ICBB 2021
INTERNATIONAL CONFERENCE ON BIOMASS AND BIOENERGY

E-PROGRAM BOOK

INTERNATIONAL CONFERENCE ON BIOMASS AND BIOENERGY

"Challenges in Biomass, Bioenergy and Biomaterials Research and Development in a Rapidly Changing World"

Online Conference on Zoom | 9-10 August 2021

Host:

IPB University — Bogor Indonesia

SBRC — Surfactant and Bioenergy Research Center

Co-Host:

ISBB — International Society of Biomass and Bioenergy

Sponsored by:

sawit

Supported by:

PUSAT UNGGULAN IPTEKS PERGURUAN TINGGI

ikabi

ABgI

VILLANOVA UNIVERSITY

Message from Chairman of Organizing Committee

I am delighted and honored to welcome you all to the International Conference on Biomass and Bioenergy (ICBB) 2021 organized by Surfactant and Bioenergy Research Center (SBRC), IPB University, in collaboration with the International Society of Biomass and Bioenergy (ISBB). The conference provides an opportunity to build a network among academicians, researchers, and practitioners for promoting more collaborations and accelerating the development of science and technology in the field of biomass and bioenergy. This year's conference theme is Challenges in Biomass, Bioenergy, and Biomaterials Research and Development in a Rapidly Changing World.

Despite of pandemic, prominent keynote speakers, invited speakers, and participants from 10 countries are enthusiastic to joint this virtual conference and present their research works. We are glad and grateful to have two notable keynote speakers at the conference, namely His Excellency Minister for Energy and Mineral Resources the Republic of Indonesia, Bapak Ir. Arifin Tasrif and Prof. Dr. Yukihiko Matsumura from the Hiroshima University. We hope this conference 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, all speakers and special thanks also extended to our main sponsor. I hope this conference will succeed with a real contribution to our life.

Bogor, August 2021

Dr. Ir. Edy Hartulistiyoso, MSc.Agr

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"*. On 10-11 August 2020, SBRC-IPB University in collaboration with the ISBB successfully conducted the International Conference of Biomass and Bioenergy by online with the theme "*Advanced Technology and Digital Innovations in Biomass, Bioenergy and Agriculture"*. 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; Vol. 460, ICBB 2019; and Vol. 749, ICBB 2020. The documentation of previous conferences is shown below.

Concerning the important issue of sustainable development goals (SDGs) in a rapidly changing world, in this year the International Conference of Biomass and Bioenergy 2021 (ICBB 2021) hosted by SBRC-IPB University in collaboration with the ISBB is continuously held with the theme "*Challenges in Biomass, Bioenergy, and Biomaterials Research and Development in a Rapidly Changing World"*. Due to the COVID-19 pandemic, ICBB 2021 is held as an online conference. Nevertheless, in 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, Japan, Philippines, USA, Chile, France, Germany, Malaysia, China, and Czech.

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 2022 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 recognition 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 - ICBB 2021
2. Original publication of International Journal of Sustainable Biomass and Biomass, 19 papers in three editions.

Content

Conference Program

Day-1: Monday, 9 August 2021

Jakarta time

Opening Ceremony	Opening and Keynote Session
07.30–08.30	Login and Registration
08.30–08.40	Opening Address (Prof Dr Arif Satria, Rector of IPB University)
08.40–08.50	Opening Address (The Indonesian Oil Palm Plantation Fund Management Agency)
08.50-09.10	Keynote Speech (The Ministry of Energy and Mineral Resources of the Republic of Indonesia) Indonesia's Policy and Contribution to Bioenergy Development
09.10–09.40	Keynote Speech (Prof. Dr. Yukihiko Matsumura, ISBB) Possibility of Biomass as a Carbon Source
Chair Kiyoshi Dowaki	**ICBB 2021 Plenary Session 1**
09.40–10.15	Prof. Dr. Akio Nishijima (The Engineering Academy of Japan) Sustainable Biomass Asia
10.15–10.50	Prof. Dr. David Herak (Czech University of Life Sciences, Czech Republic) Virtual reality and its application in the processing of agricultural products
10.50–11.25	Prof. Dr. Ahmad Zuhairi Abdullah (Universiti Sains Malaysia) Catalytic technologies for depolymerization of oil palm biomass lignin to simple phenolic substances
11.25–12.00	Prof. Dr. Navid Moheimani (Murdoch University, Australia) Saline algal culture for sustainable mass production of high value products
12.00 – 13.00	**Break**
13.00 – 16.30	**Parallel Sessions**

Day-2: Tuesday, 10 August 2021

Jakarta time

Opening Ceremony	Login Session
07.30–08.30	Login and Registration
Chair Justinus Satrio	**ICBB 2021 Plenary Session 2**
08.30–09.00	Prof. Dr. Erliza Hambali (IPB University, Indonesia) Prospects of Palm Oil Based Surfactant for Industrial Applications
09.00–09.30	Prof. Dr. Robert C. Brown (Iowa State University, USA) Heterodoxy in Fast Pyrolysis of Biomass
09.30–10.00	Dr. Oki Muraza (PT Pertamina, Indonesia) Circular Economy in Biofuel Production
10.00 – 12.00	**Parallel Sessions**
12.00 – 13.00	**Break**
13.00 – 16.30	**Parallel Sessions**
	Closing of ICBB 2021 by Conference Secretariat
16.30 - 16.50	Best Student Paper Award by Secretariat ICBB 2021
	Closing Adress by SBRC IPB
	Closing Remarks by ISBB
	Closing Remarks by Organizing Committee ICBB 2021

Day-1: Monday, 9 August 2021: 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	Author(s)	Paper	Author(s)	Paper	Author(s)	Paper	Author(s)
	SESSION 1		SESSION 1		SESSION 1		SESSION 1	
	ROOM A		ROOM B		ROOM C		ROOM D	
	Chair: Prof. Navid Moheimani		Chair: Dr. Oki Muraza		Chair: Prof. Ahmad Zuhairi Abdullah		Chair: Assoc. Prof. Nunoura	
	Operator:		Operator:		Operator:		Operator:	
13.00 - 13.20	Suwarti	[28] Description of maize check genotypes for selection on tidal-swamp land for biomass and grain production	(15.00 JST) Haruka Nakayama, Mitsuo Kameyama, Hisashi Kamiuchi and Kiyoshi Dowaki	[12] Optimization of Temperature Rise of Heat Carriers in Indirect Gasification Hydrogen Production Process Using CFD Simulation	Sang Ayu Made Sri Tandewi and Erliza Hambali	[82] Refining of Fish Oil from Fish Meal Processing By-Product Using Zeolite and Bleaching Earth	(15.00 JST) Kento Torii and Dowaki Kiyoshi	[17] LCA analysis and quantification of adsorption performance of Kanuma clay by simultaneous adsorption of H2S and NH3
13.20 - 13.40	Muhammad Hanifuddin, Riesta Anggarani, Milda Febria, Catur Y Respatiningsih, Rona Malam Karina, Setyo Widodo, Cahyo Setyo Wibowo, May Muchar and Rizkia Malik	[61] The Influence of Gasoline-Bioethanol Blends on Lubrication Characteristic of Motorcycle Engine Oil 4T	Kursehi Falgenti, Yandra Arkeman, Khaswar Syamsu and Erliza Hambali	[2] The design of blockchain network of palm oil FFB supply from certified farms and traceability system of CPO from independent smallholders	Taufik Taufikurahman, Rizka Purnamawati and Andira Rahmawati	[66] Decreased in Paddy Yield (Oryza sativa L.) as a Response to Plant Bioaccumulation of Chromium	(15.20 JST) Akihiro Oki, Takuma Kanemura and Kiyoshi Dowaki	[15] A combined evaluation on quality and eco-burdens of the tomato greenhouse air conditioner using the hydrocarbon refrigerant of GF-08
13.40 - 14.00	(15.40 JST) Shinji Kanehashi	[78] Novel Environmentally-Friendly Biomass-based Polymers	Mohamad Aman	[86] Determination of Diffusion Coefficient of Palm Oil in n-Hexane Using Laser Deflection Method and Image Processing	Evi Triwulandari, Witta K. Restu and Muhammad Ghozali	[14] Characterization and Modification of Starch Using Lactic Acid Oligomer to Decrease the Solubility in Water	Wanda Gustina Utami, Radya Yogautami, Dewi Agustina Iryani, Udin Hasanudin and Puspita Yuliandari	[80] The Potential of Energy Production and Greenhouse Gases Emission Reduction from Households Organic Waste in Bandar Lampung, Indonesia
14.00 - 14.20	Dian Burhani, Athanasia Amanda Septevani, Ruby Setiawan, Luthfia Miftahul Djannah and Muhammad Andrew Putra	[97] The effect of drying process of cellulose nanofiber from oil palm empty fruit bunches on morphology	(09.15 CEST) Sri Murniani Angelina Letsoin, David Herak and Ratna Chrismiari Purwestri	[77] Evaluation Land Use Cover Changes Over 29 Years in Papua Province of Indonesia Using Remote Sensing Data	Berlian Simanjuntak, Helen Julian and M.T.A.P. Kresnowati	[49] Downstream Process of Xylanase Enzyme Production from Oil Palm Empty Fruit Bunches: A Review	May Muchar, Riesta Anggarani, Lies Aisyah, Dimitri Rulianto, Muhammad Hanifuddin, Sylvia Ayu Bethari, Milda Febria, Cahyo Setyo Wibowo, Faqih Supriadi and Emi Yuliarita	[45] The Effect Characteristics Cetane Number of Two Types Commercial High Speed Diesel Fuel with Biodiesel Palm Oil Base Blended in Indonesia
14.20 - 14.40	Ravi Farkhan Pratama, Cahyo Setyo Wibowo, Nur Allif Fathurrahman and Edy Hartulistiyoso	[21] Effect of low percentage methanol blends in gasoline RON 90 on fuel volatility characteristics and spark ignition engine performance					Wildan Q. Salam, Helen Julian and M.T.A.P. Kresnowati	[47] Fermentation Based Sugar-Alcohol Downstream Processing: A Review

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	**Author(s)**	**Paper**	**Author(s)**	**Paper**	**Author(s)**	**Paper**	**Author(s)**
14.40 - 14.55	**BREAK**							
	SESSION 2		**SESSION 2**		**SESSION 2**		**SESSION 2**	
	ROOM A		**ROOM B**		**ROOM C**		**ROOM D**	
	Chair: Assoc Prof. Kanehashi		**Chair: Dr. Oki Muraza**		**Chair: Prof. Lee Keat Teong**		**Chair: Dr. Darmono Taniwiryono**	
	Operator:		**Operator:**		**Operator:**		**Operator:**	
14.55 - 15.15	Okta Amelia, Illah Sailah, Ika Amalia Kartika, Ono Suparno and Yazid Bindar	[62] Study on Effectivity and Efficiency of Various Drying Methods of Nyamplung Fruits (Callophyllum Inophyllum)	Erni Krisnaningsih, Yandra Arkeman, Marimin Marimin and Erliza Hambali	[36] Decision Model for Determining the Feasibility of Rice-Based Bioenergy Supply Chain Development Area with Fuzzy Logic-AHP Approach	Rossy Dwi Devitasari, Nur Allif Fathurrahman, Marsha Katilli, Cahyo Setyo Wibowo, Sylvia Ayu Bethari, Riesta Anggarani, Lies Aisyah and Maymuchar	[24] Determination of Oxidation Stability of Palm-Oil Biodiesel and Biodiesel-Diesel Blends by Rancimat and RSSOT Methods	Alfa Firdaus	[72] Strategies on the Development of Palm Oil-Based Biodiesel Agroindustry for Energy Security in Indonesia
15.15 - 15.35	(16.15 MYT) Mahmud Hakim, Muhammad Khairul Afdhol, Fiki Hidayat, Yuliusman Yuliusman, Razif Muhammed Nordin, Rosdanelli Hasibuan and Fadilul Fadly	[39] The Utilization Pineapple Skin Waste and Additive Xylene used As A Wax Inhibitors	Lukman Haris, Irman Hermadi, Ganjar Saefurahman, Dhani S. Wibawa and Yandra Arkeman	[94] Cellular Automata Machine Modeling with Probabilistic Cellular Automata to Obtain Optimal Conditions and Productivity of Microalgae Biomass	Taufik Taufikurahman, Deby Anindya Rizkyani and Andira Rahmawati	[83] Phytotoxicity of chromium-containing wastewater on germination and growth of Oryza sativa L.	Meika Syahbana Rusli, Obie Farobie and Muhammad Adi Septyan	[35] Effect of Bio-additive Derived from Essential Oils on Particulate Matter and Water Content of B30 (30% of Biodiesel Blended Fuel)
15.35 - 15.55	Fadilul Fadly, Muhammad Khairul Afdhol, Fiki Hidayat, Yuliusman Yuliusman, Razif Muhammed Nordin, Rosdanelli Hasibuan and Mahmud Hakim	[38] Bioethanol Formulation from Waste Pineapple and Additive Toluene as Wax Inhibitor	Totok Soehartanto, I Putu Eka Widya Pratama and Alvin Daviza Putra	[50] The Design of Fuel Dryer in Palm Oil Processing Industries by Utilizing the Heat Product of Boiler Based on Computational Fluid Dynamic	Salsabila Posmaryana Utami, Andre Fahriz Perdana Harahap, Muhammad Arif Darmawan, Misri Gozan and Muhammad Yusuf Arya Ramadhan	[70] Liquid-Liquid Extraction (LLE) of Furfural Purification from Oil Palm Empty Bunch with Toluene Solvent	Adil Fajar Widrian, Budiawan Sidik Arifianto, Nur Baiti and Nugroho Adi Sasongko	[63] Review Biodiesel Policy in Indonesia
15.55 - 16.15	Endang Warsiki and Kamilia Melinggawati Manan	[37] Application of Modified Atmosphere Packaging to Extend Pineapple (Ananas comosus L.) Shelf Life	Arty Dwi Januari and Haruki Agustina	[25] Palm Oil Empty Fruit Bunches and The Implementation of Zero Waste and Renewable Energy Technologies	Fabio Carisma Handita, Andre Fahriz Perdana Harahap and Misri Gozan	[56] Vapor-Liquid Equilibrium (VLE) Curve for Furfural Purification from Oil Palm Empty Fruit Bunch Hydrolysate Solution with the UNIQUAC Model	(04.55 EDT) Justinus Satrio and Maria Nydia Lynch	[26] Utilization of Grassy Biomass Grown in Heavy-Metal Contaminated Soil as Feedstock for Bioenergy Production - An LCA Study

Day-2: Tuesday 10 August 2021: 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	**Author(s)**	**Paper**	**Author(s)**	**Paper**	**Author(s)**	**Paper**	**Author(s)**
	SESSION 1		**SESSION 1**		**SESSION 1**		**SESSION 1**	
	ROOM A		**ROOM B**		**ROOM C**		**ROOM D**	
	Chair : Assoc. Prof. Kanehashi		**Chair: Prof. Navid Moheimani**		**Chair: Prof. Ahmad Zuhairi Abdullah**		**Chair: Assoc. Prof. Nunoura**	
	Operator:		**Operator:**		**Operator:**		**Operator:**	
10.00 - 10.20	(11.00 MYT) Basuki Wirjosentono, Darwin Yunus Nasution and Diana Adnanda Nasution	[89] Plastisisation of Polyvinilchloride Biofilms with Palm Oil Oleine and Methylmethacrylate as Comonomer	Widiatmini Sih Winanti, Wahyu Purwanta and Wiharja	[10] Utilization of Municipal Solid Waste into electricity energy: A performance study of the PLTSa Bantargebang Pilot Project	Herdhata Agusta, Dwi Guntoro, Mercy Bientri Yunindanova and Mei Nita Sari	[9] Thermal Hydrolysate of Coconut Trunk, Coir, and Shell as Bioherbicide	Abeth Novria Sonjaya and Adi Surjosatyo	[99] An Investigation on Gasification Conversions of Municipal Solid Waste Using Fixed Bed Downdraft: Study Case of Final Processing Site TPA Putri Cempo Surakarta Indonesia
10.20 - 10.40	Made Tri Ari Penia Kresnowati, Dianika Lestari, Ervina Desiviola Tommy, Mien Shavero Purba and Mustofa Anshori	[27] Carotene Production from Solid State Fermentation on Oil Palm Empty Fruit Bunches (OPEFB)	Muhammad Syukur Sarfat, Dwi Setyaningsih, Farah Fahma, Nastiti Siswi Indrasti and Sudirman	[51] Characterization of mono-diacylglycerols, cellulose nanocrystals, polypropylene, and supporting materials as raw materials for synthesis of antistatic bionanocomposites	Siti Nikmatin, Irmansyah Irmansyah, Muhammad Nur Indro, Gito Heryan and Mirna Mariani Sholikhah	[20] Thermal study of Ca(OH)2 coated OPEFB fibers from limestone through the calcination-hydration process	Ati Atul Quddus, Erliza Hambali, Mulyorini Rahayuningsih, Ika Amalia Kartika and Slamet Budijanto	[91] Bibliometric Mapping of Glucomannan Flour from Porang (Amorphophallus muelleri Blume) Tubers as Future Crops in Agriculture: Review and Future Research agenda
10.40 - 11.00	Mashur Mashur	[13] The Effect of Nest Box Types and Stocking Density on Multilevel of Shelf Cultivation System on Increasing Biomass Production of Eisenia foetida Savigny	Agung Nugroho, Amin Padil, Udiantoro Udiantoro and Wiwin Tyas Istikowati	[69] Characteristics and Performance of Charcoal Briquette from the Sawdust of Sungkai (Peronema canescens Jack)	Hablinur Al Kindi, Armansyah H Tambunan, Edy Hartulistiyoso, Salundik, Achmad Kemal Fadillah and Iyan Yuliana	[55] Equilibrium Behaviour of CO_2 Adsorption from Biogas Onto Zeolites	Dwi Setyaningsih, Farah Fahma, Purwoko, Aria Tri Wahyudi, Cyntia Humaira, Ellis Natalita Sitepu, Ikhrahmatul Shindy, Ilham Bintang Mahendra, Sindy Pratiwi Putri	[92] Technology Innovation and Business Model of Palm Oil Miniplant for Food and Energy
11.00 - 11.20	Gita Syarifah Ali, Erliza Hambali and Farah Fahma	[84] Potential of nanoemulsion process and method using agro-industrial based materials in skincare formulations: A review	Nur Suhascaryo and Angga Sirait	[60] Implementation of New Material "CCO" for Mud Drilling to Prevent Swelling Problem with Geonor As.	(13.00 JST) (12.00 CST) Daisuke Hara, Miao Shan, Junnosuke Shimogawa, Noboru Katayama and Kiyoshi Dowaki	[58] A Suitable Design of Metal Hydride Cartridge for a Fuel Cell Assisted Bicycle in Consideration of Heat Transfer Performace	Yogi Pramudito, Cahyo Setyo Wibowo, Nur Allif Fathurrahman, Riesta Anggarani, Faqih Supriadi, Sylvia Ayu Bethari, Dimaz Wirahadi, May Muchar, Emi Yuliarita and Dimitri Rulianto	[43] Comparison Performance CI Engine of Used fuel High Speed Diesel Fuel-Biodiesel Blend (B30) with B40 on Diesel Engine Dyno test
11.20 - 11.40	Nopia Cahyani, Andi Detti Yunianti and Suhasman Suhasman	[33] The Potential of Nano Bio Briquette from Coffee Ground and Pine Wood Waste	Alifiana Permata Sari, Rinaldi Medali Rachman, Mega Mutiara Sari and Eduardus Budi Nursanto	[52] The Utilization of Chicken Slaughter Waste for Organic Fertilizer	Sri Wahyono, Firman Laili Sahwan and Feddy Suryanto	[6] Characterization of Municipal Solid Waste for Waste to Energy Option in Jakarta	Reza Fathurahman and Adi Surjosatyo	[96] Utilization of rice husks as a fuel for gasification – A review

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	**Author(s)**	**Paper**	**Author(s)**	**Paper**	**Author(s)**	**Paper**	**Author(s)**
11.40 - 12.40	**BREAK**							
	SESSION 2		**SESSION 2**		**SESSION 2**		**SESSION 2**	
	ROOM A		**ROOM B**		**ROOM C**		**ROOM D**	
	Chair: Dr. Farah Fahma		**Chair: Dr. Dwi Setyaningsih**		**Chair: Prof. Lee Keat Teong**		**Chair: Dr. Ir. Udin Hasanudin, M.T.**	
			Operator:		**Operator:**		**Operator:**	
12.40 - 13.00	Reno Susanto, Ilman Azhari and Komalasari Komalasari	[98] Utilization of Palm Frond Waste to Control Corrosion in Industrial Piping Systems	Muhammad Fuad Fuad and Muhammad Kurniawan Kuniawan	[32] Producing biodiesel distillate with low monoglyceride for B40 Component by 1 plate and 30 plate (TBP distillation)	Siti Suharyatun, Agus Haryanto, Winda Rahmawati and Muhammad Naufal F.	[8] Valorization of Corncob Through Torrefation Process	Rizal Alamsyah, Susi Heryani, Dedi Darmawan Samid and Nobel Cristian Siregar	[64] Production of Fuel pellet From Agricultural and Plantation Estate Crops Biomass
13.00 - 13.20	Harapin Hafid and Peni Patriani	[4] Utilization of industrial waste banana chips in feed towards morphometrics and characteristics of thin-tailed sheep carcass	(14.00 MYT) Tengku Rachmi Hidayani, Basuki Wirjosentono, Darwin Yunus Nasution and Diana Adnanda Nasution	[88] Processing of Primary Sludge of Pulp Industry As Microfillers for Polystyrene foam Composites	Muhammad Fuad Fuad and Ishenny Mohd. Noor Mohd. Noor	[29] Effect addition of bioadditive in Biosolar properties	Harummi Sekar Amarilies, Iwan Sukarno, Alifiana Permata Sari and Eduardus Budi Nursanto	[54] Selection of Liquid Organic Fertilizer Packaging by Applying the Concept of Reverse Logistics Using Quality Function Deployment (QFD) Method DEPLOYMENT (QFD) METHOD
13.20 - 13.40	Ziedal Mafaaz Fafaaza Emha, Erliza Hambali and Dwi Setyaningsih	[79] Solid Alcohol Formulation as a Lighters in Charcoal Bio-Briquettes	Joko Prayitno, Rahmania Admirasari, Siti Jamilah and Agus Rifai	[30] Alternative source of nutrients for microalgae biomass production in a photobioreactor system	Ika Amalia Kartika, Satriyo Dibyo Sumbogo, Ikbal Fataya, Wega Trisunaryanti, Hartati Hartati and Illah Sailah	[7] Optimization of Calophyllum oil extraction and its application for biogasoline	(09.00 CEST) Resa Martha, Istie Sekartining Rahayu, Irmanida Batubara, Wayan Darmawan and Philippe Gérardin	[11] The promising future of tropical marine microalgae: culture, biomass production, potency, and challenges in food and health applications.
13.40 - 14.00	Muliadi Ramli, Nurdin Saidi, Muniana Murniana and Minna ti Maisarah	[41] Aceh Local Dolomite Modified Alkali Metals as Low-Cost Solid Inorganic Catalyst for Biodiesel Synthesis	Peni Patriani, Harapin Hafid, T. V Wahyuni and T V Sari	[5] The Effectiveness of Honje (Etlingera elatior) Biomass on improving the physical quality of native chicken meat	Abdul Salam, Distra Rizki, I Santa, S Supriatin, Liska Septiana, Sarno and Ainin Niswati	[46] The Biochar-Improved Growth-Characteristics of Corn (Zea mays L.) in a 22-Years Old Heavy-Metal Contaminated Tropical Soil	Diah Noerdjito, Debora Purbani, Asep Bayu, Kusmiati, Gede Suantika, I Made Sudiana and Serly Sapulete	[81] Improvement of Short Rotation Teak Wood by Glycerol-Maleic Anhydride Treatment
14.00 - 14.20	(09.00 CEST) Britta Brands and Matthias Kleinke	[57] Astaxanthin production in Xanthophyllomyces dendrorhous grown in medium containing watery extracts from vegetable residue streams	Tengku Dahril and Aras Mulyadi	[3] Applied Technology to produce Chlorella Jelly Genki to Increase Human Body Immunity from Covid-19 Illness.	(15.00 PHST) Artbellson Mamuri, Nathaniel Ericson Mateo, Thomas Ubiña and Shirley Agrupis	[22] Optimization of a 10 Liter Full Electric Reflux Distiller		
14.20 - 14.35	**BREAK**							

