CERTIFICATE

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is presented to:

Syamsidar HS, S.T.,M.Si

as Presenter on

The International Conference 2022

The 2nd International Conference of Lignocellulose 2022 (ICONLIG 2022)

with theme: "Fostering Innovation and Increasing the Economic Value of Biomass and Bioproducts through Scientific Discovery, Technological Progress, and Industrial Partnership"

virtually through Zoom meetings on November 24 - 25, 2022

Dr. Yeyen Nurhamiyah S.Si
Conference Chair

Dr. Edi Kurniawan S.T, M.Eng
General Chair

BRIN
BADAN RISET
DAN INOVASI NASIONAL

ICONLIG
2022

Research Organization for Life Science and Environment

Research Center for Biomass and Bioproducts

INTERNATIONAL CONFERENCE OF LIGNOCELLULOSE (ICONLIG)

PROGRAM BOOK

NOVEMBER 24-25, 2022

Photo by Dr. Imran Arra'd Sofianto

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Welcome Message

Dr. Yeyen Nurhamiyah
Chairman of ICONLIG 2022

Bismillahirrohamaanirrohiim,
Assalamualaikum wr. wb. Greetings to all of us.

On behalf of the organizing committee, I would like to express my sincere gratitude and officially welcome you to the 2nd International Conference of Lignocellulose. Moreover, I would like to thank distinguished speakers for being part of this prestigious event. On this year, we have been preparing the event while thoughtfully observing the recent COVID-19 condition as well as the travel situation around the world.

We always followed the recent situation regarding the travel condition locally and globally, before deciding the virtual event as the best choice to assure your safety during this uncertain situation.

Even though the conference is held virtually, we are fully devoted to give a special venue for you by inviting experts in various area. The conference will address cutting-edge research and development andidentify futuristic trends and needs in the fields ofbiomass processing, plant based chemical compound, biocomposite,wood industry and forests, biomass processing, and biopolymer.

We also encourage you to actively participate and interact with the invited speakers, other presenters, and participants, during or after the event as we plan to strengthen the networking and international collaborationvia this event. We arrange it not only to update you with the latest scientific advancement in lignocellulose field but also to serve as a platform to build a new partnership for collaboration in research.

With the spirit of collaboration, weare convinced that this conference also can be an exceptional platform tocommunicate and network globally. Through a collaborative partnership, we believe you will achieve major improvement and give a powerful impact on your research field and community also seek answers to the fundamental questions that keep changing throughout your professional career. I hope you will be able to get an enjoyable and interactive event and once again, welcome to the 2nd ICONLIG.

Welcome Message

Dr. Akbar Hanif Dawam A.

Head of Research Center for Biomass and Bioproducts

Dear Invited Speaker, Authors, Presenters
and Participants,

The venues are organized together by JSPS Alumni Association of Indonesia in collaboration with Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN) as the stage for all researchers, scientist, academia, and practitioners to promote their most recent findings in their respective fields as their valuable contributions towards the sustainable development and climate change mitigation.

We thank our distinguished speakers and authors for their active contribution and communication throughout the preparation of the event.

We understand the complexity of how to tackle issues around the seventeen sustainable development goals and global warming. However, as a scientific community, we own a solid background in our research areas that we have been working on throughout our career based on a sound understanding of the global issues.

Therefore, together with JSPS Alumni Association, the Research Center for Biomass and Bioproducts provide you with an interactive platform to share your goals and recommendations to the participants, so they will identify the key findings and understand the major contribution of your works towards the sustainable development and climate change mitigation.

I thank JSPS Alumni Association of Indonesia for their valuable assistance and suggestion to the organizing committee. I also thank our organizing committee form JSPS Bangkok Office, Thailand. I hope that we may continue to strengthen our partnership not only in organizing an international event but also in any activities focusing on how to make a better built environment in the future.

Lastly, to our participants, I hope you may take advantages of this free opportunity to interact with the speakers, to learn new solutions, and to share your ideas for more interactive and memorable events. Thank you.

Welcome Message

Prof. Yoshio Otani, Ph.D.

Director of JSPS Bangkok Office

On behalf of JSPS, Japan Society for the Promotion of Science, I would like to express my sincere gratitude to all the members of JSPS Alumni Association of Indonesia, JAAI, especially Chairman of JAAI, Prof. Dr. Wahyu Dwianto, for organizing the 2nd International Conference of Lignocellulose (ICONLIG).

JSPS is Japanese core funding agency and we place high value on both researcher autonomy and research diversity. JSPS supports from basic to applied research across all academic fields including humanities, social sciences, and natural sciences.

JSPS Bangkok office was established in 1989 to develop academic networks between ASEAN region and Japan. Our Main roles are to support the research exchange between ASEAN countries and Japan and to collect the relevant information. Our main activities are:

- Disseminate information on JSPS fellowship and research support programs
- Support JSPS alumni association activities
- Collect information on sciences in ASEAN
- Support young researchers to join JSPS programs
- Support research exchange of Japanese universities and institutes
- Collaborate various organizations to promote research exchange with Japan

I believe that the usage of biomass besides burning, which is the topic of this conference, is a key technology for sustainable development, through the utilization of various derivatives and intermediates during the physical and chemical treatments of biomass. As a part of our supporting activities of JSPS Bangkok Office, we are happy to support the JAAI members for the publication fee of proceedings of this conference. I hope many attendants of this conference will apply to our JSPS international programs to promote further research collaboration with Japan.

Welcome Message

Iman Hidayat, Ph.D.

Chairman of Research Organization for Life Science and Environment

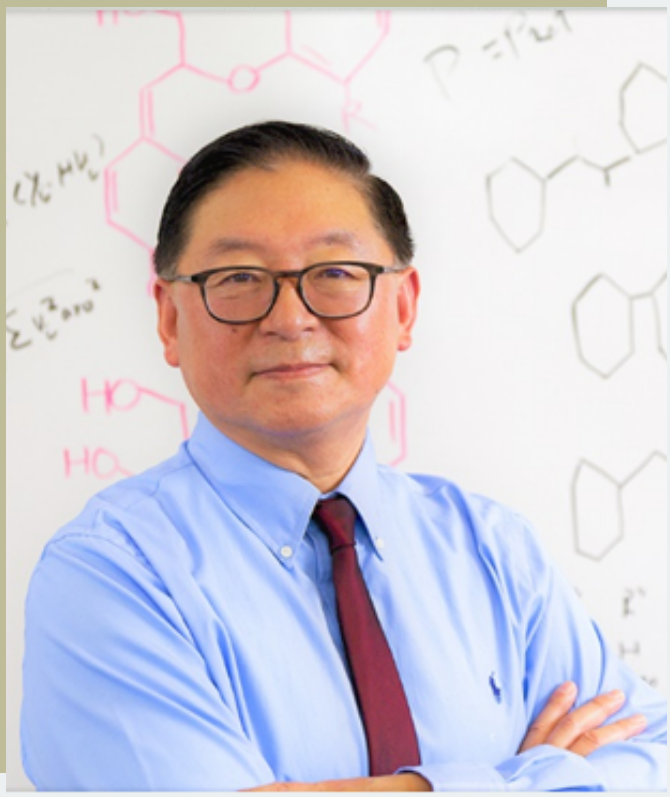
On behalf of the Organizing Committee, we warmly welcome you to virtual conference of the 2nd International Conference of Lignocellulose (ICONLIG) 2022. We are happy and honored to welcome all distinguished participants and delegates to the conference.

We have invited distinguished speakers and have deployed hundreds of participants from different backgrounds and affiliations; thanks to our partners' contributions and active involvement in organizing this event.

We believe that this conference will provides opportunities for all participants to meet people, exchange ideas and new inventions, develop ideas, establish collaborations, obtaining inputs from colleagues, and get inspired. Organizing international conference is not an easy task.

To that end, we want to thank Prof. Yoshio Otani, the Director of JSPS Bangkok Office, for the collaborative work with Research Center for Biomass and Bioproducts - BRIN in planning and organizing the current conference. It is a pleasure to work with you and your team to make this event a success. I deeply appreciate our partners; JSPS Bangkok Office, Thailand. Lastly, we would like to thank all the conference participants for their contributions which are the foundation of this conference We are looking forward to warmly welcoming you to the 2nd ICONLIG 2022 conferences!

Our Keynote Speaker



Prof. Dr. Bin Yang

Washington State University, USA

Dr. Bin Yang is a Professor in the Department of Biological Systems Engineering and the Bioproduct, Sciences & Engineering Laboratory at Washington State University. He held the Fulbright Distinguished Chair in Energy and Sustainable Use of Natural Resources (2019-2020). He is a recipient of the DARPA Young Faculty Award of 2011.

His major research interests include understanding fundamental mechanism of bioprocessing technologies for the advanced biofuels, advancing cutting-edge technologies, and facilitating the commercialization process as well as improving our knowledge of emerging technologies to meet near and long-term needs worldwide.

His current research focus on pretreatment, enzymatic hydrolysis, and conversion technologies that accelerate commercial application of biomass processing to cellulosic and lignin fuels and biobased products. He has authored more than 130 peer-reviewed papers and book chapters and has six issued patents. He also serves as an advisory editor board member for leading biorefinery journals. Dr. Yang recently has pioneered new biomass pretreatment technology and manufacturing technologies to process biomass into jet fuel, bioplastics, carbon fiber, supercapacitor, and other bioproducts.

Our Keynote Speaker

Prof. Dr.-Ing. habil. Aldo R. Boccaccini

University of Erlangen, Germany

Aldo R. Boccaccini is Professor of Materials Science (Biomaterials) and Head of the Institute of Biomaterials at University of Erlangen-Nuremberg, Germany. He is a visiting professor at Imperial College London, UK. Boccaccini has a Nuclear Engineering degree from Instituto Balseiro, Argentina (1987) and a Doctorate in Engineering Sciences (Dr.-Ing.) from RWTH Aachen University, Germany (1994). He had post-doctoral appointments at the School of Metallurgy and Materials, University of Birmingham, UK (1994-1996) and at the Institute for Mechanics and Materials, University of California, San Diego, USA (1996-1997).

He completed the Habilitation in Materials Technology at Ilmenau University of Technology, Germany in 2001. The research activities of Prof. Boccaccini are in the field of ceramics, glasses, biopolymers and composites for biomedical, functional and/or structural applications with focus on biodegradable materials for tissue engineering. He has been a visiting professor at different universities around the world and has given more than 150 presentations at international conferences (contributed, keynote, invited, plenary).

He has published more than 1000 scientific papers and 25 book chapters. He has co-edited 8 books. His work has been cited more than 55,900 times (h-index = 103, Scopus®, h-index = 121, Google Scholar®) and he was included in the “Highly Cited Researchers” lists in 2014 and 2018 (Clarivate Analytics). He is a Fellow of four major materials science/technology learning societies, namely: American Ceramic Society, Institute of Materials, Minerals and Mining (UK), European Ceramic Society, and Society of Glass Technology (UK). Prof. Boccaccini has received multiple awards and honors, including the Materials Prize of the German Materials Society (2015), the Turner Award of International Commission on Glass (2016) and Friedberg Lecture Award (2016) of American Ceramic Society. Boccaccini is also an elected member of the World Academy of Ceramics and of the National Academy of Engineering and Applied Sciences of Germany (acatech). In May 2022 he was conferred the degree of Honorary Doctor of Philosophy at Åbo Akademi University (ÅAU), Turku, Finland. He is the scientific coordinator of the Network of Argentinean Scientists in Germany and member of RAICES/MinCyT. He was recently (August 2022) named “Outstanding Personality” of his native city (San Rafael, Argentina).

Our Keynote Speaker

Prof. Biqiong Chen is the Chair of Polymer Engineering at Queen's University Belfast (QUB). She is a Fellow of the Institute of Materials, Minerals and Mining (FIMMM) and the Royal Society of Chemistry (FRSC). Prof Chen's current research interests are mainly focussed on smart sustainable polymers and multifunctional polymer nanocomposites for various engineering, healthcare and energy applications.

Prof. Biqiong Chen

Queen's University Belfast, UK

Prof. Myrtha Karina was born in April 1, 1958. She obtained her Doctorate Program from Kyoto University in 1993 in the field of Wood Science and Technology under supervision of late Prof. Takayoshi Higuchi. Her specialization is in the field of natural polymer-based composites. Bacterial cellulose is her topic of research interest in the past few years. Prof. Karina has published more than 100 original research articles, 2 books, and 11 patents with her research team. She was awarded with multiple national and international research grants. Since March 2022, she is affiliated with Research Center for Biomass and Bioproduct, National Research and Innovation Agency (BRIN).

Prof. Dr. Myrtha Karina Sancoyorini

National Research and Innovation Agency (BRIN), Indonesia

Our Keynote Speaker

David Christian

PT. Evogaia Karya Indonesia (Evoware), Indonesia

David Christian is the Founder & CEO (2016 – Now) of PT. Evogaia Karya Indonesia (Evoware). Evo & Co. is a group of brands that focuses on providing solutions to end plastic pollution by creating campaigns and offering a range of sustainable alternatives to single-use plastic items. Evo & Co. began with groundbreaking innovation from seaweed called Ello Jello edible cup, produced by our first brand, Evoware. After winning numerous awards and gaining demands, Evo & Co. determined to expand the business by offering a wider range of solutions, which marketed under our second brand Evoworld.

To give wholesome impacts, we also actively promote sustainable lifestyle through our collaborative movement: Rethink Campaign. His degree was achieved at International Trade, Canadian College, Canada (2011 - 2014).

His career experiences are including as account manager at PT Technet Vision Indonesia, Indonesia (2015 - 2016), Founder & CEO of PT. Evogaia Karya Indonesia (2016 – Now), Co- founder & Chairman of PT Terra Bina Lingkungan (Terra Bepro) (2020 – Now), Chairman & Advisor of PT Catat Buku Indonesia (Catat Buku) (2020 – Now), and Co-founder & CMO of PT Luwih Lestari Indonesia (Seagle Farm) (2021 – Now). His organization experiences are including Head of Natural Resource, Energy, Mineral & Environment of Indonesian Young Entrepreneur Association chapter West Jakarta (HIPMI JAKBAR) (2017 - 2021), Head of maritime, agriculture, forestry & environment of Jakarta Raya (HIPMI JAYA) (2021 -2024), and Vice President of Junior Chamber International (JCI) chapter Jakarta (2022 -2023).

He is also collecting some achievements including Finalist Sankalp South East Asia Award, Indonesia (2017), Top 10 Food Startup Indonesia, Indonesia (2017), Winner DBS-NUS Social Ventures Challenge, Singapore (2017), Winner Circular Design Challenge, United Kingdom (2017), Speaker at Nexus Global Summit, United Nation HQ, USA (2017), Award at Our Ocean Conference, Malta (2017), Winner DBS foundation award, Singapore (2018), Finalist L'oreal innovation Challenge, Singapore (2018), Speaker at Global People Summit, United Nation HQ, USA (2018), Speaker at World Ocean Forum, Korea (2018), Speaker at Our Ocean Conference, Indonesia (2018), Inspiring Youth 2018 from PDIP, Indonesia (2018), Leader of Tomorrow from St Gallen Symposium, Switzerland (2019), Winner King Sejong and Jang Yeong-sil Award, Korea (2019), Forbes 30 under 30 Indonesia & Asia (2020), Winner Wirausaha Muda Mandiri 2021 (2020), and Gen. T Leader of Tomorrow Honouree (2021).

Our Invited Speaker

Dr. Sanjay Mavinkere Rangappa

King Mongkut's University of Technology North Bangkok (KMUTNB), Thailand

Dr. Sanjay Mavinkere Rangappa, is currently working as a Senior Research Scientist/Associate Professor and also "Advisor within the office of the President for University Promotion and Development towards International goals" at King Mongkut's University of Technology North Bangkok, Bangkok, Thailand. He received the B. Engg (Mechanical Engineering) in the year 2010, M. Tech (Computational Analysis in Mechanical Sciences) in the year 2013, Ph.D (Faculty of Mechanical Engineering Science) from Visvesvaraya Technological University, Belagavi, India in the year 2018 and Post Doctorate from King Mongkut's University of Technology North Bangkok, Thailand, in the year 2019.

He is a Life Member of Indian Society for Technical Education (ISTE) and an Associate Member of Institute of Engineers (India). Also acting as a Board Member of various international journals in the fields of materials science and composites.

He is a reviewer for more than 100 international Journals (Nature, Elsevier, Springer, Sage, Taylor & Francis, Wiley, American Society for Testing and Materials, American Society of Agricultural and Biological Engineers, IOP, Hindawi, NC State University USA, ASM International, Emerald Group, Bentham Science Publishers, Universiti Putra, Malaysia), also a reviewer for book proposals, and international conferences. In addition, he has published more than 180 articles in high-quality international peer-reviewed journals indexed by SCI/Scopus, 9 editorial corners, 60 book chapters, one book, 29 books as an Editor (Published by lead publishers such as Elsevier, Springer, Taylor & Francis, Wiley), and also presented research papers at national/international conferences.

In 2021, his 17 articles have got top-cited article status in various top journals (Journal of Cleaner Production, Carbohydrate Polymers, International Journal of Biological Macromolecules, Journal of Natural Fibers, Journal of Industrial Textiles). He is a lead editor of Several special issues. Based on google scholar, the number of citations amounts to 9800+ and his present H-index is 51 with i10-Index of 149. In addition, 1 Thailand Patent and 2 Indian patents are granted. He has delivered keynote and invited talks at various international conferences and workshops. His current research areas include Natural fiber composites, Polymer Composites, and Advanced Material Technology. He has received a 'Top Peer Reviewer 2019' award, Global Peer Review Awards, Powered by Publons, Web of Science Group. The KMUTNB selected him for the 'Outstanding Young Researcher' Award 2020 and Outstanding Researcher' Award 2021. He is recognized by Stanford University's list of the world's Top 2% of the Most-Cited Scientists in Single Year Citation Impact 2019 and also for the year 2020.

Our Invited Speaker

Assoc. Prof. Dr. Mounir EL ACHABY

Mohammed VI Polytechnic University (UM6P), Moroco

Assoc. Prof. Dr. Mounir EL ACHABY was born in Morocco. He is know an Associate Professor at Materials Science, Energy and Nanoengineering (MSN), Mohammed VI Polytechnic University (UM6P). He had Bachelor's Degree in Physical Science at Faculty of Sciences Aïn Chock, UH2C, Casablanca, Morocco (2003 - 2006). Then he had Master's degree in Materials Physics at Faculty of Sciences Aïn Chock, UH2C, Casablanca, Morocco. After that, he had Ph.D. in Polymer Science and Engineering at MASCiR Foundation & Faculty of Sciences, Mohammed V-Agdal University, Rabat, Morocco with Dissertation Title: Nanocomposites based on Graphene/ thermoplastic polymer: Preparation and study of their structural, thermal, rheological and mechanical properties. He had academic appointment as Research fellow at MASCiR Foundation, Rabat, Morocco (2012 - 2014).

Then he became an Assistant Professor at Department of Materials Science, Energy and Nanoengineering (MSN), Mohammed VI Polytechnic University (UM6P), Ben Guerir, Morocco (2015 - 2018). Since 2019 he is an Associate Professor at Department of Materials Science, Energy and Nanoengineering (MSN), Mohammed VI Polytechnic University (UM6P), Ben Guerir, Morocco.

His research interest are including Conversion of lignocellulosic biomass into high-added value materials and nanomaterials: Cellulose derivatives & lignin based-biopolymer; Exploring the applications of cellulose derivatives (cellulose fibers, cellulose nanocrystals, cellulose nanofibrils) and biopolymers in novel advanced (bio)-polymeric systems and products through interdisciplinary research; Designing and characterizing innovative bio-based polymers and nanocomposites and bio-inspired materials; Sustainable (bio)-(nano)-composite materials for multifunctional applications (packaging, coatings, materials engineering, energy, waste water treatments, construction, ... etc.); Advanced polymer-based nanocomposite materials based on carbon nanomaterials (Graphene derivatives and carbon nanotubes); and Development of advanced light-weight thermoplastic composite materials for plastic industry (automotive, aeronautic ...etc.).

His research background and technical skills are in the field of materials and nanomaterials, biopolymer and polymer engineering, materials characterization techniques, and laboratory equipment operation and use. His publications record are including 3 patents, 75 publications, 9 book chapters, H-index : 25, citation >3000, and RG Score 33.07.

Our Invited Speaker

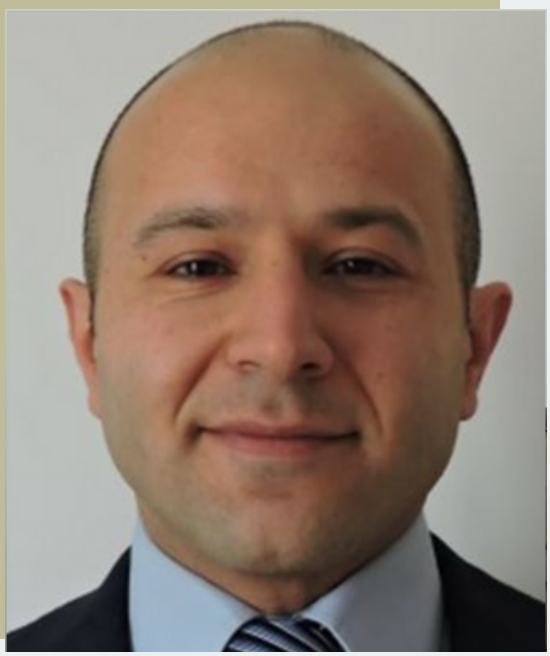
Prof. Dr. C. Hanny Wijaya

Institut Pertanian Bogor, Indonesia

Prof. Dr. Christofora Hanny Wijaya was born in Semarang, Indonesia. She is know a Professor at Fakultas Teknologi Pertanian, Institut Pertanian Bogor, Indonesia. She pursue her Bachelor Degeree at Agricultural Processing Technology, Bogor Agricultural University, Indonesia (1983), then she continue her Master Degree at Agricultural Chemistry, Hokkaido University, Japan (1987). After that she continue her Doctoral Degree at Agricultural Chemistry, Hokkaido University, Japan (1990). Her main research interest are including Food Science and Technology, and Food Chemistry.

Her area of expertise are Flavor chemistry and technology. She have research interest in the field of food chemistry including Isolation and identification of flavor component and bioactive compound from local resources, study on volatiles quality of tropical fruits produced by breeding, tropical peatland management- Asian ethnic diets and traditional herbal medicines in the perspective of functional foods and health promotion.

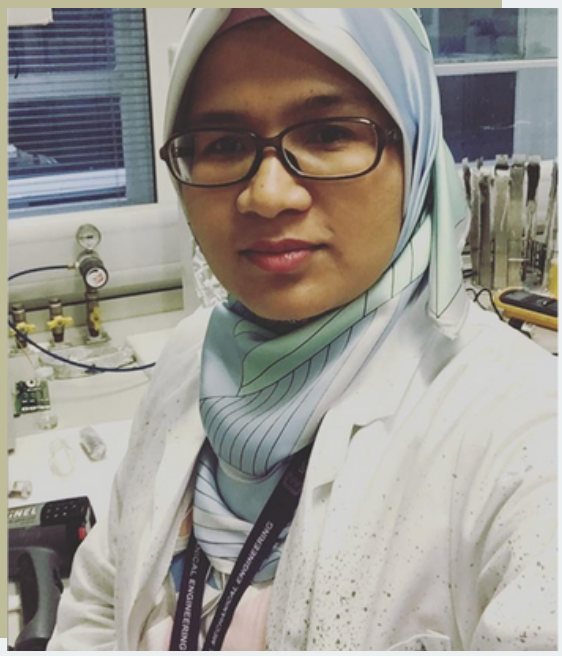
Henri Vahabi received his Ph.D in Materials Science from University of Montpellier, France, in 2011. Since then, he jointed to University of Lorraine, France as associate professor. His main research interests include flame retardancy of polymeric materials and nanocomposites. He has authored over 130 peer-reviewed scientific articles, book and book chapters. He is a committee member of the “Fire group” of the Chemical Society of France.



Henri Vahabi, Ph.D.

