quality of the physical and chemical properties of the soil under oil palm stands.

Keywords: Oil palm, soil properties, weeds

[1D-2.33] Diversity of Hydrogenase Producing Microbial from Wartawan Beach Hot Spring, Lampung

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Abstract. Biohydrogen is a potential future energy source due to recyclable and non-polluting. Biohydrogen can be catalyzed by a particular group of enzymes called hydrogenases, which catalyze the reversible oxidation of molecular hydrogen. This enzyme mostly produced by microorganisms. The aim of this study was to analyze the diversity of hydrogenase producing microbial using clone library method. A solid microbial mat sample was collected from Wartawan beach hot spring, Lampung. Series steps of clone library procedure include genomic extraction, PCR amplification and sequencing were conducted. NiFe hydrogenase (NiFe) and FeFe hydrogenase (FeFe) genes primers were used to analyzed the diversity of hydrogenase, whereas 16S rRNA primer was used for bacterial diversity analysis. The result showed that the hydrogenase genes of the sample belong to Proteobacteria, Firmicutes, Bacteroidetes, Planctomycetes, Candidate Division, Cyanobacteria, Bacteroidetes, and Proteobacteria classes. In addition, Cyanobacteria class was specifically related to NiFe, while Firmicutes was associated with FeFe. Proteobacteria and Bacteroidetes, however, were detected for both genes. The diversity of 16S rRNA showed that the microbial mat sample contained 9 phyla of bacteria and dominated by Cyanobacteria and Proteobacteria. The detected hydrogenase genes and 16S rRNA producing hydrogenase indicate that the microbial mat from hot spring at Wartawan beach is a promising source for hydrogenases isolation and further applications for biohydrogen production as a renewable energy.

Keywords: biohydrogen, diversity, hydogenase, microbial

[1D-2.44] Sustainability of Biodiesel B30, B40 and B50 in Indonesia

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Abstract. Sustainable energy is one of the main challenges of the 21st century. Indonesia is a developing country and ranked fourth in the world about densely populated country. The total increase in average population growth between 2000 and 2025 is projected at 33.2%. Thus, the problem of energy deficits must be addressed by the Government of Indonesia to overcome the shortage of energy resources in the future. The Indonesian Government's policy on biodiesel began in 2015 and continues to undergo renewal starting in September 2018, the B20 rule was set, then in January 2020 it began to shift to B30, and by the end of 2020 it was targeted to have shifted to B50 . The concept of sustainability focuses on 2 things: a combination of environmental and economic considerations. One of the important points in sustainable development related to the development of biodiesel B30, B40, and B50 is that economic development needs to be harmonized with efforts to preserve the environment through long-term maintenance of the availability of biological resources and increasing productivity of the agricultural systems, stability of the human population, limitations on economic growth, and make improvements to the quality of the environment and ecosystem. Biodiesel in Indonesia, Fatty Acid Methyl Ester (FAME) is synthesized from palm oil. Emissions from biodiesel from vegetable oils still contain high enough NOx gas. Therefore, the concept of biodiesel sustainability when viewed from the side of the impact on the environment, then biodiesel from vegetable oils needs to add additives / emulsifiers so that the quality and stability of biodiesel increases. That way the biodiesel effect really shows to be environmentally friendly compared to fossil fuels.

Keywords: Sustainability, FAME, emulsifier, biodiesel

[1D-3.45] Clustering Analysis for Production System Design of Emulsifier for Biodiesel B30 based on Digital Business Ecosystem

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Abstract. Biodiesel in Indonesia is synthesized from palm oil into Fatty Acid Methyl Ester (FAME). In Biodiesel B30, FAME and diesel fuels can't be homogeneous, because FAME is hygroscopic and has a higher density than diesel fuels. This can be solved by adding emulsifiers. However, the emulsifier production process is currently limited to the laboratory scale and poor of stability, integration processes, and product are not following the quality. This study aims to identify the relation of the attributes of emulsifier formulation then classify the quality according to the emission of NOx gas. System requirements are analyzed based on their complexity using BPMN 2.0. Then, compile rules from the real world using Association Rules Mining (ARM) and the result will be clustering by K-means algorithm. These rules can be used as a reference in taking influential attributes for emulsifier formulation. K-Means algorithm models the rules from ARM into clusters where data in one cluster has the same characteristics and different characteristics from other clusters. The dataset used is hypothetical data from the formulation and quality testing of the emulsifier. The final results of this study are ten attributes that approved in the emulsifier formulation and 4 clusters of emulsifier product quality based on NOx gas emissions and separated water layers.

Keywords: *Emulsifier, biodiesel, association rules mining, clustering, k-means*

[1D-3.60] Value Added Products from Urban Organic Wastes: A Whole Systems Perspective

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Abstract. Organic waste is a major component of landfills, which are the largest source of methane emissions in the world. In 2019, the world generated approximately two billion tons of municipal solid waste with more than a third of that not managed in an environmentally responsible manner. The United States Environmental Protection Agency (US EPA) estimated that 38 million tons of food waste went to landfill in 2014 and in 2010, 66.5 million tons of food did not make it to consumers in the United States. Publicly owned wastewater treatment plants in the United States process approximately 14 million tons of sewage sludge per year. Typically, sewage sludge is treated to produce biosolids, of which 50% is used for land application in the form of fertilizer and compost. Despite half of the biosolids being recovered and used, there is still a significant amount of organic waste not being beneficially used each year.

Hydrothermal carbonization (HTC) is proposed as a solution to the large streams of food waste and biosolids. HTC can create highly valuable, multi-use products and it is significantly more energy efficient than the industry standard processes used today, such as anaerobic digestion and incineration. Compared to other biomass conversion processes, HTC results in the highest carbon efficiency while still having the lowest rate of greenhouse gas emissions. HTC is a thermochemical process that converts wet biomass materials to a coal-like product. Under sub-critical conditions, water in the HTC reactor stays in liquid form and acts as a reductive reaction medium to break down and repolymerize the solid biomass into the coal-like product, known as hydrochar. With a temperature range of 180-240oC and the absence of a liquid-to-vapor phase change of the water, this process is significantly less energy intensive than conventional pyrolysis.

Hydrochar can be used for multiple applications ranging from a solid fuel source, soil amendment, and a base source for advanced applications such as activated carbon. To produce a form of activated carbon, the hydrochar can be subjected to further thermal treatment via pyrolysis or a chemical treatment to activate the material by enhancing porosity and changing surface functionalities. Conventional activated carbon is very effective at removing pollutants from gas and water, but the cost is often prohibitive. Additionally, coal, a non-renewable fossil fuel, is often the feedstock for this material. Since sewage sludge and food waste are abundant, inexpensive, and renewable feedstocks, they could be used to produce sustainable alternatives to conventional activated carbon if the same adsorption performance is achieved.

Villanova University, in a partnership with SoMax BioEnergy, a waste management company in the state of Pennsylvania, United States, is researching the potential to utilize hydrothermal carbonization and activation techniques to upgrade organic wastes to higher value, activated carbon products. The focus of

the study is to evaluate biosolids and food waste as feedstocks for the HTC process and subsequent activation to determine if an activated carbon adsorbent can be produced that is comparable to commercially available activated carbon. The study is a novel look at upgrading organic wastes via the HTC process and selecting the best activation options for producing an adsorbent activated carbon using a whole systems perspective. This involves determining the impacts of the process options from social, technical, environmental, economic, and political (STEEP) perspectives, with a focus on the Northeast region of the United States. This provides significant differentiation and higher probability of commercial success than the usual technical-only focus.

Keywords: Hydrothermal carbonization, Hydrochar, Activation, Biomass utilization, Organic waste, Food waste Sewage sludge, Activated Carbon

[2A-1.37] Effect of indigenous cellulolytic fungi enhancement on organic carbon and soybean production on peat soil

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Abstract. The two main issues of any application of agricultural technologies in empowering peatlands for crop cultivation are their impacts on carbon storage and crop production. Enrichment of indigenous cellulolytic fungi of peat is a technology to increase crop production because it can accelerate the release of nutrients bound by peat lignocellulosic compounds so that the availability of nutrients increases. A greenhouse experiment was conducted to study the impact of indigenous peat cellulolytic fungi enrichment on organic C and soybean production on peat soils. The experimental design was a completely randomized design (CRD) 3 treatments, each fibric, hemic, and sapric of peat. All peats were enriched by consortia of cellulolytic fungi Penicillium singorense, Aspergillus aculeatus, and Trichoderma sp. On average, the organic carbon and fiber content in all peat soils reduced 13.3% and 26.2%, respectively, and CO2 flux increased from 0.39 mg CO2/kg /day to 0.72 mg CO2/kg/day. The highest beans yield of soybean was 3.56 g/population, equivalent to 1.25 tons/ha, was on sapric peat.

Keywords: peat soils, cellulolytic fungi, Organic C, CO2 flux, soybean

[2A-1.40] Utilization of Plant Waste as Botanical Pesticide for Citrus Pest Control

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Abstract. Organic wastes from plants that contain certain secondary metabolite compounds can be used as botanical pesticides. In this study, the plant wastes used were chrysanthemum flower, JC citrus peel and foliage of tobacco. The botanical pesticides were tested for their effectiveness against the main pests of citrus that were citrus psyllid Diaphorina citri and citrus aphids Toxoptera citricidus. The study aimed to determine the effectiveness of botanical pesticides from plant wastes against both target pests. The three materials were extracted and processed by maceration method with methanol solvent. The test was arranged in a Randomized Block Design consisting of 12 treatments, that were the test concentration for each ingredient was 0.5%; 0.75% and 1%, comparative chemical insecticides dimethoat and imidacloprid, and control. The treatment consisted of two units for each target pest and repeated 4 times. The test results showed that the botanical insecticide from tobacco foliage was the most effective against both target pests compared to those from chrysanthemums flower and JC citrus peel. The insecticide tested was more effective against citrus aphids T. citricidus compared to citrus psyllid D. citri, as evidenced by the shorter time to achieve the mortality. For tobacco insecticides, further testing with lower concentrations is needed to determine the exact and effective test concentration, so that the use of materials is more efficient.