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	**Author(s)**	**Paper**	**Author(s)**	**Paper**	**Author(s)**	**Paper**	**Author(s)**
	SESSION 3		**SESSION 3**		**SESSION 3**		**SESSION 3**	
	ROOM A		**ROOM B**		**ROOM C**		**ROOM D**	
	Chair : Dr. Tatang Hernas Soerawidjaja		**Chair : Dr. Farah Fahma**		**Chair : Dr. Herdhata Agusta**			
	Operator:							
14.35 - 14.55	I Made Sudiana, Tri Ratna Sulistiyani and Ikhsan Guswenrivo	[87] Application of Compost, fertilizer and beneficial microbes to support Sorghum's Growth in Ultisol	Karnita Yuniarti, Efrida Basri and Lisna Efiyanti	[59] INTERMITTENT DRYING OF DRAGON BLOOD'S RESIN	Dwi Setyaningsih, Crisman Arianto Siagian, Neli Muna and Purwoko	[95] Synthesis of Bio Hydrocarbon from Palm Olein Through Pyrolysis at Various Temperature		
14.55 - 15.15	Nur Akmalia Hidayati, Septhian Marno, Irika Devi Anggraini, Rijal Ali Fikri, Wihdhatul Latifah, Nelliza Putri, Irma Nur Fitriani, Bayu Prabowo and Rachma Fitriani	[23] Development of fertilizer-based medium for the growth rate improvement of Chlorella sp. in the laboratory scale	Edy Hartulistiyoso, Obie Farobie and Suandireza Rholanjiba	[42] A Comparative Study on the Effect of Catalysts on the Yield of Biodiesel from Kemiri Sunan (Reutealis trisperma) Oil	Maharani Dewi Solikhah, Andrias Rahman Wimada, Anisa Galuh Arisanti, Feri Karuana, Hafizh Ghazidin, Hanafi Prida Putra, Fatimah Tresna Pratiwi and Bina Restituta Barus	[68] Influence of B30 palm based biodiesel blends upon degradation of elastomers		
15.15 - 15.35	Ahmad Nurul Muttaqin, Hairul Arsyad and Onny Sutresman	[1] Characteristics of Corn Cobs from the Ball Mill Process	Dedi Suntoro, Paber Sinaga, Radityo Cahyo Yudanto and Faridha Faridha	[73] Energy Efficiency and Energy Saving Potential Analysis of Biomass Boiler at the PT Greenfields Indonesia Milk Processing Plant	Nyoman Puspa Asri, Rahayu Saraswati, Rachmad Ramadhan Yogaswara, Suprapto Suprapto and Nadya Errys Restyani	[74] Converting of kesambi (Schleichera oleosa l.) oil into biodiesel using ZnO-based solid acid catalyst		
15.35 - 15.55	Siti Nikmatin, Irmansyah Irmansyah, Muhammad Nur Indro, Adi Cifriadi, Muhammad Farhan and Yulisa Aviani Nurwinda	[19] The Effect of Woven Oil Palm Empty Fruit Bunches (OPEFB) Filler Fiber on the Mechanical Properties of Natural and Synthetic Rubber	Hurun Iin, Sugiarto Sugiarto and Farah Fahma	[93] Production of zeolite-cellulose nanocomposites with garlic essential oil for antimicrobial tablets	Diini Fithriani and Susiana Melanie	[40] Vitamin and mineral content of microalgae Phorpyridium and Chlorella and development prospects for food raw materials		
15.55 - 16.15	Eduardus Budi Nursanto, Rinaldi Medali Rachman, Mega Mutiara Sari and Alifiana Permata Sari	[53] The Utilization of Fruit Peels as Carbon Source for Production of Organic Fertilizer			(04.35 CLT/EDT) (10.35 CEST) Rene Garrido, Joseph Reckamp, Philipp Bastian, Nicole Rumore, Charles Coe and Justinus Satrio	[34] Influences of Zinc Chloride on Fast Pyrolysis of Pinewood		
16.15 - 16.30	**BREAK**							

Abstract of Papers

[1] Characteristics of Corn Cobs from the Ball Mill Proces

Ahmad Nurul Muttaqin, Hairul Arsyad*, Onny Sutresman

Mechanical Engineering Department, Engineering Faculty, Hasanuddin University, Malino No.KM 6, Bontomarannu, Kec. Somba Opu, Kabupaten Gowa, Sulawesi Selatan 92171

E-mail: arsyadhairul@yahoo.com

Abstract. The use of corncob powder is very wide in various industrial fields, namely as a source of dietary fiber, the basic material for making bio-plastics, partial replacement of cement in the manufacture of concrete, functional chemicals, oyster mushroom cultivation media. The most efficient method in producing corncob powder is the Ball Mill Process. The purpose of this study was to evaluate the effect of working volume and milling time on the characteristics of corn cob powder. The research procedures include specimen preparation (including cutting and drying processes) and milling processes. The results obtained were then characterized using a scanning laser microscope (LSM) to analyze the morphology and size of the product, it was found that Fourier transforms infrared (FTIR) to analyze the structure of the product elements, X-ray diffraction (XRD) to analyze the crystalline and amorphous phases in the material. The highest crystalline presentation was in the milling process with a working volume variation of 20% with a milling time of 60 minutes, namely 35.2%, and amorphous presentation 64.79% with the highest intensity value was 3000 (a,u), lower working volume results in a smaller powder production with a needle-like sharp edge morphology and a higher work volume also results in a powder that has a blunt edge morphology. Although working volume can potentially be used to control particle size, this parameter has a direct effect on powder yield. As for the long milling time, it produces a smaller powder size than the faster milling time.

Keywords: Ball Mill Process, Corncobs, LSM, FTIR, XRD

[2] The Design of Blockchain Network of Palm Oil FFB Supply from Certified Farms and Traceability System of CPO from Independent Smallholders

K Falgenti[1,3*], Y Arkeman[1,2], E Hambali[1,2], K Syamsu[1]

1. Department of Agro-industrial Engineering, Faculty of Agricultural Engineering, IPB University (Bogor Agricultural University), Bogor, Indonesia
2. Surfactant and Bioenergy Research Center, IPB University, Baranangsiang Campus, Bogor, Indonesia
3. Department of Information System, Faculty of Computer Science, Universitas Nusa Mandiri, Jakarta, Indonesia

E-mail: gekfalgenti@apps.ipb.ac.id

Abstract. Mills produce Crude Palm Oil (CPO) from procurement channels of their farm, plasma farm, and independent smallholders' farm. The mill manufactures and sells CPO with low Free Fatty Acid (FFA), standard CPO, and Industrial Vegetable Oil (IVO) from all channels. CPO with low FFA for export consists of premium-grade CPO and super-grade CPO. Premium-grade CPO has FFA levels < 2%, export to the food industry in developed countries. The food industry as a CPO customer needs a lot of information about the origin of the CPO commodity and information about sustainable oil palm agriculture governance. The challenges of building a premium-grade CPO traceability system raw material of CPO come from three channel of FFB procurement and produce the various quality of CPO. This study aims to map the Fruit Fresh Bunch (FFB) supply at PT.RSI from Roundtable on Sustainability Palm Oil (RSPO) certificate farm in independent smallholders' groups' channel in the Hyperledger Fabric blockchain network. The interaction of entities with smart contracts is described in the ERD diagram, and the form of collaboration between entities is illustrated in the sequence diagram. The design of blockchain network FFB supply and traceability of FFB supply from independent smallholders group procurement channel based on FFB's sales data of premiumgrade CPO from the exporter. The contribution of Independent smallholders' groups' channel to produce premium CPO can calculate. By presenting the CPO supply system on a map, Independent smallholders' farms are contributing to making premium-grade CPO can be identified.

Keywords: Blockchain network, premium-grade CPO, independent smallholders, traceability system

[3] Applied Technology to Produce Chlorella Jelly Genkito Increase Human Body Immunity from Covid-19 Illness

Tengku Dahril, Aras Mulyadi and Eddiwan

Faculty of Fisheries and Marine Science, University of Riau, Pekanbaru, Riau, Indonesi

E-mail: dahril2011@gmail.com, aras.mulyadi@lecturer.unri.ac.id, eddiwan@gmail.com

Abstract. Chlorella Jelly Genki is one of the innovative drink products made by biomass Chlorella that can be used to increase human body frorm covid-19 illness. Chlorella was cultured in 6 l Cleo Bottle with culture media of Dahril Solution 1 made by pure chemical consisted of KNO_3 1000 mg/l, $MgSO_4$, 250 mg/l, K_2HPO_4 250 mg/l, NaCl 100 mg/l, $CaCl_2.2\ H_2O$ 10 mg/l, then Fe-solution, 1 ml/l and trace metal solution 1 ml/l. Fe solution made by $FeSO_4.\ 7H_2O$ 2000 mg/l and Na_2EDTA as much as 189 mg/l per1 litre aquades. Trace metal solutions made by H_3BO_3 2860 gr/l, $MnSO_4.7\ H_2O$ 2500 mg/l, $ZnSO_4.7H_2O$ 225 mg/l, $CuSO_4.5H_2O$ 71 mg/l dan Na_2MoO_4 21 mg/l per 1 litre aquades Based on the result of this study indicated, that Chlorell can grow well in Cleo Bottle to absorb CO_2 and produce O_2 with chemical reaction as follow, $6\ CO_2 + 6\ H_2O \lozenge C_6H_{12}O_6 + O_2\nearrow$. The high concentration of cell density was found 1.2 x 10^7 cells/ml, Chlorophil-a concentration of 184.09 µg/l, and Chlorella biomass, 1,25 g/l. The chemical compound of Chlorella Jelly Genki were also high with protein level of 45.09 %, lipid 10.85 % and carbohydrate 12.77 %. They also contain, vitamin E, mineral, beta carotene and anti oxidant essence. Chlorella Jelly Genki that made in this study can be used as supplement food to increase immunity of human body to prevent Covid-19 illness.

Keywords: Cleo Bottle, Chlorella Jelly Genki, Covid-19 illness

[4] Utilization of Industrial Waste Banana Chips in Feed Towards Morphometrics and Characteristics of Thin-tailed Sheep Carcass

H Hafid[1] and P Patriani[2*]

1. Animal Science Departement, Faculty of Animal Science, Halu Oleo University, Jl.HEA Mokodompit, Kendari 93232, South East Sulawesi, Indonesia 93232
2. Animal Husbandry Study Program, Faculty of Agriculture, Universitas Sumatera Utara, Padang Bulan, Medan, Indonesia 20155

E-mail: penipatriani@usu.ac.id

Abstract. The study aimed at the biomass of industrial waste banana chips as animal feed and its effects on morphometric size and carcass characteristics. Research material in the form of 20 male, thin tailed sheep were feed using (P0): 40% of industrial waste banana chips without fermentation in the ration, (P1): 20%, (P2): 40% and (P3): 60% of fermented industrial waste banana chips in ration. This study used a complete randomized design with 4 treatments and 5 replications. The results showed that the use of industrial waste from banana chips as a thintailed sheep feed had a very significant effect (P

Keywords: industrial waste, banana chips, feed, morphometrics characteristics, thin-tailed sheep

[5] The Effectiveness of Honje (Etlingera elatior) Biomass on Improving the Physical Quality of Native Chicken Meat

P Patriani[1*], H Hafid[2], T H Wahyuni[1], T V Sari[1]

1. Animal Husbandry Study Program, Faculty of Agriculture, Universitas Sumatera Utara, Padang Bulan, Medan 20155, North Sumatera, Indonesia
2. Animal Science Departement, Faculty of Animal Science, Halu Oleo University, Jl.HEA Mokodompit, Kendari 93232, South East Sulawesi, Indonesia

E-mail: Penipatriani@usu.ac.id

Abstract. Improving physical quality of native chicken meat is important to increase consumer acceptance. Native chicken meat is known to have a tough texture and dark color hence most consumers do not like it. One method to improve physical quality is by using cheap and abundant spices. Honje fruit (Etlingera elatior) is a fruit with a slightly sour, tuber taste from kecombrang flowers that is usually used as a spice. The research design used a completely randomized design with 4 treatments and 5 replications. The treatments consisted of P0: without marination using Honje Fruit, P2 :Marinade 2 grams of Honje Fruit, P2: Marinade 4 grams of Honje Fruit and P3: Marinade 6 grams of Honje Fruit. The parameters in this study were physical quality of the meat which consisted of pH value, water content, tenderness, cooking loss, and meat color. The results showed that marinade of 4 grams of Honje Fruit was effective in maintaining the pH value of meat, reducing the percentage of cooking loss, and increasing tenderness. Marinade using Honje Fruit was also effective in maintaining the moisture content of the meat, increasing the brightness, maintaining the freshness of meat by originating reddish and yellowish colors.

Keywords: Honje Biomass, Etlingera elatior, physical quality, native chicken, meat

[6] Characterization of Municipal Solid Waste for Waste to Energy Feedstock in Jakarta

S Wahyono*, F L Sahwan, F Suryanto

Environmental Technology Centre, BPPT, Jakarta, Indonesia

E-mail: sri.wahyono@bppt.go.id

Abstract. The characterization study of municipal solid waste for waste to energy facility is very important to Jakarta City because of its waste is still in mixed condition and may contains several materials those are not suitable for incinerator. The purpose of this study was to determine the character of the waste from several sources (shopping areas, office areas, industrial areas, city parks, and households) in the city of Jakarta and to analyse the quality of the waste to be feedstock of incinerator. The research uses a random sampling method for the wastes which were transported to the Bantargebang final disposal site. Samples were taken proportionally from the garbage truck to determine the composition, proximate and ultimate analysis. The results showed that wastes were dominated by combustible material and had a good potential as an incinerator fuel in terms of the characteristics of moisture content (less than 50%), volatile matter (above 25%) and ash content (less than 60%), as well as its LHV (above 6 MJ/kg). However, the existence of bulky waste, hazardous waste, non-combustible waste, and several types of waste that are not allowed to enter the incinerator needs to be a concern. Those wastes potentially interfere the performance of the incinerator.

Keywords: Waste characteristic, composition, ultimate analysis, proximate analysis, waste to energy

[7] Optimization of Calophyllum Oil Extraction and Its Application for Biogasoline

I A Kartika[1], S S Sumbogo[2], I Fataya[1], W Trisunaryanti[2], Hartati[3] and I Sailah[1]

1. Department of Agroindustrial Technology, IPB University, Dramaga Campus, Bogor 16680, Indonesia
2. Department of Chemistry, Universitas Gadjah Mada, Bulaksumur, Yogyakarta 55281, Indonesia
3. Department of Chemistry, Universitas Airlangga, Airlangga 4-6 Road, Surabaya 60115, Indonesia

E-mail: ikaamalia@apps.ipb.ac.id

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, temperature and stirring speed. Biogasoline production was conducted using thermal cracking at 475-575ºC of oil obtained from optimum extraction condition. The oil yield was optimized using second order polynomial model. Extraction time affected oil yield more significantly than temperature and stirring speed. Oil yield improved when extraction time, temperature and stirring speed augmented, and the optimum oil yield (59%) was predicted to be reached at 5.3 h, 49ºC and 385 rpm. Besides, the separated resin percentage was predicted to be constant (20%) with increasing extraction time, temperature and stirring speed so there was no optimum separated resin percentage. The oil obtained from optimum extraction condition showed good quality at 0.91 g/cm3 of density, 45.13 mPa.s of viscosity, 26.4 mg KOH/g of acid value, trace water and sediment content, and zero ash content. The thermal cracking of oil produced 5-79 wt.% liquid product (biogasoline). Biogasoline yield improved as temperature increased from 475 to 575ºC, and so highest biogasoline yield (79 wt.%) was obtained at 575ºC. The GC-MS analysis result of liquid product showed that the biogasoline was composed of C5-C12 fraction (32.2 wt.%), C16-C19 fraction (36.8 wt.%), and non-hydrocarbon fraction (9.4 wt.%).

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

[8] Valorization of Corncob Through Torrefaction Process

Siti Suharyatun, Muhammad Nauval Farisi, Winda Rahmawati, Agus Haryanto*

Agricultural Engineering Department, University of Lampung, Jl. Soemantri Brojonegoro No. 1, Bandar Lampung 35145.

E-mail: agus.haryanto@fp.unila.ac.id

Abstract. Corncobs is a waste of post-harvest corn processing that has great potential to be used as a source of renewable solid fuel. Its high moisture and volatile solids content produces a lot of smoke when corncob is burned, so it is rarely used as fuel. This study aims to improve the quality of corncob fuel through the torrefaction process. The corncob was naturally dried using sunrays for two days and cut into pieces of 1-3 cm in size. The torrefaction process was carried out using a cylindrical rotary reactor which operates at a speed of 30 RPM and is heated using an external heat source. The variations of torrefaction time were 30, 40, and 60 minutes. The parameters to be observed included moisture content, ash content, volatile content, mass density, bulk density, calorific value, color change, and hydrophobicity of materials. The results showed that the torrefaction process improved the quality of corncobs as seen from an increase in calorific value, an increase in hydrophobicity, and a decrease in the composition of hemicellulose and cellulose. In this study, the calorific value of the torrefaction corncobs was 18.89 MJ / kg to 21.61 MJ / kg, which was higher than the caloric value of the non-torrefactioned corncobs of 17.66 MJ / kg. The torrefactioned corncobs are also more hydrophobic and absorb less water than the non-torrefactioned corncobs.

Keywords: agricultural waste, renewable, torefaction

[9] Thermal Hydrolysate of Coconut Trunk, Coir, and Shell as Bioherbicide

Herdhata Agusta[1,2*], Dwi Guntoro[1], Mercy Bientri Yunindanova[3], Mei Nita Sari[4]

1. Department of Agronomy and Horticulture, Bogor Agricultural University, Bogor 16680, Indonesia
2. Surfactant and Bioenergy Research Center, IPB University, Bogor 16144, Indonesia
3. Faculty of Agriculture, Universitas Sebelas Maret, Surakarta 57126, Indonesia
4Inobu- Foundation, Bogor 16128, Indonesia

E-mail: agusta@ipb.ac.id

Abstract. Biomass of coconut trunk, coir, and shell as lignocellulosic waste was partially hydrolyzed in sub-critical temperature for a relatively short time. The process was implemented in an anaerobic condition which produced predominantly phenolics compounds and other complexes' organic constituents. Base on previous findings, in which allelopathic effects of growing vegetation were sourced by phenolics compounds, the filtrates of the hydrolysates were tested as bioherbicide on Borreria alata as a broadleaf weed. The testing of the weed growth covered the weed response at pre-emergence, early post-emergence, and post-emergence stages. The hydrolysate solution contained phenolic, carboxylic, and ketone groups with a yield of less than 12 mg/kg feedstock after undergoing the thermal hydrolyzation process at subcritical temperature. At the post-emergence stage, coconut shell hydrolysates were capable to suppress the growth of Borreria alata by 13-40% and cause leaf damage at the level of 43-63%. However, its affectivity was higher at the pre-emergence and the early postemergence stages, where the suppression capacity of shell hydrolysate on the weed growth reached 84-100%.

Keywords: lignocellulosic waste, weed control, allelopathic compounds, organic herbicide, phenolics herbicide

[10] Utilization of Municipal Solid Waste Into Electricity Energy: A Performance of PLTSa Bantargebang Pilot Project

W S Winanti[1], W Purwanta[2] and Wiharja[3]

1. Principal Researcher, Environmental Technology Center, BPPT, Indonesia
2. Senior Researcher, Environmental Technology Center, BPPT, Indonesia
3. Senior Researcher, Environmental Technology Center, BPPT, Indonesia

E-mail: wahyu.purwanta@bppt.go.id

Abstract. Municipal solid waste (MSW) has become a serious problem for cities in Indonesia. The increasing population and economic activity as well as the increasing difficulty in obtaining land for landfills are the real problems faced. Waste generation from urban areas currently reaches 29.4 million tons annually and that has been managed reaches 62.29%. The Indonesian government has targeted 100% waste management by 2025 by processing 70% and reducing it by 30%. To accelerate the achievement of this target, Presidential Regulation No. 35/2018 concerning installation construction acceleration of waste processing into electricity energy based on environmentally friendly technology has been issued. MSW in Indonesia contains 62,4% of biomass in the form of food waste, wood, vegetables and fruits which have the potential to be a source of energy. This paper describes the performance of PLTSa Bantargebang based on operating data in 2020. PLTSa Bantargebang is designed to be able to burn 100 tonnes of waste/day with an average calorific value of 1500 kcal/kg and an electricity output of 700 kW. This plant is also equipped with a pre-treatment plant to reduce water content and air pollution control devices that can emit exhaust that meet national emission standards. When this study was conducted, the WtE plant electricity production was around 350 kW which was only used for the internal operational needs of WtE plant. In this condition, WtE plant burns waste on average 65 tons waste per day. During 2020, the plant has burned 9,878 tonnes of waste by generating electricity of 784 MWh or an electricity conversion rate of 110.66 kWh/ton waste. Both exhaust gas emission and liquid waste have met national quality standard, so that it is an environmentally friendly WtE plant. The plant also produces fly ash and bottom ash around 19.41% of the weight of the waste burned.

Keywords: Waste-to-Energy, performance, conversion

[11] The Promising Future of Tropical Marine Microalgae: Culture, Biomass Production, Potency, and Challenges in Food and Health Applications

Diah Radini Noerdjito[1,5*], Debora Christin Purbani[1], Kusmiati[1], I Made Sudiana[1], Asep Bayu[2], Serly Sapulete[3], Gede Suantika[4], Djoko T. Iskandar[5]

1. Research Center for Biology, Indonesian Institut of Sciences (LIPI), Jl. Raya Jakarta-Bogor KM 46, Bogor, Indonesia
2. Research Center for Biotechnology, Indonesian Institut of Sciences (LIPI), Jl. Raya Jakarta-Bogor KM 46, Bogor, Indonesia
3. Research Center for Oceanography, Indonesian Institut of Sciences (LIPI), Jl. Ancol Timur 1, Jakarta, Indonesia
4. Microbial Biotechnology Research Group, School of Life Sciences and Technology, Institut Teknologi Bandung, Indonesia
5. Ecology Research Group, School of Life Sciences and Technology, Institut Teknologi Bandung, Indonesia

E-mail: drnoerdjito@gmail.com

Abstract. Recently, microalgae have been in the spotlight because of their wide application possibilities in the fields of food, animal feed, energy (fuel), fine chemicals and pharmaceuticals. Different species of microalgae have been investigated for their potential as value-added products with remarkable chemical and biological properties. Microalgae have a significant ability to convert atmospheric CO2 into useful products such as carbohydrates, lipids and other bioactive metabolites. Quite intensive research has been done on different species of microalgae in temperate regions. However, the available information about microalgae as antimicrobial agent from tropical regions, especially those from Indonesia, is still limited. In the Indonesian Culture Collection Indonesian Institute of Sciences (InaCC LIPI) different species of tropical microalgae have been cultivated, although this collection is only a small part of the microalgae found in Indonesia. The most challenging and critical issues are building culture collection, improving microalgae growth rate and product synthesis, dewatering algae culture for biomass production, biomass pretreatment, and optimizing the process for specific compound production. The current review describes the culture development, biomass production, as well as potential culture development and compound production strategies of Indonesian tropical marine microalgae.