University of Lorraine, France

Our Invited Speaker



Dr. Amalina Amir

Universiti Teknologi MARA (UiTM), Malaysia

Born and raised in Malaysia, **Dr. Amalina Amir** is now Head of Innovative Electromobility Research at Universiti Teknologi MARA (UiTM). She was graduated in New Materials and Mechanical Engineering from University College London. Then she continued her postdoctoral research at UCL and came back to Malaysia when the pandemic hit the world in 2020. She's now focusing her research in biomaterials and nanocomposites. She also venture into drug delivery systems that she learnt from UCL. After came back from London, she wrote articles to Malaysia's mainstream newspaper and now being columnist to The New Straits Times to enlighten Malaysian about new technology happening in the world. She's won several prestigious international award in British Invention Show and Seoul International Invention Fair. She's working closely with several industries in Malaysia to develop new products and involve in their R&D and also collaborate with local and international universities and agency in the related field.

Dr. Mohamad Zaki Hassan

Universiti Teknologi Malaysia (UTM), Malaysia

Dr. Mohamad Zaki Hassan is an Associate Professor at the Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia, Kuala Lumpur. Currently, he is the head of the Vehicle Engineering & Safety research group and coordinates a team of researchers working on diverse projects concerning advanced materials, composite structures, manufacturing technology, and polymer science. Dr. Zaki gained a Doctor of Philosophy (PhD) from the University of Liverpool in 2012. Since 2009, he has been a member of the Board of Engineers, Graduate Member Institution of Engineers, The Plastic and Rubber Institute, IEEE, and the Ocean Thermal Energy Association. His main research interests are in polymer and natural fiber composites, with a current focus on additive manufacturing and biomedical applications. At now, he has published 200 peer-reviewed journals, three original books, nine book chapters, and nine expert reports.

Our Invited Speaker

Ariadne L. Juwono, Ph.D.

Universitas Indonesia, Indonesia

Ariadne L. Juwono, M. Eng., Ph. D. received her Ph.D. in Materials Engineering from Monash University, Australia. The title of her dissertation is Fatigue and Fracture of Clay / Epoxy Nanocomposites, with Prof. G. Edward as the promotor. For her achievement and contribution in physics Dr. Juwono has been awarded with several prizes including the Best Researcher in Sciences from Universitas Indonesia in 1997. In 1989, she joined the Department of Physics at Universitas Indonesia as a lecturer while conducted the research on the development of nanocomposites, composites and materials science for several application applications.

Her current research interest focuses on Nano Composites, Composites, and Green Composites for Structural Application, Modification, and Characterization of Clay for Catalyst. The research activities include optimization of biodiesel production using pillared bentonite as catalyst, development of natural fiber-reinforced composites for structural application, and composites for earthquake and fire-resistant buildings.

Assoc. Prof. Dr. Mohd. Hazwan Hussin received his B.Sc. (Hons.) in Chemistry and M.Sc. degrees (funded by Malaysian Ministry of Higher Education) from Universiti Sains Malaysia, respectively. He was awarded double-PhD degree program with USM and Universite de Lorraine, France (funded by Malaysian Ministry of Higher Education and Boursier du Governement Francais) and also was awarded the Best PhD Research by Institute of Postgraduate Studies, USM. His research area involves valorization of lignocellulosic biomass for advanced material applications and corrosion protections. He was listed as Top 2 % Scientist in the world (under the category of 2019 and 2020 citation) by Stanford University. He is also a Research Fellow at CeGeoGTech, UNIMAP and a Visiting Professor at the Universite de Lorraine, France. He has published more than 150 papers of his research in reputable journals and also presented many scientific papers in various conferences. He is an Associate Editor for Frontiers in Chemistry - Green and Sustainable Chemistry and Review Editor for Frontiers in Materials - Environmental Degradation of Materials.

Assoc. Prof. Dr. Mohd. Hazwan Hussin

Universiti Sains Malaysia, Malaysia

Our Invited Speaker

Dr. Guo Juan
Chinese Academy of Forestry, China

Born and raised in Xinxiang, China, **Dr. Guo Juan** earned her Bachelor's degree from Zhengzhou University and Doctoral degree in Polymer Chemistry and Physics from Fudan University in 2012.

She started working as a researcher focusing on wood science and technology in Research Institute of Wood Industry (CRIWI), Chinese Academy of Forestry since 2012. At present, she is the associate professor, the deputy director of Department of Wood Anatomy and Utilization in CRIWI and the deputy of International Union of Forest Research Organizations (IUFRO) 5.06.00 – properties and utilization of plantation wood. She has published 50 literatures, 3 books and 3 standards. As a mother of two beautiful children, Juan make efforts to achieve the work life balance. She is pleased by exploring both the mysteries of tree life and the meaning of family.

Dr. Benoit Belleville
University of Melbourne, Australia

Dr. Benoit Belleville is a wood engineer and the leader of the Sustainable and Renewable Forest Products research group. He holds a PhD in wood science from Laval University, Canada. His research focuses on trees and plants as sustainable and renewable materials, processing and manufacturing, development and design of high-value products, and utilisation of plantation timber and agricultural resources. He has published over 100 research papers, book chapters, and articles on wood processing, wood technology and wood products manufacturing. His expertise has engaged him in research in Australia, Canada, France, Chile, Lao PDR, and Papua New-Guinea. Dr Belleville believes in building with CO2 so that the cause for climate change becomes the solution.

Our Invited Speaker

Prof. Dr. Ir. Joko Santoso, M.Si.

Institut Pertanian Bogor, Indonesia

Prof. Dr. Ir. Joko Santoso, M.Si. was born in Wonogiri, Central Java, Indonesia. He was pursuing Bachelor Degeree at Bogor Agricultural University (IPB University), Faculty of Fisheries and Marine Sciences, in the field of Fisheries Products Processing, INDONESIA (1990).

His Master Degree was conducted at Bogor Agricultural University (IPB University), Graduate Program on Food Science, INDONESIA (1998). And his Ph.D. was achieved at Tokyo University of Fisheries, Graduate School of Fisheries Science in the field of Food Science and Technology, JAPAN (2003). Since 2014 he is a Professor at Faculty of Fisheries and Marine Sciences, IPB University, INDONESIA.

His research interest is in the fields of seaweed extraction, including the physical chemical characteristics on extraction of polysaccharides / phycocolloids from seaweed (e.g. carrageenan, agar, alginic) as well as the bioactive compounds. Recent study is to utilize the seaweed and seaweed waste processing namely cellulose for the biofuel and bio-gas as a renewable energy.

Prof. Djarwanto is a Senior researcher at Research Center for Biomass and Bioproducts - PRBB, National Research and Innovation Agency - BRIN in the field of Biodeterioration and Preservation of Lignocellulosic Biomass. His current research interests are on wood forensic and biodeterioration by fungi, and nano-preservative. He was born and raised in Salatiga, Central Java May 29, 1959.

He was conducted his bachelor degree at Faculty of Mathematics and Natural Sciences, Pakuan University, Bogor. Then he continue his study on master degree at Faculty of Mathematics and Natural Sciences, University of Indonesia. And he pursue his doctoral degree at Applied Biosciences and Microbiology, Ehime University-Japan.

Prof. Dr. Drs. Djarwanto, M.Si.

National Research and Innovation Agency (BRIN), Indonesia

Terms of Reference

The Second International Conference of Lignocellulose (ICONLIG)

Fostering Innovation and Increasing the Economic Value of Sustainable Materials through Scientific Discovery, Technological Progress, and Industrial Partnership

Motivation

The 17 goals of sustainable development have been adopted by all the United Nations Member States since 2015. Not only providing a shared blueprint for peace and prosperity for the people and the planet, but the agenda also identifiesthat the global acts to end the poverty, to tackle climate change and to preserve our biosphere shall be performed together with the strategies to improve health and education, to reduce inequality, and to stimulate economic growth.

The urgent call for actions is translated into several outreach activities to provide a substantial support in achieving the sustainable development goals by all the countries-developed and developing-in a global partnership.Science, technology, and innovation, together with the climate change mitigation, are two thematic-ongoing activities alongside other sectors such as urbanization, transportation, water, ocean, waste management, and energy. To successfully deliver these roles, more specific policies such as bioeconomy is presented to reinforce the strong connection and to ensure the balance among the society, economy, and the sustainable environment.

In a global context, the bioeconomy strategy connects the sustainable use of renewable biological resources for food, bio-based products, and bioenergy while maintaining the safety and restoration ofbiodiversity, ecosystems, and natural habitat. In a more scientificcontext, the utilization of bio-based products orthe conversion of lignocellulose biomass into bioproducts or bioenergy develop substitutes to fossil-based materials that are biodegradable, renewable, recyclable, and more economical. These efforts create an emerging sector in the field of biomass conversion and bio-based smart materials that will lead to sustainable development of this industry.

As a scientific community, we aim to design and to assess effective solutions for a sustainable future as one of the actions we can actively contribute to the sustainable development goals and climate change mitigation. Therefore, our step-up action is to gather all the researchers, scientists, academia, and practitioners in a two-day conference and symposium entitled “The 2ndInternational Conference of Lignocellulose.” In these events, they will share their latest discovery in the field of science and technology by providing a strong knowledge basis with confidence that their works are built on a sound understanding of the global issues. The event is anticipated to be the largest forum for the scientific community as a platform to foster their innovation through scientific discovery and technological progress as well as to increase the economic value of sustainable materials through industrial partnership.

Scopes and Research Areas

The scopes and research areas of The 2nd ICONLIG are: A basic to advanced investigation on harvesting, conversion, and characterization of biomass as well as their respective derivative products such as forest products, cellulose, hemicellulose, lignin, tannin, essential oils, natural resin, bio-based polymer and composite. The coverage including applications in industry such as agriculture, engineering, environmental, or medical sectors, etc. Note that the lists only cover major topics; therefore, other areas related to the theme are also welcomed for submission. The decision whether the manuscript meets the scopes of the Conference will be based on the Abstract selection and will be made by the Reviewer Team.

Objectives

The objectives of ICONLIG are:

- To foster innovation and to increase the economic value of sustainable materials towards sustainable development goals by enhancing knowledge sharing among researchers, scientists, academia, and practitioners.
- To encourage international collaboration by serving as a platform for the participants to establish a scientific network related to their disciplines.
- To provide an update on the possible scientific actions to assess effective solutions for a sustainable future.

Outcomes

All accepted papers will be submitted and published this year on a global-indexed proceeding, AIP Conference Proceedings.

Venue

The Second International Conference of Lignocellulose will be held online through a social media streaming and online conference platforms with the specified dates and time below:

Date : November 24 – 25 2022

Time : 09:00 - 14:30 (UTC + 07:00)

Organizer

The two-day conference and symposium are organized by Research Center for Biomass and Bioproducts of National Research and Innovation Agency, Indonesia.

Program Schedule

Day 1 – Thursday, November 24th, 2022

Welcome Session	
MC: Dyah Ayu Agustiningrum	Conference room & registration open Conference link: 2ndICONLIG2022Day1 Meeting ID: 912 1768 3736, Passcode: iconlig-1
Time	Thursday, November 24th, 2022
07:30~08:00	**Opening by MC**
	Opening Remarks
08:00~08:05	Dr. Yeyen Nurhamiyah [Chairman]
08:05~08:15	Dr. Akbar Hanif Dawam A. [Head of Research Centre for Biomass and Bioproducts]
08:15~08:25	Prof. Yoshio Otani [Director of JSPS Bangkok Office]
08:25~08:35	Iman Hidayat, Ph.D [Chairman of Research Organization for Life Science and Environment]

	Keynote Presentation
MC: Dyah Ayu Agustiningrum Moderator: Ratih Damayanti	
Time	Thursday, November 24th, 2022
08:45~09:15	**Toward low-cost conversion of cellulosic biomass to biofuels and bioproducts** Keynote#1 [Prof. Bin Yang – Biological Systems Engineering – Washington State University, USA]
09:15~09:45	**Advanced combinations of plant-derived compounds and engineered biomaterials for biomedical applications** Keynote#2 [Prof.dr.-Ing. Habil. Aldo R. Boccaccini – Institute of Biomaterial, University of Erlangen-Nurnberg, Germany]
09:45~10:15	**Smart sustainable polymers and polymer nanocomposites** Keynote#3 [Prof. Biqiong Chen - Queen's University Belfast, United Kingdom
10:15~10:30	QnA (all speakers)
	Transition to breakout room (10:30~10:35)

Parallel Session 1 – Lignocellulose Chair: Maya Ismayati & Sukma Surya Kusumah; Co-chair: Kanti Dewi Rizqiani			
	10:35~10:40	Opening by Chair and co-chair	
	10:40~11:05	**Invited Speaker 1 - Dr. Mohamad Zaki Hassan** **[University Technology Malaysia (UTM), Malaysia]** *Biomass/Natural fibre processing*	
	11:05~11:30	**Invited Speaker 2 – Dr. Mounir El Achaby** **[Mohammed VI Polytechnic University (UM6P), Moroco]** *Advanced cellulose-based nanomaterials: from preparation to multifunctional applications*	
	11:30~11:40	QnA (all speakers)	
	11:40~12:30	*Lunch Break*	
ID	**Time**	**Authors**	**Title**
R3-01	12:30~12:40	Ahmad Syauqi, Majida Ramadhan, Agintha S Anggraeni, Hera Yuana, Fatmawati	Rapid test of bioethanol raw material: The Weende-Chesson-Datta method modification to fiber cellulose
R3-02	12:40~12:50	Novitri Hastuti, Luciasih Agustini, Safrina Dyah Hardiningtyas, Wahyu Ramadhan, Dian Anggraini Indrawan, Maya Ismayati, Aisiyah Tazkiatunnisa	Microfibrillated Cellulose from Agar Waste in Algi-nate-based Hydrogels for Papain Enzyme Immobilization
R3-03	12:50~13:00	Sri Peni Wijayanti	Evaluation of an Alginate-Chitosan-Microcrystalline Cellulose Sulfate Macroencapsulation System for Efficient Fermentation of Lignocellulosic Hydrolyzate
R3-04	13:00~13:10	Muhammad Rasyidur Ridho, Elvara Windra Madyaratri, Erika Ayu Agustiany, Nissa Nurfajrin Solihat, Deded Sarip Nawawi, Ika Juliana, Widya Fatriasari	Isolation and Characterization of Lignin from Black Liquor of Arecanut Leaf Sheath (*Areca catechu* L.) with Hydrochloric Acid and Phosphoric Acid
R3-05	13:10~13:20	Devi Nurani, Riska Surya Ningrum, Putri Amanda, Deni Purnomo, Sukardi, Nanang Masruchin	The Properties of Cellulose Nanofibrils Produced from Different Sources: Pineapple Leaves and Oil Palm Fronds
R3-06	13:20~13:30	Ali Rahmat, Hidayat, Kiki Kurniawan, Hari Hariadi, Latifa Nuraini, Aldiano Rahmadya, Hendra Prasetia, Muhammad Nurtanto, and Usep Suhendra	Chemical Properties of Coconut Lumber Sawdust Biochar Using X-Ray Fluorescence under Low Temperature Pyrolysis
	13:30~13:45	QnA (all speakers)	
R3-07	13:45~13:55	Mody Lempang and Gunawan Pasaribu	Properties and Potencial Use for Paper Pulp of Four Less-known Hardwoods Originated from Natural Tropical Rainforest in South Sulawesi Province of Indonesia
R3-08	13:55~14:05	Efrida Basri, Saefudin, Jamaludin Malik, Jamal Balfas, Jamaludin	Properties of Oil Palm (*Elaeis guineensis*) Wood Modified with Bio- Impregnant

		Malik, Adi Santoso, Karnita Yuniarti, and Wayan Darmawan	
R1-03	14:05~14:15	Muhammad Yusron, Azizatul Karimah, Muslimatul Rahmi DN, Mayang Aristika Jayanti, Bagaskoro Tuwalaid, Ady Ardhana, Fahriya Puspita Sari, Widya Fatriasari	The soda pulp characteristic of rice straw and the hydrophobicity improvement by water-soluble chitosan treatment
R3-12	14:15~14:25	Dwi Ajias Pramasari, Maulida Oktaviani, M. Zuvan Maulana Fahrezi, Ahmad Thontowi and Euis Hermiati	Short-term *Meyerozyma caribbica* Y67 adaptation in sugarcane trash hemicellulosic hydrolysate for xylitol production
R3-13	14:25~14:35	Ester Rimma Suryani Togatorop, Ria Yolanda Arundina, Prabu Satria Sejati, Sukma Surya Kusumah, Resti Marlina	Proximate and Structural Analysis of Activated Carbon with Different Structure from Oil Palm Biomass
R3-14	14:35~14:45	Mashuni, M Jahiding, La Ode Kadidae, Fitri Handayani Hamid, and Nur Arfa Yanti	GC-MS/FTIR Analysis from Coconut Shell Lignocellulose Conversion using Pyrolysis Method and as a Strong Antifungal Agent on Cocoa Seeds
	14:45~15:00	QnA (all speakers)	
R3-15	15:00~15:10	Falah, F., Zulfiana, D., Septiano, M.D.K, Nawawi, D.S, Sari, P.S., Fatriasari, W., Solihat, N.N	Antimicrobial Activity Of Acacia Mangium Lignin in Food Packaging Biofilms
R3-16	15:10~15:20	Wida B. Kusumaningrum, Firda A. Syamani, Maya Ismayati, Fazhar Akbar, Bernadeta Ayu Widyaningrum, Nurhayati, Venitalitya Alethea Sari Augustia	The Effect of Lignin Containing Nanocellulose from Sugarcane leaf on Agar Bioplastics as an Active Packaging
R3-17	15:20~15:30	Maya Ismayati, Novitri Hastuti, Widya Fatriasari, Muhammad Adly Rahandi Lubis, Lisman Surya Negara, Fahriya Puspita Sari, Dian Burhani, Bunda Amalia, Fidelia, Yuki Tobimatsu	Optimization of tannin isolation from bark of Acacia mangium and application in PLA-tannin based biofilm with antioxidant properties
	15:30~15:45	QnA (all speakers)	
	15:45~15:50	Closing parallel session 1 by chair and co-chair	

Parallel Session 2 – Biocomposite Chair: Ina Winarni; Co-chair: Bernadeta Ayu			
	10:35~10:40	Opening by Chair and co-chair	
	10:40~11:05	**Invited Speaker 3 – Dr. Henri Vahabi [University of Lorraine, France]** *Development of sustainable biobased flame retardants*	
	11:05~11:30	**Invited Speaker 4 – Ariadne L. Juwono, Ph.D** **[Universitas Indonesia, Indonesia]** *Bamboo fiber and its reinforced composites: properties and applications*	
	11:30~11:40	QnA (all speakers)	
	11:40~12:30	*Lunch Break*	
ID	**Time**	**Authors**	**Title**
R5-01	12:30~12:40	Dian Anggraini Indrawan, Lisna Efiyanti, Novitri Hastuti, Gustan Pari, Ignasia Maria Sulastiningsih and Adi Santoso	Hardboard Quality of Mixed Sisal, Gelagah Grass and Empty Palm Oil Fruit Bunches
R5-02	12:40~12:50	Agung Sumarno, Agus Mudo Prasetyo, Dany Perwita Sari, Maidina, and Luna Ngeljaratan	Thermal Analysis and Solution of Green Cementitious Composites Model under Constant and Elevated Temperature-A Preliminary Study
R5-03	12:50~13:00	Lilik Astari, Marcelino Andrean, Kurnia Wiji Prasetiyo, Firda Aulya Syamani, Yusuf Sudo Hadi	Surface roughness and mechanical properties of particleboard made from alang-alang and sorghum stalks
R5-04	13:00~13:10	Deby Mipa Salam, Aulia Nur Laksmita, Andrian Fernandes, and Rizki Maharani	Potential Benefits of Dipterocarps Resin as a Basic Utilization for Functional Usage
R5-05	13:10~13:20	Deni Purnomo, Firda A Syamani, Sasa S Munawar, Sudarmanto, Resti Marlina, Riska S Ningrum, Narto, Fazhar Akbar, Dede Hermawan	Physical and Mechanical Properties of Low-Density Coconut Fiberboard Using Polyol-Isocyanate Adhesive Binder For Insulation Material
R5-06	13:20~13:30	Much. Rafi Fahlevi, Heru Suryanto, RR. Poppy Puspitasari, Jibril Maulana, Krisrulita Segaradi Wiguna	The Influence of Coupling Agent on Interfacial Shear Strength of Sansevieria cylindrica Fiber Epoxy Composite
	13:30~13:45	QnA (all speakers)	
R5-07	13:45~13:55	Ismadi, Ariadne L Juwono and Sasa Sofyan Munawar	Investigation of Fiber Loading on Physical-Mechanical Properties and Crystallinity of Mercerized Sisal Fiber/Polyester Composites
R5-08	13:55~14:05	Wafiq Faradilla Khasanah, Triastuti, Ade Oktaviani Irlan, Ananto Nugroho, Eko Widodo, Bernadeta Ayu Widyaningrum, Riska Surya Ningrum, Ismail Budiman, Subyakto	The Influence of Hydrothermal Carbonization Duration on Concrete Properties
R5-09	14:05~14:15	Subyakto, Eko Widodo, Triyati, Naomi Dameria Lidya Andini Hutauruk, Rabiah Al Adawiyah, Kenji Umemura	Properties of moulding products from sorghum bagasse combined with alang-alang leaves, sengon wood or bamboo using citric acid-sucrose

R5-10	14:15~14:25	Erlina Nurul Aini, Deazy Rachmi Trisatya, Adi Santoso and Greitta Kusuma Dewi	Utilization of Expired Urea-Formaldehyde with the Addition of Wood Vinegar for Plywood and Particleboard Manufacturing
R5-13	14:25~14:35	Harmiansyah, Jabosar RHP, Annisa Pratama Putri, and Melbi Mahardika	Mechanical and Biodegradable Properties of Oil Palm Empty-Fruit-Bunch (OPEFB) Fiber Reinforced Banana Peel Starch/Polyvinyl Alcohol Hybrid Biocomposites for Packaging Application
R5-14	14:35~14:45	Nidya Chitraningrum, Resti Marlina, Sutistyaningsih, Hana Arisesa, Ismail Budiman, Pamungkas Daud, Ardita Septiani, Ria Yolanda Arundina, Ester Rimma Suryani Togatorop	Preparation and Characterization of Porous Carbon-based Oil Palm Empty Fruit Bunch as A Candidate Material for An Electromagnetic Waves Absorber Application
	14:45~15:00	QnA (all speakers)	
R5-15	15:00~15:10	Nadya Basa Paulina, Yessie Widya Sari, Ismail Budiman	Activated Charcoal from Robusta Coffee Waste as Adsorbent of Pollutants: Adsorption Kinetics of $FeCl_3$ (Iron (III) Chloride)
R5-16	15:10~15:20	Ria Yolanda Arundina, Ester Rimma Suryani Togatorop, Sandra Malin Sutan, Resti Marlina	Structural Properties and Adsorption Capability of Activated Carbon from Oil Palm Shell by Using Hydrothermal-Pyrolysis Method
R5-17	15:20~15:30	L.Efiyanti, D. A Indrawan, N. Hastuti, H. Wibisono, S. Wibowo, N.A. Saputra, S. Darmawan, G.Pari	Ni-impregnated activated carbon properties from mixed wood waste for hydrocracking reaction of C.manghas
	15:30~15:45	QnA (all speakers)	
	15:45~15:50	Closing parallel session 2 by chair and co-chair	