Keywords : plant waste, botanical pesticide, effectivity, citrus pest

[2A-1.54] Natural dyes extracted from longan and inthanin bok leaves as light-harvesting units for dye-sensitized solar cells

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Abstract. Renewable energy is the main key to production, long-term environmental sustainability, safe and inexhaustible amount of energy source. One of the interesting devices of renewable energy that has received considerable attention as an alternative technology is dye-sensitized solar cells (DSSC), which is considered the third generation of solar cells. These solar cells can convert solar radiation into electric current by using natural pigments as sensitizers by using the function of natural pigments in the regulation of solar energy, which is similar to the photosynthesis process of the plant. The simple preparation technique, low cost, feasible extraction processes, innocuous pigments, complete biodegradation and environmentally friendly are the advantage of DSSC. Besides, the extraction process of natural pigments is simple and inexpensive compared with synthetic dyes. These natural pigments such as chlorophyll, anthocyanin, carotenoids and flavonoids were extracted from flowers, leaves, roots and fruits from the plant source. Due to pigment advantage on DSSC, natural dyes utilization is the main objective in this study. Thus, this research focuses on the potential of natural dye by using cold extraction with methanol. A UV-visible spectrometer was used for analyzing the longan leaves (Dimocarpus longan) and inthanin bok (Lagerstroemia macrocarpa) pigments absorption wavelength for the DSSC application.

Keywords: Longan leaves, Inthanin bok leaves, Natural dye, Pigments extraction, Dye-sensitized solar cells

[2A-2.47] Utilization of Cellulose Nanocrystal (CNC) as a filler for chitosan based films for cayenne pepper packaging

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Abstract. This study was designed to investigate the effects of percentage cellulose nano crystal (CNC) on chitosan film for wrapping chili pepper during storage at room temperature for 12 days. Characterization of chitosan-CNC film was analyzed by SEM, FTIR , and physical properties were measured based on tensile strength, percent elongation, water solubility and degradable rate. The method of this research uses randomized design with four treatment and two replication . The treatment of this investigation are E0=control, E1=CNC 1%, E3= CNC3%, E5=CNC5% and E10 = CNC 10%. The quality of chili pepper is analyzed based on the concentration of vitamin C, titratable acidity, total soluble, weight loss rate. The results of the study showed that on the E3 treatment on the 12 th day data obtained from weight loss of chile pepper with chitosan-CNC film were 0,51%, vitamin C 295 mg/100g. Titratable acidity 0,25% and total soluble solid 24%.

Keywords ; chitosan film, CNC, chili pepper

[2A-2.48] Biorefinery Of Genetically Modified Soybean as Biodiesel With Sustainable Production System in Indonesia : A Review

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Abstract. Fossil energy consumption in Indonesia is high every year. This can cause an imbalance between demand and the availability of available fuel. In addition, fossil fuels are also classified as non-renewable fuels, so that the availability of fuel can be used up if exploited continuously. High diesel consumption makes it necessary for search other energy sources that can be used to meet diesel needs in Indonesia. Alternative diesel replacement that can be used is biodiesel fuel from soybeans. One of the disadvantages of using soy as a biodiesel feedstock is its low oil content. An alternative that can be done is by using genetically modified (GM) soybeans which have higher oil content. In addition, the biorefinery approach can also be carried out as an effort to make biodiesel production sustainable, both e conomically and environmentally. GM soybean can be assemble through several stages, which are selection of varieties, assembly of GM soybean and than testing and licensing. After that soybeans can be used and utilized in the Indonesian market. The biodiesel production system from GM soybeans using a biorefinery approach is carried out by utilizing residues during production into other products, so that it can be an additional income, and reduce the impact of environmental pollution. A high net energy balance ratio (NER) in some biodiesel production from soybeans makes biodiesel production from soybeans can be said to be renewable and economically sustainable. Biodiesel production from GM soybeans with the concept of biorefinery has the opportunity to become a sustainable industry, both economically and environmentally.

[2A-3.59] Oil Palm Empty Fruit Bunch Ash as a Potassium Source in the Synthesis of NPK Fertilizer

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Abstract. Some studies showed that ash from Oil Palm Empty Fruit Bunch has relatively high contain of potassium and other minerals, and also commonly used directly for soil improver. In this work, we studied about the production and characterization of ash from gasification of oil palm empty fruit bunch for the production of NPK fertilizer. Oil Palm EFB ash produced from various gasification temperature were characterized by using Atomic Absorption Spectrometry (AAS) to identify its composition. The formula of the fertilizer was developed by using EFB ash for potassium source, while nitrogen and phosphates are each obtained from Urea and Diammonium Phospate (DAP). The production of NPK fertilizer was conducted through some process including formulation, mixing, granulation, and drying. The characterization of fertilizer and EFB ash were done by using Scanning Microscope Electron/Energy Dispersive X-Ray Spectroscopy (SEM-EDX) and also X-Ray Diffraction (XRD). The fertilizer was also tested to the red onion plant compared to commercial NPK fertilizer through small scale field test by using polybags.

[2A-3.81] Using two dosages of biochar from shorea to improve the growth of Paraserianthes falcataria seedlings

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Abstract. The objective of the study was to examine the effect of biochar addition on the growth of sengon (Paraserianthes falcataria) seedlings. Biochar from shorea was produced using a traditional kiln at 400°C and 600oC. Scarification of sengon seeds were conducted using hot water with temperature at 80℃ and then soaked for 24 hours. The seeds were then spreaded onto germination media and after germinated, seedlings were moved to polybags contain soil and biochar. Two dosages of biochar such as 25%, 50% were applied and compared with control. The research is arranged in a completely randomized design with 15 replicates. The examination of seedlings growth was conducted one week after transplanting, then subsequently monitored every 2 weeks. The results showed that the addition of biochar improved the survival rate of seedlings, height and diameter increments, dry weight and root nodules. The results showed a potential of using biochar to improve the growth of sengon seedlings in the nursery.

Keywords: Biochar, *Paraserianthes falcataria*, seedling growth

[2A-3.82] Investigation of Rotary Dryer Performance Fueled by Wood Pellets for Biomass Processing

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Abstract. The drying process is necessary to reduce the biomass moisture content before it is processed into ready-to-burn fuel. Rotary dryer is one of tools used for drying biomass, as it can produce a uniform moisture content, high power, simple to use and maintain. This research aims to investigate the performance of a rotary dryer for drying biomass from tree felling waste. The dryer consists of a hopper, drum dryer chamber with flight, product discharge unit, heat exchanger, pellets burner, axial blower and drum drive motor which is equipped with an electric variable speed. The variation of experimental are mass flow rate of material with drum rotating speed of 1, 1.25, 1.5 RPM, drying air flow rate with 0.6, 1 and 1.3 m3/s and fuel consumption rate of 48 and 123 g/min. The performance evaluation showed that this dryer is capable to drying chopped tree felling waste at the decreasing moisture content rate of 0.5-2.0 %/min. The system efficiency of the dryer was found to be 9.1-38.5% depends on the drum rotary speed, drying air flow rate and drying temperature.

Keywords: *Rotary dryer, wood pellets, biomass, energy efficiency*

[2A-3.58] Solid Alcohol Formulation as a Lighters in Bio-Briquettes of Agricultural Biomass

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Abstract. Palm oil can also be used as renewable energy in the form of bio-briquettes. Bio-briquette fuel is more practical to use, besides it is safer, does not cause excessive gas emissions (smoke), environmentally friendly and does not require high capital in the production process. The weakness in the use of bio briquettes is that it still takes a long time when turned on. The lighter material is one of the solutions to speed up the flame process in bio briquettes. The existence of solid alcohol as a lighter can be a source of renewable energy in supporting daily activities. Solid alcohol is a material to start burning wood, charcoal or bio-briquettes. The scientific study in this research is to determine the best formulation and see the solid alcohol performance. The results show that this solid lighter material does not flow or does not spread when ignited so it does not provide more opportunities for fire risk when used. The formulation for making solid alcohol is also easy to apply using the basic part of waste cooking oil with a combustion time value of 34.3 s / g-1, a residual combustion rate of 7.7%, and can melt at 70oC - 76oC. Solid alcohol as a lighter material is very potential to be developed.

Keywords: Palm oil, Bio-Briquette, Solid Alcohol, Lighters

[2A-4.100] Characterization of physiological properties of bacteria isolates TM4 and BNT8 in biopesticide formulas

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Abstract. Some physiological characteristics that can be used to determine the antagonistic ability of a bacterium include the ability of bacteria to produce extracellular enzymes (chitinase, proteases, and cellulose), hydrogen cyanide (HCN), phosphate solvents, and fluorescence activities. The aim of the study was to study the physiological characteristics of bacterial isolates TM4 and BNt8 biopesticide formulations. The research was conducted at the Plant Pathology Laboratory and greenhouse of Indonesian Cereals Research Institute at Maros South Sulawesi from February to July 2018. The results showed that the two isolates tested for physiological characteristics using specific media had chitinolytic, proteolytic, cellulolytic, phosphate and potassium activity. This result is seen from the formation of a clear zone. Based on the results of in vitro tests using a completely randomized design, it was found that the two bacterial isolates tested were able to inhibit the growth of R. solani pathogen with inhibitory levels by TM4 isolates ranging from 13-26% and inhibition of BNt8 isolates around 11-38%. The percentage of bacterial inhibition on PDA media is higher than on media PDA and PDA + TSA. From the field test on corn plants, it was found that the two bacterial isolates tested could significantly increase plant growth.

[2A-4.106] Washing Metals in Rice Straw to Improve Combustion Properties

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Abstract. Straw, which is agricultural waste that has enormous potential as an alternative energy source because of its abundant availability. But as an energy source, straw has intrinsic properties that are not as good as fuel. Very high alkaline earth metal content can cause problems in the high temperature combustion process. High ash content also results in low calorific value. One effort to overcome is by washing to improve the quality of straw as fuel. This study aims to improve the energetic characteristics of rice straw by leaching alkaline earth metals (especially K). The study was conducted by soaking rice straw using 3.5, 7.5, 15, 30, 60, 720 and 1440 minutes. The parameters measured in the study were water content, ash content, calorific value, and ash composition. The results of the study stated that soaking straw can cause metal leaching so that it can improve the energetic properties of rice straw. This is indicated by an increase in the calorific value of rice straw from 13.6 MJ to reach 15.77 MJ.