Keywords: photosynthetic organism, culture, indigenous, biomass, lipid, food

[12] Optimization of Temperature Rise of Heat Carriers in Indirect Gasification Hydrogen Production Process Using CFD Simulation

Haruka Nakayama[1], Mitsuo Kameyama[2], Hisashi Kamiuchi[2], Kiyoshi Dowaki[1]

1. Department of Industrial Administration, Graduate School of Science and Technology, Tokyo University of Science, Japan
2. Japan Blue Energy Co., Ltd., Japan

E-mail: 7402523@ed.tus.ac.jp

Abstract. Hydrogen (H2) is expected to be one of the most promising secondary energy resources, which contribute to the prevention of global warming. Bio-H2, which is derived from biomass feedstock, is more environmentally friendly than hydrogen synthesized from fossil fuels. In our indirect thermochemical processes with solid-gas reactions, the effective heat transfer which is carried by circulation of alumina balls of heat carriers (HCs) is a critical issue. In particular, HCs must be certainly heated up to the target temperature in the preheater because their temperature has a significant impact on supplying the reaction heat in later stage of the pyrolysis process. Our process is characterized by its small scale and requires efficient operation within a limited vessel volume. Now, when considering the forced convection heat transfer in a packed bed with a large number of HCs, the diameter of the HCs is one of the major factors governing the heat transfer. Moreover, this factor not only governs the heat transfer in the preheater but also the duration of biomass pyrolysis in the pyrolyzer where the heat is supplied from the HCs. In this study, we first investigated the temperature rise when a 10 mm diameter HC was used by CFD simulation. In this simulation, the apparent thermal parameters were used to reproduce the heat transfer between the particles and the fluid. As a result, it was found that the HCs can be heated up by providing sufficient heat. For more effective operation, the circulation condition of HCs with smaller particle size was also studied, which could provide faster heat dissipation and more effective heat transfer in the pyrolysis furnace.

Keywords: Bio-H_2, CFD modeling, Packed bed, Indirect biomass gasification, Heat carrier

[13] The Effect of Nest Box Type and Stocking Density on Stratified Shelf Culture to Increase Earthworm Biomass Production Eisenia Fetida

Mashur

Department of Feed, Nutrition and Social Economic, Faculty of Veterinary Medicine, Mandalika University of Education, Mataram, Indonesia

E-mail: mashurntb40@gmail.com

Abstract. Eisenia fetida is one of the species of earthworm that is widely cultivated commercially because the results of its cultivation are related to agriculture and industry. Eisenia fetida biomass production in the cultivation system applied by the cultivator community is still low. We need innovations in the application of cultivation technology. This research to determine the effect of the type of nest box, the density of the distribution of earthworms, and the use of multilevel rack cultivation system technology on the biomass production of Eisenia fetida. The research was conducted in January-March 2020. The study used an experimental method with a completely randomized design with of three factors, namely: three types of nest boxes, three levels of stocking density, and three levels of cultivation racks. The results showed that the type of nest box had a significant effect on the percentage increase in biomass weight but did not affect the percentage increase in the amount of biomass. The stocking density had a significant effect on the percentage increase in the amount and weight of biomass. The level of cultivation rack did not affect the percentage of the number and weight of Eisenia fetida. The conclusion is the average percentage increase in the highest amount of biomass is 175%/nest box, and the highest percentage increase in biomass weight of 344%/nest box is achieved in a plastic tub nest box with a stocking density of 25 grams of earthworms/nest box on the third tier cultivation rack.

Keywords: biomass, eisenia, production

[14] Characterization and Modification of Starch Using Lactic Acid Oligomer to Decrease the Solubility in Water

Evi Triwulandari, Witta K. Restu and Muhammad Ghozali

Indonesian Institute of Sciences (LIPI)

E-mail: evi.triwulandari.lipi@gmail.com; witta.kartika.restu@lipi.go.id, muhammad.ghozali@lipi.go.id

Abstract. Modification of starch using lactic acid oligomer has been carried out. Modification has been manufactured via a three-step reaction. Step one is synthesis lactic acid oligomer by reflux and heating lactic acid at 160^{o}C for 4 hours equipped with the dean-stark trap. The second step is the esterification of lactic acid oligomer with acetic acid to protect hydroxyl group of lactic acid oligomer at 100^{o}C for 4 hours using sulphuric acid as catalyst and equipped with the dean-stark trap. Furthermore, the last step reacted starch with the esterification product of acetic acid and acid oligomer to produce modified starch using catalyst triethylamine. The characterization of the product obtained was conducted by analysis FTIR, NMR, GPC, DSC, and solubility.

Keywords: starch modification, lactic acid, oligomer, solubility

[15] A Combined Evaluation on Quality and Eco-burdens of the Tomato Greenhouse Air Conditioner using the Hydrocarbon Refrigerant of GF-08

Akihiro Oki[1], Takuma Kanemura[2], Kiyoshi Dowaki[1]

1. Department of Industrial Administration, Graduate School of Science and Technology, Tokyo University of Science, Japan
2. Department of Industrial Administration, Faculty of Science and Technology, Tokyo University of Science, Japan

E-mail: 7420513@ed.tus.ac.jp

Abstract. This study focuses on vegetables among perishable foods with the aim of conducting a combined evaluation of the use of GF-08, a non-CFC hydrocarbon refrigerant, to maintain the quality and reduce the environmental impact of tomatoes during air conditioning in the cultivation stage and during cold storage in the storage stage. In fact, past studies have shown that power consumption can be reduced when GF-08 replaces the existing refrigerant R410A during air conditioning use in a tomato farm. In addition, the CO2 intensity of GF-08 is extremely low in comparison to the conventional refrigerant. Regarding the air conditioner for the cultivation technology, that is, the relationship between the energy saving performance and the nutritional and freshness preservation of agricultural products has not been discussed. Therefore, in this study, the effects of temperature and/or CO2 gas controls as a parameter on nutritional and freshness preservation will be examined based on the facility demonstrated in Kesennuma City, Miyagi Prefecture. Here, our target product is tomatoes, the energy consumption and the characteristics will be analysed in the GF-08 case in comparison to the conventional status. Note that the conventional refrigerant is R410A. Then, we will prepare the experimental apparatus and estimate the quality change of tomato varying the temperatures in the storage at the consumer side. Finally, we will analyse the energy consumption and eco-burdens on basis of LCA methodology and find out the relationship between the eco-burdens and the quality due to these combined data.

Keywords: Life Cycle Assessment (LCA), Natural Refrigerant, Food Quality Control

[17] LCA Analysis and Quantification of Adsorption Performance of Kanuma Clay by Simultaneous Adsorption of H_2S and NH_3

Kento Torii, Kiyoshi Dowaki

Department of Industrial Administration, Graduate School of Science and Technology, Tokyo University of Science, Japan

E-mail: 7421518@ed.tus.ac.jp

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 from sewage sludge. The bio-syngas contains the following impurities of H2S, HCl, and NH3. These impurities could damage into the performance of FC operation. In our previous experimental studies, we proposed to use Hydroxyl aluminum silicate clay (HASClay) as an adsorbent in the impurity removal process. HAS-Clay could adsorb H2S multiple time by physisorption and was effective adsorbent in consideration of eco-design. However, it was found that NH3 decrease the adsorption performance of HAS-Clay. Based on LCA methodology, this means that any environmental contribution would be less obtained. Thus, in this study, Kanuma clay (Kc), which is a natural resource and lower impact adsorbent, was used in order to maintain adsorption performance of HAS-Clay by adsorbing NH3 before HAS-Clay. Kc's adsorption capacities of H2S and NH3 have been obtained. However, adsorption capacity in the case of simultaneous adsorption of H2S and NH3 have never been researched. Therefore, in this study, the experiments of simultaneous adsorption of H2S and NH3 were conducted, the adsorption column using Kc and HAS-Clay was designed, and environmental burden of its system was obtained.

Keywords: Biomass, Adsorption, HAS-Clay, Kanuma clay, XRD, LCA

[19] The Effect of Woven Oil Palm Empty Fruit Bunches (OPEFB) Filler Fiber on the Mechanical Properties of Natural and Synthetic Rubber

Siti Nikmatin[1], Irmansyah[1], Muhammad Nur Indro[1], Adi Cifriadi[2], Muhammad Farhan[3] and Yulisa Aviani Nurwinda[3]

1. Department of Physics, Faculty of Mathematics and Natural Sciences, IPB University, West Java, 16680, Bogor, Indonesia
2. Research Center for Rubber Technology, Indonesian Rubber Research Institute, West Java, 16128, Bogor, Indonesia
3. Physics Department, School of Graduate Studies, IPB University, West Java, 16680, Bogor, Indonesia

E-mail: snikmatin@apps.ipb.ac.id

Abstract. Oil palm empty fruit bunches (OPEFB) are biomass from palm oil (CPO) processing which can be produced into long lignocellulose and made of yarn as raw material for woven textiles for sandwich biocomposite applications. The purpose of this study was to obtain a biocomposite sandwich variation of natural rubber, butyl, and silicone reinforced with OPEFB woven fibers at optimum filler concentration by studying mechanical properties. The biocomposite of rubber sandwiches with OPEFB fiber reinforced with concentrations of 14, 20, and 28 sheets with a size of 10 x 10 x 1 cm. The methodology used is layered printing with constant pressure and heat using a hot press. The best fiber concentration based on mechanical properties is a composite with a fiber concentration of 28 sheets on 70 shore A hardness natural rubber. This is because of the fibers in the composite function as load bearers, where this containment is carried out by the distribution of stress. The more fiber concentration, the more effective and uniform distribution of stresses will be so that an increase in the mechanical properties of the composite occurs. The mechanical properties of rubber have been shown to increase with the addition of fiber as a reinforcing material, the ratio of the impact strength of rubber (control) and fiber-reinforced rubber is lower than that of fiberreinforced rubber. The natural rubber has an impact strength of 48 kJ/m^2, while natural rubber with fiber reinforcement has a higher impact strength value of 321.40 kJ/m2 .

Keyword: biocomposite, mechanical properties, OPEFB fiber, rubber, sandwich

[20] Thermal Study of $Ca(OH)_2$ Coated OPEFB Fibers from Limestone Through the Calcination-Hydration Process

Siti Nikmatin[1,2], Irmansyah[1], Muhammad Nur Indro[1], Gito Heryan[3] and Mirna Mariani Sholikhah[3]

1. Department of Physics, Faculty of Mathematics and Natural Sciences, IPB University, Bogor, West Java 16680 Indonesia
2. Surfactant and Bioenergy Research Center (SBRC), IPB University (Bogor Agricultural University), IPB Darmaga Campus, 16680 Bogor, Indonesia
3. Physics Department, School of Graduate Studies, IPB University, Bogor, West Jawa 16680 Indonesia

E-mail: snikmatin@apps.ipb.ac.id

Abstract. Limestone is one of the main mineral sources in the form of $CaCO_3$, which is very abundant in nature. Limestone can be converted into other forms of calcium for special needs in various fields. The purpose of this research is to convert limestone as a source of $CaCO_3$ to $Ca(OH)_2$ as a temporary flame-retardant material that can be applied to OPEFB fibers to improve their thermal properties. The manufacturing process uses calcination-hydration, namely the process of converting from $CaCO_3$ to $Ca(OH)_2$. The testing method used is the hanging test technique and the flammability test. Both of these techniques are used to determine the best sample as an instantaneous flame-retardant material in OPEFB fibers. The results showed that the best sample with a casination temperature of 800°C with a concentration of 1 M and immersion time of 10 minutes got the optimum thermal properties which were able to increase its thermal properties witha flame retainingtime ofmore than 45 seconds. This is evidenced by the increase in the value of onset x and the tip poin to f x samples using TGA. As well as an increase in the intensity of the alkanes and alkenes functional groups through FTIR.

Keywords: $CaCO_3$, $Ca(OH)_2$, fiber calcination-hydration, flame retardant

[21] Effect of Low Percentage Methanol Blends in Gasoline RON 90 on Fuel Volatility Characteristics and Spark Ignition Engine Performance

Ravi Farkhan Pratama[1], Cahyo Setyo Wibowo[2], Nur Allif Fathurrahman[2], Edy Hartulistyoso[1]

1. Department of Mechanical and Biosystem Engineering, Faculty of Agricultural Technology, IPB University, Bogor, Indonesia
2. Research and Development Center for Oil and Gas Technology "LEMIGAS" Jakarta, Indonesia

E-mail: ravi_farkhanp@apps.ipb.ac.id

Abstract. Methanol is one of the promising alternative fuel for gasoline that can be made from renewable sources. Methanol has high octane number, which can increase octane number of gasoline. Methanol is also an oxygenate and contain less carbon content than gasoline, so combustion emission can be reduced. Blending methanol with gasoline influences the volatility characteristics of the fuel blend where it could influence engine performance. Fuel used in this study were gasoline RON 90 blended with methanol in percentage of up to 20%. In this study, distillation and Reid vapor pressure were measured, and then engine performance test were done using those fuel blends. The obtained result showed that the vapor pressure is increasing with addition of methanol up to 15% with maximum vapor pressure of 74.75 kPa and started to decrease at 20% methanol blends. The distillation curve showed that increasing methanol addition to the fuel blend flattened the distillation curve below the methanol boiling point. Engine performance test result revealed that addition of methanol in fuel blend resulted in decrease of torque, changes in specific fuel consumption, and reduced CO and HC emission.

Keywords: methanol, gasoline, volatility characteristics, engine performance

[22] Optimization of a 10 Litre Full Electric Reflux Distiller

A Mamuri[1*], T Ubiña[2], N E Mateo[3] and S Agrupis[1]

1. 1 National Bioenergy Research and Innovation Center, Mariano Marcos State University, Quiling Sur, City of Batac, Ilocos Norte, PH
2. Department of Electrical Engineering, College of Engineering 3 Department of Mechanical Engineering, College of Engineering

E-mail: abmamuri@mmsu.edu.ph

Abstract. Sugar sap from Nipa (nypa fruiticans) palm is one of the promising sustainable feedstocks for ethanol production. There are different stages and process needed for the sap to produce ethanol particularly: collection, fermentation, and distillation. In order to produce high ethanol concentration and yield, each stage or process needs to be optimized and improved as such, this study optimize the flow rate and temperature of the cooling system of a 10 Liter full electric Reflux distiller for the production of a fuel grade (95%) bioethanol from nipa sap. The optimal power density for the 10 Liter full electric reflux distiller was also determined. Optimizing these parameters improves the concentration of the ethanol, Ethanol yield and also decreases the operational cost of the 10 Liter full electric reflux distiller. First step is to determine the power density required for the 10L Lab-Scale Distiller through experiment using different power density. After identifying the power density, multiple trials were performed with 2 protocols being the continuous method and recirculating method of the cooling system. Result shows that a flow rate of 0.77 L/min, a 270 C cooling liquid temperature and a 100W/m3 power density were obtained. An increase of 154.2% in volume of consistent 95% concentration yield was observed. Also, there is a significant increase in the yield. Continuous method is faster by an average of 26 minutes compared to the recirculating method.

Keywords: Bioenergy, Bioethanol, Reflux Distillation, Nypa fruiticans, Renewable Energy, 10 Liter full electric Reflux distiller

[23] Development of Fertilizer-Based Medium for the Growth Rate Improvement of Chlorella sp. in the Laboratory Scale

N A Hidayati[1], I D Anggraini[2], S Marno[2*], R A Fikri[2], W Lathifah[2], N Putri[2], I N Fitriani[2], B Prabowo[2], and R. Fitriani[2]

1. Departement of Chemistry, Institut Teknologi Bandung, Jalan Ganesha No.10 Bandung, Indonesia
2. Pertamina Research Technology and Innovation, Jalan Raya Bekasi Km.20 Jakarta, Indonesia

E-mail: septhian.marno@pertamina.com

Abstract. Microalgae are unicellular photosynthetic microorganisms, ubiquitous in nature which can be found in freshwater, seawater, hypersaline lakes and even in deserts and arctic ecosystems. Chlorella sp. is a eukaryotic, unicellular, photosynthetic organism with a diameter varied from 1 to 20 μm microscopically. In this study, the combination of Walne and commercial fertilizers (ZA, TSP and Urea) were proposed as a low-cost approach for the cultivation of Chlorella sp. in the laboratory basis. The modified commercial fertilizer medium formulation consists of the combination of at least 5% of Walne with different proportion of ZA, TSP and Urea. The combined used of 5% (v/v) Walne and 95% (v/v) Urea was able to retain the algal growth as compared to the combination of Urea, TSP and ZA. It is presumably considered that nitrogen source, such as urea is the most suitable type to support the growth of Chlorella sp. resulting a comparable growth rate and biomass production to the commonly used enriched medium, such as F/2 and Bold's Basal Medium. Therefore, the modified commercial fertilizer medium developed in this study could substitute the enriched medium used in the laboratory for the large-scale cultivation of microalgae.

Keywords: Chlorella sp., Walne, Urea, TSP, ZA

[24] Determination of Oxidation Stability of Palm-Oil Biodiesel and Biodiesel-Diesel Blends by Rancimat and RSSOT Methods

Rossy Dwi Devitasari[1,2*], Nur Allif Fathurrahman[1*], Marsha Katili[1], Cahyo Setyo Wibowo[1,3], Sylvia Ayu Bethari[1], Riesta Anggarani[1], Lies Aisyah[1], Maymuchar[1]

1. Department of Product Application Technology, Research and Development Center for Oil and Gas Technology "LEMIGAS", Jakarta, Indonesia.
2. Department of Chemistry, Faculty of Mathematics and Natural Sciences, Nusa Bangsa University, Bogor, West Java, Indonesia.
3. Department of Mechanical Engineering, Faculty of Engineering, University of Indonesia, 16424 Depok, West Java, Indone

E-mail: rossydwidevitasari2@gmail.com; allif.fathur@gmail.com.

Abstract. Oxidation stability of biodiesel and its blend with diesel fuel is an essential indicator for its shelf life and the quality of product composition. Determination of oxidation stability becomes key fundamental analysis to ensure biodiesel quality that degradation by oxidation yields products that may compromise fuel properties and engine durability. In this present study, the oxidation stability of palm-oil biodiesel and its blends with diesel fuel (cetane number 48) was determined using EN 15751 (Rancimat Method) and ASTM D 7545 (Rapid Small Scale Oxidation Test, RSSOT Method). Here, the determination from either test were compared and analyzed using ANOVA and the mathematical function. Based on the result, diesel fuel has oxidation stability 11 times higher than palm-oil biodiesel, analyzed by the RSSOT method. Additionally, the correlation factor of oxidation stability of biodiesel samples in this work is 21.52 and for biodiesel blend (B20 to B90) is 23.66 that was used as a conversion oxidation value between RSSOT and Rancimat method. The models presented a high correlation with the R 2 values of 0.9535 for biodiesel samples, and 0.9823 for biodiesel blend (B20-B90) indicated the accuracy of the models to predict the value of oxidation stability of both the Rancimat and the RSSOT accelerated oxidation methods.

Keywords: biodiesel blends, oxidation stability, palm-oil biodiesel, rancimat, RSSO

[25] Palm Oil Empty Fruit Bunches and the Implementation of Zero Waste and Renewable Energy Technologies

A D Januari and H Agustina*

School of Environmental Science, Universitas Indonesia, Jakarta, 10440, Indonesia

E-mail: harukiagustina@gmail.com

Abstract. Oil palm empty fruit bunches (EFB) are oil palm biomass that can be processed into organic amendments and energy sources. Therefore, this study aims to evaluate the current management of EFB waste from palm oil mills based on the concept of zero waste and renewable energy. This study used secondary data analysis of palm oil mills, field interviews, and literature study to evaluate EFB waste management. The results showed the ratio of EFB and CPO produced by palm oil mills is around 1:1. Most palm oil mills manage their EFB wastes using mulching treatment. That shows palm oil mills in Indonesia have yet to implement the existing technologies that many researchers have developed. Composting and anaerobic digestion are the alternative treatments that can be implemented by palm oil mill since both can reduce the EFB waste and produce products that can be sold and reused. Both treatments also can utilize EFB together with palm oil mill effluent (POME). Based on these results, the government of Indonesia can encourage palm oil mills to shift their waste management from using mulching treatment to anaerobic digestion and composting treatment.

Keywords: Oil palm empty fruit bunches, Waste management, Mulching, Composting, Anaerobic digestion

[26] Utilization of Grassy Biomass Grown in Heavy Metal Contaminated Soil as Feedstock for Bioenergy Production - An LCA Study

M.N. Lynch1 and J A Satrio*

Department of Chemical and Biological Engineering, Villanova University, 800 E. Lancaster Ave. Villanova, PA 19085. USA

E-mail: Justinus.satrio@villanova.edu

Abstract. Biomass is the only renewable source of carbon that, when utilized efficiently and optimally, can significantly help to reduce our reliance on fossil fuels. Certain types of perennial grasses, such as switchgrass, have great potential to be used as bio-renewable feedstock to produce bioenergy due to their relatively high yields of biomass per acreage of land. Furthermore, these grasses have the capability of extracting heavy metals from the contaminated soil, which in turn can improve the quality of the soil. A biorefinery process system consisting of two hydrolysis steps and a fast pyrolysis step to produce sugars and bio-oil by using switchgrass which was grown in lead contaminated soil was studied. The study showed that the presence of lead in the grassy feedstock did not seem to affect the yields sugars and bio-oil from the hydrolysis and the fast pyrolysis steps, respectively. An LCA study on growing switchgrass for soil phytoremediation and using the switchgrass as feedstock for the biorefinery system was performed. Results from the study showed that the combination of using switchgrass as soil phytoremediation agent and feedstock for producing energy in a biorefinery decreases GHG emissions and lowers the use of energy produced from fossil fuels when compared with a combination of a refinery system and ex-situ excavation for soil remediation.

Keywords: bioenergy, switchgrass, fast pyrolysis, hydrolysis, soil remediation, heavy metal contamination

[27] Carotene Production from Solid State Fermentation on Oil Palm Empty Fruit Bunches (OPEFB)

E D Tommy, M S Purba, M Anshori, D Lestari, and M T A P Kresnowati

Food Engineering Department, Faculty of Industrial Technology, Institut Teknologi Bandung, Let. Jen. Purn. Dr. (HC). Mashudi Street No. 1/Raya Jatinangor Street Km 20,75, Sumedang, 45363, Indonesia

E-mail: kresnowati@che.itb.ac.id

Abstract. Food coloring is an important food additive to increase attractiveness. Carotene is an important natural food coloring which is used to give red-orange color in food. Natural sources of carotene are carrots, palm oil, and sweet potatoes. This research explored the potential of using oil palm empty fruit bunches (OPEFB), the biomass waste of palm oil industry, as the substrate for carotene production via fungal based solid state fermentation using Neurospora sp. In particular, the effects of fungal spore starter concentration and additional nutrients, that were urea and MgSO4, on carotene production were studied. The results showed that both fungal starter concentration and additional nutrients increased carotene production. The best condition for carotene production was observed at fungal spore starter concentration of 0.2 g fungal giving 0.045 mg carotene/g OPEFB.

Keywords: carotene, extraction, oil palm empty fruit bunches, solid state fermentation

[28] Description of Maize Check Genotypes for Selection on Tidal Swamp-Land for Grain Production

Suwarti[1,3*], Munif Ghulamahdi[2*], Trikoesoemaningtyas[2], Didy Sopandi[2], Eko Sulistyono[2], Muhammad Azrai[3]

1. Graduate School of IPB University, Bogor 16680, Indonesia
2. Department of Agronomy and Horticulture, Faculty of Agriculture, IPB University, Bogor 16680, Indonesia.
3. Indonesian Cereals Research Institute. Jl. Dr. Ratulangi No. 274, Maros 90514, South Sulawesi, Indonesia.