Parallel Session 3 – Wood Industry and Forest Chair: Karnita ; Co-chair: Imran Arrad Sofianto			
	10:35~10:40	Opening by MC by chair and co-chair	
	10:40~11:05	**Invited Speaker 5 – Assoc.Prof.Dr. Mohd. Hazwan Hussin [Universiti Sains Malaysia, Malaysia]** *Elucidation of oil palm based lignin as a substitute for wood adhesives*	
	11:05~11:30	**Invited Speaker 6 – Dr. Guo Juan [Research Institute of Wood Industry, Chinese Academy of Forestry, China]** *From Forests to Sustainable Wood Products: Highlight and Perspective of Wood Science Progress in Chinese Academy of Forestry*	
	11:30~11:40	QnA (all speakers)	
	11:40~12:30	*Lunch Break*	
ID	**Time**	**Authors**	**Title**
R6-01	12:30~12:40	Dulsalam, Soenarno, Sona Suhartana, Yuniawati, Sarah Andini and Mutia Herni Ningrum	Usage Comparison between Reverse Conventional and Ladder-Typed Undercuts in Natural Forests at Two Logging Companies in Central Kalimantan, Indonesia
R6-02	12:40~12:50	Yunasfi, E T H Ginting and A Dalimunthe	Effect of Planting Distance from the Beach on Red Mangrove Plants (*Rhizophora apiculata*) on the Coastal Coast of Pulau Sembilan Village, Pangkalan Susu, Langkat Regency
R6-03	12:50~13:00	Yunasfi, R M Gulo and Desrita	The Effect of Planting Distance From The Beach on Mangrove Plant (*Rhizophora apiculata*) on The Coastal Coast, Village Island Sembilan, Pangkalan Susu District, Langkat Regency
R6-04	13:00~13:10	Achmad Supriadi	Machining Properties of Nyerakat and Resak Woods from West Kalimantan
R6-05	13:10~13:20	Wahyu Dwianto, Sarah Augustina, Sudarmanto, Narto, Yusup Amin, Teguh Darmawan, Danang S. Adi, Adik Bahanawan, Prabu S. Sejati, Dimas Triwibowo, Imran A. Sofianto, and Sari D. Marbun	Deformation Pattern of Compressed Wood Cell Walls in Radial Direction and Its Effect on Modulus of Rupture Values in Different Loading Directions
R6-06	13:20~13:30	Nurul Wahyuni, Yelin Adalina, and Rosita Dewi	Physicochemical Characteristics of Honey Based on Species of Bees at Kapok (*Ceiba petandra* (L.) Gaertn) Plantation in Pati Regency
	13:30~13:45	QnA (all speakers)	
R6-07	13:45~13:55	Adik Bahanawan, Fauzi Febrianto, Nanang Masruchin, Wahyu Dwianto	Beautifully of transparent biomass composites (TBC) : simple fabrication methods and visualization under various lightening (part 1)
R6-08	13:55~14:05	Listya Mustika Dewi, Andianto, Ratih Damayanti, Djarwanto, Dyah Ayu Agustiningrum, Gunawan	Forensic Investigation of Various Wood Products through Identification of Wood Species and Its Destroying Organisms

		Hadi Rahmanto, Rohmah Pari, Imran Arra'd Sofianto	
R6-09	14:05~14:15	Listya Mustika Dewi, Ratih Damayanti, YI Mandang, Sri Rulliaty, Suprihatna	Shoreoxylon Fossil Wood from Flores Island, an Early Record
R6-10	14:15~14:25	DA Indrawan, R Damayanti, B Ozarska, J Ilic, G Pari, LM Dewi, Krisdianto, R Pari, DA Agustiningrum, DS Adi, IA Sofianto, Djarwanto, RGH Rahmanto	Potential utilization of super teak
R6-11	14:25~14:35	Yusup Amin, Renaldi Purnomo Adji, Sudarmanto, Narto, Muhammad Adly Rahandi Lubis, Nareworo Nugroho, Effendi Tri Bahtiar, Wahyu Dwianto, Lina Karlinasari	Delamination and Bonding Strength of Cross Laminated Timber Made from Jabon Wood and Cold-Setting Melamine-Based Adhesive
R6-12	14:35~14:45	D Triwibowo, DS Adi, SK Himmi, R Damayanti, RGH Rahmanto, and Sung-Wook Hwang	Discrimination of Conventional and Fast-Grown Teak Wood through Fourier Transform Near Infrared
	14:45~15:00	QnA (all speakers)	
R6-13	15:00~15:10	R Pari , DA Agustiningrum, DS Adi, IA Sofianto, Djarwanto, RGH Rahmanto, R Damayanti, Setiowati, SW Hwang, C Oktapiani	Determination of Three *Shorea* Species by Near-Infrared Spectroscopy and Anatomical Structures
R6-14	15:10~15:20	DA Agustiningrum, RGH Rahmanto, R Pari, IA Sofianto, Djarwanto, R Damayanti	A Study of Discoloration of Untreated 5-year-old Fast-Grown Teak Wood
R6-15	15:20~15:30	Teguh Darmawan, Narto, Sudarmanto, Dimas Triwibowo, Yusup Amin, Adik Bahanawan, Danang Sudarwoko Adi, Imran Arra'd Sofianto, Prabu Satria Sejati, Wahyu Dwianto, and Imam Wahyudi	Physical and Anatomical Properties of Nine Years-old Platinum Teak Wood
R6-16	15:30~15:40	Sarah Augustina, Wahyu Dwianto, Dimas Triwibowo, Imam Wahyudi, I Wayan Darmawan, Jamaludin Malik	Performance of low molecular weight of phenol formaldehyde-impregnated woods on dimensional stability and durability against termites
R6-17	15:40~15:50	Jamal Balfas, Deazy Rachmi Trisatya, Rohmah Pari	Recovery Rate and Physical Properties of 32 and 37-Year-Old Sawn Oil Palm Trunks (OPT)
	15:50~16:05	QnA (all speakers)	
	16:05~16:10	Closing parallel session 3 by chair and co-chair	

Day 2 – Friday, November 25th, 2022

	Keynote Presentation
Chair: Dyah Ayu Kusumaningrum Moderator: Rizki Maharani	Conference room & registration open Conference link: 2ndICONLIG2022Day2 Meeting ID: 912 8882 6618, Passcode: iconlig-2
Time	Friday, November 25th, 2022
07.30~08.00	Registration day 2
08:00~08:05	**Opening by MC**
08:05~08:35	**Biodiversity of Marine Organism** Keynote#4 [David Cristian, CEO Evoware]
08:35~09:05	**Recent research trend of bacterial cellulose in Indonesia** Keynote#5 [Prof. Myrtha Karina Soncowijoyo, National Research and Innovation Agency, Indonesia]
09:05~09:20	QnA (all speakers)

Parallel Session 4 – Biomass Processing Chair: Jamaludin Malik; Co-chair: Adik Bahanawan			
		Opening by chair and co-chair	
	09:25~09:50	**Invited Speaker 7 – Benoit Belleville, Ph.D** **[University of Melbourne, Australia]** *Agricultural by-products to produce environmentally friendly bio-composite products and decarbonise the building and building products sectors*	
	09:50~10:15	**Invited Speaker 8 – Dr. Sanjay Mavinkere Rangappa** **[King Mongkut's University of Technology North Bangkok, Thailand]** *Lignocellulosic fiber reinforced composites: Progress, performance and applications*	
	10:15~10:25	QnA (all speakers)	
ID	**Time**	**Authors**	**Title**
R1-01	10:25~10:35	Nur Adi Saputra and Djeni Hendra	Effect of activation parameters on adsorption properties of activated carbon prepared from teak waste
R1-02	10:35~10:45	Aisyah Hanifah, Efri Mardawati Akbar Hanif Dawam	Production Optimization and Characterization of Cellulose Acetate from Oil Palm Empty Fruit Bunches
R3-11	10:45~10:55	Don Pedro Sandhyacartenz Tossano da Costa, Ika Atsari Dewi, Farah Fahma, Zuratul Ain Abdul Hamid, Lisman Suryanegara	Isolation and Characterization of Cellulose Nanofibers from Sweet Sorghum with Different Ultrafine Grinding Modes
R1-04	10:55~11:05	Putri Amanda, Setyani Budiari, Anita Amelia	Characteristic of Pickering Emulsion Stabilized by Cellulose Nanofibrils in Different Oil Phase Polarity
R1-05	11:05~11:15	Arzqa Sabila Hanifah, Dewi Sondari, Saras Dhiyaa Maitsaa, Ismail Budiman, Riksfardini Annisa Ermawar, Isalmi Aziz	Chemical Properties of Cross-Linking Biohydrogel from Oil Palm Empty Fruit Bunch

	11:15~11:30	QnA (all speakers)	
	11:30~13:30	Lunch Break and Friday Prayer	
R1-06	13:30~13:40	Suroto Hadi Saputra, Andrian Fernandes, and Rizki Maharani	Effect of combustion method on oleoresin tapping yield of Dipterocarpus grandiflorus
R1-08	13:40~13:50	Euis Hermiati, Dwi Ajias Pramasari, Adetya Lianawati	Preliminary study on hydrolysis of sugarcane trash hemicellulose by inorganic salt catalyst for xylose production
R1-09	13:50~14:00	Arfiathi, Riska Sumirat, Intan Rizka Gumilang, Muhammad Adly Rahadian Lubis, Afni Restasari, Firda Aulya Syamani, Fitry Filianty, Yeyen Nurhamiyah	The Effect of Reducing of Cyanide Level in Cassava (*Manihot Esculenta* Crantz) on the Starch Content
R1-10	14:00~14:10	Bernadeta Ayu Widyaningrum, Riska Surya Ningrum, Triastuti, Ahmad Yusuf Afandi, Deni Purnomo, Wida Banar Kusumaningrum, Yudhi Dwi Kurniawan	Effect of modified boiler ash from sugarcane bagasse for mercury adsorption: physical and chemical properties
R1-11	14:10~14:20	R Pari, RGH Rahmanto, Djarwanto, R Damayanti, DA Agustiningrum, LM Dewi, IA Sofianto	Effect of Gridling on Characteristics of Teak Wood
	14:20~14:35	QnA (all speakers)	
R1-12	14:35~14:45	H.S Syamsidar, A Ahmad, S Fauziah and D Sondari	Effect of rice husk cellulose extraction method with the addition of plasticizer on the physico-chemical properties of bioplastics
R1-13	14:45~14:55	M Jahiding, Mashuni Mashuni, Erzam S Hasan, Yuke Milen, and F S Purnamasari	The Pyrolysis Temperature Effect on Decomposition Process of Bio-oil and Bio-char from Coconut Shell for Bio-Coke Hybrid Application as Alternative Energy Resources
R1-14	14:55~15:05	Deazy Rachmi Trisatya, Dian Anggraini Indrawan, Firda Aulia Syamani, Erlina Nurul Aini and Ignasia Maria Sulastiningsih	Effect of Strand Dimension and Specific Pressure on the Performance of Strandboards made from Tali Bamboo (Gigantochloa apus (JA & JH Schultes) Kurz)
R1-15	15:05~15:15	Aulia Nur Laksmita, Deby Mipa Salam, Andrian Fernandes, and Rizki Maharani	Improving Dimension Stability of Mahagony (*Swietenia mahagony*) Wood with Oleoresin of Dipterocarpus sp. as a Bio-coating
R1-16	15:15~15:25	Khansa Tsabitah, Budi Saksono, Riksfardini Annisa Ermawar, Amalia Sitti Khayyira, Amania Zulfa , and Mohammad Ubaidillah	One Step Purification and Characterization of β-Glucosidase Enzyme from *Paenibacillus polymyxa*
	15:25~15:40	QnA (all speakers)	
	15:40~15:50	Closing parallel session 4 by chair and co-chair	

Parallel Session 5 – Plant based Chemical Compound Chair: Nidya Citraningrum; Co-chair: Novitri Hastuti			
		Opening by chair and co-chair	
	09:25~09:50	**Invited Speaker 9 – Prof. Dr. C. Hanny Wijaya** **[Institut Pertanian Bogor, Indonesia]** *Leveraging the Benefits of Renewable Forest Products in the Form of Functional Foods*	
	09:50~10:15	**Invited Speaker 10 – Prof. Dr. Drs. Djarwanto, M.Si** **[National Research and Innovation Agency (BRIN), Indonesia]** *Advance Research on Basic Properties and Preservation of Wood*	
	10:15~10:25	QnA (all speakers)	
ID	**Time**	**Authors**	**Title**
R2-01	10:25~10:35	Yunida S. Lubis, Cut Rizlani Kholibrina, and Aswandi Aswandi	Characterization and segmentation of forest essential oil products in Indonesia
R2-02	10:35~10:45	Aswandi Aswandi and Cut Rizlani Kholibrina	Essential oil and hydrosol production from leaves and resin of Sumatran camphor (*Dryobalanops aromatica*)
R2-03	10:45~10:55	Cut Rizlani Kholibrina, and Aswandi Aswandi	Forest essential oils formulation for acne treatments
R2-04	10:55~11:05	Alif Faturahman Hidayat, Nissa Nurfajrin Solihat, Deni Zulfiana, Sita Heris Anita, Maulida Oktaviani, Maya Ismayati, Widya Fatriasari, and Wasrin Syafii	Solvent Effect on Revealing Antibacterial Potency of Lignin and Tannin
R2-05	11:05~11:15	Ina Winarni, Kustiariyah Tarman, and Joko Santoso	The Potential of Brown Seaweed (*Sargassum* sp) as a Source of Antioxidant
	11:15~11:30	QnA (all speakers)	
	11:30~13:30	Lunch Break and Friday Prayer	
R2-06	13:30~13:40	Nurul Wahyuni and Agus Sukito	Antioxidant Activity and Chemical Compound Analysis of Inoculated Agarwood Extract
R2-07	13:40~13:50	Yuliar, Nursaida Setiyowati, Sri Pujiyanto, Wijanarka	Biocontrol activity of Brevibacillus sp. B1 isolated from fig stems against post-harvest chili fungal disease
R2-08	13:50~14:00	Gunawan Pasaribu and Totok K. Waluyo	Anticancer Activity of Saurauia vulcani Extract on HeLa (ATCC CCL 2) and MCF-7 (ATCC HTB 22) Cell Line
R2-09	14:00~14:10	Kanti Dewi Rizqiani, Agus Sukito	The Utilization of Agarwood (Gyrinops Versteegii (Gilg.) Domke)) Leaves for Herbal Tea
R2-10	14:10~14:20	Faizatul Falah, A. Pratama, I. G Rivo, A. Heru Prianto	Neem Cake Fractions and Its Bioactivity against *Spodoptera litura*
	14:20~14:35	QnA (all speakers)	
R2-11	14:35~14:45	Riki Ruhimat, Tirta Kumala Dewi, Tiwit Widowati, Rahayu Fitriani Wangsa P, Nani Mulyani, Entis Sutisna and Sarjiya Antonius	Fungal Producing Lignolytic and Cellulolytic Enzyme from the Various Habitat of Natural Forest in East Kalimantan

R2-12	14:45~14:55	Ratih Pangestuti, Lisman Suryanegara, Puji Rahmadi, Dedy Kurnianto	Nutritional value of under exploited seaweed from Indonesia
R2-13	14:55~15:05	Sigit Baktya Prabawa	The Utilization of Sodium Chloride (NaCl) as A Natural Preservative in Gewang Petioles (Corypha utan LAMK.) Against Subterranean Termites Attacks
R2-14	15:05~15:15	Reni Yuniarti, Aldillah Herlambang, Ahmad Husein Fatta Suherman, Anggi Pratiwi, Akhmad Zainal Abidin	Development of MASARO Compost Formula Based on Yard Waste (Dried Acacia Leaves) and Cow Manure
R2-16	15:15~15:25	Raden Esa Pangersa Gusti, Ina Winarni, and Gunawan Pasaribu	RAGU (porang-sagu) Biscuits as an Alternative Superfood
	15:25~15:40	QnA (all speakers)	
	15:40~15:50	Closing parallel session 5 by chair and co-chair	

Parallel Session 6 – Biopolymer Chair: Saptadi Darmawan; Co-chair: Erlina Nurul A			
		Opening by chair and co-chair	
	09:25~09:50	**Invited Speaker 11 – Prof. Dr. Ir. Joko Santoso, M.Si.** **[Institut Pertanian Bogor, Indonesia]** *Tropical Seaweed as a Source of Cellulose: Opportunities and Challenges*	
	09:50~10:15	**Invited Speaker 12 - Dr. Amalina Amir** **[Universiti Teknologi MARA, Malaysia]** *Recent Advances in Biocomposites and Biofibres*	
	10:15~10:25	QnA (all speakers)	
ID	**Time**	**Authors**	**Title**
R4-01	10:25~10:35	Della Apriyani Kusuma Putri , Mersi Kurniati, and Firda Aulya Syamani	Utilization of Extracted Lignin from Pulp Industry Waste for Mulch UV Retardant
R4-02	10:35~10:45	Sri Purwaningsih, Tirta Kumala Dewi, Entis Sutisna and Agung Adi Nugroho	Inventory and testing of Rhizobium bacteria in roots and soil area of East Kalimantan on the growth of Soybean (*Glycine max* L) in greenhouse
R4-03	10:45~10:55	Dany Perwita Sari, Agung Sumarno, Agus Mudo Prasetyo, Maidina, and Luna Ngeljaratan	Comparison of lighting simulation tools with focus on daylighting for sustainable building in tropical climate
R4-04	10:55~11:05	Dany Perwita Sari, Maidina, Agung Sumarno, Agus Mudo Prasetyo, and Luna Ngeljaratan	The Application of Indonesia Green Building Rating System for Sustainable Buildings
R4-05	11:05~11:15	Agus Mudo Prasetyo, Agung Sumarno, Dany Perwita Sari, Maidina, Luna Ngeljaratan, and MA. Moustafa	Comparison of Green Concrete Performance using Digital Image Correlation Algorithm based on Video Camera and Smartphone Data
	11:15~11:30	QnA (all speakers)	
	11:30~13:30	Lunch Break and Friday Prayer	
R4-06	13:30~13:40	Fahriansyah, Karnita Yuniarti, EfridaBasri, Jamaludin Malik, Jamal Balfas	The Effect of Stand Age and Sampling Position on Solar Drying Performance and Post-Drying Quality of Oil Palm Lumber
R4-07	13:40~13:50	Manggar Arum Aristri, Muhammad Adly Rahandi Lubis, Rita Kartika Sari, Raden Permana Budi Laksana, Maya Ismayati, Efri Mardawati, and Apri Heri Iswanto	Properties of Bio-Based Non-Isocyanate Polyurethane Resins Derived from Viscous Tannin of Acacia Mangium Bark, Dimethyl Carbonate, and Hexamethylenediamine
R4-08	13:50~14:00	Raden Esa Pangersa Gusti and Gunawan Pasaribu	Performance of Fortified Noodle Made from Konjac and Palm Sago Flour
R4-09	14:00~14:10	Adi Santoso and Jamaludin Malik	Formulation and Characterization of Bioresin Made from Oil Palm Bark Extract for Wood Adhesive
R4-10	14:10~14:20	Raden Permana Budi Laksana, Muhammad Adly Rahandi Lubis, Fazhar Akbar, Sukma Surya Kusumah, Ika Juliana, Rahmawati Putri, Efri Mardawati	Influence of Different Organic Acids Hardener on Performance of Ultra-Low Molar Ratio Urea-Formaldehyde Resins Adhesive

	14:20~14:35	QnA (all speakers)	
R4-11	14:35~14:45	Jajang Sutiawan, Dede Hermawan, Yusuf Sudo Hadi, Deded Sarip Nawawi, Sukma Surya Kusumah, Deni Zulfiana, and Dwi Ajias Pramasari	Termite and Decay Resistance of Three Sorghum (*Sorghum bicolor*) Accessions Bonded with Maleic Acid Adhesive
R4-12	14:45~14:55	Afni Restasari, Yeyen Nurhamiyah, Retno Ardianingsih, Luthfia Hajar Abdillah, Kendra Hartaya	Preliminary Study of Effect of Palm Oil as Secondary Plasticizer on Flow Behavior of Hydroxyl Terminated Polybutadiene (HTPB)
R4-13	14:55~15:05	Woro Setiaboma, Atia Fizriani, Djagal Waseno Marseno, Supriyanto	Cacao (*Theobroma cacao* L.) Shells: Optimization of Carboxyl Methyl Cellulose (CMC) Using Respond Surface Methodology
R4-14	15:05~15:15	Dyah Ayu Agustiningrum, Imran Arra'd Sofianto, Ratih Damayanti, Djarwanto, Raden Gunawan Hadi Rahmanto, Rohmah Pari, Listya Mustika Dewi, Adik Bahanawan, Dimas Triwibowo, Teguh Darmawan, Danang Sudarwoko Adi, Yusup Amin, Wahyu Dwianto, Sudarmanto, Narto, and Prabu Satria Sejati	Application of Near-InfraRed (NIR) Spectroscopy for Predicting Changes of Water Content and Rind Colour of Red Delicious Washington Apple (*Malus domestica*) in Room Temperature Storage
R4-15	15:15~15:25	Tatik Khusniati Dwi Oktaviani Ade Heri Mulyati and Sulistiani	Protease Stability of Indigenous Lactobacillus satsumensis EN38-32 and Fructobacillus fructosus EN17-20 at Cold and Freezing Temperatures
	15:25~15:40	QnA (all speakers)	
	15:40~15:50	Closing parallel session 6 by chair and co-chair	

Closing Session	
MC: Dyah Ayu Kusumaningrum	
Time	Thursday, November 25th, 2022
Closing Remarks	
16.00~16.10	Dr. Akbar Hanif Dawam A. [Head of Research Centre for Biomass and Bioproducts]
16:10~16:15	**Closing Video**

List of Abstracts-Parallel Session 1 – Lignocellulose*

Abstract R3-01

Rapid test of bioethanol raw material: The Weende-Chesson-Datta method modification to fibre cellulose

Ahmad Syauqi[1], Majida Ramadhan[2], Agintha S Anggraeni[3], Hera Yuana[4], and Fatmawati[5]

[1-5] *Department of Biology, Universitas Islam Malang, Malang 65144, Indonesia*

Abstract. Lignocellulose contained in plant residues from land and aquatic environments in a very abundant source of organic matter, especially from the agricultural sector for bioethanol raw materials. Cellulose fraction in fibres is very important to know and now there is no rapid analysis approach for the purpose of utilizing the feasibility of raw materials from environmental resources. How to find out cellulose content that is easily applied and fast to all type of plants. The purpose of study is to compile a fast way of cellulose analysis from resources of all environmental sectors. Research uses the experimental method with design of one shot-study by measuring the quantity of glucose hydrolysate from cellulose fraction. The glucose yield was determined by the modification Weende-Chesson method without carrying out the ash fraction and followed by the Datta method. Dry material containing minerals is hydrolyzed with sulfuric acid 0.5M at 100ºC in reflux, then two hours soaking stage of sulfuric acid 72%, and dilution to 0.5M concentration. Technical modification provided glucose molecule of 246.889 mole/Kg from cellulose content in raw material. Proposing method of cellulose valuation from plants is technical modification of the method for opening lignin and hydrolyzing hemicellulose and cellulose.

* Several abstracts are copied from the unrevised version of the associated paper and will be different with the published version after the copy-editing and typesetting following the standards of the publisher.

Abstract R3-02

Microfibrillated Cellulose from Agar Waste in Alginate-based Hydrogels for Papain Enzyme Immobilization

Novitri Hastuti [1,5], Luciasih Agustini [2], Safrina Dyah Hardiningtyas [3], Wahyu Ramadhan [3,4], Dian Anggraini Indrawan[1], Maya Ismayati [1], Aisiyah Tazkiatunnisa [4]

[1]*National Research and Innovation Agency, Research Center for Biomass and Bioproducts, Bogor, Jawa Barat, Indonesia*
[2]*National Research and Innovation Agency, Research Center for Applied Microbiology, Bogor, Jawa Barat, Indonesia*
[3]*Department of Aquatic Product Technology, Faculty of Fisheries and Marine Science, IPB University, Bogor, Jawa Barat, Indonesia*
[4]*Center for Coastal and Marine Resources Studies (PKSPL), IPB University, Bogor, Jawa Barat, Indonesia*

[5]Corresponding author: novi043@brin.go.id

Abstract. Cellulose from agar waste were extracted and disintegrated chemo-mechanically using sulfuric acid hydrolysis and sonicated to generate microfibrillated cellulose (MFC). This study aimed to characterize the properties of alginate-based hydrogels as papain enzyme immobilizer with the addition of MFC from agar waste. Bleached and neutralized aqueous MFC was added as much as 2 mL to the alginate-based hydrogel formulations with concentrations of 0.2, 0.5 and 1% (w/v). The hydrogels characteristics were analyzed including the gel fraction, swelling and enzyme release properties as papain enzyme immobilizers. The results showed a significant difference between hydrogels consisting of alginate only and hydrogels with the addition of MFC. The alginate-MFC hydrogels produced the best swelling ratio of 91.67. This treatment resulted the lowest enzyme release effectiveness at 12 % at 1 h and reached 97.12% at 24 h. Cellulose from the agar processing industries can improve the characteristics of the alginate hydrogels and control the release of enzymes. These results demonstrate the utilization of agar waste which once cleaned and the cellulose extracted, can be used for the enzyme carrier's scaffold which is very useful in bioprocess.