Keywords**:** biomass, agricultural waste, leaching, calorific value

[2A-4.99] Biodegradable foams based on extracted fractions from sorghum by-products

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Abstract. Agricultural by-products comprise abundant, renewable sources of value-added compounds for the food and packaging industries. The production of biodegradable foams can be focused on replacement of polystyrene-foam with biodegradable materials, which are regarded as environmentally friendly. In this study, biodegradable food trays were developed via thermopressing, using modified and unmodified corn starches with additional extracted fractions (celluloses, hemicelluloses, and lignin) from sorghum stalk and bran. The effect of several formulations of extracted fractions from sorghum by-products on bio-foam properties was studied. All trays presented thicknesses between 3 and 4.17 mm, density between 0.16 and 0.64 g cm-3, and moisture content between 5 and 12% (dry basis). The foam trays made from chemically modified starch had lower densities, higher tensile strength and elongation at break than unmodified starch. The increment of cellulose fraction from 2% to 5% and hemicellulose fraction from 1% to 10% had significant effect on the trays' colour properties, water absorption capacity, mechanical properties, microstructure and crystallinity. All trays exhibited no colour and structural changes during storage at 25 oC and 4 oC. The formulation presenting the best properties contained 2% of cellulose and 1% of hemicellulose, had a maximal resistance of 0.77 MPa and 9.46 mJ of total work, attributes which corresponded to a compact, homogenous, and dense microstructure.

Keywords: biodegradable foam, thermopressing, corn starch, cellulose, hemicellulose, lignin

[2A-5.110] Application of MAG (monoacyl glycerol) as emulsifier with red palm oil in body cream product

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Abstract. Palm Fatty Acid Destilate (PFAD) is one of the wastes from the palm oil processing. PFAD can be reacted with glycerol to form MAG (monoacyl glycerol). MAG is an emulgator that can be applied in a cosmetic product in the form of a red palm oil cream. Red palm oil is one of the products processed from palm oil that still has a lot of natural antioxidant content such as carotenoids and vitamin E. formulation of red palm oil cream is carried out by treating variations of stearic acid substitution with red palm oil 50 %, 75 % and 100 % as the source of active ingredients and variations in the combination of MAG and tween 80 as emulsifiers with each weight ratio of 1:3; 2:2 and 3:1. Each formula is then characterized based on its physical properties such as type of emulsion, pH, and stability of the emulsion. Some formulas that have the best physical properties will be selected and continued with sensory and total carotene tests. The synthesize MAG used has the characteristics of water content, free fatty acids and free glycerol, each at 1.27%; 0% and 0.37%. with a pure MAG yield of 18.85%. The best formula for red palm oil cream is formula with variation of stearic acid substitution with red palm oil by 50% and a variation of the MAG: tween 80 combination of 2: 2. The formula has a HLB emulgator value of 9.4 and contains active carotenoid of 311.82 ppm.

Keywords : *PFAD, MAG, Cream, Red Palm Oil*

[2A-5.111] Evaluation of M-DAG purification process in increasing m-dag yield value

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Abstract. The purpose of this study is to evaluate effect of the hydrolysis process before the esterefication process and get the best conditions in the use of hexane and ethanol solvents in the M-DAG purification process that can improve yields of M-DAG. Evaluation of the process is existence of PFAD raw material activation by hydrolysis process, determination of ratio weight hexane and sample (1:10; 1: 8; 1: 4), determination of the concentration of ethanol solvent with the ratio of ethanol to water (1; 0 ; 1: 0.5; 1: 1; 0.5: 1) with various immersion times (24 hours, 48 hours, 72 hours). The study was conducted with a description method and completely randomized design method (CRD) with a level of 5% (P <0.05%). In the hydrolysis process in the activation of PFAD raw material, it is carried out by reacting PFAD with water in a ratio of 1: 6 (w / w), with pTSA catalyst as much as 1.2% of the weight of PFAD. The hydrolysis process lasts for one hour at a temperature of 110 0C. The hydrolysis process on raw materials obtained yields of 24.7% and FFA levels of 4.69% on crude M-DAG and 0% on pure M-DAG. The best hexane volume conditions were obtained at hexane volume ratio: sample 1:10 with a yield of 19.30% and 0% FFA content. While the best ethanol concentration was found in the ratio of ethanol: water 1: 0.5 with a soaking time of 24 hours, where the yield obtained was 27.78%.

Keywords: M-DAG (Mono-Diacylglycerol), purification, hexane, ethanol

[2A-5.114] Formulation of mono-diacylglyserol from palm fatty acid distillate and glycerol as antistatic agents on plastics

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Abstract. PFAD (Palm Fatty Acid Distillate) production in Indonesia is very high. PFAD can be increased its added value by making it as MDAG (monodiacylglycerol). MDAG has free hydroxyl groups which make it possible as antistatic agent in plastics. Antistatic is main additive in plastic products, which can reduce the tendency of static electricity flow form. The methods of this study are formulation of MDAG in plastic polymer, injection molding process (plate form) and measurement of surface resistivity in each plate. This study aims to looking for the best formulation of MDAG as an antistatic agent in plastics and its potency as permanent antistatic agent in plastics. The formulation of MDAG in plastic polymers (PP, HDPE, LDPE) have been done in three steps. First, commercial antistatics and MDAG-research (3.80% FFA content), each is added to polymers for injection molding process. There is no antistatic properties detected of MDAG-research plates, meanwhile the commercial antistatic shows there is antistatic properties on its plates. It can be caused by the characteristics of MDAG-research, such as high FFA content and low hydroxyl number. Then, second formulation is using MDAG-research (improvement products) with better characteristics. Both MDAG-research and commercial antistatics shows antistatic properties on PP plates with similar surface resistivity, which is 1012 Ω/sq. Third formulation is using the same MDAG-research in PP and HDPE polymer and observe its surface rresistivity for several days. Both MDAG-research and commercial antistactics shows antistatic properties on each plate, with the range of surface resistivity at 1011-1012 Ω/sq. There is significant differences of antistatic activities in PP and HDPE plates, where antistatic properties in PP plates is immediately detected dan faster than in HDPE plates. It can be caused by the dencity difference of PP and HDPE that influence the migration rate of antistatic agent to the surface. In this third stage, is also created the MDAG masterbatch by mixing MDAG-research and LDPE polymer, which shows antistatic properties on HDPE plates after several days, with the range of surface resistivity at 1012 Ω/sq. The measurement of surface resistivity on each plastic plates shows that MDAG-research (improvement products) has antistatic properties, as well as commercial antistatic product.

Keyword: *monodiacylglycerol, antistatic, biocomposite plastics*

[2B-1.38] A system analysis of the biomass integrated gasification solid oxide fuel cell

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Abstract. In this study, we discussed the power production paths through the biomass integrated chemical conversion fuel cell systems. In our previous study, we proposed the biomass integrated gasification solid oxide fuel cell (BIG-SOFC). Regarding our proposal, we carried out the performance estimation on basis of LCA methodology. Especially, the affection of contaminants in syngas by which the system is operated was focused on. Because they cause the voltage drop of fuel cell. In general, the SOFC is worked at a high temperature. Considering the removal of impurities, the high temperature condition would be better, but it is difficult to eliminate them effectively. For instance, on the adsorbent of H2S, the metal oxide of CeO2 under a high temperature is a better candidate. However, the environmental impacts would be worse on the category of abiotic depletion potential etc.On the other hand, the methane fuel through swages sludge fermentation process would be available. Note that the operating condition is quite different from the gasification process. That is, in this case, the temperature is lower. Likewise, it should be necessary to remove them because the contaminants are contained in the fuel. In the lower temperature, the natural resource (e.g. Kanuma clay) which is eco-friendly would be available. We confirmed the adsorption performance due to the basic experiment. While, the high temperature condition requires in the SOFC operation. This aspect causes additional ecoburden. That is, we estimate the exergy efficiency and the impacts in comparison to the previous system.

[2B-1.41] Green Prosperity: A Natural-based Solution for Rural Electrification in Indonesia

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Abstract. Primary energy demand in Indonesia is growing rapidly due to urbanization, economic growth and population increase. The contribution of New and Renewable Energy to the national energy mix is mandated to reach 23% by 2025. Indonesia's Nationally Determined Contributions (NDC) stresses five sectors in which greenhouse gas (GHG) emissions are to be reduced with forestry and energy being the highest priority. While Indonesia is committed to addressing climate change through the forestry sector, there are clearly contextual challenges that need to be addressed to create the enabling conditions for REDD+. Some of the major issues include inconsistent legal frameworks, sectoral focus, unclear tenure, consequences of decentralization, and weak local governance. Biomass production for local energy needs and REDD+ payment could become the agent of change for this difficult problem. This paper proposes methodology for rural electrification in Indonesia and also show the real case in Mentawai which already implement both biomass production and land restoration that potentially could receive REDD+ payments.

[2B-1.57] Biochar production investigation from pyrolysis of lamtoro wood as a coal blends for fuel substitution in steam power plants

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Abstract. The biochar utilization reduces CO2 emissions. The objective of this study is to investigate the optimum pyrolysis temperature of lamtoro (Leucaena Leucocephala) wood to produce suitable biochar for coal blends as a fuel in steam power plant. The experiment was carried out in a batch process, applied to a fixed bed reactor, 10 OC/minute heating rate, three different variables temperature (300, 450, 600 OC) and 60 minutes residence time. The biochar yield for each pyrolysis temperature are 61.77%, 26.45% and 24.89%, respectively. This shows that the pyrolysis is carried out at a temperature of 300 to 450 OC, then ramps up to a temperature of 600 OC. Volatile matter released during the pyrolysis raise the fixed carbon content, for each pyrolysis temperature are 26.35%, 61.82%, and 65.66%, respectively. Fixed carbon content at 450 and 600 OC is identical to bituminous coal. Increased levels of fixed carbon in biochar lead the heating value to increase. The heating value of lamtoro wood was 4,576 kcal/kg(db) increasing to 5,477; 6,694 and 7,105 kcal/kg (db), respectively for each pyrolysis temperature. The biochar heating value is close to bituminous coal. The biochar energy content of lamtoro wood for each pyrolysis temperature are 81.72%, 42.77%, and 42.71%, respectively. Biochar reach their optimal point at pyrolysis temperature 450 OC which has a yield and heating value that is almost the same at pyrolysis temperature of 600 OC. The results of biochar characterization indicate that it can be used as a coal blends for steam power plants.

Keywords: lamtoro (Leucaena Leucocephala) wood, pyrolysis, biochar, coal blends, steam power plant and carbon neutral.