E-mail: warti.smile@gmail.com, mghulamahdi@yahoo.com

Abstract. Determination of check genotypes for maize biomass and grain production on the tidal swamp acid soil land environment was randomly picked among the genotypes, regarding of the lack information about check genotypes characteristics on tidal swampland. The aim of this study was to analyze maize check genotype characteristics on tidal swampland. Five check genotypes (open-pollinated variety=Sukmaraga, hybrid variety=P27, elite lines=NEI9008, elite lines=MR14, three-way cross hybrid=Bima20URI) was planted among 150 maize lines, tested on tidal swampland in three environment treatment (saturated soil culture/SSC, saturated soil culture+temporary flooding/SSC+TF, and acid dry land/DL). Augmented Randomized Complete Block Design (Augmented RCBD) with five replications was used for this experiment. Data were analyzed using PBSTAT-CL 2.1 statistic tool. The result showed that Bima20URI grain production was stable for every environment, meanwhile, P21 yield was higher on SSC+TF and DL environments. Sukmaraga genotypes yield was declining on SSC+TF, but suitable for SSC. NEI9008 genotypes were stable for every environment's and MR14 yield was declining on SSC+TF.

Keywords: maize, biomass, production, suboptimal, land

[29] Effect Addition of Bioadditive in Biosolar Properties

Muhammad Fuad Fuad[1] and Ishenny Mohd. Noor[2]

1. Lemigas, Research and devt. centre for oil gas
2. BioKing Indonesia company

E-mail: mfuad1st@gmail.com; ishnoor2010@gmail.com

Abstract. One of the weaknesses of mixed fuel diesel and biodiesel (biosolar) has a poor cold flow properties. The injection system in a diesel engine is also influenced by the value of cold flow properties such as Pour point. As The higher of the Pour Point the biodiesel, tend to increased more easlly to form solids in the fuel injection system. In modern diesel engines that have very high injection pressures, biosolar fuel is more sensitive to form solids. The addition of 1% additives derived from bioenzym vegetable oil has a positive effect on the characteristics of pour point, sediment, lubricity and also microbial growth. The pour point temperature decreased to minus 3 C, from the initial 0o C. Meanwhile the Lubricity value decreased from the initial value from 255 to 191 mikron. Lubricity is a measure of the ability of the fuel to reduce engine component friction. Meanwhile, sediment and microbial growth affect the stability and cleanliness of diesel fuel.

Keywords: biodiesel, bioadditive, pour point, injection

[30] Alternative Source of Nutrients for Microalgae Cultivation in a Photobioreactor System

H Joko Prayitno[1], Rahmania Admirasari[1], Siti Jamilah[2] and Agus Rifai[1]

1. Centre of Environmental Technology, The Agency for The Assessment and Application of Technology, Gd. 820 Geostech, Kawasan Puspiptek, Tangerang Selatan, Banten 15314, Indonesia
2. Biology Department, Faculty of Science and Technology, Syarif Hidayatullah State Islamic University, Jl. Ir H. Juanda No.95, Tangerang Selatan, Banten 15412, Indonesia

E-mail: joko.prayitno@bppt.go.id

Abstract. Photobioreactors are used to produce microalgae biomass for many purposes in industries and agriculture. This research was aimed at investigating alternative source of nutrients with lower cost to produce a sustainable microalgae biomass production in a photobioreactor system other than using F2 nutrient medium, the most commonly microalga nutrient compositions used in laboratories. Firstly, two nutrient sources were used to cultivate Chlorella sp. in the laboratory, i.e., a commercial fertilizer and a common fertilizer (NPK) having nitrogen equals to 12,3 mg/L. Chlorella sp. biomass grown in the medium containing the commercial fertilizer or NPK was not significantly different to that of F2 medium, as well as when the dose of the commercial fertilizer was doubled. The commercial fertilizer was then selected as a source of nutrients in the cultivation of microalgae in 135 litre photobioreactors. Chlorella sp. biomass grown in the photobioreactors for 14 days using F2 medium was 0,80 mg/L, while using the commercial fertilizer was 0,75 g/L. Cost analyses of microalga production using these commercial fertilizers showed that it was 80% less than the cost of using F2 nutrient composition. These results showed that commercial fertilizer could be used as alternative nutrient source for microalgae cultivation in photobioreactors

Keywords: microalgae, biomass, photobioreactors, nutrients

[32] Producing Biodiesel Distillate with Low Monoglyceride for B40 Component by 1 plate and 30 Plate (TBP Distillation)

Muhammad Fuad and Muhammad Kuniawan

Lemigas, Research and devt. centre for oil gas, jakarta

E-mail: mfuad1st@gmail.com, muhammad.kurniawan@esdm.go.id

Abstract. One of the indicators standards quality for biodiesel product specifications (FAME) is monoglyceride content. Monoglyceride (mg) is rest the reactant a component of vegetable oil that does not react in the process of making biodiesel, so that it becomes a contaminant in biodiesel. The lower the monoglycerides in the biodiesel product, the better the quality of the biodiesel. In the B40 program, one scenario of adding 10% biodiesel is using FAME distillate. The monoglyceride content in the FAME distillate for the B40 mixture was determined not exceed 0.3% m. The distillation technique is one of the effective methods for reducing monoglyceride levels in fame. Refining Fame by True Boilling Point (TBP) distillation, 30 plate, under condition 5 mmHg, refluxs 1; 2-3, showed that monoglyceride levels decreased significantly at the distillate fraction at 240-325 C, from an initial level of 0.83% wt. to 0.17% wt. the PP temperature increased 2 times from the original biodiesel pour point temperature. The pour point temperature increases, starting from the fraction from 240-325 C, 325-330 and 330-335 C, from 12 C to 21 and 24 C. At the 340-345 C distillate fraction, the pour point temperature tends to drop drastically to 3 C. By using 1 plate distillation Equipment, under operating condition pressure of 5 mmHg, monoglycerides with an initial content of 0.83 wt%, can be reduced to 0.59%, at a rate of 90% vol. distillate recovery. The level of monoglycerides decreased at the level of 86% vol, distillate recovery, so that the value became 0.29% wt.

Keywords: Fame, biodiesel, distillate, monoglyceride, distillation

[34] Influences of Zinc Chloride on Fast Pyrolysis of Pinewood

R A Garrido[1], J Reckamp[2], P Bastian[3], N H Hammer[2], C G Coe[2], and J A Satrio[2]

1. Departamento Ingeniería Geográfica, Universidad de Santiago de Chile, Alameda 3363, Estación Central, Chile
2. Department of Chemical Engineering, Villanova University,800 E. Lancaster Ave. Villanova, PA 19085. USA
3. Institute of Chemistry, University Postdam. Karl- Liebknecht- Straße 24-25. Germany

E-mail: Justinus.satrio@villanova.edu

Abstract. Fast pyrolysis is a thermochemical process which converts biomass into intermediate bio-oil and biochar products, which can be further processed to produce end products. Bio-oil is an organic liquid containing myriads of organic chemicals derived from the decomposition of cellulose, hemicellulose, and lignin components in lignocellulosic biomass. There are chemicals in bio-oil which are highly valuable as specialty chemicals, such as furfural, levoglucosan and levoglucosenone. Unfortunately, the amounts of these chemicals are typically too small, which makes it uneconomical to extract them from bio-oil. This work is focused on fast pyrolysis of pinewood, a well-known softwood used in paper industry. In this work, it was demonstrated that bio-oil containing higher fractions of furfural and levoguclosenone can be produced by treating pinewood feedstock with zinc chloride prior to pyrolysis. The batch pyrolysis studies by using a micropyrolyzer, a batch tubular reactor, and a thermogravimetric analyzer showed that the amounts of zinc chloride impregnated to pinewood feedstock significantly affect the yields of bio-oil and biochar products and the composition of chemicals in bio-oil. Increasing the concentration of zinc chloride solution used for pretreating the feedstock resulted in higher yields of biochar containing higher amount of the salt. Optimum concentrations of furfural and the two sugars in bio-oil product seemed to be obtained from pyrolysis of pinewood that was pretreated with 5wt% zinc chloride solution. Pretreatment with higher salt concentration reduced the concentration of levoglucosan but did not affect the other two valuable chemicals.

Keywords: biomass pretreatments, biochar, softwood, pyrolysis, batch reactor

[36] Decision Model for Determining the Feasibility of Rice-Based Bioenergy Supply Chain Development Area with Fuzzy Logic AHP Approa

Erni krisnaningsih, Yandra Arkeman, Marimin, Erliza Hambali

Departement of AgroIndustrial Technology, Faculty of Agricultural Technology, Bogor Agricultural University, PO Box 220 Bogor 16002, Indonesia

E-mail: erni120577krisnaningsih@apps.ipb.ac.id

Abstract. Decision on location determination for rice-based Bioenergy Agro-industrial Area is one part of the efforts to develop bioenergy supply chain. The development location is selected based on the criteria set by the government. This study aims to plan the model of determining the location of agro-industrial supply chain development area of Rice-based bioenergy as well as evaluate the important criteria that need to be considered in the selection of the location of a bioenergy agroindustry so that alternative locations can be obtained from several potential locations that are targeted for rice-based bioenergy agro-agro-industry development areas in banten province of Indonesia. By using fuzzy logic-AHP method approach, it is expected to obtain a decision model based on multi-criteria with hierarchical process. The result of this study is the most optimal district used as the location of development of rice-based bioenergy agro-agrogenertry area in Banten Province is Lebak Regency with the highest weight value. Based on the results of research Proposals for Further research this method can be applied to the development of other bioenergy agro-industry, taking into account the criteria of spatial aspects based on geographical factors as well as appropriate appropriate alignment in an industrial area.

Keywords: Decision, Development, Supply Chain, Rice-based Bioenergy, Fuzzy Logic-AHP

[37] Application of Modified Atmosphere Packaging to Extend Pineapple (Ananas Comosus L.) Shelf Life

E Warsiki*, K Manan*

Department of Agroindustrial Technology, Faculty of Agricultural Technology and Engineering, Bogor Agricultural University (IPB University) 2nd Floor FATETA Building, IPB Dramaga Campus, Bogor, Indonesia 16680

E-mail: endangwarsiki@apps.ipb.ac.id; kamiliamanan23@gmail.com

Abstract: The potential of pineapple (Ananas comosus L.) as export commodity both for fresh consumption and for the fruit processing industry continue to increase. However, pineapple can only be stored for 2-3 days at room temperature. On the other hand, the export process requires at least 35 days for delivering and retailing period. Duration and distance needed for fruit transportation require a special storage treatment to extend the shelf life. Modified atmosphere packaging has been proven to modify the air around the product to extend shelf life, especially fruit and vegetable. In this study, modified atmosphere packaging technique was applied to whole pineapple using LDPE plastic. The amount of O_2 and CO_2 at various storage temperature were tested to obtain the best condition of modified atmosphere packaging. Control were stored at 7 and 10 °C, showed a significant quality deprived. Based on research, the best atmospheric composition to extend the shelf life of whole pineapple is 1-3 % O_2 and 5-10 % CO_2 at 10 °C storage temperature. This condition has shown a decrease in quality such as the smallest weight loss equal to 0.0296 %, lowest increase in hardness value which is 0.0393 mm/second, also the highest consumer acceptance value on colour parameter.

Keywords: modified atmosphere packaging, pineapple, shelf life

[39] The Utilization Pineapple Skin Waste and Additive Xylene Used as A Wax Inhibitors

M Hakim[1], M K Afdhol[1*], F Hidayat[1], Y Yuliusman[2], R M Nordin[3], R Hasibuan[4], and F Fadly[1]

1. Department of Petroleum Engineering, Faculty of Engineering, Universitas Islam Riau, Jalan Kaharuddin Nasution No. 113, Pekanbaru 28284.
2. Department of Chemical Engineering, Faculty of Engineering, Universitas Indonesia, Depok 16424, Indonesia
3. Department of Chemistry, Faculty of Applied Sciences, Universiti Teknologi MARA, Perlis Branch, Arau Campus, 02600 Arau, Perlis, Malaysia.
4. Department of Chemical Engineering, Faculty of Engineering, Universitas Sumatra Utara, Jalan Almamater Kampus USU, Padang Bulan Medan 20155, Indonesia

E-mail: afdhol@eng.uir.ac.id

Abstract. Wax is a paraffin deposit that occurs in the petroleum transportation pipeline. Solvent is one technique used to treat wax. The solvent used as a wax inhibitor is bioethanol. Bioethanol comes from pineapple skin waste containing cellulose and hemicellulose which are the main sources of bioethanol production. The process of pineapple skin waste into bioethanol products is carried out by pretreatment, hydrolysis, fermentation and distillation processes. The effect of the variation in the concentration of the acid used, it was found that reducing sugars continued to increase. The alcohol content was seen based on the Gas Chromatography Mass Spectrometry (GCMS) test. The resulting bioethanol production is applied as a solvent in oils containing wax deposits. The used of bioethanol can reduce the pour point by 3°C and the xylene additive can reduce the pour point by 11°C. The scenario for mixing bioethanol and xylene was carried out at 3 variations of the ratio. The best blending scenario between bioethanol and xylene is obtained at a ratio (1:2) with a pour point reduction of 6°C. It can be concluded that bioethanol has good potential in overcoming deposition problems in petroleum.

Keywords: Wax, Solvent, Bioethanol, Pour point.

[40] Vitamin and Mineral Content of Microalgae Phorpyridium and Chlorella and Development Prospects for Food Raw Materials

D Fithriani[1] and S Melanie[1,2]

1 Research Centre of product processing and biotecnology Marine and Fisheries Ministry
2 Department of Material, Imperial College London, South Kensington Campus, SW72AZ, UK

E-mail: mudidara@gmail.com

Abstract. Porphyridium cruentum is a product of the division of the genus Rhodophyta. It is a single cell that lives or colonizes freely in mucillago. The cells continuously secrete mucillago compounds, forming a capsule that envelops the cells. Mucillago is a sulfate polysaccharide that is soluble in water (Vonshak 1988). Microalgae Chlorella sp. are marine algae that can grow on fresh water and sea water media. This type of algae has a green pigment included in it class Chlorophyceae of the Chlorellaceae family. The purpose of this study was to obtain information about the vitamin and mineral content of Phorpyridium and Chlorella that grown using Conway media. besides that, it is also to determine the phytochemical content of the Phorpyridium microalgae in particular. The results of the analysis show that vitamin E content of Phorpyridium higher than vitamin B1, B2 and B6 ie. 2,4 mg/100 g. Mineral analysis showed that Phorpyridium contained K minerals (45,7 mg/100g), Ca (201 g/100g), Mg (1090 mg/100g), Fe (38,2 mg/kg), Zn (3,45 mg/kg), Se (0,04 mg/kg), and P (2351 mg/kg).. Vitamin analysis of Chlorella show that vitamin B1 in Chlorella higher than Phorpyridium ie.(3,71 mg/kg). Mineral analysis showed that Chlorella contained K minerals (714 mg/100g), Ca (331 g/100g), Mg (335 mg/100g), Fe (539 mg/kg), Zn (21,7 mg/kg), Se (0,22 mg/kg), and P (2982 mg/kg).

Keywords: vitamin, mineral, food, Phorpiridium, Chlorella

[41] Aceh Local Dolomite Modified Alkali Metals as Low-Cost Solid Inorganic Catalyst for Biodiesel Synthesis

Muliadi Ramli*, Minnati Rana Maisarah, Nurdin Saidi, Murniana and Nasrullah Idris

1. Chemistry Department, Universitas Syiah Kuala, Banda Aceh, Indonesia, 23112
2. Physics Department, Universitas Syiah Kuala, Banda Aceh, Indonesia, 23112

E-mail: muliadiramli@unsyiah.ac.id

Abstract. Solid inorganic base catalyst which mainly contains calcium oxide and magnesium oxide has been successfully prepared from local Aceh dolomite minerals. The calcination process of dolomite particles (150 μm) in the air environment for 4 hours changed those calcium and magnesium carbonates compounds into their oxide form, which are subsequently referred to as inorganic oxides. Furthermore, the calcined local dolomite has been chemically modified using alkaline metal precursors (lithium, sodium and cesium precursors). Physicochemical investigation on the modified dolomite indicated that introduction of lithium metal on modified dolomite surface had been positive impact for increasing the number and strength of basic sites on the catalyst. The modified catalyst had proved their catalytic activity for biodiesel synthesis with the yield values are 82;78;51 respectively.

Keywords: Aceh local dolomite, Calcination, modified catalyst, Biodiesel

[42] Comparative Study on the Effect of Catalyst on The Yield of Biodiesel from Kemiri Sunan (Reutealis trisperma) Oil

E Hartulistiyoso[1,2], O Farobie[1,2] and S Rholanjiba[1]

1. Department of Mechanical and Bio-system Engineering, IPB University, Bogor 16680, Indonesia
2. Surfactant and Bioenergy Research Center, IPB University, Bogor 16144, Indonesia

E-mail: edyhartulistiyoso@ipb.ac.id

Abstract. Biodiesel is an alternative fuel substitute for fossil fuel, which is produced from the transesterification and esterification process of vegetable oil and animal fats. One of the potential materials to be processed to biodiesel is kemiri sunan (Reutealis trisperma), due to its high oil content and inedible amount of toxic. A study based on the literature review has been done to identify and analyze the effect of catalysts on the yield of biodiesel from kemiri sunan (Reutealis trisperma) oil. The acquired data on the catalyst used on the experimental trials was categorized as KOH with concentrations of 0.2%, 0.4%, 0.5%, 0.6%, 1.0%, 1.5% and 2.0% and NaOH with concentrations of 0.5%, 0.75%, 1.0%, 1.25%, 1.5% and 2.0%. Based on the data analysis, it was found that the biodiesel that meets the Indonesia National Standard (SNI) requirements was the biodiesel treated with 0.2% KOH and processed in two stages of trans-esterification. Further experimental studies on the multi-stages transesterification and catalyst treatments are still needed to explore the potential of kemiri sunan for biodiesel production.

Keywords: biodiesel, catalyst, literature review, kemiri sunan

[43] Comparison Performance CI Engine of Used Fuel High Speed Diesel Fuel-Biodiesel Blend (B30) with (B40) on Diesel Engine Dyno Test

Yogi Pramudito[1], Dimaz Wirahadi[1], Nur Allif Faturrahman[1], Faqih Supriadi[1], Sylvia Ayu Bethari[1], Dimitri Rulianto[1], Setyo Widodo[1], Catur Y Respatiningsih[1], Lies Aisyah[1], Emi Yuliarita[1], Riesta Anggarani[1], Maymuchar[1], Cahyo Setyo Wibowo[1,2]

1. Department of Product Application Technology, Research and Development Center for Oil and Gas Technology "LEMIGAS", Jakarta, Indonesia.
2. Departement of Mechanical Engineering, Faculty of Engineering, Universitas Indonesia, Depok, Indonesia

E-mail: yogi.dito17@gmail.com

Abstract. Biodiesel is one of the renewable energy resources to produce from palm oil now, The Indonesian government has been mandatory for used biofuel especially biodiesel blend with high-speed diesel (B30). The future will increase the percentage of blend biodiesel up to 30%. This study has an aim for comparison performance diesel engine used B30 and B40. The methodology starts from blend fuel high-speed diesel CN 48 with biodiesel two sample B30 and B40, density test, distillation test, viscosity test, and test performance used diesel engine 2400CC on the dyno test bench. The result of this study is the power engine decrease by about 1% and torque decrease by about 1,4%, and emission opacity decrease 3,2%.

Keywords: Performance engine, biodiesel, B30, B40, Emission

[45] The Effect Characteristics Cetane Number of Commercial High-Speed Diesel Fuel-Biodiesel Palm Oil-Based Blends on CFR engine

Maymuchar[1], Dimaz Wirahadi[1], Nur Allif Faturrahman[1], Milda Febria[1], M. Hanifuddin[1], Lies Aisyah[1], Faqih Supriadi[1], Sylvia Ayu Bethari[1], Rona Malam Karina[1], Dimitri Rulianto[1], Riesta Anggarani[1], Emi Yuliarita[1], Cahyo Setyo Wibowo[1,2]

1. Department of Product Application Technology, Research and Development Center for Oil and Gas Technology "LEMIGAS", Jakarta, Indonesia.
2. Departement of Mechanical Engineering, Faculty of Engineering, Universitas Indonesia, Depok, Indonesia.

E-mail: maymucharmm.mm@gmail.com

Abstract. Renewable energy is an important issue for substitute fossil fuel in the world. Biofuel is one of part used fuels for transportation, mining, industrial sector. The government of Indonesia's policy has mandatorily used biofuel for the blend to fossil fuel. Biodiesel production from palm oil base has good characteristics for substitute/blend to high-speed diesel (HSD) in the market. This study has the objective for the effect value cetane number of variant HSD-biodiesel blend and the methodology with blending two types HSD and biodiesel (0%, 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 50%, 60%, 70%, 80%, 90%, 100%). The measurement of cetane number used CFR engine in accordance ASTM D 613. The result of this study is the increasing percentage of biodiesel blend to influence increasing value cetane number, but the increasing value cetane number not linear, biodiesel can used cetane booster for HSD.

Keywords: High-speed diesel (HSD), Biodiesel, Cetane Number, Cetane Number Booster

[46] The Biochar-Improved Growth-Characteristics of Corn (Zea mays L.) in a 22-Years Old Heavy-Metal Contaminated Tropical Soil

A K Salam[1*], D O Rizki[2], I T D Santa[2], S Supriatin[1], L M Septiana[1], Sarno[1] and A Niswati[1]

1. Deparment of Soil Science Faculty of Agriculture University of Lampung Bandar Lampung Indonesia
2. Deparment of Agrotechnology Faculty of Agriculture University of Lampung Bandar Lampung Indonesia

E-mail: abdul.kadir@fp.unila.ac.id

Abstract. Biochar was suggested to lower the concentrations of heavy metals in contaminated soils and therefore may improve plant growth. This research was to evaluate the growth of corn (Zea mays L.) in a biochar-amended heavy-metal-contaminated tropical soil. Soil samples were collected from well-maintained experimental plots 22 years after amendment with heavy-metal containing industrial waste at 0 – 60 Mg ha-1. Corn plants were grown for 4 weeks in the soil samples amended with biochar at 0 – 10 Mg ha-1. The corn plant height and dry masses (roots, shoots, and the whole plants) were lowered by waste in relation to the increase in the soil Cu and Zn concentrations. The corn plant dry –weight masses (roots, shoots, whole plant) were well and negatively correlated with the soil Cu and Zn concentrations. The corn plant uptake of Cu and Zn decreased with the increase in the soil Cu and Zn concentration. Biochar improved the corn plant height and dry-weight masses, related to the decrease in the soil Cu and Zn concentrations. Biochar also increased the Zn uptake at waste level of ≥ 15 Mg ha-1 and increased the Cu uptake at waste level ≤ 15 Mg ha-1. The corn plant Cu uptake was linearly and positively correlated with plant dry-weight masses of roots, shoot, and whole plant masses.

Keywords: Copper, Industrial Waste, Uptake, Zinc

[47] Fermentation Based Sugar-Alcohol Downstream Processing: A Review

Wildan Q Salam, Helen Julian, and M T A P Kresnowati

Department of Chemical Engineering, Institut Teknologi Bandung, Jl. Ganesha no 10, Bandung 40132, Indonesia.

E-mail: kresnowati@che.itb.ac.id

Abstract. Sugar alcohols, for example sorbitol, xylitol, and arabitol, are natural sweeteners that have comparable sweetness to sucrose but have lower calories. Besides, they have special characteristics such as teeth-friendly and low glycemic index, that are attractive for food industries. The vast availability of lignocellulosic biomass waste offers the potential of sugar alcohol production from lignocelluloses, for example via hydrolysis and fermentation. Besides containing sugar alcohol, fermentation broth also contains other substances, among others are biomass cells, metabolic products, leftover substrates, and inorganic minerals. Downstream processing is necessary to further process the produced sugar alcohol containing fermentation broth to commercial crystal of sugar alcohol. This paper reviews the crystallization of sugar alcohol as well as series of preceding processes necessary to obtain high quality sugar alcohol crystals. In particular, membrane based processes to pretreat the fermentation broth before the crystallization process is proposed.