Keywords: Agar; cellulose; enzyme; hydrogel; microfibril

Abstract R3-03

Evaluation of an Alginate-Chitosan-Microcrystalline Cellulose Sulphate Macroencapsulation System for Efficient Fermentation of Lignocellulosic Hydrolyzate

Sri Peni Wijayanti[1, a)]

Author Affiliations
[1]*Research Center for Sustainable Production System and Life Cycle Assessment, National Research and Innovation Agency, Puspiptek Serpong, Indonesia*
.
Corresponding author
[a)]srip005@brin.go.id

Abstract. In recent years, ethanol production from lignocellulosic as raw materials has increased. Lignocellulosic materials are cheap renewable resources and are available in large amounts. Hydrolysis using sulphuric acid at high temperature and pressure is one of the fast and cheap methods for acquiring sugars from lignocellulose, while enzymatic hydrolysis usually takes a long time. On the other hand, acid hydrolysis also produces more inhibitors giving adverse effects on fermentation processes. The toxicity of inhibitory compounds derived from the cellulose, hemicellulose, and lignin fractions of the feedstock in lignocellulosic acid hydrolyzate would inhibit the activity of yeast *Saccharomyces cerevisiae* from converting sugars to ethanol. Some applications to prevent the cells from toxic acid hydrolyzates have been investigated. Immobilizing the cells into a polymer structure is one method that can produce high biomass of cells on the beads. A successful method to reduce the inhibitory effect is trapping the yeast cells in membrane capsules. During encapsulation, cells are confined in a semi-permeable, spherical and thin membrane. A newly synthesized sodium microcrystalline cellulose sulphate (NaMCS) was evaluated as a supporting compound for capsule cell *Saccharomyces cerevisiae* alginate-chitosan-microcrystalline cellulose sulphate for producing ethanol from lignocellulosic hydrolyzate.

Abstract R3-04

Isolation and Characterization of Lignin from Black Liquor of Arecanut Leaf Sheath (*Areca catechu L.*) with Hydrochloric Acid and Phosphoric Acid

Muhammad Rasyidur Ridho[1, 2, a)], Elvara Windra Madyaratri[1,2, b)], Erika Ayu Agustiany[1,2, c)], Nissa Nurfajrin Solihat[2, d)], Deded Sarip Nawawi[1, e)], Ika Juliana[3, g)] Widya Fatriasari[2, 4, f)],

[1]Department of Forest Products, Faculty of Forestry and Environment, IPB University, Bogor 16680, Indonesia
[2]Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Jl Raya Bogor KM 46 Cibinong 16911, Indonesia
[3]PT. Greenei Alam Indonesia, Jl. Letnan Sutopo No 1 Kota Tengerang Selatan Banten 15310, Indonesia
[4]Research Collaboration Center for Biomass-Based Nano Cosmetic, Collaboration between National Research and Innovation Agency (BRIN) and University of Mulawarman, East Kalimantan, 75119, Indonesia

Corresponding author: [f]*widy003@brin.go.id*
[a]*muhammadrasyidur@apps.ipb.ac.id*
[b]*elvaraelvara@apps.ipb.ac.id*
[c]*erika_agustiany@apps.ipb.ac.id*
[d]*nissa.nurfajrin.solihat@brin.go.id*
[e]*dsnawawi@apps.ipb.ac.id*
[g]*ikajulianna@gmail.com*

Abstract. Most of the Arecanut Leaf Sheath (ALS) was burned and disposed of as waste, in which lignin, including a major cell wall component of ALS, has potency as a green chemical. Up to now, there is a limited report on lignin extraction and isolation from ALS. Hence, this research used kraft pulping with different percentages of active alkaline (17 and 19%) and sulfidity (20%) as a delignification method for lignin extraction from ALS. And this study aimed to describe the effect of the variation of inorganic acids (HCl and H_3PO_4) in the lignin isolation process on lignin characterization. Furthermore, the characterization of isolated lignin entails moisture content, yield, purity, ash content, thermogravimetry analysis (TGA), Fourier transform infrared spectroscopy (FTIR), and PyGCMS. Interestingly, acid precipitation had a critical effect on lignin yield, where HCl obtained a higher yield (38-40%) than H_3PO_4 (14-15%). The result showed that less active alkali resulted in higher lignin purity by both acid precipitation, AIL of 19.11 and 15.69 % for each 17 and 19% active alkali (AA) by HCl precipitation and 40.74 and 30.62 % by H_3PO_4. Less AA also obtained less residue by TGA analysis and a lower s/g ratio by Py-GCMS. Nevertheless, the difference of acids (HCl or H_3PO_4) do not show any difference in terms of s/g ratio, but they impact the purity and thermal properties of produced lignin. FTIR spectrum showed that all isolated lignin has a similar functional group to commercial lignin.

Keywords: Arecanut leaf sheath, chemical characterization, inorganic acid precipitation, kraft pulping, lignin properties

Abstract R3-05

The Properties of Cellulose Nanofibrils Produced from Different Sources: Pineapple Leaves and Oil Palm Fronds

Devi Nurani[1], Riska Surya Ningrum[2], Putri Amanda[2], Deni Purnomo[2], Sukardi[1], Nanang Masruchin[2]

[1]Departement of Agroindustrial Technology, Brawijaya University, Jl. Veteran Malang 65145, Jawa Timur Indonesia
[2]Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Jalan Raya Bogor Km.46 Cibinong, Bogor Indonesia

Email: riska.surya.ningrum@brin.go id

Abstract. Both pineapple leaves and oil palm fronds contain high lignocellulose. In this study, the cellulose content of bleached pineapple leaf pulp is higher than the bleached oil palm fronds pulp, which is 64,68% and 59,11%. Cellulose can be transformed into nanocellulose, either cellulose nanocrystal (CNC) or cellulose nanofibrils (CNF). Cellulose nanofibrils of bleached pineapple leaves and oil palm fronds pulps were obtained by mechanical treatment using Masuko Sangyo ultrafine grinder and analyzed the properties of zeta potential, rheology, and morphology. According to the analysis in this study, CNF-P (CNF from pineapple leaves) has a white color of the suspension, low zeta potential (-52,6 mV), and high viscosity (131,68 mPa.s -1). While CNF-O (CNF from oil palm fronds) has a light brown suspension, the zeta potential of -41,6 mV, and 114,11 mPa.s -1 of the viscosity. Both CNF have an average fiber diameter of 50 nm and have a good stability emulsion. Keywords: cellulose nanofibrils, nanocellulose, oil palm fronds, pineapple leave.

Abstract R3-06

Chemical Properties of Coconut Lumber Sawdust Biochar Using X-Ray Fluorescence under Low Temperature Pyrolysis

Ali Rahmat[1,a)], Hidayat[1,b)], Kiki Kurniawan[1], Hari Hariadi[1], Latifa Nuraini[1], Aldiano Rahmadya[1], Hendra Prasetia[1], Muhammad Nurtanto[2], and Usep Suhendra[3]

[1]*National Research and Innovatioan Agency, Indonesia, Indonesia*
[2]*Sutlan Ageng Tirtayasa University, Indonesia*
[3]*Pakuan University, Indonesia*

Author Emails
a) alyrahmat@yahoo.com.
b) pavaja86@gmail.com

Abstract. One of the abundant wastes in the timber industry is coconut lumber sawdust. To control this problem Coconut lumber sawdust can be used as biochar which is useful for soil improvement. The purpose of this study was to determine the chemical properties of biochar derived from coconut lumber sawdust. Making biochar is done by burning the coconut lumber sawdust using a furnace with a temperature of 250°C and 350°C, then ground and sieved with a size of 355 micrometers carried out at the Limnology and Water Resources Research Center. Chemical property analysis using X-Ray Fluorescence Spectrometer (XRF) at the Chemical Research Center, BRIN. Based on the results of the analysis using XRF showed that the highest content in terms of nutrition of biochar is Calcium around 7-12%, then Potassium around 4-5%, Phosphor around 1-2%. However, the concentration of Fe is also high around 46-50%, and it can be toxic if applied to the soil. On another hand, Coconut lumber sawdust can be a source of silica due to the silica content being quite high 19-20%.

Abstract R3-07

Properties and Potencial Use For Paper Pulp of Four Less-known Hardwoods Originated from Natural Tropical Rainforest in South Sulawesi Province of Indonesia

Mody Lempang[1, a)], Gunawan Pasaribu[2, b)]

[1,2] *Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Indonesia.*

[a)]*mlempang18@gmail.com*
[b)]*gun_pa1000@yahoo.com*

Abstract. In general, all wood species can be use for paper pulp. But much better for wood with long fiber, low in Runkel ratio, moderate in specific gravity and high of cellulose content.This research was carried out to examine wood properties (specific gravity, fiber quality and cellulose content) of four less-known hardwoods from natural tropical rainforest in south Sulawesi province of Indonesia and assessed their potensial use for paper pulp. Those hardwood species comprised of cempedak (*Artocarpus integer* Merr.), jabon merah (*Anthocephalus macrophyllus* Hav.), saling-saling (*Artocarpus teysmanii* Miq.) and simpur (*Dillenia serrata* Thunb.). The specific gravity determined by the weight of ovendry wood and volume of airdry wood where the wood volume be measured by water immersion method, the fiber dimensions measured through maceration preparations which was made using the Franklin procedure, while TAPPI method used for chemical analysis. In condition to paper pulp raw material, the specific gravity categorized as moderate, while fiber quality classified as good (class II) and cellulose content categorized as moderate to high for all those less-known hardwoods. Thereby, all of four less-known hardwoods studied potentially use for paper pulp raw materials. But simpur is the most potential due to very long fiber and higher specific gravity.

Keyword: less-known hardwoods, specific gravity, fiber quality, cellulose, paper pulp

Abstract R3-08

Properties of Oil Palm (*Elaeis guineensis*) Wood Modified with Bio-Impregnant

Efrida Basri[1], Saefudin[1], Jamaludin Malik[1], Jamal Balfas[1], Jamaludin Malik[1], Adi Santoso[1], Karnita Yuniarti[1], and Wayan Darmawan[2,a]

[1]Research Center for Biomass and Bioproduct, BRIN, Cibinong Science Center - Botanical Garden, Jl. Raya Jakarta-Bogor No.KM. 46, Cibinong, Bogor Regency, West Java 16911
[2]Department of Forest Products, Faculty of Forestry and Environment, IPB University, Bogor 16680, Indonesia

[a]Corresponding author: wayandar@indo.net.id

Abstract. The research aimed to investigate the properties of oil palm wood from 25 and 32 years old that have been impregnated using a bio-impregnant made from the extract of oil palm bark. The sample for the analysis was taken from the outer part of the stem's base. The impregnant was uniformly distributed throughout the impregnated oil palm wood. The best results, in comparison to the control, were obtained for 32-year-old wood that had been vacuum-pressured, with the average value ranges for density was from 0.45 g/cm^3 to 0.65 g/cm^3; compression strength parallel to grain was from 79 kg/cm^2 to 231 kg/cm^2; compression strength perpendicular to grain wasfrom 75 kg/cm^2 to 148 kg/cm^2; moisture content after 12 months of storage was 10.3% (9.60 – 10.84 %). Drying property of control oil-palm wood (without impregnation) from both ages was very poor quality. Meanwhile, the properties of corresponding wood impregnated with vacuum-pressure method were classified as low to rather low and fair to quite good quality for 25 and 32 year age consecutively. Based on the wood drying properties test, the best drying schedule was observed for the 32 year old oil-palm wood impregnated with vacuum pressure, i.e. 50 to 75/80 ^{o}C temperature and 83 to 12% humidity.

Keywords: oil-palm bark extract, physical property, mechanical property, drying property, drying schedule

Abstract R1-03

The Soda Pulp Characteristic of Rice Straw and the Hydrophobicity Improvement by Water-soluble Chitosan Treatment

Muhammad Yusron[1], Azizatul Karimah[1,2], Muslimatul Rahmi DN[1,2], Mayang Aristika Jayanti[3], Bagaskoro Tuwalaid[3], Ady Ardana[3], Fahriya Puspita Sari[2], Widya Fatriasari[2,4,a)]

[1]Department of Forest Products, Faculty of Forestry and Environment, IPB University, Bogor 16680, Indonesia
[2]Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Jl Raya Bogor KM 46 Cibinong, Bogor 16911, Indonesia
[3]PT. Solusi Biru Indonesia, Rukan Sentra Niaga Blok A-9, Green Lake City, Duri Kosambi, Jakarta Barat – 11750, Indonesia
[4]Research Collaboration Center for Marine Biomaterials, Jl. Ir. Sukarno, KM 21, Jatinangor, Sumedang 45363, Indonesia

[a)]Corresponding author: widya.fatriasari@biomaterial.lipi.go.id

Abstract. The preparation of hydrophobic rice straw pulp soda has been carried out successfully. The rice straws have been pulped by atmospheric hot soda (AHSP) and soda (SP) pulping. To improve its hydrophobicity, the pulps were modified with water-soluble chitosan treatment at 1% and 2%. The screen pulp yield, kappa number, and delignification selectivity were analyzed to evaluate the properties of pulp, while hydrophobicity properties were evaluated by its water absorption capacity and contact angle. The FTIR was used to investigate the possibility of a new functional group formation after modification. The screen pulp yield of AHSP (29.22%) was relatively higher than SP (21.94%). However, SP pulp has a lower kappa number with higher delignification selectivity than AHSP pulp due to the more severe pulping condition of the SP pulping system. The delignification process in SP pulping is more selective than AHSP for dissolving lignin and produces a higher screen pulp yield. After pulp modification, the hydrophobicity of modified pulp increases in line with the increasing concentration of water-soluble chitosan. The AHSP pulp with a 2% water-chitosan treatment has the highest hydrophobicity indicated by the lowest water absorption capacity at 60 minutes i.e 41.99%. Therefore, AHSP and SP modified with a 2% water-soluble chitosan treatment have better hydrophobicity. This treatment attracted as a method to improve the hydrophobicity of pulp-based products.

Keywords: rice straw pulp, pulp-based product, soda pulping, water soluble-chitosan, hydrophobicity

Abstract R3-12

Short-Term *Meyerozyma caribbica* Y67 Adaptation in Sugarcane Trash Hemicellulosic Hydrolysate for Xylitol Production

Dwi Ajias Pramasari[1, a)], Maulida Oktaviani[2, b)], M. Zuvan Maulana Fahrezi[3, c)], Ahmad Thontowi [2, d)] and Euis Hermiati [1, e)]

[1]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN)*
[2]*Research Center for Applied Microbiology, National Research and Innovation Agency (BRIN)*
[3]*Faculty of Agricultural Technology, Universitas Brawijaya, Malang, Indonesia*

[a)] Corresponding author: dwi.ajias.pramasari@brin.go.id
[b)] maulida.oktaviania@brin.go.id
[c)] zuvanfahrezi18@gmail.com
[d)] ahmad.thontowi@brin.go.id
[e)] euis.hermiati@brin.go.id

Abstract. Xylitol is a common sugar replacement used throughout food and pharmaceutical applications as well as a component in a wide range of chemical products. Xylitol could be produced from lignocellulosic biomass through acid or enzymatic hydrolysis, continued by fermentation of the xylose rich hydrolysate using yeasts. In order to obtain better results during fermentation of acid hydrolysate, the yeast should have a good tolerance to acidic environment. For improving the tolerance of *Meyerozyma caribbica* Y67 to low pH conditions, we suggested a short-term adaptation technique in this work to enhance xylitol production on sugarcane trash hemicellulosic hydrolysate (STHH). The hydrolysate was prepared by dilute acid hydrolysis using 1.8% (v/v) maleic acid assisted by a microwave digester (1:10 solid/liquid ratio, 180 °C, 5 min, 195 rpm). Yeast was cultivated in YPX broth (pH 5.0) for 24-h to obtain inoculum cells and consecutively transferred to the subsequent YPX broth with variations in pH adjustment (4; 3.5; 3; 2.5) and each was adapted for 4 days. Adapted cells were used as inoculum in fermentations using STHH for 72-h at the same pH as that they were adapted to. The adapted yeast at pH 2.5 produced the highest xylitol concentration, (0.48 g/L) with a yield (Yp/s) of 0.05 g/g xylose in 72 h. Short-term adaptation of yeast cells in STHH was demonstrated to be an effective method for enhancing yeast tolerance to the low pH of the acid hydrolysate as well as its fermentative performance.

Keywords: acid hydrolysate, yeast cell adaptation, fermentation, xylan, xylitol

Abstract R3-13

Proximate and Structural Analysis of Activated Carbon with Different Structure from Oil Palm Biomass

Ester Rimma Suryani Togatorop[1], Ria Yolanda Arundina[1], Prabu Satria Sejati[2], Sukma Surya Kusumah[2], Resti Marlina[2a)]

[1]*Department of Agricultural Engineering, Faculty of Agricultural Technology, Brawijaya University, Malang, 65145, Indonesia*
[2]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Cibinong, 16911, Indonesia*

[a)]Corresponding author: resti.marlina@brin.go.id

Abstract. Biomass-based activated carbon (AC) has become a trend recently due to its low price, environmentally friendly, and abundant availability. This study used Oil Palm Empty Fruit Bunches (OPEFB), Oil Palm Shell (OPS) and OPS-char to prepare activated carbon using chemical and physical activation. The different structures of activated carbon from oil palm waste will be investigated through OPEFB and OPS while the differences of carbonization methods between hydrothermal and pyrolysis was performed on OPS and OPS-char. These materials were activated using solid KOH and $FeCl_2.H_2O$, followed by pyrolysis at 800^oC in N_2 atmosphere. Physical characterization was carried out by proximate analysis to determine the quality of activated carbon using ASTM standards. Meanwhile, the structural characterization was carried out using XRD, BET and FESEM methods to observe the structural morphology of each activated carbon. The results of the proximate analysis show good results that meet ASTM standards with low moisture, ash content, volatile matter and high fixed carbon values. In the methylene blue adsorption test, the highest value was found in AC OPEFB. XRD analysis showed that our samples have an amorphous structure while BET analysis presents our samples have high surface area namely, AC OPEFB (775.58 m^2/g), AC OPS (733.04 m^2/g), and AC OPS-char (594.093 m^2/g). The FESEM images show the formed AC pores depending on natural structure and type of carbonization method. In general, these material properties can potentially be applied to pore-based applications such as adsorbents in wastewater treatment or electrodes in energy storage.

Keywords: *Activated Carbon, Hydrothermal, Oil Palm Biomass, Proximate Analysis, Pyrolysis, Structural Analysis*

Abstract R3-14

GC-MS/FTIR Analysis of Coconut Shell Lignocellulose Conversion using Pyrolysis Method and as a Strong Antifungal Agent on Cocoa Seeds

Mashuni Mashuni[1,a], M Jahiding[2,b], La Ode Kadidae[1,c], Fitri Handayani Hamid[1,d], Nur Arfa Yanti[3,e]

[1]*Department of Chemistry, Faculty of Mathematics and Natural Science, Halu Oleo University, Southeast Sulawesi, Indonesia*
[2]*Department of Physics, Faculty of Mathematics and Natural Science, Halu Oleo University, Southeast Sulawesi, Indonesia*
[3]*Department of Biology, Faculty of Mathematics and Natural Science, Halu Oleo University, Southeast Sulawesi, Indonesia*

Correspondence author: mashuni@uho.ac.id
mjahiding@uho.ac.id
lkadidae@gmail.com
fitrihandayanihamid@gmail.com
nur.yanti@uho.ac.id

Abstract. Coconut shell (CS) is a plantation biomass waste containing lignocellulosic components, which can to converted into chemical materials through the pyrolysis method. The pyrolysis process produces bio-oil and biochar as green chemicals that can be applied as antifungals. This study aims to produce antifungal material using bio-oil and biochar to overcome fungal problems in cocoa seed preparation. The CS pyrolysis process at a temperature of 200-600°C was analyzed using GC-MS for bio-oil and FTIR for biochar. It tested the effectiveness of bio-oil and biochar as antifungal agents on cocoa seeds using the Total Plate Count (TPC) method. The GC-MS analysis of bio-oil obtain the main chemical compounds were phenol; 3-methyl-1,2-cyclopentanedione; 2-methoxy-phenol; 3,6-dimethyl-1,2,4,5-tetrazine; 3,4-dimethoxy-phenol and methoxy(4-methoxyphenyl)dimethylsilane. Meanwhile, the FTIR analysis of biochar showed the presence of functional groups were O-H, $-CH_3$, C≡C, C=C, C-C, and C-H. The effectiveness of 20% bio-oil concentration combined with biochar as antifungal on cocoa seeds during storage did not show any fungal colonies found on the 10^{th} day of observation. In contrast, on the 15^{th} day, the TPC was 5.5×10^2 CFU g^{-1}. After these results, CS biomass can be considered a potential source of material for antifungal and valuable chemical products in cocoa seed preparation.

Keywords: Antifungal, bio-oil, biochar, coconut shell, cocoa seed, pyrolysis.

Abstract R3-15

Antimicrobial Activity of Acacia Mangium Lignin in Food Packaging Biofilms

Faizatul Falah[1,3], Deni Zulfiana[1], M. Dhifas Kurniawan Septiano[2], Deded Sarip Nawawi[2], Fahriya Puspita Sari[1], Widya Fatriasari[1], Nissa Nurfajrin Solihat[1]

[1]Research Center for Biomass and Bioproducts – National Research and Innovation Agency, Cibinong, Indonesia
[2]Department of Forestry and Environment – IPB University, Bogor, Indonesia

[3]Corresponding author:fayzaa_falah@yahoo.com

Abstract. This research aims to utilize lignin from Acacia mangium pulp mill waste in the form of lignin biofilms and its activity as an antimicrobial agent in food packaging by combining it with starch and poly lactic acid (PLA) and forming it into biofilms for paper coating materials. This study showed that lignin isolates from black leachate of pulp mills had antimicrobial activities. Isolated lignin with ethanol-water as solvent showed optimum antibacterial activities at a concentration of 0.1 g/ml lignin with inhibition zones of 0.6 cm against E.coli, 0.7 cm against S.typhi, and 0.35 cm against S.aureus. The best antimicrobial activity of starch/lignin biofilm was obtained at a concentration of 1.5% lignin with an inhibition zone of 0.63 cm against S.typhi, and in starch/PLA//lignin biofilms was obtained at 2% lignin with an inhibition zone of 0.3 cm and 0.6 cm against E.coli and S.typhi.

Keywords: lignin, starch, biofilm, antimicrobial, active packaging

Abstract R3-16

The Effect of Lignin Containing Nanocellulose from Sugarcane Leaf on Agar Bioplastics as an Active Packaging

Wida B. Kusumaningrum[1, a)] Firda A.Syamani[1], Maya Ismayati[1] , Fazhar Akbar[1] , Bernadeta Ayu Widyaningrum[1] , Nurhayati[2] , and Venitalitya Alethea Sari Augustia[3]

[1]Research Center for Biomass and Bioproduct, National Research and Innovation Agency, Jl Raya Bogor Km 46 Cibinong, Bogor
[2]Research Center for Marine and Land Bioindustry, National Research and Innovation Agency, Telukode, Mataram
[3]Departmen of Chemical Engineering, Faculty of Industrial Technology, Islamic University of Indonesia, Jl Kaliurang Km 14, Yogyakarta

Author Emails
[a)]wida002@brin.go.id

Abstract. Plastics-based food packaging is increasingly used recently especially, for fresh products such as fruits and vegetables. Active packaging based on bioplastics which counter to water resistance, water vapor barrier, thermal stability, and UV protection to maintain the metabolomics process after harvest has been developed in this study. Lignin-containing nanocellulose (LCNF) which has a lignin content of about 4.12% and cellulose of about 69.65% used as an active agent for agar-based bioplastics. LCNF was produced using an ultrafine masuko grinder with the stone gap in -30, -50, -70, and -10 mm with 5 cycles for each gap. Some LCNF in about 2.5% up to 20% was blended in plasticized agar solution at 90℃ for about an hour then cast in 20 x 20 cm molding. The bioplastics were conditioned at room temperature for 24 h and then oven-dried at 50℃ for another 24 h. The bioplastics of agar-LCNF with a thickness of about 0.1 mm have been produced. The novel finding of this study is LCNF incorporated with residual silica dioxide of sugarcane leaf. The addition of LCNF up to 15 - 20% improves water uptake ratio by about 54%, water solubility by about 5%, and water vapor penetration rate by about 73.81% than plasticized agar. The agar-LCNF bioplastic remains transparent with less UV blocking ability. The mechanical properties especially elongation at break enhance about 22% more than plasticized agar. The thermal stability of agar-LCNF bioplastic improves by about 3.7% for Tonset and 5,1% for Tmax.