[2B-2.120] The characteristics of graphene-like materials derived from biomass wastes and its electrical conductivity

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Abstract. Graphene-like materials were derived from coconut oil palm shells wastes using two-step method of carbonization and activation approaches. Through the carbonization stage, two synthesis parameters were used including different temperature (400, 500, 600 and 700 C) and addition of Pt catalyst to every samples. Meanwhile, for the activation stage, KOH was implemented followed by nitrogen gas flow. In this work, series of characterizations were examined such as field emission scanning electron microscopy (FESEM), high-resolution tunnelling electron microscopy (HRTEM), and x-ray diffraction (XRD). For electrical conductivity of the samples, the measurement is conducted by four-point probe instrument. From the results obtained, the sample produced without Pt catalyst at 600℃ showed the highest conductivity which calculated to be 1.3 x 10−6S/cm as compared to the sample synthesized without Pt catalyst (= 1.3 x 10−6S/cm). This result is supported by the morphology analysis in which the sample without catalyst shows a highly exfoliated layers of graphene, thus believed to responsible in increasing the conductivity. This research has developed accurate standard conditions and procedure in producing graphene from activated oil palm shells biochar. This research also will add to the knowledge and understanding of the characteristics of graphene from biomass which is very useful for a variety of markets and applications such as in supercapacitor's electrodes.

Keywords: graphene-like materials, biomass wastes, electrical conductivity

[2B-2.49] Fuel Properties of Two Types High Speed Diesel Blending with Palm Oil Biodiesel in Indonesia

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Abstract. Biodiesel from palm oil (Elaeis guineensis) is one of the promising renewable sources in Indonesia. Biodiesel is renewable transportation fuel and nowadays is being used as a blend with high speed diesel (HSD). There are two types HSD in fuel specification of Indonesian Government, HSD with Cetane No. 48 and and HSD with Cetane No. 51. This paper investigates the fuel properties of HSD 48 and HSD 51 blends with palm oil biodiesel with composition 90:10 (B-10), 80:20 (B-20), and 70:30 (B-30). The experimental investigation shows that the fuel blending, HSD 48 and HSD 51 with biodiesel up to 30% improves the quality of HSD, such as increasing cetane number by 10%, increasing lubricity by 10-18%, and decreasing sulphur content by 35%. Furthermore, the addition biodiesel to HSD has negative effect that increasing acid value and water content, also decreasing heating value and cold-flow performance, such as cloud point, pour point, and cold filter plugging point. This can be improved by tightening up the quality of biodiesel. However, the addition palm oil biodiesel up to 30% (B-30) is potential to promote the renewable fuels with tolerable characteristics with HSD fuel specification by improving the quality and specification of biodiesel and blends. Keywords: biodiesel; fuel properties; fuel blend; high speed diesel.

[2B-2.88] Performance Analysis of Microalgae Cultivation in Photobioreactors with IOTs (Internet of Things)

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Abstract. Internet of Things (IOTs) is an evolution of the concept of internet use that aims to expand the benefits of internet connectivity that is connected continuously with the ability to control remotely (remote control), share data (data sharing), carry out continuous monitoring (real time monitoring) and current (up to date). The application is very broad, for example controlling and monitoring physical objects. food materials, electronics, and any equipment, including living objects, all of which are connected to local and global networks through electronic sensors that are embedded in the observed object and are always "on" as long as the network is available. In this dissertation research proposal related to the cultivation of microalgae as a source of food and energy of the future, in the design of photobioreactors that are integrated with IOTs, so that it can be monitored continuously, controlled and used as a model for the development of greater microalgae cultivation technology. Development of automation in the cultivation of microalgae needs to be done to improve productivity and maintain quality so that the cultivation of microalgae can lead to industrialization, so that the development of microalgae as raw material for various needs can be optimized. Cultivation in this study is a closed system photobioreactor, will produce microalgae that are not contaminated by external contaminants, growth analysis can be done based on the parameters that affect it, including the cultivation room temperature, lighting level (luminance), and the color of water in the photosynthesis process of microalgae, and also control of aeration. All processes carried out in this cultivation are done semiautomatically, because there is still a process of human interaction in setting parameters and controls in the process of harvesting microalgae. In this study microalgae were evaluated using 4 cultivation tubes that uses 3 different treatment with initial concentration 10%, 20% and 30%.. Visualization of controlled parameters includes, parameters of temperature, light intensity, change and color of water. The observed parameters will be displayed in a graphical user interface (GUI) in real time using the internet. Cyber physic interaction can be done from devices contained in cultivation instruments with two-way communication between cultivation systems and external control with devices connected to the internet, such as laptops or gadgets. The optimal growth in this experiment is comes from 10% concentration.

Keywords: microalga cultivations, photobioreactor, IOTs (internet of things)

[2B-3.79] Sythesisi of biodiesel from kesambi oil (Schleichera oleosa L.) using carbon nanotube-supported zinc oxide heterogeneous catalyst

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Abstract. Multi wall carbon nano tubes (MWCNTs)-supported zinc oxide (ZnO/MWCNTs) heterogeneous catalyst has been prepared using impregnatiom and gel process. This catalyst has utilized to synthesize biodiesel via ternsesterification process from Kesambi (Schleichera Oleosa L.) oil (SOO) and methanol. The prepared ZnO/MWCNTs catalyst prior was characterized using the X-ray diffraction (X-RD), Brunauwer-Emmett Teller (BET), and Scanning Electron Microscopy with energy dispersive X-Ray microscopy (SEM-EDX) methods. The transesterification process was performed in a three necks round bottom flask batch type reactor. The influence o several parameters include reaction time (h) and amount of catalyst (wt% to SOO) on the yield of biodiesel were studied. It was found that ZnO/MWCNTs potentially used as heterogeneous catalyst for transesterification of kesambi oil. The highest biodiesel yield of 41.9% was achieved at 65◦C, 5 h of reaction time, 4% of catalyst amount, and 1:15 of molar ratio SOO to methanol.

[2B-3.61] Characteristics of biochar produced from the harvesting wastes of meranti (Shorea sp.) and oil palm (Elaeis guineensis) empty fruit bunches

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Abstract. The objective of this study was to determine the properties of biochar from meranti (Shorea sp.) and oil palm (Elaeis guineensis) empty fruit bunches (OPEFB). Biochar was produced using a traditional kiln with a temperature of 400°C and 600°C. The char yield, pH, and proximate analysis were evaluated. The results showed that the maximum char yield was obtained at 400°C and the increase of temperature resulted in a decrease of char yield. At the same pyrolysis temperature, char yield was higher in meranti than OPEFB. The results revealed that pH of meranti and OPEFB changed into basic after pyrolysis which is important when biochar is added to soil to neutralize soil acidity and increase the soil cation exchange capacity. The results also showed an increase of fixed carbon in meranti and OPEFB after pyrolysis at 400°C and 600°C.

Keywords: Biochar, meranti wood, oil palm empty fruit bunch

[2B-3.66] Potential evaluation of anaerobic mono-digestion on dry water primrose for biogas production

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Abstract. The energy consumption in the world is overexploitation due to population development and economic growth. Renewable energy, such as biogas production from agriculture biomass, is getting more and more attention to numerous research studies. However, agriculture biomass typically composes complex structures against faster degradation. Therefore, pretreatment of biomass material is a necessary step to break down their chemical structure and boost biogas yield. Many agricultural countries, including Thailand, have abundant agronomic land, grassland, and wetlands biomasses that are suitable for bioenergy production. This study aimed to evaluate potential biogas production from water primrose and examined the effect of alkaline pretreatment applied on samples through biogas production efficiencies. Anaerobic mono-digestion was carried out for 45 days of operation, using 1L triplicate fermentors. Pretreatment was applied using sodium hydroxide (NaOH) solution (w/v) at different concentrations (0, 1, 2, 3 and 4%) with 10% of total solid (TS) based on dry matter. The gas produced was measured daily by water displacement method and gas composition was determined by gas analyzer. The 2% of NaOH pretreatment results show suitable for further scale-up studies.

Keywords: Water primrose, Pretreatment, Mono-digestion, Biogas production

[2B-3.112] Development of Smart Algae Pond system for Microalgae Biomass Production

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Abstract. The production of microalgae biomass is very promising as an alternative sustainable food, feed, high value biochemical, and 3rd generation biofuel. However, the use of microalgae biomass for the production of biofuel is still considered less feasible at this time. The main obstacle is the scale up of biomass production, high processing costs and low efficiency using the conventional biomass production system. The use of advanced digital technology such as sensor, automation applications and the Internet of Things (IoT) is expected to increase optimal productivity of microalgae biomass production that is controlled effectively and efficiently. This research developed a Smart Algae Pond system that equipped with three main functions of smart mixing by manipulating the speed of paddle wheel, controlling pH and CO2 supply, and the automatic harvesting system.

[2B-4.95] Performance and Emission Effects of B30 Usage in PLTD and PLTMG

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Abstract. In 2020, Indonesia Government through the Ministerial Regulation of Energy and Mineral Resources Number 12 of 2015 obligates the use of 30% biodiesel mixed diesel fuel (B30) for various sectors including the power generation sector. The obligation potentially affect the performance of diesel power plants (PLTD) and gas engine power plants (PLTMG) that are common power plant technologies used by the State-owned Electricity Company (PLN) in remote and disadvantaged areas. The objective of this study is to estimate effects of B30 usage on performance and emissions of PLTD and PLTMG. We compare performance and emission data of 3 (three) power plants before and after using B30. Our results show that the uses of B30 increases spesific fuel consumption (SFC) by 0.009 litre/kWh in PLTD and by 0.0071 litre/kWh in PLTMG. However, emissions SO2, CO, and particulate gas are lower after using B30 except NOx emission.

[2B-4.101] An effect of Distilled Palm Methyl Esther as a blend fuel on precipitation and vehicle performance

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Abstrac. Indonesia has implemented biodiesel with ratio of 30% by volume (B30) starting from January 2020. Precipitation still remain a big issue for B30 application due its monoglyceride content and cold temperature application. This study investigated an effect of Distilled Palm Methyl Ester (DPME) which has low monoglyceride content as blend fuel for diesel fuel on precipitation and vehicle performance. An experiment was conducted using two types of fuel qualities for both of diesel fuel (B0) and biodiesel (B100). Here, Diesel fuel was fulfilled Euro3 and Euro 4 specifications while SNI 7182:2015 fulfilled FAME and DPME were utilized for biodiesel. Precipitation test and vehicle performance were conducted using a modified ASTM D7510 and Un-ECE R85, respectively. Precipitation test condition was varied at 2 different temperature of 25OC and 15OC and soaking time was placed at 1 day, 7 days and 14 days. The result showed that B30 from DPME could decrease amount of precipitation for both of temperature and soaking time variations, especially at low temperature in which DPME could suppressed precipitation more than 50% compared with FAME. Vehicle performance of B30 using DPME showed similar result with FAME at power maximum. Therefore, DPME is one of promising alternative for B30 blend fuels to overcome an issue of precipitation on real application in Indonesia.