Keywords: Crystallization, Downstream Process, Membrane Distillation, Xylitol

[49] Downstream Process of Xylanase Enzyme Production from Oil Palm Empty Fruit Bunches: A Review

Berlin Simanjuntak[1], Helen Julian[1,2], M. T. A. P Kresnowati[2]

1. Department of Chemical Engineering, InstitutTeknologi Bandung, Jl. Ganesha no 10, Bandung 40132, Indonesia
2. Department of Food Engineering, InstitutTeknologi Bandung, Kampus Nangor, Jatinangor, Sumedang 45363, Indonesia

E-mail: kresnowati@che.itb.ac.id

Abstract. As an enzyme that can hydrolyze the glycosidic bond of hemicellulose, xylanase is widely used in pulp and paper, feed, food and beverage industries. The vast availability of lignocellulosic biomass waste offers the potential of the xylanase production by microorganism via sub merged and solid state fermentation. However, the specific activity of produced crude enzyme is still too low to be directly used in commercial application. Downstream processing of the enzyme, that are purification and concentration, is necessary. Centrifugation or filtration can be used as pre-treatment process to biomass separation before the next purification technologies. Precipitation, aqueous two phase system (ATPS), chromatography, and membrane ultrafiltration (UF) are technologies for enzyme purification. Freeze drying can be used also as a late stage purification procedure. ATPS and membrane UF have also emerged as a recovery method enabling the purification and concentration the target biomolecule in a single operation. The downstream process of enzyme usually accounts for 70-90% of the total production cost. Nonetheless set of purification methods which have high purification factor, cost effective, high productivity, and environmental benign strategies are needed such that the xylanase production process can be conducted economically at industrial/ commercial scale. This paper reviews processes for xylanase purification/ concentration produced by using solid state fermentation configuration. A membrane based process for downstream processing of xylanase production is suggested.

Keywords: Xylanase, Precipitation, Aqueous two phase system, Chromatography, Membrane ultrafiltration, Freeze drying

[50] The Design of Fuel Dryer in Palm Oil Processing Industries by Utilizing the Heat Product of Boiler Based on Computational Fluid Dynamic

Totok Soehartanto[1,2*], I Putu Eka Widya Pratama[1] and Alvin Davisa Putra[2]

1 Department of Instrumentation Engineering, Institut Teknologi Sepuluh November, Building-A ITS Campus Sukolilo, Surabaya, Indonesia 60117
2 Department of Physics Engineering, Institut Teknologi Sepuluh November, ITS Campus Keputih, Surabaya, Indonesia 60117

E-mail: totokstf@gmail.com, eka.widya@its.ac.id

Abstract. Incomplete combustion process from boiler in palm oil processing industry usually discharged into the air in the form of black smoke due to the high water contain in the fuel of the boiler which will pollute the air. With this problem the research was conducted of designing a simulation of fuel dryer to dry out the boiler fuel before it used by utilizing the exhaust heat of the combustion system in the boiler. The simulation design of the fuel dryer is based on computational fluid dynamic (CFD) with parameters control are air velocity and heat temperature of fuel dryer. The results obtained the distribution of air velocity in the dryer has a value range of 0-40 m/s with the highest velocity occurring when hot exhaust air enters the dryer while the temperature distribution inside the dryer has a value range of 90-270 0C with the highest temperature appearing around hot air inlet exhaust and the lowest temperature appears in the hot air outlet section of the dryer.

Keywords: Boiler Heat Product, Fuel Dryer, Computational Fluid Dynamic (CFD)

[51] Characterization of Mono-Diacylglycerols, Cellulose Nanocrystals, Polypropylene, and Supporting Materials as Raw Materials for Synthesis of Antistatic Bionanocomposites

Muhammad Syukur Sarfat[1], Dwi Setyaningsih[1,2], Farah Fahma[1], Nastiti Siswi Indrasti[1], Sudirman[3]

1. Department of Agroindustrial Engineering, IPB University, Bogor, Indonesia, 16680
2. Surfactan and Bioenergy Reasearch Center, IPB University, Bogor, Indonesia, 16144
3. National Nuclear Energy Agency of Indonesia, Puspitek, Serpong, Indonesia, 15314

E-mail: mssarfat.oct87@gmail.com

Abstract. The antistatic bionanocomposites can be synthesised using mono-diacylglycerols (M-DAG) as an antistatic agent, cellulose nanocrystals (CNC) as an reinforcement, and polypropylene (PP) as an termoplastic matrix. The purpose of this study was to determine the physical characteristics of the raw materials for the synthesis of antistatic bionanocomposites. Characteristics of the raw materials consists of morphology analysis using scanning electron microscopy (SEM), degree of crystallinity and particle size analysis using X-ray diffraction (XRD), Infrared spectrum analysis using fourier transform infrared (FT-IR), and thermal properties analysis using differential Scanning Calorimetry (DSC). The results of this research showed that the morphology analysis showed that the particle distribution of M-DAG is uniform and not separated from each other, while the particle distribution of CNC is not uniform and separated from each other. The XRD profile of M-DAG showed that the peaks at 19,508º, 20,401º, 22,607º, and 23,973º representing the diffraction structure of glycerol monostearate, particle sizes ranging between 0.1050 to 1.7814 nm with an average was 1.0460 nm, 92.85 % degree of crystallinity, and 7.15 % amorphous components. The XRD profile of CNC showed that the peaks at 5.8530º and 22.581º representing the diffraction structure of cellulose I, particle sizes ranging between 4.7364 to 79.0949 nm with an average was 41.9157 nm, 98.95 % degree of crystallinity, and 1.05 % amorphous components. The FT-IR spectrum of M-DAG showed that the most significant changes in spectrum were in the region between 3500 cm-1 to 2800 cm1 and 1850 cm-1 to 1650 cm-1. The FT-IR spectrum of CNC showed that the most significant changes in spectrum were in the region between 3700 cm-1 to 2500 cm-1 , 1700 cm-1 to 1550 cm1 , and 900 cm-1 to 800 cm-1 . The thermal properties of CNC showed that the melting temperature (Tm) was 241.65 – 323.74 ºC, the heat of crystallinity (ΔHm) was 324.515 J/g, the glass tansition temperature (Tg) was 240.74 – 357.54 ºC, and the degree of crystallinity (Xc) was 96.949 %. The supporting materials consists of maleic anhydrate polypropylene (MAPP), antioxidant (AO), dan mineral oil (MO) were also identified.

Keywords: antistatic bionanocomposites synthesis, mono-diacylglycerols, cellulose nanocrystals, polypropylene.

[52] The Utilization of Chicken Slaughter Waste for Organic Fertilizer

Alifiana Permata Sari[1], Rinaldi Medali Rachman[1], Mega Mutiara Sari[2], Eduardus Budi Nursanto[1*]

1. Chemical Engineering Department, Universitas Pertamina, DKI Jakarta, Indonesia
2. Environmental Engineering Department, Universitas Pertamina, DKI Jakarta, Indonesia

E-mail: eduardus.bn@universitaspertamina.ac.id

Abstract. The city of South Jakarta that belong to Special Region of Jakarta, Indonesia has a big demand for chicken meat. Around 60.000 chicken were slaughtered to supply chicken meat in city of South Jakarta. Almost half of the supply fulfilled from chicken slaughterhouses in Cipulir, South Jakarta city. The slaughterhouses in Cipulir are home industry without wastewater treatment facility. Wastewater from chicken slaughterhouse raises environmental problem since all the wastewaters are dumped in city sewer. One of the solutions to overcome the wastewater problem is to utilize the wastewater from chicken slaughterhouse as a resource for organic liquid fertilizer. The fermentation process is needed to produce organic liquid fertilizer from chicken slaughterhouse wastewater. In this research, we applied the variation of carbon sources from several type of sugar during the fermentation process.

Keywords: chicken slaughterhouse wastewater, organic liquid fertilizer, anaerobic fermentation

[53] The Utilization of Fruit Peels as Carbon Source for Production of Organic Fertilizer

Eduardus Budi Nursanto[1*], Alifiana Permata Sari[1], Rinaldi Medali Rachman[1], Mega Mutiara Sari[2]

1. Chemical Engineering Department, Universitas Pertamina, Indonesia
2. Environmental Engineering Department, Universitas Pertamina, Indonesia

E-mail: eduardus.bn@universitaspertamina.ac.id

Abstract. Banana and orange consumption rate in Indonesia are quite high, since prices are cheap also the supply are abundant. The problem from banana and orange consumption rate is the organic waste from fruit peels. This fruit peels are still rich in fructose and can be utilize as a carbon source for fermentation process in the production of organic liquid fertilizer. The utilization of fruit peels can substitute common sugar during the fermentation, and it will effect on the production cost of organic liquid fertilizer. In this research, we applied banana and orange peels as a carbon source for the fermentation of chicken slaughterhouse wastewater.

Keywords: fruit peels, anaerobic fermentation, organic liquid fertilizer, Chicken slaughterhouse wastewater

[54] Selection of Liquid Organic Fertilizer Packaging by Applying the Concept of Reverse Logistics Using Quality Function Deployment (QFD) Method

Harummi S Amarilies[1], Iwan Sukarno[1], Alifiana P Sari[2] and Eduardus B Nursanto[2]

1. Logistics Engineering Department, Universitas Pertamina, South Jakarta, Indonesia 12220
2. Chemical Engineering Department, Universitas Pertamina, South Jakarta, Indonesia 12220

E-mail: harummi.sa@universitaspertamina.ac.id,
eduardus.bn@universitaspertamina.ac.id

Abstract. Packaging of a product is used to contain, to transport, to protect, to provide product-related information and to market the product. This paper is about the selection process of packaging design for liquid organic fertilizer made of chicken slaughterhouse waste in the city of South Jakarta. The research purpose is determining the most appropriate design, additional features, and the type of plastic as the liquid organic fertilizer container that applies reverse logistics concept. Quality Function Deployment (QFD) is applied as a method to select the best packaging type that fulfils consumers' requirements. This QFD method analyses the features and helps selecting the best design out of various liquid container designs available in the market. The results showed that the liquid organic fertilizer to be used is made of thick High-Density Polyethylene (HDPE) plastic bottle with sprays on its screw-type lid that enables the reverse logistics concept.

Keywords: Organic liquid fertilizer, Packaging, Quality Function Deployment (QFD) Method

[55] Equilibrium Behavior of CO_2 Adsorption from Biogas Onto Zeolites

Hablinur Al Kindi[1], Armansyah H Tambunan[2], Edy Hartulistiyoso[2], Salundik[3], Achmad Kemal Fadillah[2], Iyan Yuliana[2]

1. Department of Mechanical Engineering, Ibn Khaldun University Bogor, 16162, Indonesia
2. Department of Agriculture and Biosystem Engineering, Bogor Agricultural University, 16680, Indonesia
3. Department of Animal Production Science and Technology, Bogor Agricultural University, 16680, Indonesia

E-mail: hablinur@ft.uika-bogor.ac.id; ahtambun@gmail.com

Abstract. Biogas is one of the types of renewable energy that has a major gas content of CH_4 and CO_2. One of the methods for upgrading biogas is adsorption. The principle of adsorption's work is to deliver biogas into a column with containing adsorbent, so that a CO_2 gas is bound to zeolite, causing the CH_4 to increase in the result product. The biogas used in research came from a cow feces that was dumped into a 10bar pressure vessel. Adsorbent used zeolite 13X that was activated. The biogas tube has a height 0.3 m and diameter 3 cm. It was made of stainless steel and there was a cartridge heater inside. Biogas was channeled into adsorbent column with pressure variations 0.8, 1.2, 1.6 and 2 bars and temperature variations 30, 50 and 100oC. The flow rate of biogas used 4 L/minute with a 4-minute data retrieval. Data retrieval was continuous, so that the composition of CO_2 gas from beginning to end recorded on the Gas analyzer. The research aims to identify the balance of adsorption with variations in pressure and temperature by Langmuir equation which has been developed. The results show if the higher the pressure, then CO_2 that was absorbed is inversely proportional to the temperature where the higher the temperature, the less CO_2 was adsorbed. This research succeeded in getting the Langmuir constant, maximum amount adsorbed of CO_2, and heat of adsorption.

Keywords: Adsorption, biogas, Langmuir, zeolite

[57] Astaxanthin Production in Xanthophyllomyces Dendrorhous Grown in Medium Containing Watery Extracts from Vegetable Residue Streams

B Brands and M Kleinke*

Rhine-Waal University of Applied Sciences, Faculty of Life Sciences Marie-Curie-Str.1, 47533 Kleve, Germany

E-mail: m.kleinke@hsrw.eu

Abstract. Xanthophyllomyces dendrorhous DSM 5626 is a basidiomycetous yeast [1]. It produces the carotene Astaxanthin, which is used in fish farming and gives the flesh a characteristic salmon colour [2–5]. Astaxanthin has antioxidative properties and is said to have anti-inflammatory properties [6] and potential in human health [7]. Currently, in the industry astaxanthin is isolated from the algae Haematococcus pluvialis. Recent studies have shown that the yield of astaxanthin in X. dendrorhous can be increased by optimizations in the medium composition [8–10]. In the BIVAC project, several vegetable residue streams were analysed for their composition. Many of them contained sugars and proteins, which could have a positive influence on the production of astaxanthin in X. dendrorhous, so we analysed the astaxanthin levels in X. dendrorhous after cultivation in media with different watery extracts of these residue streams; these results are presented here. The process could contribute to the utilization of surplus biomass and provide a possible path to sustainable biomass use in a rapidly changing world.

Keywords: Astaxanthin, residue streams, Xanthophyllomyces dendrorhous

[58] A Suitable Design of Metal Hydride Cartridge for a Fuel Cell Assisted Bicycle in Consideration of Heat Transfer Performance

Daisuke Hara[1*], Shan Miao[2], Junnosuke Shimogawa[2], Noboru Katayama[2], Kiyoshi Dowaki[1]

1. Department of Industrial Administration, Graduate School of Science and Technology, Tokyo University of Science Japan
2. Department of Electrical Engineering, Graduate School of Science and Technology, Tokyo University of Science Japan

E-mail: 7420524@ed.tus.ac.jp

Abstract. Metal hydride (MH) hydrogen storage that can store hydrogen that can be produced from biomass resources at low pressure with high volumetric energy density is an attractive hydrogen storage method. Despite of these advantages, the hydrogen flow rate drop due to the endothermic reaction is occurred and prevent the power generation of FC. In addition, focusing on the utilization of biomass hydrogen, it was reported in the previous study that the hydrogen capacity of MH would drop about 20 % due to the hydrogen sulfide contained in biomass hydrogen. That is, considering this degradation of hydrogen capacity, the hydrogen charged in MH should be discharged as much amount of hydrogen as possible. Thus, in this study, the MH utilization to Fuel Cells (FC) assisted bicycle was investigated in terms of the weight of MH based hydrogen system and heat transfer characteristics. As a result, focusing on the weight of MH based hydrogen storage system, its weight can be below the 8 kg that is the limit to get an advantage of travel distance compared to lithium-ion battery derived bicycle and theoretically achieves the twice longer travel distance. Also, using the mathematical model of hydrogen discharging from MH, the heat transfer of small MH cartridge for FC bicycle was investigated. Consequently, the center of the cartridge was cooled approximately 20 K compared to initial temperature. Thus, the heat injection to MH cartridge was revealed to be necessary however high the initial and boundary temperature is. Also, it was concluded that the 83 % of hydrogen charged in MH can be potentially excluded keeping the enough hydrogen flow rate to run 220 W of FC.

Keywords: Metal Hydride, Fuel Cell Bicycle, Biomass Hydrogen, Heat Transfer, Cartridge Design

[59] Intermittent Drying of Dragon Blood's Resin

K Yuniarti*, L Efiyanti, E Basri, G Pasaribu and TK Waluyo

Center of Forest Products Research and Development, Ministry of Environment and Forestry Indonesia, Jl Gunung Batu 5 Bogor

E-mail: karnitayuniarti2015@gmail.com

Abstrac. Dragon blood's resin is one of herbal commodities from Indonesia's forest, mainly obtained from the rattan fruits called Jernang (Daemonorops sp). The effectiveness of its simplicia as medical material is affected by, one of which, the processing stages it exposes to, i.e the drying techniques being applied. Intermittent drying is a drying technique combining heating phase at certain temperature and period with non-heating phase at ambient temperature and certain period. The cycle was alternated until the samples being dried reach the final target condition. This study particularly investigated the effect of implementing different intermittent drying conditions on the drying rate and quality of dragon's blood resin. Three heating temperatures, 60°C, 55°C and 55/60°C, and 2 non-heating periods, 15 and 30 mins, were applied. A 1-hour heating phase was applied and alternated regularly with the non-heating period. c. Further statistical analysis confirmed that the heating temperature levels and non-heating periods, as well as their interaction, significantly affected several quality parameters of dragon blood's resin (dracorhodin, final moisture, ash and impurity levels). Intermittent drying with heating phase at 60°C and 15-mins non-heating period is potential for further application.

Keywords: intermittent drying, dragon blood's resin, drying quality, drying rate

[60] Implementation of New Material "CCO" for Mud Drilling to Prevent Swelling Problem with Geonor As.

Angga Pratama Sirait[1], Nur Suhascaryo[2]

1. Petroleum Engineering, Faculty of Mineral Technology, University of Pembangunan Nasional Veteran Yogyakarta, Yogyakarta, Daerah Istimewah Yogyakarta, 55283
2. Petroleum Engineering, Faculty of Mineral Technology, University of Pembangunan Nasional Veteran Yogyakarta, Yogyakarta, Daerah Istimewah Yogyakarta, 5528

E-mail: anggasirait27@gmail.com1; nur.suhascaryo@upnyk.ac.id

Abstract. On the drilling operation drilling mud has an important part to make drilling operation safely and optimization to prevent drilling problems. Drilling problem caused by many factors, one of factor caused drilling problem comes from the condition of formation, The condition of formation that make the drilling problem is coming from shale formation. The shale formation has a tendency to become sloughing and swelling, to prevent that thing the mud drilling must be designed to encounter that condition to reduce risk of drilling operation. The cutting sample for this study get from EG wellsite that have a reactive clay that caused the shale problem. To calculate the effectiveness the material that used in drilling mud this study used methelyne blue test and geonor swelling test. In this study, crude coconut oil (CCO) as natural material have a good condition for used in this case.

Keywords: mud drilling, swelling, mbt, geonor as, crude coconut oil

[61] The Influence of Gasoline-Bioethanol Blends on Lubrication Characteristic of 4T Motorcycle Engine Oil

M. Hanifuddin[1*], Rizkia Malik[1], Milda Fibria[1], Catur Y Respatiningsih[1], Rona Malam Karina[1], Setyo Widodo[1,2], Riesta Anggarani[1], Maymuchar[1], Cahyo Setyo Wibowo[1,3]

1. Department of Product Application Technology, Research and Development Center for Oil and Gas Technology "LEMIGAS", Jakarta, Indonesia.
2. Department of Chemical Engineering, Faculty of Industrial Technology, Institut Teknologi Bandung, Indonesia.
3. Department of Mechanical Engineering, Faculty of Engineering, Universitas Indonesia, Depok, Indonesia

E-mail: mhanifuddin12@gmail.com

Abstract. Bioethanol produced from renewable resources can be the substitute of gasoline or blended with it, gives better exhaust emissions, and has oxygen content to boost combustion. The combustion chamber liner of motorcycles' engine need tobe lubricated with lubricants of engine oil characteristics. The unburned fuel from gasoline-bioethanol blends have a tendency to enter the oil sump. The increasing amount of bioethanol content accumulated within the oil may degrade the quality the engine oil. The aims of this study are to identify and to analyze the influence of gasoline-bioethanol blends accumulation on the characteristic of engine oils. The methodology applied in this study were adding gasoline-bioethanol blends (E40,E50,E60) into 3 types of commercial four-strokes motorcycle engine oils (SAE 5W-30, SAE 10W-40, SAE 20W-50) and analysing the effects of these addition to the engine oils characteristics by comparing the properties of each mixtures of fuel-lube blends. The engine oil properties choosed to be the studied parameters are density (ASTM D4052), kinematic viscosity (ASTM D445), flash point (ASTM D92) and four ball wear test (ASTM D 4172). The result gained from this study showed that the bioethanol content as fuel diluent resulted from unburned bioethanol decrease the quality of engine oils.

Keywords: Bioethanol, Gasoline, Lubrication, Fuel Dilution, Wear

[62] Study on Effectivity and Efficiency of Various Drying Methods of Nyamplung Fruits (Callophyllum Inophyllum)

Okta Amelia[1*], Illah Sailah[1], Ika Amalia Kartika[1], Ono Suparno[1], Yazid Bindar[2]

1. Department of Agroindustrial Technology, IPB University, Bogor, Indonesia, 16680
2. Department of Bioenergy Engineering and Chemurgy, Faculty of Industrial Technology, Bandung Institute of Technology, Bandung 40116

E-mail: ameliao40@yahoo.com

Abstract. Nyamplung fruit has a very high industrial potential, especially for the bioenergy industry. The seeds contain high levels of oil that can be transformed into biodiesel. The advantage of nyamplung fruit as bioenergy raw material is that the seeds have a high yield, can reach 74%. One of the difficulties of transforming the fruit into a product with high economic potential is in terms of taking out the seed from its shell, which is influenced by the moisture content of the fruit. To reduce the moisture content, nyamplung fruits require a drying process. The drying process is usually done by utilizing sunlight. This method has the disadvantage of taking a long time and is affected by the weather. Therefore, it is necessary to conduct a study to select one of several drying methods based on their efficiency and effectiveness. The study results showed that drying using the oven for 6 hours produced a moisture content of 10% wet base while drying using a 6-hour roasting method produced a moisture content of 6.5% wet base, and drying using sunlight for 168 hours produced a moisture content of 10.23% wet base. Water content between 6.5-10.23% makes it easy to separate seeds from their shells. Based on this study, it can be concluded that drying methods affect the moisture content of the fruit, and the method of drying using the oven turned out to be more effective.

Keywords: Drying, Nyamplung Fruit, Moisture Content

[63] Review Biodiesel Policy in Indonesia

Adil Fajar Widrian[1], Budiawan Sidik Arifianto[1], Nurbaiti[1], Nugroho Adi Sasongko[1,2]

1. Energy Security, Indonesia Defence University, IPSC Area, Sentul, 16810, Indonesia
2. National Research and Innovation Agency, Jakarta, Indonesia

E-mail: adilfajar@gmail.com, budiawan.sidik@gmail.com, nurbaitiii0909@gmail.com, nugroho.sasongko@idu.ac.id, nugroho.adi@bppt.go.id

Abstract. Indonesia known as energy-rich country, both fossil and renewable. In 2019, national energy supply still relies on oil, coal and natural gas with a total proportion in the primary energy mix of 91.5%. Import dependency on petroleum and high burden of the state budget for fuel subsidies are reasons for the Indonesian government to implement biofuel policies in Indonesia. Biofuel development in Indonesia has been implemented since 2006 with the existence of Presidential Regulation No. 5 of 2006 to Regulation of the Minister of Energy and Mineral Resources No. 41 of 2018. Since 2008, the government has issued a mandatory policy for using biodiesel with a mixture content of 2.5%. The government gradually encourages increasing biodiesel content to 7.5% in 2010, 10% in 2011, and 15% in 2015, and 20% in 2016. By 2020, biodiesel mandatory targeted to be 30%. Over the years, biodiesel industry shows an increase both in terms of quantity and capacity. The policy of using biofuels has many impacts such as reducing diesel import and CO2 emission, increasing the added value of CPO and labour. On the other hand, the mandatory biofuel policy gives a negative impact on the environment due to the possibility of land expansion. This study aims to review biodiesel policies in Indonesia since 2006 and analyze the problems and outputs in each policy as well as challenges for future biodiesel development.