Keywords: active packaging, agar, bioplastic, lignin containing nanocellulose, sugarcane leaf

Abstract R3-17

Optimization of tannin isolation from bark of *Acacia mangium* and application in PLA-tannin based biofilm with antioxidant properties

Maya Ismayati[1, a)], Novitri Hastuti[1, b)], Widya Fatriasari[1, c)], Muhammad Adly Rahandi Lubis[1, d)] Lisman Suryanegara[1, e)], Fahriya Puspita Sari[1, f)] Dian Burhani[1, g)], Bunda Amalia[2, h)] Fidela Devina Agrippina[3, i)] Sri Hidayati[3, j)] and Yuki Tobimatsu[4, k)]

[1]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN)*
[2]*Center of Chemical and Packaging, Ministry of Industry, Jl. Balai Kimia I Pekayon, Pasar Rebo, Jakarta 13710, Indonesia*
[3]*Department of Forestry, University of Lampung, Lampung, 35141, Indonesia*
[4]*Research Institute for Sustainable Humanosphere, Kyoto University, Uji, Kyoto, 611-0011, Japan*

[a)] Corresponding author: maya.ismayati@brin.go.id
[b)] novi043@brin.go.id
[c)] widy003@brin.go.id
[d)] muha142@brin.go.id
[e)] lism001@brin.go.id
[f)] fahr007@brin.go.id
[g)] dian047@brin.go.id
[h)] bundy.amalia@gmail.com
[i)] fidel.devina.agrippina@gmail.com
[j)] sri.hidayati@gmail.com
[k)] ytobimatsu@rish.kyoto-u.ac.jp

Abstract. Recently, fossil-based packaging with non-environmentally friendly has begun to be reduced and substituted by active agents from nature. This study aims to synthesize the biofilm PLA-based with tannin form bark of A.mangium as an antioxidant agent. Some properties of biofilm were conducted such as antioxidant activity, tensile strength, and also FTIR analysis to determine the possible reactions that occur between tannin and PLA. Tannin was extracted from bark of A. mangium with hot water at temperature is 90oC as the optimal temperature and yielded tannin extracts about 26.58 %, respectively. An efficiently extrusion method was proposed to prepare a sustainable composite/biofilm based on poly lactic acid (PLA) and condensed tannin from *A. mangium.* The crude tannin extract of bark of A. mangium have apotency as antioxidant in food packaging application. The optimum condition of crude tannin extract was performed at temperature of 70oC with IC50 value is 14.07% and total phenolic content (GAE, mg.g) is 44.63%, respectively. The C-PLAT and E-PLAT biofilms were have decreased the free radical scavenging with value are 65.61% and 86.97%. Unfortunately, the mechanical properties of PLAT was stiff and further investigation need to improve by adding plasticizer. Further-more, this biofilm will be applied as food packaging which can extend the shelf life of commodi-ties through the reduction of free radicals through the DPPH test.

List of Abstracts-Parallel Session 2 – Biocomposite*

Abstract R5-01

Hardboard Quality of Mixed Sisal, Gelagah Grass and Empty Palm Oil Fruit Bunches

Dian Anggraini Indrawan[1, a)] Lisna Efiyanti[1], Novitri Hastuti[1], Ratih Damayanti[1], Gustan Pari[1], Ignasia Maria Sulastiningsih[1] and Adi Santoso[1]

[1]Research Center for Biomass and Bioproducts, Research Organization for Life Sciences and Environment, National Research and Innovation Agency, Jl. Raya Jakarta-Bogor Km. 46, Cibinong, Kab. Bogor 16911, Jawa Barat - Indonesia Republic of Indonesia

[a)]Corresponding author: dian076@brin.go.id

Abstract. Wood is the raw material that is most frequently utilized in pulp industry in Indonesia. Several substitute non-wood fiber sources, for instance sisal, gelagah grass, and empty palm oil fruit bunches (EPOFB), can be utilized as the primary component of hardboard. The pulping method applied was a semi-chemical open hot soda process using NaOH concentrations of 9.0% and 10.5%. Gelagah grass pulp, EPOFB and sisal were mixed with four variations of composition and then formed into hardboard with a target density of 1.00 gram/cm^3. The hardboard then tested for physical and strength (mechanical) properties including density, flexural strength (MOE), fracture modulus (MOR), moisture content, water absorption, thickness expansion, internal bond strength (IB), thermal conductivity, and heat resistance as well as XRD analysis. Based on the results study, the best fiber for hardboard was EPOFB, followed by gelagah grass, and lastly was sisal. Meanwhile, in the form of mixed fiber for hardboard, the order of the most prospective proportions was EPOFB (50%) + sisal (50%), gelagah grass (50%) + sisal (50%); sisal (100%); and finally gelagah grass (33.33%) + EPOFB (33.33%) + sisal (33.33%).

Keywords: hardboard, open hot soda process, gelagah grass, empty palm oil fruit bunches, sisal.

Abstract R5-02

Thermal Analysis and Solution of Green Cementitious Composites Model under Constant and Elevated Temperature-A Preliminary Study

Agung Sumarno [a)], Agus Mudo Prasetyo, Dany Perwita Sari, Maidina, and Luna Ngeljaratan

Research Center for Structural Strength Technology, National Research and Innovation Agency, BJ Habibie Science and Technology Center, Gedung 220, Setu, Tangerang Selatan 15314, Indonesia

[a)]agun025@brin.go.id

Abstract. A cementitious composite carefully designed and mixed using aggregates, cement and waste materials that forms a green concrete, providing potentials in saving the environment especially by reducing the carbon consumption in the construction industry. Reliable design of green cementitious composites thermal conductivity leads to significant energy saving in residential building especially when being used as exterior or interior walls. This preliminary study briefly describes a concept of mathematical modeling of green concrete heat transfer since an effective solution to the problem will not only improve the energy saving inside the residential but also increase the efficiency in heat-protection of the structures. The study is aimed at generating a mathematical model to simulate the thermal properties into a computational model in order to understand the model behavior under constant and elevated temperature considering steady-state and transient-state solutions. A two-dimensional thermal model is created first then the thermal properties such as thermal conductivity, mass density, and specific heats are assigned into the model. Seven variables to express the thermal conductivity of concrete are adopted in this study based on previous research. The analysis is then continued by specifying a heat source within two model geometries, i.e. a solid model and a model with cavity. The heat flux is also assigned to estimate the heat exchange between the boundaries. The model is then analyzed, the mathematical model is solved to generate the results of temperature, gradient, and heat rates as well as heat fluxes. This study enables the characterization of thermal transfer and distribution on a green concrete model to be used as approximations in predicting the trends related to thermal properties of a green cementitious composite.

Keywords: green cementitious composite, steady-state, transient-state, solid model, model with cavity, constant temperature, elevated temperature

Abstract R5-03

Surface Roughness and Mechanical Properties of Particleboard made from Alang-alang and Sorghum Stalks

Lilik Astari[1, a)] , Marcelino Andrean[2], Kurnia Wiji Prasetiyo[1], Firda Aulya Syamani[1], and Yusuf Sudo Hadi [2]

[1]*Research and Innovation Agency of Republic of Indonesia-BRIN, Jalan Raya Bogor KM.46 Cibinong Bogor-16911, Indonesia.*
[2]*Bogor Agricultural University, Dramaga-Bogor, Indonesia*

[a)] Corresponding author:lili015@brin.go.id

Abstract. Indonesia has numerous sources of lignocellulosic materials that can be applied to produce composite panels. The research was conducted to investigate several applied properties of experimental particleboard made from alang-alang and sorghum stalks, as a potential substitute for particleboard's raw material. Flexural strength includes modulus of rupture (MOR), and modulus of elasticity (MOE) was evaluated. Internal bond strength (IB) and thickness swelling (TS) were also observed in this research. In addition, surface roughness (Ra) and mean peak-to-valley (Rz) were applied to determine the quality of particleboard's surface roughness. One-layer particleboard were made with dimension 30 x 30 x 1 cm and targeted density 0.8 g/cm^3. The adhesive used in the research was urea-formaldehyde (UF) and phenol-formaldehyde 10% based on particle dry weight. Variable factors were the ratio of alang-alang and sorghum and the adhesive type. The result shows particleboards made from 100% sorghum using UF adhesive perform higher physical properties and the surface roughness average values. The combination of alang-alang and sorghum (25:75) using PF adhesive results in higher MOR and MOE.

Keywords: Particleboard, alang-alang, sorghum stalks, surface roughness

Abstract R5-04

Potential Benefits of Dipterocarps Resin as a Basic Utilization for Functional Usage

Deby Mipa Salam[1, a)], Aulia Nur Laksmita1, a), Deby Mipa Salam 1, b), Andrian Fernandes1, c) and Rizki Maharani 1, d)

Author Affiliations
[1]Research Center for Biomass and Bioproducts, Research Organization for Life Sciences and Environment, National Research and Innovation Agency, Jl. Raya Jakarta-Bogor Km 46, Cibinong, Bogor, West Java, Indonesia

Author Emails
a) Corresponding author: debymipasalam@gmail.com
b) aulia.laks@gmail.com
c) af.andrian.fernandes@gmail.com
d) rizma_annisa@yahoo.com

Abstract. Borneo's lowland tropical rain forest is dominated by dipterocarp species that produce exudate, namely resin. The resins produced from Dipterocarps species such as shorea laevis and vatica rassak have not been widely used, and their chemical content is unknown. This study aims to determine the phytochemical and chemical content of resins from S. laevis and V. rassak for further potential usages. Resins from S. laevis and V. rassak were obtained from injured trees in the Nature Tourism Area of Bukit Bangkirai, East Kalimantan. Tests were carried out in phytochemical testing (alkaloids, flavonoids, saponins, and tannins) and GC-MS testing (active compound). Phytochemical test showed that V.rassak resin contained moderate concentrations of alkaloids, flavonoids, and saponins, while, S. laevis resin was not contained alkaloids but it contained moderate concentrations of flavonoids and highest concentration of saponins. Tannins were not found in these two resins. Alkaloid contained in V. rassak is heavily used in medication as anti-inflammation, anti-bacteria, anti-tumor etc. Flavonoid compound that was found in V.rassak and S. laevis have phenol cluster that naturally functions as antioxidant. Meanwhile, saponin of both resins were presumed to be useful as an antifilarial medicine, antioxidant and to bond pollutant. GC MS analysis of both resins were predicted to be used as antimicrobial, antifungal, anti-parasitical, antibacterial, anticancer, anti-inflammatory agent, and also as a cure for asthma, antioxidant, and etc. The present study was thus expected to discover potential benefits that exist from chemical compounds contained in V.rassak and S.laevis resins for its advance functional usages.

Keyword: Dipterocarps, Shorea laevis, Vatica rassak, resin, phytochemicals, GC-MS

Abstract R5-05

Physical and Mechanical Properties Of Low-Density Coconut Fiberboard Using Polyol-Isocyanate Adhesive Binder For Insulation Material

Deni Purnomo[1], Firda A Syamani[2], Sasa S Munawar[2,b], Sudarmanto[2], Resti Marlina[2], Riska S Ningrum[2], Narto[2], Fazhar Akbar[2], Dede Hermawan[1]

[1]*Bogor University Agricultural Institute Jl. Raya Dramaga Campus IPB Dramaga Bogor, West Java 16680, Indonesia*
[2]*Research Center for Biomass Bioproduct, National Research and Innovation Agency Cibinong Science Center - Botanical Garden, Jl. Raya Jakarta-Bogor KM. 46, Bogor, West Java 16911, Indonesia*

[a)]Corresponding author:putra.purnama1@gmail.com
[b)]sasa001@brin.go.id

Abstract. Natural fibers are very abundant in Indonesia. Coconut fiber (*Cocos Nucifera*) is used as an insulation composite for wall fillers. In general insulation walls still use non-natural materials such as glass wool, polyurethane, fiberglass, polyimide foam, and so on. This research aim is to analyze the quality of the fiberboard's physical and mechanical properties. Physical tests were conducted on density, moisture content, water absorption, and thickness expansion. On the other hand, mechanical tests were compression, and bending tests (standardized using JIS A 5905-2003). The morphological analysis was carried out to determine visual characterization on the fiberboards using a 3D Keyence microscope. The test samples were produced with a size of 210 x 120 x 5 cm. Coconut fibers were mixed with polyurethane adhesive with variation density of 0.04; 0.06; 0.08; and 0.1 g/cm^3, then cold-pressed with a pressure of 5 kg/cm^2 for 2 hours, and then cut to a size of 30 x 30 cm. The results showed that higher fibreboard density improved the physical and mechanical properties of fiberboards. The fibreboard with a density of 0.1 g/cm^3 shows the best mechanical properties.

Keywords: Natural fiber, polyurethane, insulation, physical properties, mechanical properties.

Abstract R5-06

The Influence of Coupling Agent on Interfacial Shear Strength of *Sansevieria cylindrica* Fiber Epoxy Composite

Much. Rafi Fahlevi[1,b)], Heru Suryanto*[1,2,a)], RR. Poppy Puspitasari[1,c)], Jibril Maulana[1,d)] and Chrisrulita Sekaradi W[1,e)]

Author Affiliations
[1] Departement of Mechanical Engineering, Universitas Negeri Malang, Jl. Semarang 5, Malang 65145, Indonesia
[2]Center of Excellence for Cellulose Composite (CECCom), Departement of Mechanical Engineering, Universitas Negeri Malang, Jl. Semarang 5, Malang 65145, Indonesia

Author Emails
[a)]Corresponding author: Heru.suryanto.ft@um.ac.id
[b)] rafiifahlevi56@gmail.com
[c)] poppy@um.ac.id
[d)]jibrilm49@gmail.com
[e)] rulitawiguna1@gmail.com

Abstract. This study aims to determine the influence of silane coupling agent concen-tration on the interfacial shear strength in the fiber composite of the *Sansevieria cylindrica* fiber. The methods included fibers treatment using ethanol as a dissolving and silane coupling agent with concentrations of 2.5%, 5%, 7.5%, and 10%. The interfacial shear strength test was conducted through a single fiber pull-out test. Fiber morphology, crystallinity, and the functional group were observed using a scanning electron microscope and X-ray diffrac-tion (XRD), respectively. As a result, the morphology of *S. cylindrica* fibers became rougher and showed a rougher surface after a silane concentration of 7.5%, but with the proper concentration, some fiber surfaces provide a good interface. Analysis using X-ray diffraction (XRD) on *S. cylindrica* fibers without treatment showed a crystalline index of 66%. Increasing the concen-tration of silane by 10%, increasing the crystalline index by 75%. The inter-facial shear strength increases when the concentration of silane coupling agent increases, with the highest shear strength of 91.321 MPa at a silane concentration of 10%.

Keyword: Composite, coupling agent, *Sansevieria cylindrica* fiber, interfacial shear strength.

Abstract R5-07

Investigation of Fiber Loading on Physical-Mechanical Properties of Mercerized Sisal Fiber/Polyester Composites

Ismadi[12], Ariadne L Juwono[1] and Sasa Sofyan Munawar[3]

[1]Departement of Physics, F-MIPA, Universitas Indonesia, Depok, Indonesia
[2]Research Center for Biomass and Bioproducts-BRIN, Cibinong, Indonesia
[3]Research Center for Clean and Enviroment Technology-BRIN, Indonesia

[2]Corresponding author: isma011@brin.go.id.

Abstract. Natural fibers are increasingly being used as reinforcing materials in composite materials. Besides being cheap, abundant, and strong, natural fibers are also environmentally friendly because they can be reproduced safely and produce few greenhouse gases. However, the weak bond between the natural fiber surface and the matrix, especially the thermoset matrix, makes the strength of the natural fiber-reinforced composite not optimal. One way to increase the interfacial bond between natural fibers and the matrix is to give the natural fibers an alkaline treatment. The effects of sisal fiber content on the physical and mechanical properties of composites are the aim of the study. The sisal fiber was soaked in 5% NaOH solution for 2 hours, then rinsed with clean water until neutral and dried. Mercerized sisal fiber with a moisture content of $\pm$10% is used to make composites with an unsaturated polyester. The composition of the fiber volume fraction used is 0, 5, 10 and 15%. The compression molding method was used to make the composites. Furthermore, the composites are tested for their physical properties namely; density, water absorption, and thickness swelling. Tensile and flexural tests of composites were also carried out with reference to ASTM D 638 and D 790 standards. The tensile strength values of the untreated sisal fiber-reinforced composites with fiber volume fractions of 5, 10 and 15% were 18.6 MPa, 16.15 MPa, and 53.78 MPa and the tensile modulus values were 1.9 GPa, 1.92 GPa and 3.04 GPa. While the tensile strength values of sisal fiber reinforced composites with NaOH treatment with fiber volume fractions of 5, 10 and 15% were 40.94 MPa, 45.34 MPa, and 58.06 MPa and the tensile modulus values were 2.76 GPa, 2. 61 GPa and 3.31 GPa. With the increase in fiber volume fraction, the phenomenon of fiber pull out is further increased.

Keywords: alkali treatment, sisal fiber, composite, mechanical properties

Abstract R5-08

The Influence of Hydrothermal Carbonization Duration on Concrete Properties

Wafiq Faradilla Khasanah[1], Triastuti[2,a], Ade Oktaviani Irlan[1], Ananto Nugroho[2], Eko Widodo[3], Bernadeta Ayu Widyaningrum[2], Riska Surya Ningrum[2], Ismail Budiman[2], Subyakto[2]

[1]*Faculty of Civil Engineering and Planning, Universitas Trisakti*
[2]*Research Center for Biomassa and Bioproducts, National Research and Inovation Agency (BRIN)*
[3]*Departement of Physics, Faculty of Mathematics and Natural Sciences, Universitas Indonesia*

[a]Corresponding author : triastuti@brin.go.id

Abstrack. The process of hydrothermal carbonization, also known as HTC, is a thermochemical pretreatment method that involves the utilization of heated, pressurized water for the purpose of treating biomass and producing hydrochars. This study will evaluate the impact that the duration of time spent in the hydrothermal carbonization process and the chemical treatment of coconut fiber have on the qualities of concrete. Throughout the hydrothermal carbonization process, usually last from for 2, 3, and 4 hours, the temperature 160 ^{0}C is kept constant. In this particular investigation, two types of coconut fiber were utilized. There was coconut fiber that had not been treated at all as well as coconut fiber that had been treated. The characteristics of the concrete, including its slump, dry density compressive strength and splitting tensile strength, were analyzed. The diameter of the sample is 10 cm, and it is 20 cm from top to bottom. Compressive strength, slump, and splitting tensile strength were influenced and both the duration of HTC and the chemical treatment.

Abstract R5-09

Properties of Moulding Products from Sorghum Bagasse Combined with Alang-alang Leaves, Sengon Wood or Bamboo Using Citric acid-Sucrose

Subyakto[1, a)], Eko Widodo[1], Triyati[2], Naomi Dameria Lidya Andini Hutauruk[3], Rabiah Al Adawiyah[3] and Kenji Umemura[4]

[1]*Research Center for Biomass and Bioproducts-BRIN, Jl. Raya Bogor Km 46, Cibinong, Bogor, Indonesia*
[2]*Politeknik STMI Jakarta, Jl. Letjen Suprapto 26, Cempaka Putih, Jakarta, Indonesia*
[3]*Fakultas Teknologi Pertanian, Universitas Brawijaya, Jl. Veteran, Malang, Indonesia*
[4]*Research Institute for Sustainable Humanosphere, Kyoto University, Gokasho-Uji, Kyoto, Japan*

[a)]Corresponding author: suby001@brin.go.id

Abstract. Moulding products commonly made from wood and synthetic adhesives. Wood is becoming scarce and expensive, while synthetic adhesive is not renewable and toxic. Therefore utilization of substitute raw materials and natural adhesives was important. In this work, moulding properties made from sorghum (*Sorghum bicolor*) bagasse combined with alang-alang (*Imperata cylindrica*) leaves, sengon wood (*Paraserianthes falcataria*) or bamboo (*Dendrocalamus asper*) using citric acid-sucrose were investigated. Ratios of sorghum bagasse to alang-alang leaves or sengon wood or bamboo were 100:0, 75:25, 50:50, 25:75 and 0:100. Citric acid and sucrose (50/50 w/w) as adhesive was used at 20 weight percent of the total moulding weight. The dumbbell-shaped moulding was prepared using a hot press machine at temperature of 180, 200^{o}C, pressure of 4 MPa for 10 minutes. The target board density was set at 1 g/cm^3. Bending strength and dimensional changes due to cyclic test were determined. Results showed that with increasing ratio of alang-alang leaves or sengon wood or bamboo decreased the bending properties but increased the dimensional changes. Pressing temperature of 200^{o}C produce better molding properties compare to 180^{o}C.

Abstract R5-10

Utilization of Expired Urea-Formaldehyde with the Addition of Wood Vinegar for Plywood and Particleboard Manufacturing

Erlina Nurul Aini[1,a)], Deazy Rachmi Trisatya[1,b)], Adi Santoso[1,2c)], and Greitta Kusuma Dewi[3, d)]

Author Affiliations
[1]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Cibinong 16911, Indonesia*
[2]*Cilegon College of Analytical Chemistry, Cilegon 42411, Indonesia*
[3]*Faculty of Forestry, Gadjah Mada University, Bulaksumur 55281, Indonesia*

Author Emails
[a)] Corresponding author: erlina.nurul.aini@brin.go.id
[b)]drtrisatya@gmail.com
[c)]profadisantoso@gmail.com
[d)]greitta.k.d@ugm.ac.id

Abstract. Expired glue is one of the wastes generated from the adhesive and wood processing industries. Non-optimal management of expired glue can cause financial loss and environmental danger. This research tries to utilize the expired urea-formaldehyde (UF) glue with the addition of wood vinegar in compositions of 0%, 10%, 20%, and 30% for producing composite products, i.e., for acacia plywood and rubberwood particleboard. The addition of wood vinegar decreases solid content and adhesive acidity. Meanwhile, adding wood vinegar tends to increase both composite products' properties. The best properties of plywood and particleboard are obtained at 30% wood vinegar composition. Acacia plywood bonded with expired UF-30% wood vinegar has a dry shear strength of 16.48 kg/cm², wet shear strength of 14.89 kg/cm², and formaldehyde emission of 0.49 mg/L. Rubberwood particleboard bonded with expired UF-30% wood vinegar has an internal bond strength of 3.65 kg/cm², modulus of rupture of 187.28 kg/cm², modulus of elasticity of 25149.2 kg/cm², screw-holding strength of 61.60 kg, and formaldehyde emission of 3.12 mg/L. The properties of all plywood and particleboard produced in this research can meet the SNI requirements.

Keywords: expired, plywood, recycled particleboard, urea-formaldehyde, wood vinegar.

Abstract R5-13

Mechanical and Biodegradable Properties of Oil Palm Empty Fruit Bunch (OPEFB) Fiber Reinforced Banana Peel Starch/Polyvinyl Alcohol Hybrid Biocomposites for Packaging Application

Harmiansyah[1], Jabosar Ronggur H. Panjaitan[2], Annisa Pratama Putri[1], and Melbi Mahardika[3,4 a)]

[1]*Department of Biosystems Engineering, Sumatera Institute of Technology, South Lampung 35365, Indonesia*
[2]*Department of Chemical Engineering, Sumatera Institute of Technology, South Lampung 35365, Indonesia*
[3]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Cibinong 16911, Indonesia*
[4]*Research Collaboration Center for Nanocellulose, BRIN - UNAND, Padang, 25163, Indonesia*

[a)]Corresponding author: melbi.mahardika@brin.go.id

Abstract. Sintetic plastic is difficult to disintegrate in a short period and making it an environmental issue. The alternative solution is to produce bioplastics based on banana peel starch using polyvinyl alcohol as a matrix and cellulose fiber from oil palm empty fruit bunches (OPEFB) as reinforcement. This study aims to analyze the rate of biodegradation and mechanical properties of bioplastics based on banana peel starch and PVA with the addition of OPFB fiber reinforcement with cellulose fiber variations of 0%, 2%, 4%, 6%, and 8%. Based on the study's results, the percentage of degradation with the fastest treatment was without the addition of cellulose fiber variations, with an average weight loss percentage of 31.2% on day 3, 36.3% on day 6, and 44.9% on day 9. In testing the mechanical properties, the highest tensile strength was the addition of 8% cellulose fiber with a tensile strength of 3.6 MPa, a strain at break of 22%, and a modulus of elasticity with a percentage value of 16.1 MPa. This result informs that the OPEFB fiber-reinforced banana peel starch/polyvinyl alcohol hybrid biocomposites could have the potential for food packaging materials.