Keywords: Biodiesel, DPME, FAME, Precipitation, B30

[2B-4.118] Review article : potential of renewable energy from animal waste and napier grass

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Abstract. Renewable energy is one of alternative energy to be used as human consumption. Energy plays the important rule in daily life because people cannot live without energy usage. Anaerobic Digestion is one of alternative renewable energy process. The low cost and high performance of energy production already reported. During anaerobic digestion process, there some factors that can affect biological reaction inside. Some factors, namely : pH, temperature, organic loading rate, C:N ratio, and hydraulic retention time. It needs consider and proper knowledge before applying this process to get the effective anaerobic digestion to produce higher biogas. One of potential biomass substrate to produce biogas is Napier Grass that is widely cultivated in Thailand, Indonesia and Malaysia. Usually Napier grass planted as feedstock for cow or other livestock. Co-digestion of high content of lignin substrate with animal manure could also improve nutrient balance or C : N ratio in the digestion process. While chicken manure is widely used as co-substrate for anaerobic digestion. In this article, the pre-treatment process, advantages and this advantages, and energy process from animal waste and Napier grass are well summarized. This would be beneficial for people who are interested in renewable energy in animal waste and Napier grass.

Keyword: renewable energy, animal waste, Napier grass, biogas, energy.

[2B-5.96] Technical assessment of the xylitol production process using thyme (Thymus vulgaris) as raw material

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Abstract. The thyme demand is quite low compared with other aromatic products such as marigold, basil, and valerian. On other hand, biotechnological products such as xylitol are highly demanded in food industry. Nevertheless, the unit price of xylitol is high. Even so, this can be reduced using lignocellulosic feedstocks. However, the technical feasibility of the process should be studied. Thus, the purpose of this work is to elucidate the technical feasibility of the xylitol production using thyme as feedstock through the use of a set of mass and energy indicators. For this, the physicochemical characterization of thyme was. Then, this information was used to simulate the xylitol production process using Aspen Plus v.9.0. The simulation process was accomplished using experimental data reported in literature and applying process design concepts. The technical assessment was done calculating mass indicators such as product yield (PY), conversion efficiency (CE), and mass intensity (MI). Moreover, energy indicators such as specific energy consumption (SEc), resource energy efficiency (RE), and renewability energy index (RI) were calculated. The xylitol mass indicators result give a PY of 75 kg/t, a CE of 34.75%, and a MI of 41.55 kg/kg. Furthermore, the energy balances of the process allowed estimate a SEc of 417 kW/kg, a RE of 76%, and RI of 62%. These indicators compared with other reports shows the potential application of thyme as feedstock to produce xylitol. Thus, further steps related to the economic, environmental and social analysis should be done to elucidate the overall sustainability of the process.

[2B-5.107] Effect of Pyrolysis Operating Conditions on The Biomass Shrinkage Process of Leaf Waste and the Formation of Oxygenate and Non-Oxygenate Compound Products in BioOil Using ZSM-5 and YSZ Catalysts

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Abstract. Leaf waste can be converted into more useful products by using several processes, one of which is using a pyrolysis process. Pyrolysis process can be carried out by requiring several parameters, namely raw material, temperature, residence time, and also the rate of heating. In the pyrolysis, biomass undergoes a shrinkage process. In this study, the variables used are temperature, gas flow rate, and catalyst combination ratio with the aim of seeing the relationship of these variables with the shrinkage process and the resulting pyrolysis product. The pyrolysis process produces products in the form of liquid, gas and solid products. The liquid product formed was analyzed using the Gas Chromatography - Mass Spectroscopy (GC-MS) tool and it was found that the liquid product contained oxygenate and non-oxygenate in it. Oxygenate and non-oxygenate content in liquid products is increased by using ZSM-5 catalysts (Zeolite Socony Mobil-5) and YSZ (Yttria Stabilized Zirconia). ZSM-5 serves as an acid catalyst that can increase the hydrocarbon content and YSZ serves to increase the production of nonoxygenate in the resulting bio-oil product. Distribution products produced by catalytic processes have a more diverse distribution of products. The addition of catalysts also reduced the activation energy used by 5.41%.

[2B-5.109] The Characterization of Hydrocarbon Compounds in Bio-Oil produced by Pyrolysis of Biomass from the Essential Oil Distilled Residue Using ZSM-5 and YSZ Catalysts

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Abstract. The main hydrocarbon stocks are essentially containing in the petroleum and natural gas, but these non-renewable resources are with the time could diminish their supply. Actually, the hydrocarbon compounds are important feed stocks for various kind of fuel and petrochemical products and the world dependence on these compounds is so high in the almost all aspects of demands. That is why, the development of environmentally friendly hydrocarbon resources alternative whose more secure and sustainable should be driven. One of the origins could be come from derivation of biomass material from the residue of distillation process of essential oils with using catalytic pyrolysis that would produce the hydrocarbon distribution products. Due to the problem on the pyrolytic bio-oil is that the compound mainly are the oxygenated product, so the use of acid catalysts such as zeolite-based catalysts (ZSM-5) can improve the hydrocarbon containing bio-oil. The zeolite catalyst has been proving to be able to carry out deoxygenation reactions and catalytic cracking to increase the production of hydrocarbon compounds in catalytic pyrolysis reactions. However, the use of zeolites can mainly accelerate the cracking higher/long molecules into make hydrocarbon molecules simpler by forming carbonium ions from carbon-carbon chain. Thus, requiring a modification of the catalyst which can cut off oxygen from the hydrocarbon group is needed. With this mechanism, the results of catalytic pyrolysis expected to be improved. One material that has this potential is YSZ (Yttria-Stabilized Zirconia). The results of this study showed that the rise of pyrolysis temperature was able to increase the yield of steam products and the production of non-oxygenated hydrocarbon compounds, in which the temperature 550°C is the optimum temperature of pyrolysis. Similarly, the optimization condition of argon gas flow rate is 100 ml/min. In that condition, the fluidization of biomass material occurs maximally, and the occurrence of the heat transfer process is very fast. While the optimum ratio of YSZ/ZSM-5 catalyst achieved by 3:2 ratio. In this condition, YSZ is very effective at 550°C in assisting ZSM-5 to form non-oxygenated hydrocarbon compounds. Keywords: Fuel, YSZ Catalyst, ZSM-5, Catalytic Pyrolysis, Essential Oil Distillation Residu, Hydrocarbon Distribution Product.

[2C-1.25] Natural Volatile Organic Compounds from Streptomyces sp. against Oil Palm Pathogen Ganoderma boninense

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Abstract. The sustainability of oil palm plantation is threatened by the Basal Stem Rot (BSR) disease which causes huge economic losses to Indonesia and Malaysia annually. BSR is caused by the phytopathogenic fungus, Ganoderma boninense. Fungicides have been applied to halt the spread of this fungus, however, consistent used of these chemicals have negative impacts on the environment such as damaging the beneficial soil microbe community and development of fungicide resistance in the pathogen. Therefore, the development of a new strategy which is environmentally friendly such as the application of biological control is essential. Therefore, this study aims to determine the Volatile Organic Compounds (VOCs) from locally isolated soil microbe with antifungal activity against G. boninense. Dual-chamber assay against G. boninense showed strong antagonistic effects against the G. boninense; with Percent Inhibition of Radial Growth (PIRG) values of more than 70%. Several VOCs were known to act as antifungals such as Benzyl cyanide and hexamethylcyclotrisiloxane were identified from the Gas ChromatographyMass Spectrometry (GC-MS) analyses. These findings indicate that local isolates can potentially be used to develop bio-chemical agents in managing the spread of G. boninense and ensuring sustainable production of the oil palm industry.

Keywords: antifungal; bio-chemical agents; Ganoderma boninense; oil palm; Streptomyces sp.

[2C-1.30] Non-stationary analysis and LCA analysis of impurity adsorption using Kanuma clay and HAS-Clay in a Bio-H2 production system

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Abstract. In recent years, the fuel cell (FC) applications are promising to contribute to the abatement of greenhouse gases (GHGs) emissions, so the hydrogen fuel demand would be expanded. The current energy resource of hydrogen is generally fossil fuel origin. Therefore, for GHGs emission mitigation in the hydrogen production stage, we focused on biomass-derived hydrogen (Bio-H2) production process. In this study, we argue the environmental impact of BioH2 through the biomass pyrolysis process of Blue Tower (BT) biomass gasification. The biosyngas contains the following impurities of H2S, HCl, and NH3. These impurities could damage into the performance of FC operation. In our previous experimental studies, using Hydroxyl aluminum silicate clay (HAS-Clay) as an adsorbent in the impurity removal process. However, based on LCA methodology, it was found that the impact of HAS-Clay was higher. This means that any environmental contribution would be less obtained in the one through operation using HAS-Clay. Thus, in this study, using Kanuma clay, which is a natural resource and lower impact adsorbent, we experimented test of desulfurization and designed the optimal process to mitigate the ecoburden and maintain removal performance. Finally, using the dynamic process simulator of ANSYS fluent (2020 R1), we compare the proposal process to the conventional one in terms of the plant performance, and evaluate the environmental impacts. At the result, we estimated that the eco-benefits due to the replacements of Kanuma clay and HAS-Clay were approximately 12.3% reduction of GWP in comparison to the chemical adsorbent of ZnO.

[2C-1.91] Colomn CO2 fractionation method from fish oil to omega-3, 6 and 9 ---review

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Abstract. Commercial interest in getting polyunsaturated fatty acid concentrates, especially omega-3 fatty acids such as EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) is increasing. Unsaturated fatty acids can prevent cardiovascular disease and improve cognitive function of the brain. Fish oil is the main source of fatty acids, especially omega-3 fatty acids. The content of omega-3 fatty acids (24%), omega-6 (5.37%) and omega-9 (12.6%) fish oil is quite high. Fish oil concentrate is needed in the food and pharmaceutical industries. Degradation of thermolable compounds cannot be avoided in conventional separation methods. Some conventional oil separation methods have weaknesses and strengths. Colomn chromatography: the concentrate is very difficult to separate so it requires a lot of solvents; distillation: low oil yield due to a lot of yawning; centrifugation: the results are heterogeneous; membrane: easy to plug; using solvents: low cost, technology exists, can be at room temperature and atmospheric pressure, the results are homogeneous. The choice of solvent determines the level of yield and safety. CO2 as a solvent is non-polar, non-toxic, volatile, high diffusivity, low surface tension, low viscosity, good extract degradation, low critical temperature, (310 C), can prevent thermal degradation, fast, cheap and efficient.