Keywords: Biodiesel, Biofuel, Energy, Indonesia Regulations, Policy

[64] Production of Fuel pellet from Agricultural and Plantation Estate Crops Biomass

Rizal Alamsyah*, Dedi Darmawan Samid, Susi Heryani, Nobel Christian Siregar

Center for Agro-Based Industry-CABI

Email: rizalams@yahoo.com

Abstract. Biomass contains energy that can be used as solid fuel, so biomass will have high added value. Directly combustion of biomass has caused environmental pollution problems. Agricultural and plant estate plantation biomass waste that widely spread in Indonesia needs to be utilized. The research was aimed at designing and producing biomass pellet for pilot scale capacity of 200 kg/hour. The biomass used consisted of empty oil palm fruit bunches (OPEFB), oil palm shells (OPS), cocopeat, corn cobs and sugar cane bagasse. Pellets are formed by pressing biomass powder with high pressure using a 10 hp pelletizer. The quality of pellets produced was tested based on the standard DIN 53731. The performance test of a pelletizing machinery showed that such machineries can be produced for 150-200 kg/hour. The test results showed that almost all quality parameters of biomass pellet (moisture content, calorific value, ash content, density, length, and diameter) met the requirements. Synthetic gas produced from burning biomass pellets in the gasifier and stove are able to use for drying and heating for 80 minutes. Pelletizing can enhance the volumetric and calorific value, reduce the transport and storage costs; reduce the moisture content; and improve the handling characteristics of biomass.

Keywords: biomass, fuel pellet, pilot plant, densification

[66] Decreased in Paddy Yield (Oryza sativa L.) as a Response to Plant Bioaccumulation of Chromium

Taufik Taufikurahman*, Rizka Purnamawati, Andira Rahmawati

School of Life Sciences and Technology, ITB

E-mail: taufik@sith.itb.ac.id

Abstract. In leather tannery industry such as a case in Sukaregang, Garut, untreated or poorly treated wastewater which contain chromium has been severely polluting nearby river. The polluted river water (PRW) has been used by local farmers to irrigate their paddy fields. In this study we planted Sarinah variety (Svar) and Rojolele variety (Rvar) of paddy in soil and watered with PRW, $K_2Cr_2O_7$ solutions with concentration of 50 and 100 mg/L and clean water as a control, for a period of four months. Chromium solutions were added gradually to the soil until reached final concentrations of 50 and 100 mg/L. The result showed that the treatment with PRW and Cr solutions reduced plants weight, shoot length and paddy production. Treatment with Cr solutions significantly decreased plants fresh and dry weight by 26.53% and 36.69% for Svar, 32.14% and 19.74% for Rvar. Paddy yield also decreased as higher Cr concentration was accumulated in plant tissues. The amount of filled grains decreased by 33.05%, while empty grains increased by 50.21% in Svar. In Rvar the amount of filled grains decreased by 21.44% and empty grains increased by 31.95%. Chromium treatment by gradual increase allowed plant to survive at an exposure of 100 ppm Cr, although the plant reduced its growth, biomass and yield.

Keywords: Chromium hexavalent, Oryza sativa, Plants Biomass, Plants yield

ICBB
INTERNATIONAL
CONFERENCE
ON BIOMASS
AND BIOENERGY
2021

[69] Characteristics and Performance of Charcoal Briquette from the Sawdust of Sungkai (Peronema canescens Jack)

Agung Nugroho[1,3*], Amin Padil[1], Udiantoro[1], Wiwin Tyas Istikowati[2,3]

1. Department of Agro-industrial Technology, Lambung Mangkurat University, Banjarbaru
2. Department of Forestry, Lambung Mangkurat University, Banjarbaru
3. Wetland-Based Materials Research Center, Lambung Mangkurat University, Banjarbaru, Indonesia, 70714

E-mail: anugroho@ulm.ac.id

Abstract. Sungkai wood (Peronema canescens Jack) is one of prominent materials used for production of furniture and other decorative elements in Kalimantan and Sumatra due to its beautiful fiber and color, and also its fairly smooth texture. Since of massive production, the waste resulted from the processing of sungkai wood are very abundant. Utilization of sawdust or wood shavings of sungkai still generates a relatively low value. In order to increase the value of sawdust of sungkai, this research was aimed to identify the characteristics and performance of briquette produced from the sawdust of sungkai. This research was performed by evaluating the characteristics and performance of bio-briquettes produced from three concentrations (10%, 15%, and 20%) of glue material made from tapioca starch. The results show that, except of the volatile matter, all parameters of the characteristics and performance of the tested briquettes comply with the Indonesian National Standard (SNI) of briquette product. The characteristics and performance of the tested briquettes at the lowest levels are follows: water content (4.52%; SNI: max 8%), ash content (4.36%; SNI: max: 8%), volatile matter (42%; SNI max: 15%), density (0.46 g/cm3; SNI: 0.45-0.85 g/cm3), combustion time (0.14 g/min), ignition time (2.5 second/g), and calorific value (5.889 kcal/kg; SNI: min 5000 kcal/kg). It requires optimization on the carbonization process in order to reduce the volatile matter.

Keywords: briquette, calorific value, combustion time, Peronema canescens, sungkai, wood

[72] Strategies on the Development of Palm Oil-Based Biodiesel Agroindustry for Energy Security in Indonesia

Alfa Firdaus

Universitas Mercu Buana, Indonesia

E-mail: alfastmt@gmail.com

Abstract. The development of biodiesel agroindustry in Indonesia is part of the Government's efforts on energy diversification to achieve national energy security. However, there is no clear measurement regarding the current state of energy security and the energy security to be addressed, so that the improvement of energy security in the context of biodiesel agroindustry is still undirected. It is because energy security is a concept that is very bound to the context. Therefore, the main objective of this research is to formulate policy recommendations for the Government in determining the direction of developing biodiesel agroindustry to achieve national energy security. In conjunction with the main objective, a study is needed relating to the formulation of energy security dimensions and indicators in the context of biodiesel agroindustry. Similarly, a study is needed regarding the design of models to determine the impact of biodiesel agroindustry on energy security. This study consisted of 8 stages that followed the flow of dynamic system model development, namely understanding the system; problem identification and definition; drafting the system concept (causal loop); model formulation; data collection; verification, simulation and validation; preparation of energy security dimensions and indicators; and policy formulation. This study successfully identified 4 dimensions and 12 indicators of energy security with the index construction method. Based on the energy security index, it is known that the level of energy security in the context of biodiesel agroindustry over the last 4 years has experienced an upward trend. These results are in line with the results of the National Energy Council study, which shows that the direction of developing biodiesel agro-industry in Indonesia has been in line with efforts to strengthen the level of national energy security. This research also succeeded in designing a dynamic model to determine the impact of biodiesel agroindustry on national energy security. The simulation results using LEAP software with status quo scenario shows a trend of decreasing energy security in the period of 2022- 2025 and the target of biodiesel production set at the RUEN can only be achieved in 2027. This is mainly related to biodiesel stock which has decreased in the period of 2022-2025 due to the rate of consumption growth is faster than the rate of growth of production. Therefore, an alternative scenario from status quo is the scenario of increasing biodiesel agroindustry productivity with simulation results showing a relatively stable IKE value in the 2019-2030 period and biodiesel production targets set at RUEN can be achieved in 2023. To answer the main objective, this research succeeded in formulating policy recommendations for the government in determining the direction of developing biodiesel agroindustry to achieve national energy security, namely the intensification and extensification strategies. The intensification strategy focuses on increasing productivity through improved CPO yield rates, while the extensification strategy focuses on increasing biodiesel production capacity.

Keywords: biodiesel agroindustry, energy security, simulation

[73] Energy Efficiency and Energy Saving Potential Analysis of Biomass Boiler at the PT Greenfields Indonesia Milk Processing Plant

Dedi Suntoro[1], Paber Sinaga[1], Radityo Cahyo Yudanto[2], and Faridha[1]

1. Research and Development Centre of Electricity, New, Renewable Energy and Energy Conservation Technology, Ministry of Energy and Mineral Resources of Indonesia
2. Directorate of Energy Conservation, DGNREEC, Ministry of Energy and Mineral Resources of Indonesia

E-mail: dedisunt@yahoo.com

Abstract. Boilers are one of the most important utility equipment in a milk processing plant because they provide steam which is primarily used in process heating application, including pasteurization, cooking and evaporation. Energy use in boilers is the most significant energy use in milk processing plants, therefore it is very important to keep the boiler efficient. This study aims to evaluate the efficiency and energy saving opportunities of the biomass boiler in the milk processing plant of PT Greenfield Indonesia, which is located in Malang, East Java, Indonesia. The fuel used in the boiler is candlenut shell, which is widely available in the area. Boiler efficiency was evaluated by direct and indirect methods referring to ASME PTC 4-1. In the direct method, the energy gain by working fluid is compared with energy content of fuel, while in case indirect method various losses compared to the energy input. The data used in this study were obtained from operation logbook data and field measurement data. Our result shows that the biomass boiler efficiency is 82.24% by using direct method and 75,34% by using indirect method with flue gas being the largest energy losses in the biomass boiler. Energy savings can be obtained by installing an air preheater, setting excess air and adding insulation on some boiler walls.

Keywords: biomass, biomass boiler, boiler efficiency, energy saving, milk processing plant

[74] Converting of Kesambi (Schleichera oleosa l.) Oil into Biodiesel using ZnO-Based Solid Acid Catalyst

N P Asri[1*], R Saraswati[2], R R Yogaswara[3], N Eriswari[1], and S Suprapto[4]

1. Chemical Engineering Department, Faculty of Engineering, Universitas W. R. Supratman, Indonesia, 60111.
2. Department of Industrial Engineering, Faculty of Engineering, Universitas W. R. Supratman, Indonesia, 60111.
3. Chemical Engineering Department, Faculty of Engineering, Universitas Pembangunan Nasional "Veteran" Jawa Timur, Indonesia, 60294
4. Chemical Engineering Department, Faculty of Industrial Technology, Institut Teknologi Sepuluh Nopember, Indonesia, 60117.

E-mail: nyoman_puspaasri@yahoo.com

Abstract. Alumina-supported zinc oxide-copper oxide (ZnO-CuO/γ- Al2O3) solid catalyst which coded ZCA and zinc oxide with multi-walled carbon nanotube support (ZnO/MWCNTs) coded by ZCNT catalyst have been successfully synthesized and used to produce biodiesel from Kesambi (Schleichera olesosa l.) oil. The catalyst was synthesized using a combination of precipitation and impregnation method based on modified Stober gel-based process. Before being used for transesterification of kesambi oil, ZCA and ZCNT catalyst was characterized using N2 adsorption-desorption followed by Brunauer-Emmett Teller (BET) calculation and Scanning Electrone Microscopy (SEM) analysis. The transesterification process was conducted in a glass batch type reactor with refluxed methanol. The effect of loading ZnO (wt.% to catalyst support) on the yield of biodiesel were investigated. The results showed that the catalyst of ZCA was potentially used for transesterification of kesambi oil. The highest biodiesel yields above 80% was achieved after 3 hours of transesterification.

Keywords: alumina, biodiesel, multi-walled carbon nanotube, Schleichera oleosa, zinc oxide

[77] Evaluation Land Use Cover Changes Over 29 Years in Papua Province of Indonesia Using Remote Sensing Data

Sri Murniani Angelina Letsoin[1,2*], David Herak[1], RatnaChrismiari Purwestri[3,4]

1. Department of Mechanical Engineering, Faculty of Engineering, Czech University of Life Sciences Prague, Kamycka 129, 16500 Praha-Suchdol, Czech Republic
2. Faculty of Engineering, University of Musamus, Merauke Regency, Papua 99611, Indonesia
3. Faculty of Forestry and Wood Sciences, Czech University of Life Sciences Prague, Kamycka 129, 16500 Praha-Suchdol, Czech Republic
4. Institute of Nutritional Sciences, University of Hohenheim, Garbenstrasse 28, 70599 Stuttgart, Germany

E-mail: letsoin@tf.czu.cz

Abstract. Land use/cover change (LUCC) observation and determination have been extensively discussed in natural resources management studies, biodiversity and ecosystem preservation, land management also climate changes studies. In the present work, an evaluation of the LUCC in Merauke, the easternmost city of Indonesia, was conducted to gain relevant information in agriculture and forestry-based on historical information from remotely sensed land cover data. To obtain the historical dynamics of the LUCC, a supervised classification algorithm was implemented to the Landsat images of 1990,1996,2009,2015, and 2019 as well as statistical analysis Wilcoxon signed rank. This study aims to investigate land use cover change, and to analyse the LUCC over a period of 29 years. The results show a significant decline in the forest area by around 7% in 2019. As compared to the LUCC in 1990, agriculture sector such as dry-land agriculture, shrub-mixed dry land and paddy field gained an area higher than 50%, while the area of the water body is a decline by 0.61 % over the period. The evaluation of LUCC will help government development plans in the protection of commodities in this Province.

Keywords: Land use cover change (LUCC), Remotely, Wilcoxon signed rank

[78] Novel Environmentally-Friendly Biomass-based Polymers

Shinji Kanehashi

Tokyo University of Agriculture and Technology

E-mail: kanehasi@cc.tuat.ac.jp

Abstract. To achieve the agenda for Sustainable Development Goals (SDGs) adopted by United Nations and circular economy, worldwide environmental problems such as global warming, depletion of fossil fuels, waste plastic pollution, water-, air-, soil- pollution, food and water crisis, etc have to be solved.

We are focusing on environmentally-friendly functional materials for sustainable society. Novel functional polymer materials derived from unutilized biomass (e.g., natural phenol compounds) have been investigated. Developed polymers had several interesting features such as chemical resistance, thermal stability, anti-microbial property, transparency with room temperature curable property. Hence, these polymers can be expected as novel biomass-based functional materials for various applications.

Keywords: Biomass, Biomass-based polymer, Polyphenol

[79] Solid Alcohol Formulation as a Lighters in Charcoal Bio-Briquettes

Ziedal Mafaaz Fafaaza Emha, Erliza Hambali, Dwi Setyaningsih

1. Department of Agroindustrial Engineering, Faculty of Agriculture Technology, IPB University
2. Surfactant and Bioenergy Research Center, IPB University

E-mail: ziedalmafaaz@apps.ipb.ac.id

Abstract. Biomass or bio resources is a material that is used as a source of energy based on biological resources in large quantities. Biomass specifically refers to agricultural waste which can be used as an alternative energy source to replace fossil fuels and become a renewable energy source in the form of charcoal bio-briquettes. Charcoal bio-briquette fuel is more practical to use, safer, does not cause excessive gas emissions (smoke), environmentally friendly and cheaper production cost. The weakness of bio briquettes is takes a long time to burn. The lighter material is one of the solutions to accelerate the flame process in bio briquettes. The existence of solid alcohol as a lighter material can be a source of renewable energy to support daily activities. Solid alcohol is a starting material in burning wood, charcoal or charcoal bio-briquettes. The purpose of this research are to determine the best formulation and see the performance of solid alcohol. The formulation for making solid alcohol is also easy to apply using bioethanol, olein and stearin oil, and NaOH as a solidifying agent. The results show that the solid alcohol can ignite the fire quickly, does not cause soot, does not stream down or does not spread when ignited so it has lower potenial of fire hazard. Solid alcohol has the ability to light a fire in less than 15 seconds, melting time of ± 3 minutes, and the orange flame tends to be yellow. Solid alcohol as a lighter material has good combustion performance, economical and has the potential to be developed

Keywords: Bio-Briquette, Solid Alcohol, Ligh

[82] Refining of Fish Oil from Fish Meal Processing By-product Using Zeolite and Bleaching Earth

Sang Ayu Made Sri Tandewi[1*], Erliza Hambali[1,2]

1. Department of Agroindustrial Technology, Faculty of Agricultural Technology, IPB University (Bogor Agricultural University), Bogor, West Java, Indonesia
2. Surfactant and Bioenergy Research Center, IPB University, Baranangsiang Campus, Bogor, Indonesia

E-mail: tandewiyude10@gmail.com

Abstract. Fish oil as a by-product of the fish meal processing industry is a material that has the potential to be reused if it undergoes further processing. A method that can be applied is the bleaching process. This study aimed to determine the quality of fish oil before and after the addition of bleaching earth and zeolite adsorbents, the best bleaching process conditions, and the effects of the type and concentration of bleaching earth and zeolite adsorbents on the fish oil quality. Crude fish oil was weighed and heated. Then, adsorbents with various concentrations were added when the temperature has reached 55-60 oC. The oil was returned and stirred at 80 oC for 30 minutes. After that, the oil was centrifuged at 6,500 rpm for 20 minutes. The characteristics of crude fish oil after bleaching had different values from fish oil before bleaching to improve the quality and quality of fish oil. The use of zeolite adsorbents and bleaching earth is considered effective in improving the quality of fish oil from fish meal processing. The best type and concentration of adsorbents for the bleaching process was using a zeolite with a concentration of 1%. The interaction of type and concentration of adsorbent had a significant effect on each test parameter of density, viscosity, free fatty acid content, acid number, peroxide number, total oxidation number, and p-anisidine value on the fish oil quality.

Keywords: Curisi and bigeye tuna fish oil, Refining, Oil quality fish

[83] Phytotoxicity of Chromium-Containing Wastewater on Germination and Growth of Oryza sativa L.

Taufik Taufikurahman*, Raden Roro Deby A. Rizkyani, Andira Rahmawati

School of Life Sciences and Technology, ITB. Jalan Ganesha 10 Bandung

E-mail: taufik@sith.itb.ac.id

Abstract. Leather tanning industries in Sukaregang area, Garut district-West Java, have been using chromium since 1980s. Since that time chromium containing wastewater has been polluting river water in the area since there has not been effective waste water treatment available until today. The polluted river water spread bad smell to the environment and the water also has been used by local farmers to irrigate their paddy field. This research was conducted to examine the effect of chromium containing wastewater to germination rate and growth of paddy, including the level of chromium content in plant organs. For germination study, two varieties of paddy i.e. var. Ciherang (Cvar) and var. Sarinah (Svar) were examined using rolled test paper which has been moistened by leather tanning wastewater. Chemical solutions of K2Cr2O7 with concentrations of 50, 100, 200 mg/L, and polluted river water (PRW) were treated to the plants, with distilled water used as a control.. For further examination of the effect of chromium to plant growth, Cvar was grown in soil and treated with the same variations used in germination test for a period of four months. Chromium concentration of 50 and 100 mg/L reduced germination percentage by 10%, while at 200 mg/L the reduction reached 15%. High concentration of chromium (100 and 200 mg/L) reduced seedling growth up to 7% . Root and first leaf growth were inhibited severely. On plants growth, direct exposure of chromium 100-200 mg/L killed the plants a week after treatment. Exposure of the plant to wastewater and chromium 50 mg/L reduced plants growth. After being exposed to chromium 50 mg/L for 4 months, plant accumulated total chromium in its roots in the amount of 80 mg/L. Chromium accumulation was also occured in shoot, leaves, and seeds in the concentration within the range of 5-10 mg/L. Hence rise the issue of its safety for consumption. In general the effect of chromium-containing wastewater to paddy was similar to the effect when the plant was exposed to 50 mg/L of chromium.

Keywords: Chromium, leather tanning, paddy, germination, growth.

[84] Potential of Nanoemulsion Process and Method using Agro-Industrial Based Materials in Skincare Formulations: A Review

Gita Syarifah Ali[1], Erliza Hambali[2], Farah Fahma[2]

1 Program Studi Pascasarjana Teknik Industri Pertanian, IPB University, Bogor, Indonesia
2 Departemen Teknologi Industri Pertanian, IPB University, Bogor, Indonesia

E-mail: gita_syarifahali@apps.ipb.ac.id

Abstract. Consumer demand for high quality skincare products, which combine performance, safety and active compound content is increasing. However, the combination of the formulation of active compounds and process techniques is a challenge in itself. The application of nanotechnology to formulate skincare has attracted interest because it has more potential than conventional methods. Nanoemulsion technology in the skincare production process plays an important role in improving product quality. Nanoemulsion has a small droplet size which increases the ability of the active compounds to penetrate the skin. Nanoemulsion forming components are similar to conventional methods but the dispersed particles and droplets are smaller in size with a diameter of 20-200 nm. Nanoemulsion has been widely applied to skincare products to increase stability and to improve quality. Agroindustrial based nanoemulsions have potential in the formulation of skincare products. A general description of the formulation, process and application of skincare products will be presented in the discussion. The method used consists of two parts, namely the high energy method which includes microfluidization, high pressure homogenization and ultrasonication, while the low energy method consists of phase inversion composition, phase transition temperature, solvent displacement and newly developed approaches such as D phase emulsification. The purpose of this literature study is to discuss the process and methods of skincare nanoemulsion formulations to increase stability, the potential of agro-industrial based material as a nanoemulsion and cover the potential for scale-up.

Keywords: formulation, nanoemulsion, stability

[87] Application of Compost, Fertilizer and Beneficial Microbes to support Sorghum's Growth in Ultisol

I Made Sudiana[1*], Tri Ratna Sulistiyani[1], Atit Kanti[1], Toga Pangihotan Napitupulu[1], Indriati Ramadhani[1], Arwan Sugiharto[1], Muhamad Amin[2], Ismu Purnaningsih[1], Idris[1], Arief Nurahmadiyanto[3], Reni Lestari[3], Rizki Hestiningtiyas[4], Ikhsan Guswenrivo[5] and Masaru Kobayashi[5]

1. Research Centre for Biology, Indonesian Institute of Sciences - LIPI, Jl. Raya Bogor Km. 46, Cibinong 16911, West Java, Indonesia
2. Indonesian Cereals Research Institute (ICERI), Jl. Dr. Ratulangi No. 274 Kotak Pos 173, Maros 90514 - South Sulawesi
3. Center for Plant Conservation, Botanic Gardens, Indonesian Institute of Sciences
4. Faculty of Agriculture Brawijaya University
5. Research Center for Biomaterial
6. Graduate School of Agriculture, Kyoto University, Japan

E-mail: imadesudianalipi@gmail.com

Abstract. Marginal land in Indonesia is approximately about 157,246,565 hectares covering both wetlands and dry land. For the dry land, most of the soil is ultisol. The nutrients content of ultisols is low due to the intensive base leaching, while the organic contents are low due to the fast decomposition process and some are carried away by erosion. Hence the sorghum cultivation in ultisol needs fertilizer application to improve the growth of sorghum. Application of type of fertilizers and urea dose is expected to improve the biological characteristics and plant growth. The objective of this research was to evaluate the effect of type of fertilizers and urea dose on plant growth and soil biology on sorghum for production of biomass energy in ultisol. This experiment used completely by randomized design which has 25 combinations of soil treatment, compost, plus compost, slow-release fertilizer and urea fertilizer with different dose with 3 replications. The parameter observed include the soil biological characteristics (soil microbes' respiration, the total of fungus and bacterium population, microbial biomass C), the Chemical characteristics of soil (pH and C-organic), the plants' growth, and the biomass of the plants. The result of the study showed that the type of fertilizers and urea does give a significant difference result in the growth improvement and the biomass of sorghum. The interaction that gives significant difference on the biomass was the type of fertilizers and urea dose. In the case of plant height, type of fertilizers and urea dose did not give positive interaction. Type of fertilizers and urea affected on the improvement of soil biology. Type of fertilizers and urea dose also affected on the soil microbial respiration, and bacteria and fungi population. Higher biomass production was achieved when fertilizer and compost along with biofertilizer were applied.