Keywords: Banana peel starch/polyvinyl alcohol, biodegradable, biocomposites, mechanical.

Abstract R5-14

Preparation and Characterization of Porous Carbon-based Oil Palm Empty Fruit Bunch as A Candidate Material for An Electromagnetic Waves Absorber Application

Nidya Chitraningrum[1, a)], Resti Marlina[1, b)], Sutistyaningsih[2, c)], Hana Arisesa[2, d)], Ismail Budiman[1, e)], Pamungkas Daud[2, e)], Ardita Septiani[3, f)], Ria Yolanda Arundina[4, g)], Ester Rimma Suryani Togatorop[4,h)]

Author Affiliations
[1]Research Center for Biomass and Bioproduct, National Research and Innovation Agency, BRIN, Bogor 16911 Indonesia;
[2]Research Center for Telecommunication, National Research and Innovation Agency, BRIN, Bandung 40135 Indonesia
Research Center for Advanced Materials, National Research and Innovation Agency, BRIN, Bandung 40135 Indonesia
[3] Department of Agricultural Engineering, Brawijaya University, Malang, Indonesia

Author Emails
[a)]Corresponding author: nidya.chitraningrum@gmail.com
[b)]resti.marlina@brin.go.id
[c)]suli011@brin.go.id
[d)]arisesa.hana@gmail.com
[e)]ismail.budiman@brin.go,id
[f)]pmkdaud@gmail.com
[g)]ardita.septiani@brin.go.id
[h))]riayolanda@student.ub.ac.id

Abstract. An absorber with lightweight, low-cost, high absorption and broad frequency bandwidth are highly expected for a design of an electromagnetic wave absorber application. In this paper, the carbon materials based agricultural waste from oil palm empty fruit bunch (OPEFB) were studied to investigate the electromagnetic wave, especially the microwave absorption properties within the range from 8 to 12 GHz (X-band). The carbon-based OPEFB is prepared by hydrothermal carbonization (at 180 ^{o}C for 8 hours) followed by chemical (using KOH activating agent) and physical (at 800 ^{o}C for 2 hours) of carbonization processes. We studied the microwave absorption properties of the porous carbon-based OPEFB with 20 % of KOH concentration. The microwave absorption properties are taken by a vector network analyzer (VNA) within the X-band frequency range. The results indicate the ability to absorb electromagnetic waves in all X-band frequencies for porous activated carbon-based OPEFB samples. The reflection loss is reach -32.21 dB at 10.64 GHz. This research show that the porous carbon-based OPEFB can be a promising candidate for a lightweight, green, and renewable of electromagnetic waves absorber in the future.

Keywords: EM waves absorber, microwave absorption, activated carbon OPEFB, reflection loss

Abstract R5-15

Activated Charcoal from Robusta Coffee Waste as Adsorbent of Pollutants: Adsorption Kinetics of $FeCl_3$ (Iron (III) Chloride)

Nadya Basa Paulina[1], Yessie Widya Sari[1], Ismail Budiman[2,*]

[1]*Departement of Physics, Faculty of Mathematics and Natural Sciences, IPB University*
[2]*Research Center for Biomass and Bioproducts, National Research and Innovation – BRIN*

*Corresponding author: ismail.budiman@brin.go.id

Abstract. Activated charcoal is one of the materials that serve to adsorb heavy metals. This research was conducted to know the effect of silica mass and physical activation of activated charcoal from robusta coffee waste material on physical properties and to determine activated charcoal's adsorption on Iron (Fe) solution. The methods used were drying the material, mixing the material and silica, carbonization, physical activation, and removing silica after activated charcoal activation. Several tests on activated charcoal were carried out, including the characteristics of charcoal based on the Indonesian National Standard (SNI SNI 06-0730-1995), FTIR, SEM, and BET. The treatment of activated charcoal without silica and within silica produced a different quality of activated charcoal and adsorption on ion Fe metal. Activated charcoal without silica produces good adsorption values, but some results have not met the standard. Activated charcoal with silica, producing activated charcoal with good quality according to the standard, but the adsorption value was not too high.

Keywords: activated charcoal, iron, robusta coffee, silica.

Abstract R5-16

Structural Properties and Adsorption Capability of Activated Carbon from Oil Palm Shell by Using Hydrothermal-Pyrolysis Method

Ria Yolanda Arundina[1], Ester Rimma Suryani Togatorop[1], Sandra Malin Sutan[1], and Resti Marlina[2, a)]

[1]*Department of Bioprocess Engineering, Brawijaya University, Malang, Indonesia*
[2]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Cibinong, Indonesia*

[a)]Corresponding author: resti.marlina@brin.go.id

Abstract. Biomass-derived activated carbon has attracted much attention in replacing fossil-based carbon precursors due to the environmental issues**.** In this research, Oil palm shell (OPS), one of the byproducts in oil palm industry, was used as a raw material due to high lignin content to produce high yield activated carbon (AC). Hydrothermal and pyrolysis method was conducted at 220ºC for 8 hours and at 800ºC for 1 hour, respectively, by varying the activator agents. The characterization was carried out to determine the difference between variations of activated carbon by using H_3PO_4 and $ZnCl_2$ activators. The structural properties were characterized by Raman spectroscopy, X-Ray Diffraction, and N_2 Adsorption-Desorption measurement. The structural results indicate that our material has amorphous structure with the dominance of microstructure pores while the highest surface area owned by AC with H_3PO_4 activator with the value of 859.52 m^2/g. The adsorption capability of AC was tested over the methylene blue adsorption which is shows that our materials have approached with SNI standard for technical activated carbon. In addition, rhodamine b test was performed to investigate the adsorption ability of activated carbon. In general, this material can potentially be used for adsorbents to purify liquids in many applications especially in reduced color in wastewater treatments.

Abstract R5-17

Ni-impregnated activated carbon properties from mixed wood waste and its application for hydrocracking reaction of C. manghas

L. Efiyanti[a)], D.A. Indrawan, N. Hastuti, H. Wibisono, S. Wibowo, N.A. Saputra, S. Darmawan, G. Pari

Research Center for Biomass and Bioproducts, Research Organization for Life Sciences and Environment, National Research and Innovation Agency, Jl. Raya Jakarta-Bogor Km. 46, Cibinong, Kab. Bogor 16911, Jawa Barat - Indonesia Republic of Indonesia

Author Emails
[a)]Corresponding author: lisn002@brin.go.id, lisnaefiyanti@gmail.com

Abstract. Wood waste can be converted into valuable other materials/bioproducts. Lignocellulosic waste such as wood is essential in functional activated biocarbon raw material. This study aimed to determine the potential of wood waste as raw material for activated biocarbon containing Ni metal as a catalyst. The results showed that the catalyst yield ranged from 91.20% of activated biocarbon. The moisture, ash, volatile matter, and fixed carbon content were 6.56%, 7.33%, 30.67%, and 62%. The adsorption capacity of the Ni-impregnated biocarbon for iodine, pyridine, and ammonia was 714.41 m^2/gram, 2.8051 mmol/gram, and 8.8752 mmol/gram, respectively. The functional groups on the catalyst's surface consisted of OH, C-H, C-O, and C-C with an irregular and porous surface morphology. The crystallinity and surface area of the Ni-impregnated biocarbon was 52.33% and 870, 662 m^2/g, respectively. The hydrocracking reaction was conducted to obtain the liquid product with several group compounds. The product contained alcohol, ketones, ester, carboxylic acid, and aliphatic hydrocarbon. The main desirable compound achieved in this research was the aliphatic hydrocarbon compound of 42% which mainly contained dodecane (27.58%).

List of Abstracts-Parallel Session 3 – Wood Industry and Forest *

Abstract R6-01

Usage Comparison between Reverse Conventional and Ladder-Typed Undercuts in Natural Forests at Two Logging Companies in Central Kalimantan, Indonesia

Dulsalam[1,a)], Soenarno[1,b)], Sona Suhartana[1,c)], Yuniawati[1,d)], Sarah Andini[1,e)] and Mutia Herni Ningrum[1,f)]

Author Affiliations
[1]*Center for Biomass and Bioproduct Research, National Research and Innovation Agency, Jl. Raya Jakarta-Bogor Km. 46 Cibinong, Kabupaten Bogor, Jawa Barat 16911*

Author Emails
[a)]Corresponding author: dul.salam@gmail.com
[b)]soen002@brin.go.id.
[c)]sona001@brin.go.id
[d)]yunia_las@yahoo.co.id
[e)]sarahandini8@yahoo.com
[f)]mutiahernin@gmail.com

Abstract. Tree felling techniques are essential to ensure felling performance during forest harvesting activities. We investigated the tree felling techniques of two undercut styles in two Central Kalimantan logging companies in 2013. Reverse conventional and ladder-typed undercuts were applied in this research. The data and information on their productivity, efficiency, and residual stand damage were collected. A t-test was performed to analyze the difference between treatments. The investigation results in both logging companies of PT Barito Putera and PT Dasa Intiga revealed that: 1) the felling productivity with reverse conventional undercut was significantly higher than the ladder-typed undercut ($p = 0.0219$); 2) the felling efficiency with reverse conventional undercut was not significantly higher than with ladder-typed undercuts ($p = 0.2174$); 3) the residual stand damages caused by felling with reverse conventional undercut was not significantly lower than with a ladder-typed undercut ($p = 0.7609$); and 4) the felling productivity with reverse conventional undercut type was lower than with conventional undercut type. Therefore, the conventional undercut type is still suggested to be applied at felling activity in the field.

Keywords: Felling, undercut, productivity, efficiency, residual stand damage

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Abstract R6-02

Effect of Planting Distance from the Beach on Red Mangrove Plants (*Rhizophora apiculata*) on the Coastal Coast of Pulau Sembilan Village, Pangkalan Susu, Langkat Regency

Yunasfi [1*], E T H Ginting[1] and A Dalimunthe[1]

Faculty of Forestry, University of North Sumatra, Medan, Indonesia

*Email: Yunasfijamhar@yahoo.co.id

Abstract. This study aims to determine the effect of growth on the red mangrove plant *Rhizophora apiculata* from the coastal distance to the north wind direction in Pulau Sembilan village. The study was carried out from October 2020 to December 2020. This study used a completely randomized design (CRD) with distance treatment consisting of treatment 1 (planting distance from the beach 43 m), treatment 2 (planting distance from the beach 44 m), treatment 3 (planting distance from the beach 45 m), treatment 4 (planting distance from the beach 46 m), treatment 5 (planting distance from the beach 47 m). The results of the study of plant spacing on *R. apiculata* mangrove seedlings for 12 week show that no there is influen cereal which significant. The percentage of plant growth was obtained at 100%. Based on the results, the study showed that the most optimal spacing was at P5 treatment (47 m spacing) where the average seedling height was 37.9 cm/12 weeks, the average diameter was 3.5 m m/12 weeks. Results anova test shows the value of sig. > 0.05 so it was concluded that the spacing of *R. apiculata* seedlings had no significant effect on the parameters of plant height, stem diameter, number of leaves, wet weight (leaves, stems, roots), dry weight (leaves, stems, roots), leaf area and leaf area index.

Keywords : Distance, mangrove, Pulau Sembilan, *Rhizophora apiculata*

Abstract R6-03

THE EFFECT OF PLANTING DISTANCE FROM THE BEACH ON MANGROVE PLANT (*Rhizophora apiculata*) ON THE COASTAL COAST, VILLAGE ISLAND SEMBILAN, PANGKALAN SUSU DISTRICT, LANGKAT REGENCY

Yunasfi[1*], R M Gulo[1]and Desrita[2]

[1]Faculty of Forestry, University of North Sumatra, Medan, Indonesia
[2] Faculty of Agriculture, Universitas Sumatera Utara, Medan, Indonesia

*E-mail: yunasfijamhar@yahoo.co.id

Abstract: Mangroves are a unique ecosystem in coastal areas and are influenced by tides. This study aims to study and determine the effect of plant spacing that is useful for increasing growth for the mangrove ecosystem of *R. apiculata*.This research was conducted from December 2020 to February 2021 on the coast of Pulau Sembilan, Pangkalan Susu District, Langkat Regency, North Sumatra. This study used a completely randomized design (CRD) with distance treatment (J) consisting of (a) A1 (planting distance from the beach 37 m), (b) A2 (planting distance from the beach 38 m), (c) A3 (planting distance from the beach 39 m), (d) A4 (distance from the beach 40 m) (e) A5 (planting distance from the beach from the beach 41 m). The percentage of plant growth is 100%. Observational data on measurements of height, diameter, number of leaves, and leaf area, showed that the treatment at the spacing of the plants could increase the growth of *R. apiculata* seedlings. Based on the results of the study, the most ideal spacing for use in the process of planting or rehabilitating mangroves on *R. apiculata* seedlings was in treatment A1 (planting distance from the beach 37 m).

Keywords : Distance, mangrove, Pulau Sembilan, *Rhizophora apiculata*

Abstract R6-04

MACHINING PROPERTIES OF NYERAKAT AND RESAK WOODS ORIGINATED FROM WEST KALIMANTAN

Achmad Supriadi

Research Center for Biomass and Bioproducts, National Research and Innovation Agency

Abstract. This paper describes research results about machining properties of nyerakat (*Hopea cenua* Teijsen & Binn.) and resak (*Vatica spp*.) woods, originated from West Kalimantan. Testing of wood-machining properties referred to the modified standard of ASTM D-1666-64. The machining properties as examined/observed covered those of planing, shaping, boring, turning, and sanding. Number of main samples for each species were 20 defect-free boards. For any species, meanwhile, number of testing samples for each of the machining properties and each of their moisture contents were 20 wood specimens. Observations on those qualities were performed visually using loupes, capable of 10-time magnification. Results revealed that nyerakat woods afforded very good machining qualities associated with boring, turning, and sanding actions were very good (hence categorized as class I); meanwhile, with respect to planing and shaping, the machining qualities were good (regarded as class II). For resak woods, the machining qualities with respect to shaping, boring, and sanding were judged as very good (as class I); while the qualities related with planing and turning belonged to consecutively good and very-good-to-good category (as classes II and I-II, respectively). Those two wood species were recommendable to be processed into varying wood-working products with machining qualities, e.g. indicatively good until very good.

Keywords: machining properties, nyerakat wood, resak wood, wood-working products

Abstract R6-05

Deformation Pattern of Compressed Wood Cell Walls in Radial Direction and Its Effect on Modulus of Rupture Values in Different Loading Directions

Wahyu Dwianto [1, a)], Sarah Augustina [2, b)], Sudarmanto [1, c)], Narto [1, d)], Yusup Amin [1, e)], Teguh Darmawan [1, f)], Danang S. Adi [1, g)], Adik Bahanawan [1, h)], Prabu S. Sejati [1, i)], Dimas Triwibowo [1, j)], Imran A. Sofianto [1, k)], Sari D. Marbun [2, l)]

Author Affiliations
[1]Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Jl. Raya Bogor Km. 46, Cibinong, Bogor 16911, Indonesia
[2]Post-doctoral at Research Center for Biomass and Bioproducts, BRIN, Jl. Raya Bogor Km. 46, Cibinong, Bogor 16911, Indonesia.

Author Emails
[a)] Corresponding author: wahyudwianto@brin.go.id
[b)] sarahaugustina@gmail.com
[c)] sudarmantokm@gmail.com
[d)] nart001@brin.go.id
[e)] yusu007@brin.go.id
[f)] teguh.darmawan@biomaterial.lipi.go.id
[g)] danang.sudarwoko.adi@brin.go.id
[h)] adikbahanawan@gmail.com
[i)] prab004@brin.go.id
[j)] dima018@brin.go.id
[k)] imra003@brin.go.id
[l)] sari.delvianamarbun@gmail.com

Abstract. This study aimed to determine the deformation pattern of wood cell walls, and the effect of loading directions on modulus of rupture (MOR) values of radially compressed wood in drying set condition. Hinoki (*Chamaecyparis obtusa* Endl.) wood with a specific gravity of 0.44 was used to determine the deformation pattern due to it has a clear boundary between early and latewood. The deformation levels were observed at strain levels of 0.1, 0.2, and 0.3. Microscopic observations of wood cell walls were carried out using a Laser Scanning Microscope (LSM) at a scale of 200 µm. The wood samples used for bending tests were Agathis (*Agathis* sp.) and Rubber wood (*Hevea brasiliensis*) with specific gravity of 0.45 and 0.70, respectively. The wood samples were compressed in the radial direction at 0.35 strain level or 35%, after softening by using a hot press at 100°C for 4 hours until it reached drying set condition without being damaged. The results showed that the deformation of wood cell walls at a strain level of 0.1 started from the surface and the earlywood which has thin cell walls. At strain levels of 0.2 and 0.3, the number of deformed cell walls at the surface and below the latewood increased, and only the latewood cell walls remain unchanged. MOR values of uncompressed wood in radial loading direction were almost the same as that in tangential loading direction. However, the MOR values of radially compressed wood in tangential loading direction were higher than that in radial loading direction. Compression in radial direction collapsed the wood cell walls from their initial shapes to almost flats and arranged structure tangentially. Therefore, the MOR values of radially compression wood increased when it was loaded parallel to its tangential direction.

Abstract R6-06

Physicochemical Characteristics of Honey Based on Species of Bees at Kapok (Ceiba petandra (L.) Gaertn) Plantation in Pati Regency

Nurul Wahyuni1,a), Yelin Adalina1,a), Rosita Dewi2,b)

[1]Research Center for Biomass and Bioproducts- National Research and Innovation Agency (BRIN), Jl. Raya Jakarta-Bogor Km.46, Cibinong 16911, Jawa Barat, Indonesia
[2]Research Center for Ecology and Ethnobiology, National Research and Innovation Agency, Gedung B.J.Habibie, Jl. M.H. Thamrin No. 8, Jakarta-Indonesia

Corresponding author: a) nunik.colin@gmail.com; a) yeli001@brin.go.id

Abstract. Types of bees that are widely cultivated by the community in Pati Regency include Apis mellifera, Apis cerana, and Trigona laeviceps bees. Randu (Ceiba petandra (L.) Gaertn) is a source of nectar and pollen for honey bees with a flowering period of two to three months. This study aims to determine the physical and chemical characteristics of honey from the nectar of the kapok tree (C.petandra) produced by three types of bees (A.mellifera, A.cerana, and T.laeviceps). Samples of randu honey were taken by purposive sampling from beekeepers in Telogowungu District, Pati Regency. Variables observed consisted of water content, color, pH, hydroxymethylfurfural (HMF), acidity, and reducing sugar content of honey. To determine the presence of a group of secondary metabolites, phytochemical tests were carried out. Data analysis is presented descriptively and tabulated. The results of the analysis showed that all samples of honey from the three bee species had water content above the required SNI (Indonesian National Standard) 8664-2018, while the levels of reducing sugar, sucrose, HMF, and acidity complied with SNI 2018. Honey from the bee species T.laeviceps and A.mellifera contained saponins as active substances, while A.cerana contained flavonoids and saponins. Different types of bees have different physicochemical characteristics of honey and types of secondary metabolites.

Keyword: Honey, randu plants, A.cerana bees, A.mellifera, T.laeviceps, Pati Regency

Abstract R6-07

Beautifully of transparent biomass composites (TBC) : simple fabrication methods and visualization under various lightening (part 1)

Adik Bahanawan[1,a)], Fauzi Febrianto[2], Nanang Masruchin[1], Wahyu Dwianto[1]

Author Affiliation
[1]Research Center for Biomass & Bioproduct
National Research and Innovation Agency, Cibinong, Bogor, West Java, Indonesia
[2]Forest Product Technology, Forestry
IPB University, Dramaga, Bogor, West Java, Indonesia

Author Email
[a)]Corresponding author : adikbahanawan@gmail.com

Abstract. Wood and bamboo are prospective raw materials for development of advanced materials such as transparent material with optical optimization. This study aims to determine the fabrication method and performance of Transparent Biomass Composite (TBC). Sungkai wood (*Peronema canescens* Jack.) and Ampel Kuning bamboo (*Bambusa vulgaris* Schrader ex Wendland (Var. Sriata) were used. NaOH, KOH, H_2O_2, etanol & aceton were used in partial delignification process and polymer impregnation using epoxy resin. Results showed differences visualization of TBC. Average *E** values for transparent Sungkai were 77.81 (CIELab) and 115.28 (CIELch). Average *E** values for transparent Ampel Kuning were 76.14 (CIELab) and 105.66 (CIELch). Average *E** values for transparent cornhusks were 81.74 (CIELab) and 121.93 (CIELch). TBC have beautiful visualization, unique and capable penetrating light explains that resulting product with wider range of advanced applications by optimizing their characteristics such as transparent glass, transparent screens and photovoltaic devices in solar cells based on renewable materials.

Keywords: wood, bamboo, transparent, translucent, color

Abstract R6-08

Forensic Investigation on Various Wood Products through Identification of Wood Species and Its Destroying Organisms

Listya Mustika Dewi[1, a)], Andianto[2], Ratih Damayanti[1], Djarwanto[1, b)], Dyah Ayu Agustiningrum, Gunawan Hadi Rahmanto[1], Rohmah Pari[1], Imran Arra'd Sofianto[1]

[1]*Research Center for Biomass and Bioproducts, Research Organization for Life Sciences and Environment, National Research and Innovation Agency (BRIN)*
[2]*Research Center Research Center for Biosystematic and Evolution, Research Organization for Life Sciences and Environment, National Research and Innovation Agency (BRIN)*

[a)]Corresponding author: listya.mustika.dewi@brin.go.id
[b)]djar003@brin.go.id

Abstract. Forensic investigations into wood products are frequently required to support law enforcement of the timber trade. In this paper, we elaborate on some cases of a forensic investigation into various forms of wood products, such as plywood and decayed wood products. The unsatisfactory form of wood samples and heavily damaged wood have become a challenging effort to identify wood species. We used various sectioning techniques to reveal as many wood characteristics as possible to identify wood species. Wood samples were collected from the damaged components of investigated buildings and exported plywood to identify the wood species. Wood identification was undertaken based on the standards listed by the International Association of Wood Anatomists (IAWA). For decayed wood samples, we investigated the wood decay organisms by using the Bavendamm test and observing the footprint attacks. The result showed a variety of wood species such as *Quercus* sp. and *Cassia* sp. for decayed building components; *Shorea* spp., *Anthocephalus* sp., *Maranthes* sp., *Durio* sp., and *Ficus rubinensis* for plywood products. The identified wood decay organisms are subterranean termites (*Coptotermes* sp.), white-rot fungi (*Trametes* sp., *Pycnoporus* sp.), brown-rot fungi (*Dacryopinax* sp.) and soft-rot fungi. The investigation results have been used by related parties as scientific evidence for law enforcement.