[2C-2.51] The study of parameters essential oil extraction from black pepper seed using microwave hydrodistillation by modeling

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Abstract. Nowadays, people more concerned about being healthy. As much as possible, people attempt to use natural products ranging from food and beverages, medicines, and beauty products. One of the essential oils that often used in those products is black pepper oil due to its various potential. However, the seeds of black pepper are very hard that becomes a barrier in the extraction process. On the other hand, some researchers have proved that microwave hydrodistillation could accelerate and increase the extraction yield because microwaves can directly be absorbed by dielectric compounds of materials extraction and help the rupture mechanism of matrix cells. In connection with that matter, black pepper oil extraction using microwave hydrodistillation has been analyzed by modeling with response surface methodology followed by the kinetic model. The obtained model could represent the extraction process and showed there an interaction among parameters on the yield, but extraction time had the most significant effect. Besides, optimization of the model obtained an optimum condition process extraction with the predicted value closed to the actual yield. Furthermore, the firstorder kinetic model represented the phenomenon of mechanism extraction. The compounds of the sample were analyzed using GC-MS.

[2C-3.64] Characterization of Pyrolysis Products of Oil Palm Empty Fruit Bunch

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Abstract. Oil Palm Empty Fruit Bunch (EFB) is the waste product in the palm oil industry. Currently, EFB has not been optimally utilized because of its low calorific value. The purpose of this research is to analyze the potential of EFB conversion into solid (biochar), liquid (bio-oil), and synthesis gas (syngas). The experiment was carried out in the batch process at atmospheric pressure and temperature of 600 oC (heating rate of 60 oC/min). Biochar was cooled and analyzed its proximate, ultimate, and calorific value. The volatile matter of pyrolysis product was passed through a condenser so that bio-oil and water were condensed and separated based on density difference. Bio-oil was analyzed by fractionation based on its boiling point. The syngas composition was analyzed by using GC. The proximate analysis results of biochar such as inherent moisture, ash, volatile matter, and fixed carbon are 6.24%, 26.30%, 14.14% and 53.32%, respectively. Meanwhile, the ultimate analysis of biochar showing the composition of C, H, O, S and N is 55.76%, 2.92%, 12.5%, 0.34% and 2.18%, respectively. The biochar calorific value is 4,966 kcal/kg adb, showing a similar characteristic to sub-bituminous coal, suggesting that biochar can be utilized as coal substitution to reduce the CO2 emission on Electric Steam Power Plant. Bio-oil fractionation showed that the initial boiling point (IBP) temperature started at 67.8 oC and final boiling point (FBP) temperature at 666.8 oC. The largest fraction was kerosene (36.2%) and diesel, indicating that bio-oil has the potential to be processed further into fuel oil. Syngas analysis results showed that the main gas compositions are CH4 (13 – 17% vol), H2 (28 – 33% vol), CO (17 – 26% vol) and CO2 gases (16 – 31% vol) with a calorific value of 2,600 – 3,300 Kcal/Nm3 . Some alternatives to syngas utilization are as a source of pyrolysis energy and for chemicals syntheses such as methanol and DME.

[2C-3.69] Potential of polypropylene nanocomposite reinforced with cellulose nanofiber from oil palm empty fruit bunch as sustainable industrial packaging: a review

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Abstract. Sustainable industrial packaging is a concept of industrial packaging that requires in evaluation and analyses the raw material selection (input), processing stage (technology process), product and byproducts (input), energy using, and lifecycle of the packaging production. Sustainable industrial packaging is focussed to production of packaging that promate the environmental, socyals, and economic health. The use of thermoplastic in industrial packaging has been raised concern about environmental impact, so needed the research to develop the alternative industrial packaging materials, to reduction the environmental impact industrial packaging from thermoplastic materials. Cellulose Nanofiber (CNF) has been considered a sustainable industrial packaging material due to its low weight, high strenght, higt abundance, rigidity, and biodegradability. Therefore, an innovative approach with CNF from Oil Palm Emty Fruit Bunch (OPEFB) can be a useful raw material to development of sustainable industrial packaging. Therefore, CNF from OPEFB is the potential additional raw material to development of sustainable industrial packaging. However, the limited of research that focused on CNF preparation to polypropylene nanocomposite (PPNC) production. PPNC is product of nonocomposite (NC) from polypropylene (PP) that reinforced with CNF from OPEFB. Therefore, this review are explane the potential of CNF from OPEFB as additional raw material to PPNC production.

[2C-3.97] Performance evaluation of the levulinic acid production using calendula (Calendula Officinalis) as potential feedstock.

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Abstract. Levulinic acid is one of the most important building blocks of the chemical industry. This product can be produced using lignocellulosic feedstocks through the implementation of the Biofine process. Nevertheless, the yields obtained are diverse. Thus, the assessment of potential raw materials should be done to ensure a good production. On the other hand, calendula (Calendula Officinalis) residues from the essential oil production are not valorized. Thus, the purpose of this work is to elucidate the performance of the levulinic acid production using calendula residues from essential oil extraction as feedstock. For this, the physicochemical characterization of calendula residues was done. Then, this information was used to simulate the xylitol production process using Aspen Plus v.9.0. The simulation process was accomplished using kinetic expressions and the patented Biofine Process flowsheet. The performance evaluation was done calculating mass indicators such as product yield (PY), conversion efficiency (CE), and mass intensity (MI). Moreover, energy indicators such as specific energy consumption (SEc), resource energy efficiency (RE), and renewability energy index (RI) were calculated. The acid production process results give a PY of 32 kg/kg, a CE of 81%, and a MI of 76.42 kg/kg. Furthermore, the energy balances of the process allowed estimate a SEc of 1.24 MW/kg, a RE of 48%, and RI of 35%. The performance assessment allows elucidate the potential of the calendula residues to produce levulininc acid. In addition, the simultaneous production of essential oil and levulininc acid could give a feasible biorefinery because the production of highly-marketable products.

[2C-3.121] AC-Fe Catalyst Modification on SS Cathode Affects Hydrogen Production in Microbial Electrolysis Cell

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Abstract. Microbial Electrolysis Cell can be used to produce hydrogen gas from organic matter contained in wastewater. However, at the cathode MECs, hydrogen production may be limited by methanogenesis wherein CO2 and hydrogen protons react to form methane and water. In this study, activated carbon (AC)-Fe was used as a catalyst coated onto SS mesh 304 as cathode. AC-Fe/SS was chosen for its high surface area and good activity and stability. The combination of the two is expected to increase hydrogen production in MECs. Adsorption and phase inversion were chosen to coat AC-Fe mixture on SS. The research was carried out in a 100mL MEC reactor with an operating time of 258 hours. The produced hydrogen was analyzed for its purity using a GC-TCD. Voltage measurements were carried out using a multimeter and bacterial growth was analyzed using a spectrophotometer. The highest fraction of hydrogen gas production was 60% without catalyst but only 0.08% with AC-Fe/SS. The highest value of optical density for bacterial growth was 0.611 with AC-Fe/SS but only 0.427 without catalyst. The highest current density was 2385.85 mA with AC-Fe/SS but only 1432.432 mA without catalyst. The results suggested AC-Fe/SS increased bacterial growth and the voltage generated but small amount of hydrogen gas production was produced.

Keywords: AC-Fe Catalyst, Hydrogen Production, Microbial Electrolysis Cell

[2C-4.84] Study on utilization of essential oil as an additive for Pure Plant Oil (PPO) in single cylinder diesel engine

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Abstract. This paper has studied an effect of Essential oils based bio-additive to improve pure plant oil (PPO) characteristics. Essential oils used such as citronella oil, clove oil, and their fraction derivatives to be formulated became bio-additive. The concentration of bio-additive added to PPO was 1% by volume. Testing was conducted on single cylinder diesel engine for agriculture application which refer to Indonesia national standard SNI of 0119:2012. The results of fuel characteristics showed that bio-additive+PPO could fulfilled the the quality standards of SNI 7431: 2015after five days storage. Here, the best bio-additive formulation was obtained from formulation of turpentine component. Engine test results showed that engine performance fueled with bioadditive+PPO was better compared with PPO without additive at the whole engine performance and emissions. At engine speed of 1800 rpm, bioadditive+PPO could reach a maximum power of 6.08 HP, maximum torque of 24.06 Nm, smoke opacity of 6.87 FSN and specific fuel consumption of 145.62 gr/kWh while the PPO had maximum power of 5.89 HP, maximum torque of 23.31 Nm, smoke opacity of 7.56 FSN and specific fuel consumption of 150.12 gr/kWh.

Keywords: Bio-additive; essential oil; PPO;engine

[2C-4.86] Optimizing chemical and physical pretreatment conditions to enhance sugar recovery from tobacco stalks biomass for bioethanol production

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Abstract. Tobacco is one of the most valuable agricultural products in the world. Tobacco is grown in over 125 countries, including Thailand, on over 4 million hectares of land. After the leaves are harvested, the stalks are most of the place burned in the field; and this approach is bringing about environmental severe pollution issues. Therefore, waste to energy concept, tobacco stalks were used in this study to determined the sugar productivity, also resulting in the wastage of renewable biomass resources. Total and reducing sugars were analyzed and after pretreatment and hydrolyzing procedure. Phenol-sulfuric method and dinitrosalicylic acid method were used for total sugar and reducing sugar determination for chemical, and physical pretreated samples. The development of efficient and cost-effective pretreatment before hydrolysis is essential for the economical production of bioethanol from tobacco stalks. Therefore, low-cost alkaline (calcium oxide) pretreatment designs with include stem-assisted, was applied with different concentrations (i.e., 0%, 1%, 2%, 3% and 4% w/v). In this study results, tobacco stalks biomass were pretreated by calcium oxide (2% w/v) shows the highest sugar yield, which is applicable for bioethanol production with cost-saving aspects.

Keywords: Tobacco stalks, Waste biomass, Pretreatment, Fermentable sugar

[2C-5.87] Catalytic Co-pyrolysis of Crude Palm Oil and Polypropylene in a Stirred Tank Reactor to Produce Non-Oxygenated Bio-oil

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Abstract. Catalytic co-pyrolysis of crude palm oil (CPO) and polypropylene (PP) has been carried out in a stirred tank reactor to produce bio-oil at heating rate of 10oC/min and maximum pyrolysis temperature of 550oC with a nitrogen gas flow rate of 100 mL / min. Catalyst of ZrO2 /γ-Al2O3 - TiO2 was used and prepared through calcination at heating rate of 7 oC/min with the maximum temperature of 1150oC. Catalyst as much as 15% of the total feed was used. Composition of CPO and PP was varied and it was found that the feed containing 50%PP achieved the highest yield of bio-oil. The GC-MS analysis shows that the biofuel contains mostly alkanes and alkenes with less than 20% oxygenated compounds. The H-NMR and C-NMR analysis shows that biofuel contains mostly chemical bonds of alkyls, followed by vinyl and carbonyl. The presence of catalyst of ZrO2 /γ-Al2O3 - TiO2 in the co-pyrolysis allows the production of more bio-oil and more yields of alkanes and alkenes in the bio-oil.