Keywords: Marginal land, Sorghum bicolor, ultisol, fertilizer

[88] Processing of Primary Sludge of Pulp Industry as Microfillers for Polystyrene-Based Composite Foams

Tengku Rachmi Hidayani[1], Basuki Wirjosentono[2*], Darwin Yunus Nasution[2], Diana Adnanda Nasution[3]

1. Industrial Chemical Technology Polytechnics, Medan 20228, Indonesia
2. Department of Chemistry, Universitas Sumatera Utara, Medan 20155, Indonesia
3. School of Materials and Mineral Resources Engineering, Universiti Sains Malaysia, Penang, Malaysia

E-mail: basuki@usu.ac.id

Abstract. Primary sludge as main byproduct wastes in a pulping industry still contain some biomass and potentially affects the environment when was not handled properly. The pulp industry primary sludge (PIPS) can be processed as microfiller for polystyrene-based foam composites for various engineering applications, such as sound and vibration damping materials. The PIPS has been dried, milled and shieved to 100-400 mesh particle sizes. Physical and chemical properties of the PIPS have been tested using: particle size analysis (PSA), FTIR spectroscopy, then its thermal properties using differential scanning calorymetry (DSC). Incorporation of the PIPS microfiller in maleic anhydride-modified polystyrene (MAm-PS) matrices for composite foam was carried out in a reflux reactor in xylene solution using Tween 80 as surfactant under stirring. The composite foam was characterized, firstly based on their densities compared to that of fresh PS resin, then using electron microscopy (SEM) for morphology properties. It was found that mean particle size of the dried and milled PIPS powder was 14.84 μm and its biomass content was 10.5%. Result of FTIR spectroscopy showed that many of the selected characteristic bands of lignocelluloses overlap, specifically, the selected band 1366 cm-1 for cellulose is very close to the 1368 cm-1 selected for hemicellulose. Whereas result of and its decomposition temperature 549.86oC with heat of combustion 16.34 cal/g, which indicating suitability of the PIPS powder as filler for polymeric foam microcomposites. The result of morphology analysis of the PIPS-filled microcomposites foam based on MA-m-PS (optimum weight ratio of MA-m-PS/PIPS: 80/20, density 0.88 g/cm^3), using SEM showed that PIPS microfillers were well distributed within the MA-m-PS matrices

Keywords: pulp industry primary sludge, microfillers, polystyrene, maleic anhydride, composite foams

[89] Plastisisation of Polyvinilchloride Biofilms with Palm Oil Oleine and Methylmethacrylate as Comonomer

Basuki Wirjosentono[1*], Darwin Yunus Nasution[1], Diana Adnanda Nasution[2]

1. Department of Chemistry, Universitas Sumatera Utara, Medan 20155-Indonesia
2. School of Materials and Mineral Resources Engineering, Universiti Sains Malaysi, Penang-Malaysia

E-mail: basuki@usu.ac.id

Abstract. Polyvinylchloride (PVC) is the second largest thermoplastics produced after polyethylene (PE), polypropylene (PP) and polystyrene (PS), especially for packaging, households, toys, and other commodity products. However when used for food packaging, PVC has to be plastisised using plastisisers (added upto 30%), which may not comply with safety requirements for food biofilms. Palm oil oleine (POO) is a nontoxic and edible triglyceride containing double bond and can be bounded onto PVC backbone in the presence of methylmethacrylate (MMA) as comonomer and benzylperoxide (BPO) as initiator. The PVC resin was dissolved in tetrahydrofurane (THF), added with POO, MMA and BPO, (in various compositions), under constant stirring in a reflux reactor. The reaction mixtures were then refluxed for 3 hours under nitrogen atmosphere at constant pressure 1 atm. Plastisised PVC films were obtained after casting the reaction mixtures on a glass plates, and dried under vacuum at constant temperature 40oC. Mechanical properties of the films were tested and their morphology were analysed under scanning electron microscope (SEM) and FTIR spectoscopy. Optimum clear and flexible PVC films was obtained when weight composition of the reaction mixture: PVC/MMA/POO/BPO: 2/0.5/0.5/0.35. Elongation at break of the optimum film was more than 95% higher, whereas the tensile strength was 60% lower when compare to those of pure casted PVC film. SEM analysis of the film surface also showed good homogenous morphology, whereas analysis of FTIR spectra of the films before and after exhausted washing in n-hexane, indicating 48.5% binding of MMA and POO in the PVC films.

Keywords: plastisisation, PVC biofilms, palm oil oleine, methylmethacrylate, binding

[91] Bibliometric Mapping of Glucomannan Flour from Porang (Amorphophallus muelleri Blume) Tubers as Future Crops in Agriculture: Review and Future Research Agenda

Ati Atul Quddus[1,3], Erliza Hambali[2], Mulyorini Rahayuningsih[2], Ika Amalia Kartika[2], Slamet Budijanto[3]

1. Department of Food Science Technology, Faculty of Agriculture, Garut University, Indonesia
2. Departement of AgroIndustrial Technology, Faculty of Agricultural Technology, Bogor Agricultural University, PO Box 220 Bogor 16002, Indonesia
3. Departement of Food Science Technology, Faculty of Agricultural Technology, Bogor Agricultural University, PO Box 220 Bogor 16002, Indonesia

E-mail: atisyaiful2020ati@apps.ipb.ac.id, erlizahambali@apps.ipb.ac.id, ikaamalia@apps.ipb.ac.id, mulyorini @apps.ipb.ac.id, slametbudijanto@apps.ipb.ac.id

Abstract. Porang (Amorphophallus muelleri Blume) is a type of tuber that has the potential to be developed as a substitute for wheat flour. The high carbohydrate and starch content makes porang can be used as a staple food raw material. The porang tuber also contains glucomannan which has the benefit of being developed in the industrial sector. Porang is one of the types of non-timber forest products (HHBK). Porang tuber is one of the export commodities so that it has prospects for cultivation. The purpose of this study was to determine the research trend in the potential for good porang tuber cultivation to have glucomannan content above 90%. The research was carried out by reviewing several articles along with a combination of bibliography, frequency of joint appearance, and consideration of citation from the author, articles, titles, keywords, and providing direction on the focus of future research, the scope of research based on the metadata of forty-three articles in the database. Google Scholar. Bibliometric analysis tools using VOSviewer, Harzing's Perish, or Publish software were used to analyze the index. Mapping of porang cultivation, porang tubers, porang flour, glucomannan, using VOSviewer. The results of the bibliometric analysis concluded that the processing of porang tubers into glucomannan flour which has many benefits has not been carried out and has not been optimal. For future research, porang as an agroforestry crop is focused on porang (Amorphophallus muelleri Blume) cultivation and processing into glucomannan.

Keywords: Bibliometric, Mapping, Porang (Amorphophallus muelleri blume), Google scholar, VOSviewer

[92] Design of Innovative Palm Oil Mill Mini Plant to Produce Crude and Refined Palm Oil

Dwi Setyaningsih[1,2*], Farah Fahma[1,2], Purwoko[2] and Ilham Bintang Mahendra[2]

1. Surfactant and Bioenergy Research Center
2. Dept of Agroindustrial Technology, IPB University

E-mail: dwisetya.sbrc@gmail.com

Abstract. Palm oil is Indonesia's main export commodity and has many contributions to the economy. Palm Oil Mill is usually built by private or state-owned company with a large capacity and far from smallholder plantations. Transportation costs and delays have caused the quality of fresh fruit bunch decrease and prices have dropped in farmer level. This study aims to design a palm oil mini plant by evaluating existing technology and innovations in process and equipment design including financial analysis. The methods used in this research are literature study, laboratory test, interview, and observation. The selected process technology was sterilization using the steam method (t = 90 minutes, T = 130oC, P = 300 kPa), threshing with rotating speed of 21 rpm, heating method on the digester (t = 14 minutes, T = 90oC, v = 23 rpm), extraction of oil palm fruit with a screw press machine (P = 4500 kPa, v= 11 rpm). The process of refining Crude Palm Oil (CPO) goes through 3 stages, namely degumming with the water degumming method, neutralization using the deacidification method, and fractionation using the dry method to produce Refined Palm Oil (RPO). Technological innovations are carried out in vertical sterilizers with the addition of water to the sterilizer, the use of augers and improvements to the sterilization system. The products produced in this mini plant are CPO, RPO which high antioxidants activity derived from α-carotene, β-carotene, tocopherols and carotenoids, and Palm Kernel (PK). The processing of oil palm produces waste, it is known that 1 ton of fresh fruit bunches of oil palm produces waste in the form of empty fruit bunch 23%, shells 6.5%, fibers 13%, and liquid waste as much as 50%. Liquid waste treatment is carried out using a pond (lagoon) system. The financial feasibility analysis of palm oil mini plant resulted in an NPV value of IDR 33,797,284,055, IRR of 17.72%, BCR of 2.3 and PBP of 1 year. This shows that the palm oil mill mini plant is financially feasible to build.

Keywords: mini plant, innovative, mill, Crude Palm Oil, Refined Palm Oil

[94] Cellular Automata Machine Modeling with Probabilistic Cellular Automata to Obtain Optimal Conditions and Productivity of Microalgae Biomass

Lukman Haris[1*], Irman Hermadi[1,2], Ganjar Saefurahman[2*], Dhani S. Wibawa[2] and Yandra Arkeman[2,3*]

1. Department of Computer Science, IPB University, Bogor, Indonesia
2. Surfactant and Bioenergy Research Center, IPB University, Indonesia
3. Departement of Agroindustrial Technology, IPB University, Dramaga Campus, Bogor, Indonesia

Email: lukman.haris@apps.ipb.ac.id, ganjarsadja@gmail.com, yandra@apps.ipb.ac.id

Abstract. The main factors that influence the growth process, carbon fixation and the production of microalgae biomass are type of species, CO2 supply, nutrients, light, temperature, pH and mixing. The precision farming system in microalgae biomass production uses advanced digital technology by developing Cellular Automata Machine modeling, namely Probabilistic Cellular Automata. The application of this technology on a large scale apart from the factors mentioned above, the characteristics of microalgae growth and harvesting need to be known in order to obtain optimal conditions and maximum yield. Cellular Automata is a decentralized computing model that provides a platform that is useful for implementing a more complex computing. By combining the Cellular Automata technique and the Markov chain, we can obtain a microalgae growth model for optimizing the biomass productivity.

Keywords: Cellular automata, Microalgae, Markov chain

[95] Synthesis of Bio Hydrocarbon from Palm Olein Through Pyrolysis at Various Temperature

Dwi Setyaningsih[1,2*], Crisman Arianto Siagian[2*], Neli Muna[1*] and Purwoko[2*]

1. Surfactant and Bioenergy Research Center (SBRC), IPB University
2. Dept of Agroindustrial Technology, IPB University

E-mail: dwisetya.sbrc@gmail.com; chrismansiagian25@gmail.com; muna_ipb@yahoo.co.id; purwoko@apps.ipb.ac.id

Abstract. The synthesis of biofuels through the pyrolysis of vegetable oil is studied as an alternative to the biodiesel process because it produces bio hydrocarbons that have similar properties to fossil fuels. This study uses palm olein as raw material reacted at gradually increasing temperatures ranging from 225, 250, 275, and 300°C, using zeolite as catalyst at normal pressure. The volatiles compounds are condensed and collected according to the fraction and analyzed for density, viscosity, calorific value, moisture content and composition of volatile compounds using GC-MS. Palm olein as raw material had the characteristics of moisture content of 0.095% (w/w), viscosity of 41.25 mm2/s, calorific value of 39.93 MJ/kg and pour point of 20oC. The hydrocarbon fractions of various temperatures had a red to bright yellow color, liquid phase and only the 300oC fraction which had a solid fraction. The density was in the range of 0.8452 - 0.8527 g/cm3(40°C), viscosity of 3.0726 - 3.8137 mm2/s, moisture content of 0.0801 - 0.1878% (w/w) and pour point of 4 - 22 ° C. Density, viscosity and pour point from a temperature fraction of 225 – 275oC met national biodiesel standards. The composition of volatile compounds mainly consisted of n-decanoic acid, undecanoic acid, dodecanoic acid, 8-heptadecene, heptadecane, tetradecanoic acid, 2-heptadecanone, and n-hexadecanoic acid. The main content of volatile compounds was still in the form of fatty acids where n-hexadecanoic acid was the dominant compound (42.8 - 71.6%). In general, the characteristics and profiles of the volatile compound's fractions 225, 250 and 275oC were similar and different from the 300oC fraction.

Keywords: bio hydrocarbon, pyrolysis, fatty acid, palm olein

[96] Utilization of Rice Husks as a Fuel for Gasification – A Review

Reza Fathurahman*, Adi Surjosatyo

Department of Energy System Engineering, Faculty of Engineering, University of Indonesia, Depok, Indonesia

E-mail: reza.fathurahman@ui.ac.id

Abstract. Rice husks are widely known as a fuel for electricity generation through gasification technology. Rice husks are abundant in agricultural countries, especially in South and Southeast Asia. Although it is useful, if it is not handled properly, rice husks can become dangerous waste. Abandoning them at large amounts of wastes in fields can damage soil and water contaminated, increase the emission of methane due to its natural decomposition, and produces rainwater leachates. Rice husks are produced from 20% of the weight of rice produced. The content of rice husk is cellulose (50%), lignin (25-30%), silica (15-20%), and moisture content (10-15%). Rice husks have low bulk density by the range of 90-150 kg/m_3. From studies obtained equivalent ratio (ER) is range 0.15-0.35, gasifier temperature was conducted at 600-900oC. This paper presents a review of studies conducted on rice husk gasification. Recent researches have been reviewed and key findings are highlighted based on each result of syngas produced. Syngas produced from gasification has a low heating value of 1373.18 kcal/Nm3 – 2603 kcal/Nm_3. Syngas compositions are CO, CO2, CH4, and H2. Rice husks syngas are used as a fuel to the internal combustion engine (ICE) as the prime mover to produces electricity.

Keywords: Rice Husks; Gasification; Syngas; Internal Combustion Engine

[97] The Effect of Drying Process of Cellulose Nanofiber from Oil Palm Empty Fruit Bunches on Morphology

Dian Burhani[1*], Athanasia Amanda Septevani[2], Ruby Setiawan[3], Luthfia Miftahul Djannah[4] and Muhammad Andrew Putra Pratama[4]

1. Research Center for Biomaterial, Indonesian Institute of Sciences, Cibinong Science Center, Cibinong, West Java, 16911
2. Research Center for Chemistry, Indonesian Institute of Sciences, Kawasan PUSPIPTEK, Serpong, South Tangerang, Banten, 13411
3. Research Center for Biology, Indonesian Institute of Sciences, Cibinong Science Center, Cibinong, West Java, 16911
4. Department of Bioprocess, Brawijaya University, Malang, East Java, 65145

E-mail: dian.burhani@lipi.go.id

Abstract. One major manufacturing challenge in nanocellulose production is getting the dry form of nanocellulose while maintaining its nano-size dimensions. Different drying techniques will produce nanocellulose with different sizes and morphologies. Each has its own specific application. In this study, three methods were performed to dry nanocellulose suspension, specifically cellulose nanofiber, including freeze-drying, spray-drying, and oven drying. The morphology and particle size of the dried CNF were analyzed using Field Emission Scanning Electron Microscope (FE SEM). Sponge-like material, also known as aerogel with low density (0.01 – 0.02 g/cm^3) and high porosity (98%), was obtained via freeze-drying. Meanwhile, finely grounded solid in a spherical and irregular form has resulted from the spray drying process of CNF, with an average diameter of less than 2 µm. Oven-dried CNF formed rigid thin film with a rough surface. FE SEM micrograph indicated that the nanoscale dimension of the oven-dried CNF has no longer existed.

Keywords: Drying, cellulose nanofiber, spray drying, freeze-drying, morphology

[98] Utilization of Palm Frond Waste to Control Corrosion in Industrial Piping Systems

Reno Susanto*, Ilman Azhari, Komalasari

Material and Corrosion Laboratory, Faculty of Engineering, Universitas Riau

E-mail: renosusanto12345@gmail.com

Abstract. Corrosion is the degradation or deterioration of metal due to the chemical reaction of a metal with its environment. The use of an inhibitor is the best way to prevent corrosion of the internal surface of the pipe. The extracted palm fronds act as natural inhibitors. This study aims to utilize palm fronds as a green corrosion inhibitor, determine the effect of immersion time and inhibitor concentration, determine the inhibition efficiency of oil palm frond extract, and determine the optimum variables and conditions for the concentration of corrosion media, soaking time and inhibitor concentration on corrosion rate. The palm frond extraction method used is the soda method with a solid to liquid ratio of 1: 8 (w / v) with a temperature of 1400C and a pressure of 7 bar. To determine the rate of corrosion, it was carried out using the weight loss method, as well as UV-Vis and FT-IR tests for the obtained lignin and SEM-EDX tests to determine the morphology and composition of ASTM A36 steel after immersion with inhibitors and without inhibitors. The lowest corrosion rate was obtained in a solution of 0.5 N HCl with the addition of a 1500 ppm inhibitor with a soaking time of 72 hours, which was 48.023 with an efficiency obtained of 84.631%. The variables that influence in this study are inhibitor concentration (L), immersion time (L) and immersion time (Q), respectively

Keywords: corrosion rate, inhibition efficiency, inhibitor, palm fronds

[99] An Investigation on Gasification Conversions of Municipal Solid Waste Using Fixed Bed Downdraft: Study Case of Final Processing Site TPA Putri Cempo Surakarta Indonesia

Abeth N. Sonjaya* and Adi Surjosatyo[1]

University Indonesia, Depok 16424 West Java, Indonesia

E-mail: Abethw21@gmail.com, adisur11@gmail.com

Abstract. Municipal solid waste (MSW) is still a problem in its management. In accordance with the government program contained in presidential regulation number 35 of 2018 that the acceleration of waste processing development into electric energy based on environmentally friendly technology needs to be developed. One of the technologies to convert waste into renewable energy is to use thermochemical processes or gasification. The aim of this paper is to investigate the conversion of municipal solid waste gasification (MSW) using a fixed bed downdraft gasifier by calculating the mass balance of municipal solid waste (MSW) to be converted into syngas with variation of air-fuel ratio (AFR) of 0.1 to 1.0 and gasifier temperature at 500-1000oC. The results showed that the fixed bed downdraft gasifier produced syngas with composition of CO (24.78%), CO2 (18.65%), H2 (15.6%), and CH4 (4.06%), with an AFR of 0.3 at a gasification temperature of 600 oC.

Keywords: municipal solid waste, fixed bed downdraft, gasification, syngas

The design of fresh fruit bunch palm oil purchase system from independent smallholders to support Indonesia's biodiesel development program

To cite this article: K Falgenti *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **749** 012007

The design of fresh fruit bunch palm oil purchase system from independent smallholders to support Indonesia's biodiesel development program

K Falgenti[1*], Y Arkeman[1,2], E Hambali[1,2], K Syamsu[1]

[1]Department of Agro-industrial Engineering, Faculty of Agricultural Engineering, IPB University (Bogor Agricultural University), Bogor, Indonesia
[2]Surfactant and Bioenergy Research Center, IPB University, Baranangsiang Campus, Bogor, Indonesia
*Email: gekfalgenti@apps.ipb.ac.id; yandra.arkeman@gmail.com

Abstract. Miniplants established by the independent smallholder's secondary cooperative is one of the efforts to get rid 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 in spite of in limited capacity. Each channel of FFB sales should be supported by the credible price information and the integrated purchase system. To fulfill the need of real-time & transparent price information and the integrated FFB purchase system can be realized by developing mobile application Software as a Service (SaaS) of FFB's purchase based on a cloud platform. The method used to develop the mobile application is a 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 designing 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 smallholders' FFB can be used for biodiesel development programs as expected by the government of Indonesia.

1. Introduction

The sale of Fresh Fruit Bunch (FFB) from the independent smallholders highly depends on the mills. Their dependency on mills forms monopsony market [1]. On the monopsony market, the sale channel only goes toward to one party. This condition causes the independent smallholders will not possess the sale bargaining. The independent smallholders are the significant element for palm oil industry, however their main role is only needed when the demand increased [2]. The mill only purchases FFB in particular months to optimize CPO (Crude Palm Oil) and PKO (Palm Kernel Oil) productions [3]. Otherwise, while the CPO demand decreased, the independent smallholders are difficult to sell FFB with the normal price.

To overcome that kind of condition stated above, the independent smallholder's secondary cooperative in certain provinces as Bangka Belitung and South Kalimantan try to get rid of the monopsony market constructing people's mills or miniplants. With the existence of the miniplant, the

mill will not be the only FFB purchaser and CPO producer. Miniplant also the hub for the CPO production, albeit in limited capacity.

Secondary cooperatives consist of several primary cooperatives, it receives FFB delivery orders directly from the mill. Meanwhile, the primary cooperative fosters independent smallholders and collects independent smallholder palm oil FFB, then the FFB is sent to secondary cooperative to fulfill mill orders. The innovation in establishing miniplant by the secondary cooperative is a process of transformation on CPO production. The transformation on CPO production is followed by the transformation on the system of the purchase in FFB the supply chain. One of the challenges in transforming the purchasing system in FFB supply chain of the independent smallholders is how to provide the update and transparent price information [2]. Price information is a key factor in the amount of supply and demand in trading a commodity [4]. The real time price information simplifies and fastens the purchase of FFB transaction. The Information Communication Technology (ICT) support enables the FFB purchase transaction more responsive.

The ICT functions to enhance the coordination among the various business entities in supply chain. The ICT is tool and technique which makes it possible to share information among the various business entities in supply chain by integrating both the internal business system and the external one [5]. With the ICT support, the price information system becomes so centralized that aids the independent smallholders obtain the real time and credible price information. The real time price information can be used for developing the FFB purchase application of the independent smallholders. The cloud platform can integrate the business process on FFB buyer and seller entities in a platform as a service. The buyers within FFB supply chain of the independent smallholders include middleman, cooperative and Peron. The FFB purchase application that is powered by cloud service can ensure the increase of transaction volume of various buyers and sellers within the centralized system. The effective FFB purchase can support the continuity of FFB delivery to the mill and miniplant with the accurate quantity, accurate time and good quality.

The price information system and the independent smallholders' FFB purchase system based on cloud is an essential part of digital transformation of FFB procurement. Nowadays FBB allocation is highly used to develop biodiesel. Indonesian could produce biodiesel production 4.7 Million KL, within two years, the production reached 9.6 Million KL in 2019. The statement released by the Indonesia Palm Oil Fund Management Agency (Badan Pengelola Dana Perkebunan Kelapa Sawit/BPDPKS) states that the land owned by the independent smallholders is relied to supply FFB to support the biodiesel development program [6] but the mechanism and the regulations do not exist. Without both, the independent smallholders will not benefit from the biodiesel development program. BPDPKS as a government institution funds biodiesel development programs concerns more on the distribution process of B20 and B30 upstream. The system of biodiesel distribution has been supported by the information system to supervise and control the subsidized biodiesel payment [6]. BPDPKS pays more attention to the biodiesel distribution system, while the FFB and CPO procurement are on the contrary. Meanwhile at the downstream, procurement of FFB and CPO to develop biodiesel are managed by the mill. Hence, the source of FFB and CPO cannot be traced. No mechanism can ensure FFB and CPO of the independent smallholders are part of biodiesel supply chain. The independent smallholders will not benefit from the biodiesel development program. We can learn from the biodiesel development program in Thailand. Biodiesel development program Increases farmers' income, but it doesn't imply much on palm oil price [7]. One of the ways how the independent smallholders to gain more benefit from biodiesel development is by making their FFB and CPO as a part of FFB procurement system for biodiesel.

E-Procurement Service can be applied in procurement system of FFB and CPO for biodiesel. E-procurement is one of the promising tools of operation to construct digital supply chain of the independent smallholders FFB. However, in order to establish the digital supply chain of FFB, then, all the challenges, business, technical and policy should be handled well. The development of the FFB purchase system based on cloud service solves one of the technical challenges faced, established E-procurement of FBB and CPO for the biodiesel development program.