Keywords: wood identification, forensic, wood species, wood decay organisms, timber trade

Abstract R6-09

Shoreoxylon Fossil Wood from Flores Island, an Early Record

Listya Mustika Dewi[1, a)], Ratih Damayanti[1, b)], YI Mandang[2], Sri Rulliaty[2], Suprihatna[3]

Author Affiliations
[1]*Research Center for Biomass and Bioproducts, Research Organization for Life Sciences and Environment, National Research and Innovation Agency (BRIN)*
[2] *Forest Products Research and Development Center (FORDA), Ministry of Environment and Forestry (MoEF)*
[3]*Wae Wuul Nature Reserve, Ministry of Environment and Forestry (MoEF)*

Author Emails
[a)]Corresponding author: listya.mustika.dewi@brin.go.id
[b)]ratih.damayanti@brin.go.id

Abstract. A recovered silicified fossil wood from Flores Island has been investigated to find out the botanical identity and geographical aspect. The results showed that the overall anatomical characteristics of the specimen demonstrating the affinities with the extant wood Shorea, tribe *Rubroshorea*, of the Dipterocarpaceae family, regardless the fact that members of Shorea does not exist living in the present-day natural forest in Flores Island. It was characterized by the presence of axial intercellular canal in long tangential lines, vasicentric parenchyma, simple pit fibres, 1-3 ray width, idioblast cell in ray cell, alternate and vestured intervessel pits, and tyloses. The specimen could be differentiated from other *Shoreoxylon* spp. previously discovered in other areas such as Pakistan, Java, and Sumatra Island. Therefore, it might be considered in to a new taxon, *Shoreoxylon floresiensis*. However, more investigation on fossil wood from other potential areas on the Flores Island need to be undertaken more comprehensively to reconstruct the past floristic composition.

Keywords: fossil wood, Shoreoxylon, Dipterocarpaceae, Flores Island, Indonesia

Abstract R6-10

Potential Utilization of Super Teak

DA Indrawan[1], R Damayanti[1, a)], B Ozarska, J Illic[2], G Pari[1], LM Dewi[1], R Pari[1], DA Agustiningrum[1], DS Adi[1], IA Sofianto[1], Djarwanto[1], RGH Rahmanto[1]

[1]Research Center for Biomass and Bioproducts, Research Organization for Life Sciences and Environment, National Research and Innovation Agency, Jl. Raya Jakarta-Bogor Km. 46, Cibinong, Kab. Bogor 16911, Jawa Barat – Indonesia, Republic of Indonesia
[2]School of Ecosystem and Forest Sciences, The University of Melbourne, Burnley Campus, 500 Yarra Boulevard, Richmond, Victoria 3121, Victoria, Australia

[a)] Corresponding author: ratih.damayanti@brin.go.id

Abstract. Super teak is a fast grown species of teak (*Tectona grandis* Linn. f) derived from several clones. This has facilitated plantation rotations as short as 5 years. Young teak wood from plantation forest usually has a small diameter. The main target of plantation teak was initially for high value logs. The wood from very young stems is unsuitable for direct utilization but advance wood processing technology can provide improvement of the wood properties from small diameter logs. This study aimed to provide an assessment of the potential utilization of super teak for furniture, flooring, veneer, pulp paper and wood pellets, based on the National Indonesian Standard requirements. According to several standards, super teak is suitable for furniture production. It is classified into Grade C for ply wood because the presence of sapwood, pinholes, tight and lose knots. For flooring, super teak is regarded in the range of soft flooring group, while it is classified into Class Quality/Group II with very low active alkali consumption and low Kappa Number for pulp and paper production. Young super teak is also suitable for wood pellet production.

Abstract R6-11

Delamination and Bonding Strength of Cross Laminated Timber Made from Jabon Wood and Cold-Setting Melamine-Based Adhesive

Yusup Amin[1,2*], Renaldi Purnomo Adji[2], Sudarmanto[1], Narto[1], Muhammad Adly Rahandi Lubis[1,3], Nareworo Nugroho[2], Effendi Tri Bahtiar[2], Wahyu Dwianto[1], Lina Karlinasari[2]

[1]Research Center for Biomass and Bioproducts, National Research and Innovation Agency Cibinong 16911, West Java, Indonesia
[2]Department of Forest Products, Faculty of Forestry and Environment, IPB University, Bogor 16680, West Java, Indonesia
[3]Research Collaboration Center for Biomass and Biorefinery Between BRIN and Universitas Padjadjaran, National Research and Innovation Agency, Cibinong 16911, West Java, Indonesia

*Corresponding author: yusu007@brin.go.id

Abstract. Cross laminated timber (CLT) is one of the engineered wood products which is currently experiencing rapid and innovative development. CLT can be made from the same wood species, or a combination of different species of woods between layers for the purpose of efficiency and quality improvement. One of the factors that need to be considered in the manufacture of CLT is the adhesive. This study aims to evaluate the characteristics of delamination and bonding strength of the CLT products made of Jabon wood using cold-setting adhesive based on melamine-formaldehyde (MF) and polymeric 4,4-methylene diphenyl diisocyananate (pMDI) at a glue spread of 300 g/m2. The cold-setting adhesive mixture consisted of MF resins as the base, citric acid at 5% level based on the solids content of MF resins as catalyst, pMDI at 3% level based on the solids content MF resins as cross-linker, and wheat flour at 10% based on the total mixture as filler. The viscosity of the adhesive increased remarkably after the addition of pMDI and wheat four, indicating that the mixture could be used as cold-setting adhesive. The Jabon wood measuring 5.5 x 5.0 x 2.0 cm which were glued to each other across the fiber direction and cold-pressed with a pressure of 0.8 – 1.0 Mpa for 2 h. The delamination test was carried out with reference to the standard EN 391-2001, while the bonding strength test was carried out using UTM at a load cell of 50 kN. This study is expected to support the development of CLT in the future.

Keywords: cold-setting adhesive, bonding strength, cross laminated timber, jabon wood, melamine-formaldehyde, pMDI

Abstract R6-12

Discrimination of Conventional and Fast-Growing Teak Wood through Fourier Transform Near-Infrared

D Triwibowo[1], DS Adi[1, a)], SK Himmi[2, b)], R Damayanti[1], RGH Rahmanto[1], and Sung-Wook Hwang[3]

[1]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Indonesia*
[2]*Research Organization for Life Sciences and Environment, National Research and Innovation Agency (BRIN), Indonesia*
[3]*Research Institute of Agriculture and Life Sciences, Seoul National University, Republic of Korea*

Author Emails
[a)]Corresponding author: danang.sudarwoko.adi@brin.go.id
[b)]khoi003@brin.go.id

Abstract. The discrepancies between conventional and fast-growing teak woods are challenging due to the similarity of their characteristics. This study was conducted to classify those woods by using Fourier Transform Near Infrared (FTNIR) in combination with the Random Forest Classifiers (RF). The conventional teak wood from Perhutani (a state forest enterprise) and several fast-growing teak wood varieties (Platinum, JUN, and community) were scanned at the Near Infrared (NIR) spectra 10,000-4,000 cm^{-1} and then analyzed by RF. The results showed that the best accuracy to distinguish slow and fast-grown teak was 98.2% at the optimal estimator parameters 11. The RF feature importance correlation showed that the band 6,000 cm^{-1} assigned as lignin was the main factor affecting the classification. Moreover, the RF analysis revealed that this method could also separate the conventional, Platinum, JUN, and community teak woods with high accuracy of 98% at n-estimators 31. The third range was the main factor affecting the model, which contains CH vibration from the aromatic framework. However, some part of the fourth range, which corresponds to the cellulose regions of the NIR wavenumber has also affected the determination.

Keywords: Community teak, JUN teak, Near Infrared, Random Forest Classifier, Platinum teak

Abstract R6-13

Determination of Three *Shorea* Species by Near-Infrared Spectroscopy and Anatomical Structures

R Pari[1], DA Agustiningrum[1,a)], DS Adi[1], IA Sofianto[1], Djarwanto[1], RGH Rahmanto[1], R Damayanti[1], Setiowati[1], SW Hwang[2], C Oktapiani[3]

[1]*Research Center for Biomass and Bioproducts, Research Organization of Life Sciences and Environment, National Research and Innovation Agency, Republic of Indonesia*
[2]*Research Institute of Agriculture and Life Sciences, Seoul National University, Republic of Korea*
[3]*Center for Standardization of Sustainable Forest Management Instruments, Agency for Standardization for Environment and Forestry Instruments, the Ministry of Environment and Forestry, Republic of Indonesia*

[a)]Corresponding author: dyah018@brin.go.id

Abstract. Shorea, well known as Meranti, is one of the most important woods in Indonesia. However, identifying the species is still challenging, especially in the timber trading at field. A non-destructive method is required as a rapid and handy tool. This study aimed to determine three species of Shorea namely *Shorea parvifolia*, *S. leprosula* and *S. bracteolata* originating from Indonesia (Sumatra and Kalimantan) using Near-Infrared Spectroscopy (NIRS), and then validated by their anatomical characteristics. Principal Component Analysis (PCA) and a pre-treatment Savitzky-Golay filter were applied to collect the NIR spectral signal at wavenumber 8000-4000 cm^{-1}. Further-more, the data was classified using the K-NN and SVM classifier. The results showed that K-NN can separate *S. parvifolia* at high accuracy but cannot separate *S. leprosula* and *S. bracteolata*. While SVM approaches better at separating *S. leprosula* and *S. bracteolata*, even the accuracy was low. The observation of anatomical structures revealed differences between Shorea species. Crystals presented in *S. parvifolia* and *S. leprosula*, however radial canals were observed only in *S. leprosula*. Crystals were absent in *S. bracteolata*, but silica bodies were found in rays parenchyma. The observation of microscopic structures can differentiate three Meranti wood up to species level, but this method takes time and needs specific knowledge. Thus, NIRS can be an alternative as a rapid wood identifier.

Abstract R6-14

A Study of Discoloration of Untreated 5-year-old Fast-Grown Teak Wood

DA Agustiningrum[1], RGH Rahmanto[1, a)], R Pari[1], IA Sofianto[1], Djarwanto[1], R Damayanti[1]

[1]*Research Center for Biomass and Bioproducts, Research Organization of Life Sciences and Environment, National Research and Innovation Agency, Republic of Indonesia*

[a)]Corresponding author: rade036@brin.go.id

Abstract. Indonesian fast growing teak wood or wel known as Jati Utama Nusantara (JUN) is widely cultivated in Indonesia as a material for furniture. One of the properties considered for furniture material is the decorative pattern. This study observed discoloration of untreated 5-year-old fast grown teak wood after displayed indoor for eight years. The observation was carried out on wooden boards made from 5-year-old fast-grown teak wood harvested from dry area (East Java) and wet area (West Java) with three diameter classes, namely large, medium, and small. The color was observed using color reader and characterized by CIELAB color systems. The data were then compared to the color data from previous measurements that have been carried out in 2014. To test the color changes happened during the display duration, Wilcoxon Matched Pairs Test method was applied. The results showed that the parameters L* (brightness) was decreased, while a* (redness) and b* (yellowness) were increased. It meant that the wood color changed darker, redder, and more yellow compared to the first measurements, showing sharper and more attractive pattern. The value of ΔE showed that the wood color difference between 2014 and 2022 was 22.9. Statistically, the results showed that wood board samples have significantly changed color in 2022 compared to 2014.

Abstract R6-15

Physical and Anatomical Properties of Nine Years-old Platinum Teak Wood

Teguh Darmawan [1,a], Narto [1], Sudarmanto [1], Dimas Triwibowo [1], Yusup Amin [1], Adik Bahanawan [1], Danang Sudarwoko Adi [1], Imran Arra'd Sofianto [1], Prabu Sa-tria Sejati [1], Wahyu Dwianto [1], and Imam Wahyudi [2]

Author Affiliations
[1]Research Center for Biomass and Bioproducts, National Research and Innovation Agency-BRIN, Cibinong, Indonesia
[2]Faculty of Forestry, IPB University, Bogor, Indonesia

Author Emails
[a)]Corresponding author: tegu018@brin.go.id

Abstract. Testing and recording continuity the wood basic properties of new developed fast growing wood such as Platinum teak are important as a aguidance for managing the wood stand. This study is a series for evaluating the basic properties of 9 years-old Platinum teak, especially the physical and anatomical characteristics. The results revealed that this wood is promising due to the proportion of heartwood is more dominant than sapwood. The percentage of heartwood was 55%, while the sapwood was 45%. The distribution of wood density in radial position was increased since increasing on every growth increment, which those range were 0.5 to 0.56 g/cm^3. The TR ratio was very high, which was more than 2.4, indicating this wood was not stable for facing with the air humidity. The color of platinum teak is similar to that of fast-growing teak, especially its brightness. The heartwood has a color and brightness that is not uniform, the inner heartwood tends to be lighter than the outer heartwood. Anatomically, the microscopic observation showed that this wood was similar to those conventional one. It has ring porous, sometime tend to diffuse porous with clear boundaries between heartwood and sapwood. Tylosis was also appeared on the vessel cell. It has more vessel in per square milimeter than conventional teak. The fiber length was 942.78 µm, with the quality of those fiber derived value was classified on the class II.

Keywords: Platinum Teak wood, physical properties, anatomical properties, fiber derived value

Abstract R6-16

Performance of low molecular weight of phenol formaldehyde-impregnated woods on dimensional stability and durability against termites

Sarah Augustina[1], Wahyu Dwianto[2] *, Dimas Triwibowo[2], Imam Wahyudi[3], I Wayan Darmawan[3], Jamaludin Malik[4]

[1]Post-doctoral at Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Jl. Raya Bogor Km. 46, Cibinong, Bogor 16911, Indonesia
[2]Research Center for Biomass and Bioproducts, BRIN, Jl. Raya Bogor Km. 46, Cibinong, Bogor 16911, Indonesia
[3]Department of Forest Products, Faculty of Forestry, IPB University, Bogor 16680
[4]Forest Products Research and Development Center, Bogor 16610

*Corresponding author, wahyudwianto@yahoo.com

Abstract. Performance of low molecular weight of phenol formaldehyde (LmwPF) as impregnating agents on dimensional stability and durability of three lesser-used wood species grown in North Kalimantan Province, namely nyatoh (Palaquium spp.), sepetir (Sindora spp.), and pisang putih (Mezzettia spp.) were studied and analyzed in this research. Impregnation process started by putting the samples within LmwPF solution with 7,8,9, and 10% concentrations (w/w), continued by vacuuming at -98 kPa for 15 minutes, followed by applying 350 kPa of pressure for 4 hours, then immersing at 80 °C for 3 hours. Results showed that LmwPF-impregnated wood had significantly improved dimensional stability and durability compared to untreated (control) wood. Sepetir wood impregnated by LmwPF had a higher WPG value, which resulted in better improvement on dimensional stability (S, ASE, WA, and TS), and durability against termites than nyatoh- and pisang putih-impregnated wood. LmwPF-impregnated woods tended to increase in durability class as concentration increased, becoming durable class II for 7% concentration and durable class I for 11% concentration.

Keywords: dimensional stability, durability againts termites, impregnation, lesser-used wood species, low molecular weight of phenol formaldehyde.

Abstract R6-17

Recovery Rate and Physical Properties of 32 and 37-Year-Old Sawn Oil Palm Trunks (OPT)

Jamal Balfas[1, a)], Deazy Rachmi Trisatya[1)], and Rohmah Pari[1, 2)]

Author Affiliations
[1]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Cibinong, 16911, Indonesia*
[2]*Graduate Student of Forest Product Science and Technology, Department of Forest Product, Faculty of Forestry and Environment, IPB University, Dramaga, Bogor, 16680, Indonesia*

Author Emails
[a)]Corresponding author: jamal.balfas@brin.go.id

Abstract. Oil palm (*Elaeis guineensis* Jacq.) provides raw materials for food, edible products, chemicals, household care, and energy materials. The tree has an economic life of approximately 25 to 30 years, upon which the tree is felled for replanting. Currently, there are several million trees scheduled to be felled every year and considered as a waste. The oil palm trunk (OPT) could be an option for substituting wood panel product. The aim of this research was to examine the effect of different age OPTs on the productivity and characteristics of the OPT lumber. In this study, recovery rate and physical properties of sawn oil palm trunk were observed. The recovery rate of 32-year-old sawn OPT (65.165%) appeared to be higher than the sawn 37-year-old OPT (61.675%). The results revealed that the 37-year-old OPT have moisture content, specific gravity, and density values of 197%, 0.322, and 0.404 g/cm3. Similar trends were also recorded for the shrinkage samples. The findings showed that the 37-year-old OPT has higher physical properties compared to the 32-year-old OPT.

List of Abstracts-Parallel Session 4 – Biomass Processing*

Abstract R1-01

Effect of activation parameters on adsorption properties of activated carbon prepared from teak waste

Nur Adi Saputra[1, a)] and Djeni Hendra[1)]

[1]*National Research and Innovation Agency, KM 54 Cibinong– Bogor 16911, Indonesia*

[a)]Corresponding author: nadisaputra@gmail.com

Abstract. Activated carbon has been produced using teak plantation thinning waste material from 5 years old class. Temperature variations were set at narrow intervals of 750 and 800 ºC, while the holding time parameter was up to 240 minutes. The effect of activation parameters was observed by the iodine adsorption behavior. This study confirmed the improvement of the adsorption properties which was increased from 686 mg/g to 699 mg/g. Prolonged holding time resulted in a sharp increase in iodine adsorption. The highest absorption of activated carbon in this study was 887 mg/g.

Keywords: activated carbon, physical activation, teak waste, iodine adsorption, porosity

* Several abstracts are copied from the unrevised version of the associated paper and will be different with the published version after the copy-editing and typesetting following the standards of the publisher.

Abstract R1-02

Production Optimization and Characterization of Cellulose Acetate from Oil Palm Empty Fruit Bunches

Aisyah Hanifah[1, a)] Efri Mardawati[1,2,b)] and Akbar Hanif Dawam[2, 3]

[1]*Department of Agroindustrial Technology, Universitas Padjadjaran.*
[2]*Research Collaboration Center for Biomass and Biorefinery between BRIN and Universitas Padjadjaran.*
[3]*Biomass and Bioproduct Research Center, BRIN.*

[a)]aisyah17013@mail.unpad.ac.id
[b)]efri.mardawati@unpad.ac.id

Abstract. Oil Palm Empty Fruit Bunches (OPEFB) are solid waste from the palm oil processing industry. The components of OPEFB include cellulose, hemicellulose, and lignin. OPEFB has a large cellulose content so it has the potential to be processed into a cellulose derivative product that is cellulose acetate. Cellulose is extracted through the stages of hydrolysis, delignification, pulping, and bleaching. The extraction process resulted in a cellulose yield of 19.6% with 98.6% of α-cellulose. Cellulose is synthesized into cellulose acetate through the stages of activation, acetylation, and hydrolysis. In this study, optimization of the hydrolysis process using Response Surface Methodology (RSM) was carried out to produce cellulose acetate with 39-40% acetyl content. The results showed that, under the optimum conditions of the water-cellulose ratio, treatment time, and hydrolysis temperature (2:1, 60 minutes, and 30˚C), the acetyl content produced was 39.5%. Synthetic and commercial cellulose acetate were analyzed using instrumental analyses such as Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA), and Fourier Transform Infrared (FTIR). TGA results showed that commercial cellulose acetate lost a mass of 12.16% until the temperature of 185.8˚C while synthetic cellulose acetate lost a mass of 13.08% up until 170˚C. In the next stage, the mass loss reaches 70-80% at a temperature of 300-400˚C. DSC analysis showed that synthetic cellulose acetate had a glass transition temperature (T_g) of 133.4˚C and a melting temperature (T_m) of more than 250˚C, higher than commercial cellulose acetate which had a glass transition temperature (T_g) of 109˚C and melting point (T_m) of 229.23˚C. Morphological analysis of FTIR showed that cellulose acetate consisted of the hydroxyl group (-OH), C-H group, C=O group, C-O group, and C-O-C glycosidic bond.

Abstract R3-11

Isolation and Characterization of Cellulose Nanofibers from Sweet Sorghum with Different Ultrafine Grinding Modes

Don Pedro Sandhyacartenz Tossano da Costa[1,4 b)], Ika Atsari Dewi[1 c)], Farah Fahma[2 d)] , Zuratul Ain Abdul Hamid[3 e)], Lisman Suryanegara[4 a)]

[1]*Departement of Agroindustrial Technology, Brawijaya University, Jl. Veteran Malang 65145, Jawa Timur Indonesia*
[2]*Department of Agro-Industrial Technology, Institut Pertanian Bogor University, Jl. Raya Dramaga, Babakan, Kec, Dramaga, Kabupaten Bogor, Jawa Barat 16680*
[3]*School of Materials & Mineral Resources Engineering, University Sains Malaysia, 14300 Nibong Tebal Pulau Pinang*
[4]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Jalan Raya Bogor Km.46 Cibinong, Bogor Indonesia*

a) Corresponding author: lisman.suryanegara@brin.go.id
b) donpedrodacosta@gmail.com
c) ikaatsaridewi@ub.ac.id
d) farah_fahma@yahoo.com
e) srzuratulain@usm.my

Abstract. Cellulose nanofibers (CNF) can be obtained from lignocellulosic biomass, which is abundant in nature. This study aims to characterize the isolated cellulose nanofibers from sweet sorghum bagasse using a combination of chemical and mechanical treatment. Cellulose fibers were isolated from sorghum bagasse powder by alkalinization using sodium hydroxide (NaOH), then the bleaching process using hydrogen peroxide (H2O2) followed by alkaline hydrogen peroxide (AHP). Furthermore, cellulose fibers were fibrillated using ultrafine grinder with six different distances of gap in grinder (from zero position): -10; -30; -50; -70; -90; and -110 µm with 5 passes in each gap. Chemical content analysis of the Sorghum bicolor (L.) Moench fibers showed that the content of cellulose, hemicellulose, and lignin are 32.78%, 20,93%, and 8,55%, respectively. The FT-IR spectra showed a peak around 1427 cm-1, indicating the presence of crystallinity band or the vibration of symmetrical CH2 in the FT-IR spectrum, which only appears in alkalized-H2O2 and alkalized-H2O2-AHP sorghum fibers. FE-SEM images showed that the diameter of fibrillated fiber could reach 22.4 nm. The x-ray analysis indicated the highest crystallinity using an ultrafine grinder through -110 µm, which was 57.25%. These results showed that the different distances of gap affected the size and crystallinity index of sorghum cellulose nanofibers.

Keyword: Cellulose nanofibers, sweet sorghum, ultrafine grinder, isolation and characterization

Abstract R1-04

Characteristic of Pickering Emulsion Stabilized by Cellulose Nanofibrils in Different Oil Phase Polarity

Putri Amanda[1, a)], Setyani Budiari[2] and Anita Amelia[3]

[1]Research Centre for Biomass and Bioproduct, National Research and Innovation Agency, Kawasan Sains Teknologi Dr. (H.C.) Ir. H. Soekarno, Jl. Raya Bogor KM 46, Cibinong, 16911, Indonesia
[22]Research Centre for Chemistry, National Research and Innovation Agency, Puspiptek 456, Serpong, South Tangerang, Indonesia
[3]Environmental and Industrial Hygiene Division, PETROLAB Services, PT Pisangan Lama 3 Street No.28, Jakarta, 13230, Indonesia

[a)] Corresponding author: putri.amanda@brin.go.id

Abstract. Most emulsifiers work with polar and non-polar oils, but each emulsifier has specific preferences. It means that changes in the polarity of the oils used in an emulsion can significantly impact its characteristics and stability. Here we describe the characteristic of oil-in-water Pickering emulsion using cellulose nanofibril (CNF) as a Pickering agent in different oil phase polarities: Ethyl acetate, Toluene, and Hexane. The viscosity, distribution of droplet size, and creaming index were investigated to learn the effect of oil polarity on the stability of the emulsion. The result showed that the emulsification process of the Pickering emulsion in all types of oil phase polarity is dependent on the CNF concentration. The viscosity of Pickering emulsion increases with the decrease of polarity in the oil phase and confirmed by the distribution of oil droplet size in the lower polarity oil phase smaller than in the high polarity oil phase. The CNF was more suitable for non-polar solvents, as seen by the stability of hexane in water emulsion, which was better than Toluene and Ethyl Acetate. In addition, the difference in viscosity, droplet size, and creaming index of hexane in water are less than those of the others after storage, which shows better stability. Studying the interaction of the particle as a stabilizer with different oil phase polarity, we can easily alter the viscosity and stability of the Pickering emulsion based on the product concept and requirements.