[2C-5.89] Characteristic of Bio-Briquettes from Kemiri Sunan (Reutealis trisperma) shell at several adhesive ratios

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Abstract. Kemiri Sunan (Reutealis trisperma) can be used as raw material of biodiesel. Production of biodiesel from Kemiri Sunan generates shell as the by-product, that can be utilized as bio- briquette material. During production process, adding adhesive for bio-briquette is a must in order to create solid and hard shell Kemiri Sunan bio-briquette. This study aims to find out the best ratio of adhesive (tapioca) at the production of bio-briquette. Kemiri Sunan shell was burned on gasifier, grinded (mesh 30) and mixed with some adhesive ratio, then molded. The ratio of Kemiri Sunan shell and adhesive were 1:50. 1:25, 1: 16, 1:12, and 1: 10 (w/w). The study showed that adhesive ratio affected characteristic of Kemiri Sunan bio-briquette. The best ratio was 1: 16 with characteristic: drop test value was 0.1%, water content was 5.5%, ash content was 6.6%, bound carbon was 49.94%, heating value was 6,372 cal/g, and burning time was 101 minutes.

Keywords: Kemiri Sunan shell, bio-briquette, adhesive, heating value

[2C-5.90] Formula Optimization of Foaming Agent Using Mixture D-Optimal Method and Application in Peat Fire Suppression

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Abstract. Foaming agents for fire suppression on peatland were formulated from the saponification product of palm oil fatty acids, namely sodium laurate and potassium palmitate. This study aimed to obtain the best formulation of sodium laurate and potassium palmitate as raw material for foaming agent concentrate through formula selection based on physical parameters foaming ability, foam stability, and surface tension. In addition to obtaining the best formula, foam liquid performance test for the foaming agent was also conducted on the peat fire suppression applications. Formulation of sodium laurate and potassium palmitate that produce the best foaming agent concentrate was 20% sodium laurate, 5.58% potassium palmitate, and 74.42% water, which produced a foaming response of 393.58%, foam stability of 69.59%, and surface tension of 31.11 dyne/cm. Foam performance test for the mixture of water and foaming agent showed that peat fire could be extinguished in 3 hours 50 minutes 42 seconds using 4.56 L/m2 extinguishing solution. Meanwhile, fire suppression with water requires 5 hours 31 minutes 59 seconds, with the application of 9.72 L/m2 solution. Water mixed with a foaming agent concentrate can extinguish peat fires faster than using water alone, besides being faster the application of foaming agents can reduce water consumption.

Keywords: fire suppression, foaming agent, formula, palm oil

[2D-1.65] Techno-Economic Analysis of Furfural Production with Various Pretreatment of Oil Palm Empty Fruit Bunches Using SuperPro Designer

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Abstract. Oil palm empty fruit bunches (OPEFB) are solid wastes that can be processed into several chemicals, one of which is furfural. Furfural can be used as a solvent and intermediate compound in many chemical industries. Nowadays, furfural needs in Indonesia are fulfilled through imports, especially from China. Therefore, developing a furfural plant in Indonesia is required to fulfill the needs of furfural in Indonesia and surrounding countries. Based on that necessity, this study provides the preliminary study and simulation of furfural production from OPEFB by three kinds of pretreatment methods: soaking in aqueous ammonia (SAA), steam explosion (SE), and ammonia fiber expansion (AFEX). Simulation is conducted by using SuperPro Designer Academic License to get the plant's mass & energy balance and economic parameter. The plant is built in Kawasan Industri Dumai, Pelintung, Riau. Then, by the assumption of 7920 hours annual operation time and 2000 kg OPEFB/h input rate, the simulations showed that furfural production with AFEX pretreatment is more economically feasible than with SAA and SE pretreatment by the value of profitability parameters as follows: Internal Rate of Return (IRR) = 49,77%, Net Present Value (NPV) at i = 9,6% = USD 39.210.000, and payback time = 1,75 years.

[2D-1.70] Development of Self Sufficient Energy in Tapioca Industry

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Abstract. Tapioca industries are one of main industries in Lampung province. Not less than 70 tapioca industries are operated to process cassava tuber into tapioca. Before 2005, tapioca industries consumed energy from grid and fossil fuel. Methane capture program was implemented through CDM or others project to reduce green house emission and at the same time also produce bioenergy. The objective of this research was to evaluate biogas generation from tapioca wastewater through anaerobic digestion process and its utilization to substitute fossil fuel in tapioca industry, especially for tapioca drying process. The research was conducted in a medium tapioca industry by observing biogas generation and energy requirement for tapioca drying process. Biogas production and energy consumption were measured in the tapioca industry with milling capacity of 400 tons of cassava per day. About 176,8 m3 of biogas was produced from a ton of tapioca production. At the same time, tapioca drying process consumed about 210,2 m3 of biogas. The deficit energy was resulted due to under capacity of the tapioca industry. During observation, the tapioca industry was operated at about 140 tons of cassava/day, much lower than the design capacity. As a consequence of this situation, dryer efficiency decreased to about 52 %. Maintaining optimal capacity is important to keep the tapioca industry become self sufficient energy industry.

Keywords: tapioca, wastewater, bioenergy, biogas

[2D-1.105] Environmental performances on the adsorbents of HAS-Clay, Kanuma-Clay and coffee residue for Bio-H2 purification

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Abstract. Recently, the fuel cell (FC) system operated by hydrogen of renewable source (e.g. biomass feedstock) has been developed to contribute the abatement of environmental impacts and/or to create the environmental business scheme. In this study, the bio-hydrogen produced through the biomass gasification process was focused. Considering the bio-hydrogen use, the production efficiency and/or the fuel cost are sensitive problems. In terms of technological barriers, the removal of impurities besides the performance related to the plant cost is highly impacted into the operating cost and/or the eco-burden. At the present, we focus on the removal system using the eco-friendly adsorbent. Due to the protection of the voltage drop of FC, the impurities should be eliminated. In addition, in terms of LCA thinking, not only the performance but also the content of adsorbent would be highly impacted. In our study, HASClay (hydroxyl aluminum silicate clay) is one of attractive candidates. It is shown that HASClay has good potential to remove H2S, HCl, and NH3 at the same time. While, the eco-burden of HAS-Clay would not be mitigated in comparison to that of conventional adsorbent. Using the results of adsorbent tests, HAS-Clay was unable to repeatedly adsorb NH3. Therefore, as alternative adsorbents, we compared Kanuma-Clay and coffee residue using the adsorption performance data on basis of LCIA (Life Cycle Impact Analysis) methodology. Note that the indexes of LCIA are GWP (global warming potential) and ADP (abiotic depletion potential). As a result, Kanuma-Clay was the best among them.

Keywords: HAS-Clay, Kanuma-Clay, Coffee residue, LCIA, Bio-hydrogen, adsorb NH3

[2D-2.102] Growth performance of nyamplung at a bioenergy trial plot in Bukit Soeharto Research and Education Forest, East Kalimantan

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Abstract. The Indonesian government has committed to providing its entire population with energy through the National Energy Policy (Kebijakan Energi Nasional) which highlights the importance of diversification, environmental sustainability and enhanced deployment of domestic energy resources. The contribution of new and renewable energy (NRE) to the nation's energy supply is mandated to reach 23% by 2025, with bioenergy an important NRE alternative. If developed and deployed appropriately, bioenergy plantations have potential to restore degraded land and support biodiversity. As a potential biofuel tree species suited to the tropics, Calophyllum inophyllum (nyamplung) is being tested across wide-ranging degraded forest conditions in Indonesia, including previously-burned land in Mulawarman University's Bukit Soeharto Research and Educational Forest. Nyamplung is a potential biodiesel alternative as it grows well in harsh environmental conditions, produces non-edible seed oil, has high amounts of kernel oil and fruits profusely. Here we report growth performance in a plantation trial plot established in February 2018, on previously-burned land. Growth of this two-year-old plantation is strong compared to other Indonesian sites, with average survival rate above 90% on ultisols soil which is classified low fertility and soil acidity. The findings reveal that different doses of fertilizer applications and slopes have no significant effects to the growth performance. In addition, trees have already started to flower and fruit, and are colonized by bird species and insects, including bees and butterflies. The study indicates that nyamplung is adopted well on different land and soil types.. Bioenergy plantations on degraded land are a promising approach for land restoration, and enhance native biodiversity while providing a source of renewable energy.

Key words: Calophyllum inophyllum; nyamplung; bioenergy; degraded land; growth performance; East Kalimantan

[2D-2.103] Potency and prospect of various raw materials for bioethanol production in Indonesia: a review

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Abstract. An increased population has an impact on rising fuel needs. Sources of fuel used today are still dominated by non-renewable sources, so it is necessary to find alternatives to produce renewable fuel. Bioethanol is one of the bioenergy sources that can replace gasoline. Bioethanol generates very low emission and uses renewable sources. The development of bioethanol has three beneficial aspects, namely the environment, energy security, and the improvement of the socio-economic community. Various studies have been conducted on the potential materials that can be used as raw materials for bioethanol. Raw materials for bioethanol production are divided into three categories, i.e. first generation, second generation and third generation. Analysis of the characteristics, yield, productivity, availability and economy are mostly done to get the most prospective raw materials for bioethanol production. This paper discusses various raw materials for bioethanol based on differences in characteristics, sources, yield, productivity and availability of materials. In addition, the advantages and disadvantages of each as prospective materials in Indonesia are discussed.

[2D-2.104] Life Cycle Inventory of Electricity Production from Biomass Power Plant System using Life Cycle Assessment in Aceh Province, Indonesia

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Abstract. Biomass are the important material sources for bioenergy generation using gasification technology. Empty fruit bunch (EFB) is one of the rests of biomass from palm oil production that underutilized in Aceh Province, Indonesia. In the previous research gasification technology was implemented in converting biomass to electricity. Life Cycle Assessment (LCA) are the well-known method and quantitative approach to evaluate the Environmental impact of the gasification system. LCA process consist of goal and scope definition, life cycle inventory (LCI), impact assessment (IA) and interpretation. Data sources, quality, and comprehensiveness in LCI is essential to evaluate the environmental impact in LCA analysis. The purpose of this research was development of LCI of electricity production using EFB biomass-based power plant in Aceh Province, Indonesia. The process of LCI development was consist of goal and scope definition, data collection, data verification, and development of LCI. The result of this research was the LCI of gasification technology to produce electricity in Aceh Province, Indonesia.