Based on previous studies, there are not many research topics that discuss ICT support for independent smallholders. One of the studies discusses about single FFB price reference is the government of Malaysian through the Malaysian Palm Oil Board (MPOB) that has transformed the determination of the price of a single FFB reference [9]. The single reference price will make a transparent FFB trading and ensure that the relationship among smallholders, FFB traders and mills remains in harmony. In Indonesia, the topic of research on independent smallholders focuses on strengthening the institutions of independent smallholders [2], Prioritize the use of the fund to clarify smallholders land tenure rights, so that they could get access to sustainable certification and financial institutions. [10]. Develop a model to improve the performance of independent smallholders [11], application of Good Agricultural Practice [12]. The study of the contribution of independent smallholder oil palm plantations to poverty alleviation in rural areas, but also independent smallholders also contributed to increase forest fires [13].

This study aims at analysing and designing the FBB purchase system of independent smallholders based on Cloud service. To analyse and design the FFB purchase system uses system approach. The first phase of the study determines components to construct the FBB purchase system. The analysis and design system follow the System Development Life Cycle (SDLC), starting from the ideas, user requirement, system requirement, designing, deployment and maintenance [8]. The second phase, create users' requirement and system requirement model using UML. The model constructed is Use Case Diagrams, Conceptual Data Model and mock up interface FFB purchasing application. To capture the business process to fulfil the system requirement uses BPMN 2.0. The Next section provides research method. The third section presents result and discussion. The last section concludes by providing an answer of research objective.

2. Methodology

2.1. Requirement analysis and modelling system

The requirement analysis includes the first phase in designing using the system approach. In this stage, all components of independent smallholders' FFB purchase system are analysing, starting from the actors involved as well as their roles. The input and output data, regulation, resources needed (Fig. 1).

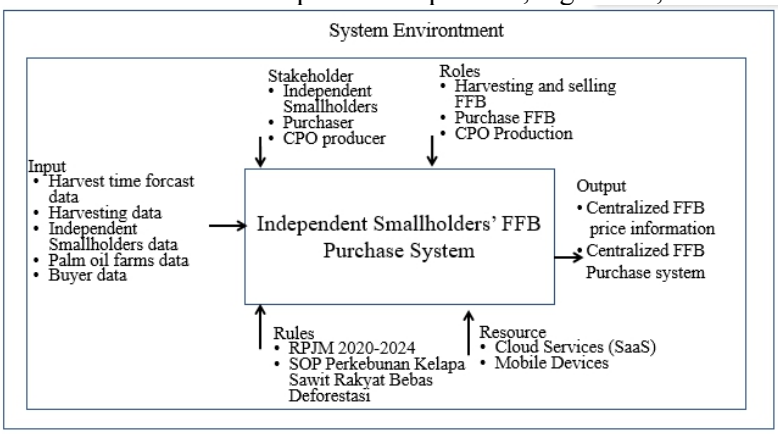


Figure 1. Components of Independent Smallholders' FFB Purchase system [8].

The analysis and design system follow the System Development Life Cycle (SDLC), starting from the ideas, user requirement, system requirement, designing, deployment and maintenance [8]. Based on research background there are two main ideas; 1) how to provide single price reference system and 2) how to provide FFB purchase system for two channels of FFB Sales. The Users' requirement analysis is process to gather all the information like what the customer wants to build. This research captures user requirement based on SOP for harvesting and FFB sales published by the Oil Palm

Farmers Union (Serikat petani Kelapa Sawit/SPKS) [14]. system requirement specification or software requirements specification is a document or set of documentation that describes the features and behaviour of a system or software application. The user requirement of FFB's purchase system modelled by Use case diagram and The system requirement of independent smallholders' FFB purchase system modelled by Business Process Model and Notation (BPMN) 2.0. There are two output of design stage, Conceptual Data Model and the interface design. SDLC is restricted until the stage of designing and generating Business Process Diagram, Use Case Diagram, Data Conceptual Model and the interface of mobile app. All of diagram and model are made using power design software from SAP.

2.2. Research object

Research object includes several cooperatives of the independent smallholders in Bangka Belitung. The system of FFB purchase is made to answer the cooperative needs of price information system and the integrated FFB purchase system in Bangka Belitung province. Prototype of the independent smallholders' FFB purchases application to be examined in several cooperatives in Bangka-Belitung province.

3. **Results and discussions**

3.1. User Requirement Analysis

The manual FFB purchase system of the independent smallholders will be transformed by constructing an application of FFB purchase based on Cloud service. In order to use the service, the actors involved should register and then after it is done, followed by the process of authentication. The actors involved: the independent smallholders whose harvest FFB and the buyers, categorized as middleman, cooperatives and Peron. CPO producers include: mill and miniplant. User_DB and SaaS are entities in FFB purchasing service. After register and successfully log in, the independent smallholders register their farms by inputting data the farm they manage. Then, the independent smallholders note the harvest time forecast based on the previous harvest time in the farm registered. Referring to the recapitulation of the harvest time forecast of the cooperative members, the cooperative can forecast the number of FFB to be allocated to fulfilling delivery order of FFB from the mill. For the mill itself, the harvest time forecast is required to determine the production planning of CPO. The purchase price of FFB in the mill fits the price set by the local government. The buyer based on their category determines the purchase price of FFB based on the price set by the mill. Each actor notes the transaction of the FFB purchase through mobile application. The transaction is then saved in a centralized system with a support from SaaS service. The relation among entities or actors in the system of FFB purchase of the independent smallholders captured in Use Case Diagram as shown in fig 2.

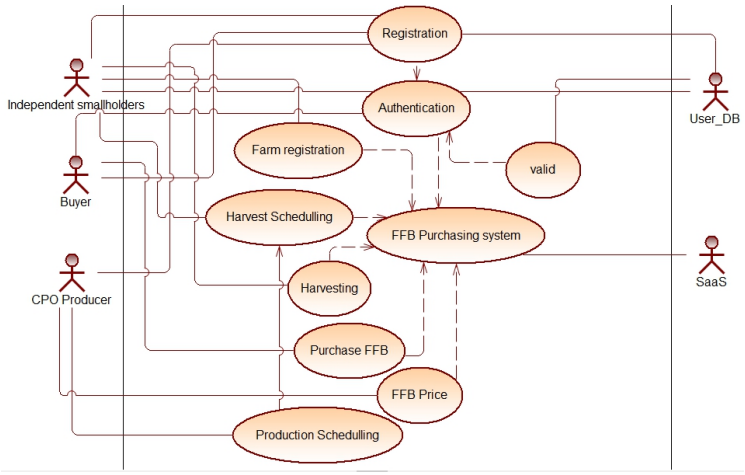


Figure 2. Use Case diagram FFB Purchase System.

3.2. System Requirement Analysis

The independent smallholder FFB purchase system consists of two main business processes, FFB Harvests and FFB purchases. System requirement analysis change the 'as-is' business process into a 'to-be' business process. To-be business process described in fig. 3 & 4. The independent smallholders require FFB price as set by the local government and stakeholders. At harvest they already get price information. Besides, the service required in harvesting process include: the farm registration service and the harvest time forecast. The farm registration service is used to get all data regarding the land such as the size, location and GPS coordinate point. After the farm registered, the independent smallholders note the harvest time forecasting the farm.

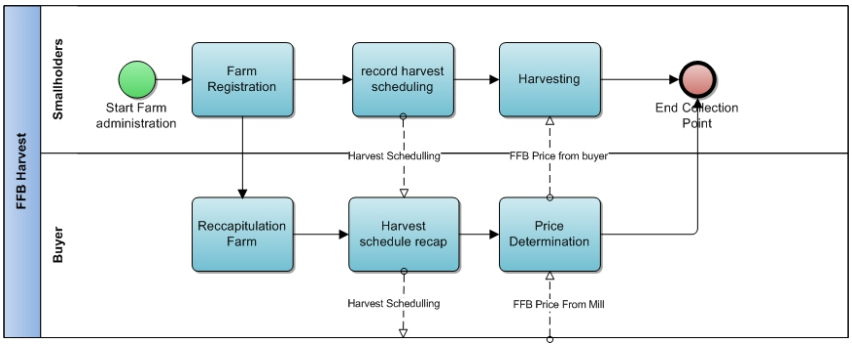


Figure 3. Business Process of FFB Harvest.

Buyers are also required to register by inputting the identity of the business owner including contact number, location, etc. The cooperative lists their membership including farmers who have registered their farm in the FFB purchase system. The cooperative can see the recapitulation of farm, the recap. Of harvest time forecast. There are two kinds of cooperatives: 1) Primary cooperative that is related directly with the farmers and actively buys FFB of the independent smallholders. 2) Secondary cooperative that is related directly with the mill and actively fulfils delivery order of FFB based on the contract signed. Several secondary cooperatives initiate to establish miniplant. Middleman can also list their membership, namely the non-cooperative member farmers. Middleman can also see the farm registration and the harvest time forecast. Peron's gather middleman to be their members.

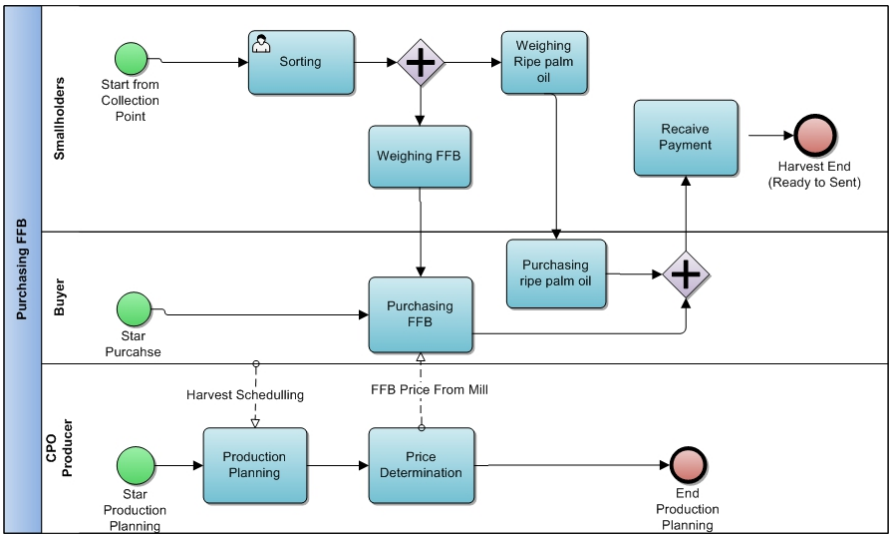


Figure 4. Business Process of Purchase of FFB and ripe palm oil.

In the process of FBB purchase, the independent smallholders require their FBB recapitulations including FBB quantity, FBB weigh and weigh of overripe FBB. After the harvest time, farmers sort their harvest, input data including their harvest time and the number of FBB. The sale of FBB is through two channels. The first channel ends at the mill, while the second channel ends at miniplant. For the first channel, the non-cooperative members are banned to sell to the mill directly. They must pass through middleman and Peron. The cooperative member farmers sell FBB to the cooperative. The process of FBB purchase by the cooperative and middleman is not similar. Middleman must pick up to grab the FBB in the farms and weigh at their places. Then, the farmers can have their cash directly. For the cooperative members, the farmers can weigh their FBB on location but the farmers must wait the payment from the mill before they can have their cash. The second channel, in certain location, farmers can sell FBB and overripe straight to the miniplant.

3.3. Conceptual Data Model

Data requirements for system development are obtained during the process of user requirements analysis and system requirements analysis. Data requirements are described in the conceptual data model (fig. 5.).

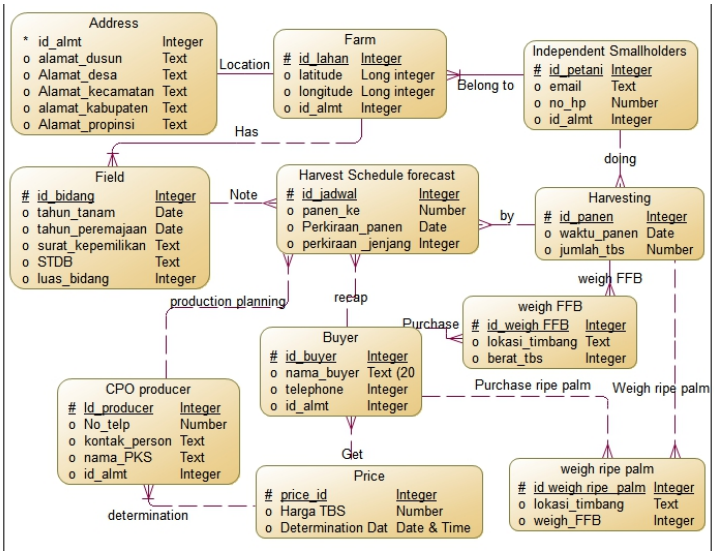


Figure 5. Conceptual Data Model of FFB Purchase System.

3.4. The Interface Design of Mobile Application for FBB Purchase

Homepage is an initial page that is firstly displayed while farmers open the application (see appendix). This page contains FFB reference prices in Bangka Belitung. This page also displays prices set by collectors, cooperatives and Peron. The other services are restricted because the users are only as guests. In order to have an access, a farmer must register themselves. Farmers must provide all data such as username, password, email. The farmers can access home user page with a menu. after they get their registration confirmation through email. User' menu consist of; profile, farm, harvest time forecast, buyer, harvesting and news. In the registration form, farmers fill in farm data. The system will display 11-digit farm id after the farmer inputs the farm status, STDB (Surat Tanda Daftar Budidaya), farm address and GPS coordinates. The 11 digits follow the regional format standard based on data from globalforestwatch.com. The first two digits are the province code, the next two digits district code and the next three digits the sub-district code and finally the land number**.**

The farm page contains data that has been filled by farmers. Previously the farmer entered the data by filling in the location of the GPS coordinates, farm address and farm administrative data. Each farm consists of one or more fields. Fields are added when farmers expand their oil palm farms. The time to plant oil palm is different in each field, therefore the harvest time forecast is also different. The harvest time forecast is filled by farmers based on previous harvest data. On the harvest time forecast page, farmers offer crops to buyers by pressing the inquiry button.

The buyer's recapitulation of harvest time forecast page (see appendix) contains information on the forecast of harvest time input by the farmer in his mobile application. Inquiry is accepted when the buyer presses the accept button. This means that the buyer agrees to buy FFB when it is harvested, the Tri Tunggal cooperative as a buyer receives inquiry from independent smallholder Suhardi and Herman. During the harvest, Suhardi recorded the weight, quantity and price of FFB. The Tri Tunggal cooperative received FFB and ripe palm oil purchases records on its mobile app purchase page in accordance with the FFB sales data inputted by Suhardi.

The design of mobile applications for purchasing FFB focuses on the seller's side. The mock up feature discusses the independent farmer cellular app because farmland and harvest data are needed for future development. Recording farmland and harvest data is the first step in digitizing the independent smallholder FFB supply chain. With the support of digital supply chains, the industry is able to identify and mitigate risks because the flow of information in money, and goods in more detail and real time [15]. The sustainability of biodiesel development will be ensured by the ability of digital supply chains to identify and reduce risks in the flow of money, goods and information.

4. **Conclusion**

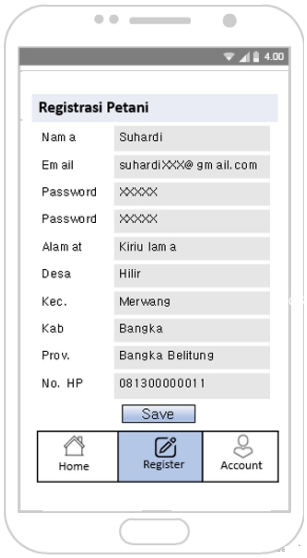
This FFB purchase application design to build a better FFB trading system. An integrated FFB's reference price in Bangka Belitung will make a transparent FFB trading and ensure that the relationship among smallholders, FFB traders and millers remains in harmony. The FFB purchase system using a mobile application is the initial stage of the digital transformation in independent smallholder FFB supply chains. 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 for biodiesel development program. GPS coordinate point of smallholders' farm, mills and miniplants data can be used to build FFB delivery order systems with location-based service technology. Data on the age and size of independent smallholder oil palm plantations can be used to support the rejuvenation of smallholders oil palm program (Peremajaan Sawit Rakyat/PSR). Data of cooperative and middleman as collectors can be used as a database to build FFB and CPO Supplier Management System.

References

[1] Syahza A 2011 Percepatan ekonomi pedesaan melalui pembangunan perkebunan kelapa sawit. *Jurnal Ekonomi Pembangunan Kajian Masalah Ekonomi dan Pembangunan* **12**(2):297
[2] Sapta R, Marimin, Machfud, Papilo P, Safriyana M Y, Massijaya M, Asrol and M A Darmawan 2020 Institutional strengthening model of oil palm independent smallholder in Riau and Jambi Provinces, Indonesia. *Heliyon* Volume **6**, Issue 5, E03875, May 01, 2020
[3] Renta R 2015 Analisis optimalisasi pengadaan Tandan Buah Segar (TBS) sebagai bahan baku produksi Crude Palm Oil (CPO) dan Palm Kernel (PK) di PMKS Sei Kandang PT. Asiatic Persada-Ams Group. *Jurnal Mix* Volume V, No. **3** 347 – 67
[4] Puspitasari D I, Syukur A dan Supriyanto C 2015 Prediksi rentet waktu jangka pendek harga TBS berbasis algoritma backpropagation neural network *Jurnal Sistem Informasi dan Teknologi Informasi*. Vol. **4**, No. 1, April 2015, 64 –75
[5] Marinagi C, Trivellas P and Sakas D P 2014 The impact of information technology on the development of supply chain competitive advantage. Procedia - *Social and Behavioral Sciences*, **147**, 586–91. (387)
[6] BPDP, 2020 Press release BPDP Press release BPDPKS siap melaksanakan program green fuel sesuai RPJMN 2020-2024 https://www.bpdp.or.id/press-release-bpdpks-siap-melaksanakan-program-green-fuel-sesuai-rpjmn-2020-2024 Access : 20/07/2020
[7] Chongprode K, Shabbir H. Gheewala, and Soydoa V 2013 Does biodiesel demand affect palm oil prices in Thailand? *Energy for Sustainable Development* Vol **17**, Issue 6, Pages 658-70,
[8] Charles W 2016 *System Engineering Analysis, Design, and Development: Concept, Principles, and Practices*, John Willey & Son, 2016 New Jersey (US)
[9] Jamil N, Chandramohan D, Yusof B and Venugopal R 2001 MPOB Daily FFB Reference Price: towards a more transparent market *Planter* Vol.77 No.902 pp.265-73
[10] Nurfatriani F, Ramawati Sari GK, and Komarudin H 2019 Optimization of crude palm oil Fund to support smallholder oil palm replanting in Reducing Deforestation in Indonesia. *Sustainability* **11**, 4914.
[11] Marimin, Tuafik D, Machfud, M Asrol, P Papilo, Taufik B and Darmawan M A (2020) Supply chain performance measurement and improvement of palm oil agroindustry: A case study at Riau and Jambi Province *International Conference on Food and Bio-Industry. IOP Conf. Series: Earth and Environmental Science* **443** (2020) 012056
[12] Idsert J, Lotte S W, Jean O, and Arya H 2019 D Do wealthy farmers implement better agricultural practices? An assessment of implementation of Good Agricultural Practices among different types of independent oil palm smallholders in Riau, Indonesia, *Agricultural Systems*, Volume **170**, Pages 63-76
[13] Naylor, R L, Higgins M M, Edwards R B et al. 2019 Decentralization and the environment: Assessing smallholder oil palm development in Indonesia. *Ambio* **48**, 1195–1208
[14] SPKS 2017 *SOP Perkebunan Kelapa Sawit Rakyat Bebas Deforestasi* SPKS (Jakarta (ID))
[15] Zsidisin, G. A., & Henke, M. (Eds.). (2019). *Revisiting Supply Chain Risk*. Springer Series in Supply Chain Management. Springer

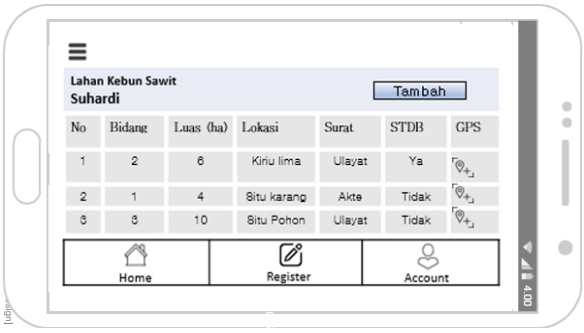
Appendix

'Farmer' Homepage

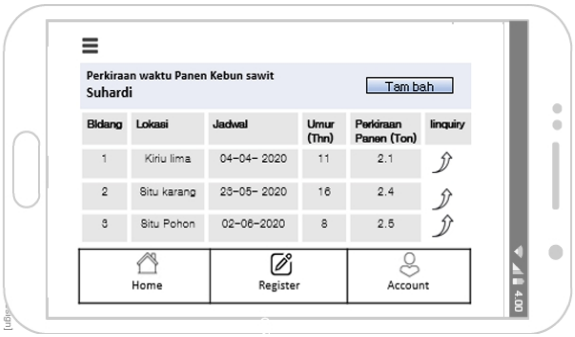


Farmer' Registration form

Farmer' menu list

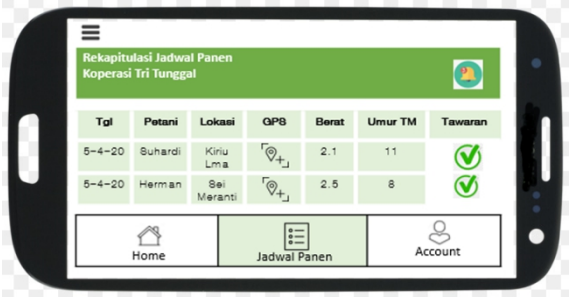


Independent smallholders' farms page

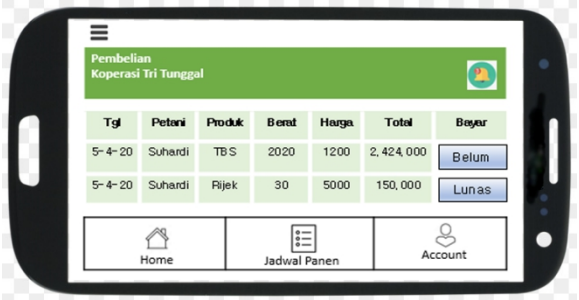


Harvest time forecast page

Farm registration



The buyer's recapitulation of harvest time forecast page



Buyer purchase page

INTERNATIONAL CONFERENCE ON BIOMASS AND BIOENERGY 2021

"Challenges in Biomass, Bioenergy and Biomaterials
Research and Development in a Rapidly Changing World"

Certificate

This is to certify that

Kursehi Falgenti

Has participated as a

Oral Presenter

Bogor, 9-10 August 2021

Director of SBRC IPB University

Dr. Ir. Meika Syahbana Rusli, M.Sc, Agr

SURAT TUGAS

214/D.01/LPPM-UNM/VIII/2021

Tentang

Web Seminar (Webinar) Internasional
9 - 10 Agustus 2021
IPB University
TEMA
Challenges in Biomass, Bioenergy, and Biomaterials Research and Development in a Rapidly Changing World

Menimbang :
1. Bahwa perlu di adakan pelaksanaan Seminar dalam rangka Seminar.
2. Untuk keperluan tersebut, pada butir 1 (satu) di atas, maka perlu dibentuk Pemakalah Seminar.

MEMUTUSKAN

Pertama : Menugaskan kepada saudara yang tercantum sebagai Pemakalah

Kursehi Falgenti M. Kom

Kedua : Mempunyai tugas sbb:
Melaksanakan Tugas yang diberikan dengan penuh rasa tanggung jawab.

Ketiga : Keputusan ini berlaku sejak tanggal ditetapkan, dengan ketentuan apabila dikemudian hari terdapata kekeliruan akan diubah dan diperbaiki sebagaimana mestinya.

Jakarta,2 Agustus 2021
Ketua LPPM
Universitas Nusa Mandiri

Norma Yunita, M.Kom

Tembusan
- Rektor Universitas Nusa Mandiri
- Arsip
- Ybs