[2D-3.80] Impact Of B30, B40 And B50 Policies On The Economy Of Indonesia

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Abstract. The mandatory B30 program in early 2020 was implemented in almost all provinces in Indonesia. It hasn't been a year since the government has thought about the idea of applying to increase fuel with a mixture of B40 and B50. The application of B30 which has a strong reason is the exploration of renewable sources of fossil substitutes in realizing the nation's commitment to switch to clean energy in a solution to reduce greenhouse gas emissions. at home and create multiplayer effects especially for edible oil farmers. then the steps of the government can be assessed whether the government policy has been assessed appropriately or not in its policies to increase the percentage of biodiesel use in its main mixture of diesel and see the effects of its weakness whether it causes harm to consumers who use it. When viewed from the side of the influence of policies on socio-economic economy this has a positive impact on the government but has a negative value for the community. Meanwhile, if viewed from the perspective of the environment a positive impact because it can reduce cabon emissions. So it can be concluded that the government's policy efforts to increase the concentration of B30, B40 and B50 in terms of the economy, especially on foreign exchange of the state budget have a significant impact. But in the efficient use of the vehicle engine because it can be detrimental to the customer. In addition, environmental issues if this policy is implemented also need to be assessed whether it can threaten biodiversity because energy consumption is increasing so that year after year.

[2D-3.93] Genetic diversity assessment of Indonesian sorghum germplasm based on Agro-morphological Traits

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Abstract. Sorghum is a multifunctional crop that has been traditionally cultivated in Indonesia, especially in the eastern part where marginal and drought prone areas dominate the region. To understand similarities and genetic relationship between various accessions, study of genetic diversity was conducted using agro-morphological data to differentiate accessions and to obtain its genetic variance component. This research was conducted in 2012 and assigned in randomized complete block design with 2 replications in 5 m plot. Genotypes were 38 accessions of sorghum collected from various regions in Indonesia and also introduction lines. Traits observed were according to sorghum descriptors released by UPOV. The results of this study showed that there was significant effect of genotypes across quantitative traits, and also specific trait such as total biomas, brix content and juice extract volume ($p < 0.01$). Analysis of genotypic and phenotypic variance suggests that diversity between accessions were broad and heritability ($H2$) varies from middle to high. Genetic correlation showed that juice extract volume was highly correlate and significant with total biomass weight and stalk weight. Based on quantitative traits dendogram of accessions was grouped to 12 different clusters at 0.20 coefficients, with the highest contain 7 accessions. Abundant and very diverse germplasm collection indicates high potential of possible heterotic patern to be used further in breeding program in order to develop high yielding varieties for biomas (stalk) and food (grain).

Keywords : Sorghum, Genetic diversity, Agro-morphological, Biomass

[2D-3.72] Techno-Economic Analysis of Furfural Purification by Distillation and Extraction from Hydrothermal Hydrolysis of Oil Palm Empty Fruit Bunches

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Abstract. Furfural is a high-selling compound that can be produced from cellulose and hemicellulose conversion and the level of demand in Indonesia is still high. This study examined the economic evaluation and process simulation of furfural production from oil palm empty fruit bunch (OPEFB) by varying the purification method with distillation and extraction method using Superpro Designer 9.5 software. Two plant locations were also used as variation based on the raw material location in Banten and the customer location in Cilacap. Based on the economic evaluation results, the toluene extraction purification scheme was more profitable with internal rate of return (IRR) of 26.02% and furfural purity of 99.95% compared to the distillation purification scheme with IRR of 25.86% and furfural purity of 99.96%. Economic evaluation also result showed that the plant location in Cilacap was more profitable with net present value (NPV) of $ 89,739,000 compared with location in Banten with NPV of $ 87,430,000 eventhough the IRR were same for both locations.

[2D-3.115] The Role of Planting Media in the Growth of Antigonon leptopus as beneficial plant on Oil Palm Plantation

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Abstract. In the sustainable management of oil palm plantations, besides fertilization, pest and disease control are also important factors in the success of FFB production. Fire caterpillar pest as one of the important pests in oil palm. Biological control of fire worm pests in oil palm plantations can be done by planting Antigonon leptopus. This is because A. leptosus has the liquid or nectar needed by pest control agents as a parasitoid host and predator of palm leaf-eating caterpillars.Plant growth from seed to mature plants is very much influenced by the condition of the planting media and plant maintenance. The study was conducted at the Cikabayan Experimental Station, Dramaga, IPB University. This study aims to obtain the best media composition for plant growth of A. leptopus. The treatment consists of a mixture between soil + sand + manure with a ratio of 1: 0: 0 (M0), 2: 1: 1 (M1), 1: 1: 1 (M2), 1: 1: 0 (M3) and 1 : 0: 1 (M4). The results showed that the planting media did not significantly affect the germination and viability of the seeds. The planting media of 2: 1: 1 (M1) mixture composition gave the best vegetative growth and number of flower for A. leptosus plants.

Keywords: Planting Media, Antigonon leptopus, Oil Palm Plantation

[2D-4.116] Catalytic Reactions of 5-Hydroxy Methylfurfural in Zeolite

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Abstract. Due to limited supply of non-renewable natural carbons, alternative efforts on the transformation of sugars and biomass carbohydrates into 5-hydroxymethylfurfural (HMF) has been studied. Core oil palm trunk fiber (COPTF) is a potential candidate for the carbohydrate sources due to its high cellulosic contents. Moreover, this source is abundantly available in Indonesia and Malaysia in a form of waste. In this work,a comprehensive synthesis of 5-HMF from sugars were done and compared later with COPTF with the addition of zeolite and magnesium oxide (MgO). The reactions were carried out in water-methanol solvent system for 1 to 5 hours at 180ºC. The synthesized 5-HMF from sucrose with 10 wt% zeolite showed the highest yield at 5 hr reaction. Contradict with fructose and glucose, the 5-HMF yield were high in reaction without catalysts. However, the yield between these three sources are comparable and persistent. The two-way ANOVA found zeolite gives a significant effect in the synthesis because of its efficiency in dehydration and isomerization. While in COPTF, the highest 5-HMF concentration obtained by different catalyst loading was 5.40 g L-1 (5 wt %), 3.59 g L-1 (3 wt %) and 3.25 g L-1 (1 wt %) and 5.14 g L-1 (0 wt %) of zeolite. From FT-IR spectra of zeolite, it depicted the active sites was insignificantly changes after reactions. In summary, this study proven that COPTF can be a substitute carbon source for the 5-HMF synthesis.

Keywords: core oil palm trunk, dehydration, glucose, isomerization, methanolysis

[2D-4.117] Magnetic Properties of Silicon dioxide from Rice Straw

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Abstract. Silicon dioxide (SiO2) from rice straw is one of the alternatives used to replace silicon dioxide from natural minerals. In this study, an analysis related to the magnetic properties. The method is carried out by measuring the sample of silicon dioxide that has been extracted from rice straw with varying concentration of HCl (3%, 5%, 7%) using an LCR-meter. Analysis of the electrical and magnetic properties of silicon dioxide using LCR-meter with a frequency range of 50Hz – 5MHz, alternating current voltage of 1V, and alternating current of 50mA, data collection points 200 point for 7 min (420 sec), the average time is 2.1 sec per data. The results of the analysis of magnetic properties show that the value of Vicinity Magnetic Induction (VMI) calculated on silicon dioxide samples from rice straw with order 10-5 - 10-4 tesla and magnetic flux values calculated on samples with order 102 - 104 Wb on all variations of HCl concentrations. Application of magnetic properties in the form of Vicinity Magnetic Induction (VMI) and magnetic flux of silicon dioxide from rice straw is the forerunner as a magnetic sensor.

Keywords: magnetic flux, magnetic sensor, rice straw, silicon dioxide, Vicinity Magnetic Induction

[2D-5.73] Physical pretreatment and algal enzymes hydrolysis of dried low-grade and waste longan fruits to enhance its fermentable sugar production

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Abstract. Fruits production in Thailand has been increasing due to the practical farmers' knowledge of agro-ecology and their sustainable farming. Thailand is one of the productions of the most massive fruit in southeast Asian countries. On the other hand, the status of fruits waste, which becomes stuck previous to landfills, is concerned by researchers over the years. Low grade and waste longan fruits are also no exceptions that are feedstock material for bioethanol production. Hence, the purpose of this study is to evaluate bioethanol production from dried low-grade and waste longan fruits by using physical pretreatment (boiling and autoclave) and algal enzymes for hydrolysis. After pretreatment, total and reducing sugar was 227.63 ± 2.63 g/L and 89.26 ± 1.70 g/L, respectively. Algal enzymes were added at a pH of 7.0 in the hydrolysis process; subsequently, total and reducing sugar were achieved 348.68 ± 3.95 g/L and 183.33 ± 14.70 g/L, respectively. The present study shows that using algal enzymes in the hydrolysis process improves fermentable sugar production and applicable for bioethanol production.

Keywords: Low-grade longan fruits, Damaged longan fruits, Pretreatment, Algal enzymes, Fermentable sugars

[2D-5.78] Torrefaction to Improve Biomass Pellet Made of Oil Palm Empty Fruit Bunch

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Abstract. This study aims at determining the effect of the torrefaction process on the fuel quality of biomass pellet made from oil palm empty fruit bunches (EFB). The torrefaction process was carried out using a rotary reactor which has a cylinder with a diameter of 15 cm and a length of 15 cm made from iron plate. The cylinder was heated externally using a horizontal heater fuelled with LPG. To homogenize the heat and prevent pellets from colliding during the process, the reactor cylinder was filled with 1.5 kg of clean sand. The torrefaction process was conducted with a load of 300 grams of EFB pellets at temperatures around 240-310°C at variations of reaction time (20, 30 and 45 minutes) and the reactor cylinder rotation speed (16, 31, and 37 RPM). The results showed that the torrefaction process improved the quality of the EFB pellet fuel. This was reflected from the very low moisture content (0.32- 0.52%) of torrefied pellets and its calorific value, which increased from 15.82 MJ/kg (without torrefaction) to 17.59 MJ/kg (with torrefaction for 45 minutes). Torrefied pellets showed good hydrophobicity where pellet was not broken when immersed in water for 24 hours. Pellet without torrefaction was destroyed in water in just one minute.

Keywords: biomass pellet, palm oil, renewable, torrefaction, hydrophobic