Abstract R1-05

Chemical Properties of Cross-linking Biohydrogel from Oil Palm Empty Fruit Bunch

Arzqa Sabila Hanifah[1,2a], Dewi Sondari[1a], Saras Dhiyaa Maitsaa[2], Ismail Budiman[1], Riksfardini Annisa Ermawar[1], Isalmi Aziz[2]

[1]Research Center of Biomass and Bioproduct, Research and Inovation Centre Agency, Cibinong Science Centre, West Java, Indonesia, 16911, Indonesia
[2]Department of Chemistry, Faculty of Science and Technology, Syarif Hidayatullah Islamic State University, Ir H. Juanda street, 15412, Indonesia

[a)]Corresponding author: dewi004@brin.go.id and Sabilaarzqa1610@gmail.com

Abstract. Cellulose can be separated from lignocellulose biomass of oil palm empty fruit bunch (OPEFB) using delignification methods, such as physical and chemical treatments. Our preliminary research on isolating cellulose from OPEFB biomass by using both methods of acid-microwave and alkaline-autoclave treatments has produced high amount of cellulose up to 44.87%. The isolated cellulose has the potential as hydrogel material by addition of crosslinker, such as glutaraldehyde, aluminium sulfate and some carboxylic acid. This research aims to synthesize biohydrogel from OPEFB cellulose by application of various concentration of epichlorohydrin (ECH) at 5%, 7.5% and 10% and NaCMC at 1.75%, 2.5% and 3.25%. Chemical Properties of biohydrogel was characterized by swelling capacity, percent degree of crosslinking, FTIR, and SEM. Results showed that biohydrogel was optimally synthesized by ECH at 5% and NaCMC at 1.75%. The FTIR analysis result was also in line with the chemical measurement (swelling and percent degree of crosslinking). In conclusion, cellulose from OPEFB can be synthesized into hydrogel by addition of crosslinker, such as ECH with optimum consentration.

Keywords: cellulose, epichlorohydrin, FTIR, swelling capacity, SEM

Abstract R1-06

Effect of Combustion Method on Oleoresin Tapping Yield of Dipterocarpus grandiflorus

Suroto Hadi Saputra1,a*, Andrian Fernandes1,b*, and Rizki Maharani1,c

[1]*Research Center for Biomass and Bioproducts, Research Organization for Life Sciences and Environment, National Research and Innovation Agency, Jl. Raya Jakarta-Bogor Km 46, Cibinong, Bogor, West Java, Indonesia*

[a)]Suro003@brin.go.id
[b)]andr051@brin.go.id
[c)]rizk049@brin.go.id

Abstract. Oleoresin is a non-timber forest product of a potential Dipterocarps family tree that it can be yield from tapping process of Dipterocarpus spp. tree or locally known as Keruing. Some countries, such as Thailand, and Laos, combustion method was conducted in the tapping hole to increase oleoresin yield. However, in East Kalimantan, combustion method in tapping holes has never been carried out, and results are still unknown. This study aimed to determine effect of combustion method in Dipterocarpus grandiflorus tapping hole on volume, specific gravity and colour changes of oleoresin yielded. The research was carried out in forest area with special purposes (KHDTK) Labanan, Berau, East Kalimantan by making burning and non-burning tapping holes in two groups of different diameters of D. grandiflorus trees. The volume of oleoresin yielded for two weeks was collected in a plastic bottle, then it was measured. Specific gravity testing was conducted by using the pycnometer method, and colour properties of oleoresin by using computer vision analysis method. Present study showed that a tree diameter of 50 cm contained more oleoresin yield than a tree diameter of 40 cm, both in combusted and non-combusted tapping holes. Combustion tended to decreased amount of oleoresin yielded, even up 31.53% lower than non-combusted tapping hole. Meanwhile, specific gravity showed small different results in combusted method on oleoresin yielded. However, colour changes analysis performed differences in colour of oleoresin yielded in the parameters L*, a* and b*.

Keywords : Oleoresin, Dipterocarpus grandiflorus, combustion method, tapping hole method, yield.

Abstract R1-08

Preliminary Study on Hydrolysis of Sugarcane Trash Hemicellulose by Inorganic Salt Catalyst for Xylose Production

Euis Hermiati[1,2 a)], Dwi Ajias Pramasari[1, b)], and Adetya Lianawati[1, c)]

[1]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Jl. Raya Bogor Km 46, Cibinong, Bogor 16911, Indonesia*
[2]*Research Collaboration Center for Biomass and Biorefinery between BRIN and Universitas Padjadjaran, Jatinangor, Sumedang 45363, Indonesia*

Corresponding author:
[a)]euis.hermiati@brin.go.id
[b)]dwi.ajias.pramasari@brin.go.id
[c)]adetyalianawati@gmail.com

Abstract. Sugarcane trash is abundant underutilized biomass, which has high hemicellulose content as a source of xylose. Inorganic salts, such as $Al_2(SO_4)_3$ and $FeCl_3$ could act as acids and hydrolyse biomass components, especially hemicellulose. In this study, those catalysts were used to hydrolyse hemicellulose in sugarcane trash in an autoclave or microwave digester with water or 1% oxalic acid as a medium. The amount of catalyst was 50 and 100 µmol/ g biomass, while the heat treatment was at 121 °C for 30 min in autoclave or 180 °C for 5 min in microwave digester. Results of the study show that the use of microwave digester with catalyst 100 µmol /g biomass in acid medium resulted in the highest biomass solubilization (40.2-41.2%). The highest reducing sugars concentration (28.1-29.8 g/L) was obtained from the process using autoclave or microwave digester with acid medium and $FeCl_3$ catalyst (100 µmol /g biomass). However, if water medium is used, the highest solubilization and reducing sugars concentration (24.1% and 15.6 g/L, respectively) are that from the process with $Al_2(SO_4)_3$ catalyst (100 µmol /g biomass). The addition of catalysts in acid medium does not increase or even decrease xylose concentration. Meanwhile, the addition of $Al_2(SO_4)_3$ catalyst (100 µmol /g biomass) could increase xylose concentration from 0.1 to 2.4 g/L and xylooligosaccharide concentration from 1.4 to 6.3 g/L when the hydrolysis is conducted in water medium using microwave digester. Hydrolysis using $Al_2(SO_4)_3$ catalyst in water medium is more promising as an alternative of acid hydrolysis in xylose production than that using $FeCl_3$ catalyst. The higher amount of catalyst resulted in higher biomass solubilization, reducing sugars and xylose concentration in the hydrolysate. Process using microwave digester gives better results of hydrolysis, including xylose recovery.

Abstract R1-09

The Effect of Reducing Cyanide Level in Bitter Cassava (*Manihot Esculenta Crantz*) on the Starch Content

Arfiathi,[1,2,b] Riska Sumirat,[1,2,c], Intan Rizka Gumilang,[3,d] Muhammad Adly Rahadian Lubis,[1,e] Afni Restasari,[1,f] Firda Aulya Syamani,[1,g] Fitry Filianty[2,h], Yeyen Nurhamiyah[1, a]

Author Affiliations
[1] Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Jl. Raya Bogor Km. 46 Cibinong, Bogor, Indonesia
[2] Department of Agro-industrial Technology, Padjajaran University, Jl. Raya Bandung Sumedang KM.21. Indonesia.
[3] Department of Chemistry, Padjajaran University, Jl. Raya Bandung Sumedang KM.21. Indonesia.

Author Emails
[a)]yeye001@brin.go.id
[b)]arfiathi20001@mail.unpad.ac.id
[c)]riska17004@mail.unpad.ac.id
[d)]intan19014@mail.unpad.ac.id
[e)]muha142@brin.go.id
[f)]afni002@brin.go.id
[g)]fird003@brin.go.id
[h)] fitry.filianty@mail.unpad.ac.id

Abstract. Bitter cassava (*Manihot Esculenta Crantz*) is often seen as a 'dangerous toxic crop' due to its high cyanide level (>100 mg/kg). The reduction of cyanide hydrogen level in bitter cassava was conducted through two different methods: soaking treatment (24 h, 48 h, 72h, and 96 h) and heating treatment (room temperature, 30^{o}C, 45^{o}C, 60^{o}C, 75^{o}C). The cyanide content was determined through the Bradbury method and the intensity of the cyanide (CN) functional group in the Fourier Transform Infrared Spectroscopy (FTIR). The effect of the reduction of cyanide treatment on the starch content and amylose/amylopectin was then investigated. The result shows the highest cyanide elimination was observed in the soaking treatment of 96 h (85%) meanwhile the highest starch content was examined at the soaking treatment of 24 h (84.3%). Overall, the reduction of cyanide methods is not significantly reduced the starch content and the effective method for cyanide reduction is the soaking treatment. The starch soaking and heat treatment could significantly reduce cyanide levels but had no significant effect on bitter cassava starch content. No clear differences were noted in the infrared spectrum peaks between soaking, and heat treatment.

Abstract R1-10

Effect of Modified Boiler Ash from Sugarcane Bagasse For Mercury Adsorption: Physical and Chemical Properties

Bernadeta Ayu Widyaningrum1[1, a)], Riska Surya Ningrum[1], Triastuti[1], Ahmad Yusuf Afandi[2], Deni Purnomo[1], Wida Banar Kusumaningrum[1], and Yudhi Dwi Kurniawan[3]

[1]*Research Center for Biomass and Bioproduct, National Research and Innovation Agency, Jl Raya Bogor KM 46 Cibinong, Bogor 16911, Indonesia*
[2]*Research Center for Limnology, National Research and Innovation Agency, Jl Raya Bogor KM 46 Cibinong, Bogor 16911, Indonesia*
[3]*Research Center for Pharmaceutical Ingredient and Traditional Medicine, National Research and Innovation Agency, Kawasan Puspiptek Serpong, South Tangerang, Banten 15314, Indonesia*

Author Emails
[a)]Corresponding author: bernadeta.ayu.widyaningrum@brin.go.id

Abstract. Abundant boiler ash from biomass especially from sugarcane bagasse has great potential to be utilized as heavy metal adsorbent. In this study, the raw boiler ash (RBA) was modified into three condition treatments such as the alkali modified (AM), oxidized modified (OM), and modified with magnetite (MM). The detailed comparison of the physical and chemical properties of each modified boiler ash were characterized using the Field emission scanning electron microscopy (FESEM), Fourier transform infrared spectroscopy (FTIR), X-Ray Fluorescence (XRF), X-ray diffraction (XRD), and the Brunauer–Emmett–Teller (BET). The percentage removal of each modified materials was investigated in batch systems with similar condition of the initial Hg(II) ions concentration (20 mg/L), pH (6), adsorbent dose (2 g/L), contact time (45 min) and room temperature. The results showed that the physical and chemical properties could contribute to the mercury sorption. The percentage removal of mercury adsorption for AM, OM and MM were 3.3, 2.3 and 3.6 times greater than RBA. Notably, modified fly ash could be considered as potential adsorbent materials with applicability to wastewater treatment.

Keywords: Modified boiler ash, mercury ions, adsorption, physical properties, chemical properties

Abstract R1-11

Effect of Gridling on Characteristics of Teak Wood

R Pari[1,2], RGH Rahmanto[1], Djarwanto[1], R Damayanti[1], DA Agustiningrum[1,] LM Dewi[1], IA Sofianto[1]

[1]Research Center for Biomass and Bioproducts, Research Organization for Life Sciences and Environment, National Research and Innovation Agency, Cibinong, 16911, Indonesia.
[2]Graduate Student of Forest Product Science and Technology, Department of Forest Product, Faculty of Forestry and Environment, IPB University, Dramaga, Bogor, 16680, Indonesia.

[2]Corresponding author: rohmah.pari@brin.go.id

Abstract. Teak wood has always been in demand because it is famous as strong and durable timber. One of the efforts to increase the quality of the teak wood is girdling the trees before harvesting. The girdling is carried out in a circle up to the cambium part to stop the growth because new cells are not formed. Three trees each for girdled and un-girdled treatment were cut and collected at the breast-height. The physical and mechanical properties of 80-year-old teak wood that were girdled for one year were identified to determine the wood characteristics by using British standards. The results showed that in one year girdling teak wood, the green moisture content decreased by 55% and had slightly higher physical properties (1.3%) in air-dry moisture content than without girdling treatment. The mechanical properties were also slightly higher 0.2% and 2.0% at hardness and compressive strength, respectively, and modulus of rupture was higher by 5.0%. Statistically, possibly because the trees were old, a year gridling treatment had no significant effect on the value of physical and mechanical properties of teak wood.

Abstract R1-12

Effect of Rice Husk Cellulose Extraction Method with the Addition of Plasticizer on the Physico-Chemical Properties of Bioplastics

H.S Syamsidar[1,a)], A Ahmad[2,b)], S Fauziah[3,b)], and D Sondari[4,c)]

Author Affiliations
[1]State Islamic Institut of Religion Bone, Watampone-Indonesia HOS Cokroaminoto No 1 Street, Watampone-Indonesia
[2]Departement of Chemistry, Science Faculty, Hasanuddin University, Perintis Kemerdekaan Street Km. 10 Tamalanrea, Makassar , Indonesia
[3]Research Center for biomaterial, BRIN, Cibinong Jawa Barat 16911, Indonesia,

Author emails
[a)]Email: idarhs@gmail.com
[b)]Email: ahyarahmad@gmail.com
[c)]Email: stfauziah@unhas.ic.id
[d)]Email: dewi004@brin.ac.id

Abstract. Research has been effecting of rice husk cellulose extraction method on the physico-chemical properties bioplastics with addition plasticizers. The extraction method consists of precipitation and heating methods. This study to determine effect of cellulose preparation with extraction on physico-chemical properties of bioplastics. Rice husk precipitation method was adding 5% NaOH and Na_2CO_3, The rice husk autoclave method added 6% NaOH, 2.5% H_2O_2 and water. And rice husks were added NaOH 5 M of microwave exposure. The results are cellulose content maseration method was greater are 55.68%, but the color was whiter through microwave exposure. And the tensile strength value of bioplastics with the optimum extraction and heating methods (outoclave and microwave) has a tensile strength of 2.08 MPa; 3.96 MPa, 2.57 MPa and 0.97% elongation; 0.54%; and 0.75%. Rice Husk Cellulose Bioplastics can be degraded within 21 days on soil media. Functional groups that appeared the peak of O-H stretching of PSS bioplastic has a shift in wave number from 3414.00 to 3441.01 cm^{-1}. The AUS and MCS bioplastics which shifted from 3415.93 to 3419.79 cm^{-1} and 3412.08 to 3439.08 cm^{-1}. The C-N peak was in the 1350-1000 cm^{-1} area. 1641.42 cm^{-1} for MSS and AUS bioplastics, H-O-H as a water absorption.

Keywords: Extraction, Cellulose, Precipitation, Microwave, Autoclave

Abstract R1-13

The Pyrolysis Temperature Effect on Decomposition Process of Bio-oil and Bio-char from Coconut Shell for Bio-Coke Hybrid Application as Alternative Energy Resources

M Jahiding[1, a)], Mashuni Mashuni [2], Erzam S Hasan[1], Yuke Milen[1] and F S Purnamasari

[1]*Department of Physics, Halu Oleo University, Kendari, Indonesia*
[2]*Department of Chemistry, Halu Oleo University, Kendari, Indonesia*

[a)]Corresponding author: mjahiding@uho.ac.id

Abstract. Coconut shell (CS) biomass waste contains lignocellulosic components, which can be decomposed through the pyrolysis process into substitute materials for alternative energy sources. The biomass pyrolysis process produces bio-oil and bio-char, which can be applied as a bio-coke hybrid. This study aims to determine the effect of pyrolysis temperature on the decomposition of CS and its characteristics as a bio-coke hybrid material as an alternative energy source. The CS biomass decomposition process used a temperature variation of 500-700°C. The results showed that the analysis of GC-MS bio-oil, obtained compounds phenol; 2,6-dimethoxy-phenol; 4-methoxy-3-(methoxymethyl)phenol and 1-(2,3,6-trimethoxyphenyl)propan-2-amine. For the purification of bio-oil using the distillation method, obtained compounds furfural; 4-hydroxyphenyl phosphoric acid; 2-methoxy-phenol; phenol and creosol. Meanwhile, the characterization of SEM-EDS bio-char contains the main constituent elements, including carbon and minor elements consisting of oxygen, sodium and chlorine. A comprehensive analysis will show the best pyrolysis temperature for converting CS biomass into materials for hybrid bio-coke applications as a renewable alternative energy source.

Keywords: biomass, bio-oil, bio-char, coconut shell, energy, pyrolysis.

Abstract R1-14

Effect of Strand Dimension and Specific Pressure on the Performance of Strandboards made from Tali Bamboo (*Gigantochloa apus* (JA & JH Schultes) Kurz)

Deazy Rachmi Trisatya[1)], Dian Anggraini Indrawan[1)], Firda Aulia Syamani[1)], Erlina Nurul Aini[1)], and Ignasia Maria Sulastiningsih[1, a)]

Author Affiliation
[1]Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Cibinong, Indonesia

Author Email
[a)]Corresponding author: igna009@brin.go.id

Abstract. Bamboo is a lignocellulose material that has the potential for substituting wood and wood-based materials. It could be utilized as a biocomposite product, such as strandboards. Tali bamboo (*Gigantochloa apus* (JA & JH Schultes) Kurz) has long been used in Indonesia as a traditional material for housing construction, woven products, and handicrafts. It is abundantly grown and widely planted in Java, Bali, Sumatera, and Kalimantan. The purpose of this research was to determine the physical and mechanical properties of bamboo strandboards (BSB). Tali BSB with the dimension of 30 cm x 30 cm x 1.2 cm were fabricated in a laboratory with three strand dimension levels, i.e. 75, 100, and 150 mm in length, and two different specific pressure levels, i.e. 25 kg/cm^2 and 30 kg/cm^2, with the target density of 0.75 g/cm^3. A mixture of 7% (resin solid) phenol formaldehyde (PF), 0.5% wax emulsion based on the dry weight of the strand, and 1% of paraformaldehyde based on PF weight were applied. The Japanese Industrial Standard for Particleboard (JIS) A 5908-2015 was used to evaluate the physical and mechanical properties. Results revealed that strand dimension and specific pressure significantly influenced the physical and mechanical properties of tali BSB, with the exception of moisture content and density.

Keywords: Bamboo, phenol formaldehyde, physical and mechanical properties, strandboard, strand dimension

Abstract R1-15

Improving Dimension Stability of Mahogany (*Swietenia mahagoni*) Wood with Oleoresin of *Dipterocarpus* sp as a Bio-coating

Aulia Nur Laksmita[1, a)], Deby Mipa Salam [1, b)], Andrian Fernandes[1, c)] and Rizki Maharani [1, d)]

Author Affiliations
[1] *Research Center for Biomass and Bioproducts, Research Organization for Life Sciences and Environment, National Research and Innovation Agency, Jl. Raya Jakarta-Bogor Km 46, Cibinong, Bogor, West Java, Indonesia*

Author Emails
[a)] *Corresponding author: aulia.laks@gmail.com*
[b)] *debymipasalam@gmail.com*
[c)] *af.andrian.fernandes@gmail.com*
[d)] *rizma_annisa@yahoo.com*

Abstract. Mahogany (*Swietenia mahagoni*) wood is widely used as a raw material for furniture. Unfortunately, it has unstable dimensions. Natural coating (bio-coating) is one alternative to improve the dimension stability of the wood surface, such as the oleoresin of *Dipterocarpus* sp. The surface coating can be caused discoloration of the wood. This study aimed to determine the ability to improve oleoresin mixture coating for *S. mahagony* wood, and its color change occurred. *S. mahagony* wood is obtained from local sawmills under air-dry conditions. The treatment consisted of control and a mixture of oleoresin dissolved in diesel fuel with concentrations of 0%, 10%, 20%, and 30%. Dimensional stability tests can be classified according to the method used for the wood shrinkage test (ASTM D143-21), oleoresin viscosity and coating mixed (Zahn cup 2), and wood color change performance (computer vision analysis). Recent study showed that higher concentration of oleoresin mixture caused more concentrated in viscosity (45.33 to 233.71 centistokes) with a decreased level of color clarity and tended to be white. Coating the oleoresin mixture on *S. mahogany* showed improvement in dimensional stabilization. The shrinkage from air dry to kiln dry in the longitudinal direction decreased from 3.25% to 1.37%, radial direction decreased from 8.6% to 5.67%, and tangential direction decreased from 13.05% to 5.97%. *S. mahagony* wood was coated with a mixture of oleoresin, which showed that the color had changed to a darker one.

Keyword: Oleoresin, *Dipterocarpus sp, Switenia mahagony,* dimensional stability, bio-coating

Abstract R1-16

One Step Purification and Characterization of β-glucosidase Enzyme from *Paenibacillus polymyxa*

Khansa Tsabitah[1,2], Budi Saksono[1], Riksfardini Annisa Ermawar[1a], Amalia Sitti Khayyira[3], Amania Zulfa[3], and Mohammad Ubaidillah[2]

[1]Research Center of Biomassa and Bioproduct, National Research and Innovation Agency, Cibinong Science Center, West Java, Indonesia, 16911, Indonesia
[2]Departemen of Agrotechnology, Faculty of Agriculture, Jember University, Kalimantan Street, Tegalboto No. 37, Krajan Timur, Sumbersari, Jember Regency, East Java, Indonesia, 68121, Indonesia
[3]CV. Amalose Indonesia, Jatijajar Estate Block D 24 No.5, Jatijajar, Tapos, Depok City, West Java, Indonesia, 16451, Indonesia

Corresponding author: riksfardini.annisa.ermawar@brin.go.id

Abstract. *Paenibacillus polymyxa* is one of the bacteria carrying the gene encoding β-glucosidase (Bgl) enzyme. The β-glucosidase enzyme is capable of hydrolyzing lactose and synthesizing galactoorisaccharides troughthe transglycosylation process. Our study using heterologous expression of the β-glucosidase enzyme in *Escheria coli* BL21 (DE3) has been carried out previously. This study aims to futher characterize the purity of recombinant β-glucosidase enzyme in various temperature and pH. Purification was carried out by one-step purification method using 6x-His Tag system. The purity of β-glucosidase was evaluated using SDS-PAGE electrophoresis and its specific activity were analyzed by p-nitrophenol beta-D-glucopyranoside (pNPG) assay (at 400 nm) and Bradford assay (at 595 nm) using spectrophotometry. β-glucosidase enzyme was successfully purified by one-step purification. The purity of β-glucosidase was confirmed by the appearance of a single band at 52 kDa on the SDS-PAGE electrophoresis gel. Specific activity of the pure β-glucosidase enzyme was at 4.1 U/mg. The pure β-glucosidase axhibited optimum pH and temperature at 6.0 and 55°C, respectively. Further study will explore the transglycosylation potential of the recombinant β-glucosidase enzyme from *Paenibacillus polymyxa*.

Keyword: Bradford, pNPG, recombinant, SDS-PAGE, spectrophotometry

Abstract R1-17

List of Abstracts-Parallel Session 5 – Plant Chemical and *

Abstract R2-01

Characterization and segmentation of forest essential oil products in Indonesia

Yunida Syafriani Lubis [1,2], Cut Rizlani Kholibrina [1,3], and Aswandi Aswandi [1,4]

[1]*Research Center for Biomass and Bioproduct, National Research and Innovation Agency, Indonesia*

[4]Corresponding author, aswa004@brin.go.id
[2]yunidalubis@gmail.com
[3]cutr001@brin.go.id

Abstract. The COVID-19 pandemic has increased global awareness of importance of leading a healthy and balanced lifestyle. This is reflected in the growth of the essential oil market for lifestyle, beauty, and daily remedies. Unfortunately, rising demand for essential oils hasn't been met by domestic product development. Limited information in determining the market segmentation was identified as the cause of less competitive local products. This research identified market segmentation and characterization of essential oil products derived from Indonesian forests. A total of 500 consumers were interviewed from 2020 to 2021 regarding their consumption patterns and knowledge of essential oil products. A two-step cluster analysis approach was also used to determine segmentation and characterization. According to study, the largest consumer market segment is distinguished by higher levels of income and education, access to information, and awareness of a healthy and balanced lifestyle. As a result, demand for essential oil products will rise along with the higher socioeconomic status and access to e-commerce. Consumers in this segment obtain products from online markets, which typically offer imported products alongside limited local products. Therefore, the advantages of local products need to be disseminated to reduce imports, particularly those made from materials derived from Indonesia's forests.

Keywords: bioproduct, essential oil, segmentation, aromatherapy, two-step cluster analysis

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Abstract R2-02

Essential oil and hydrosol production from leaves and resin of Sumatran camphor (*Dryobalanops aromatica*)

Aswandi Aswandi [1,2], and Cut Rizlani Kholibrina [1,3]

[1]*Research Center for Biomass and Bioproduct, National Research and Innovation Agency, Indonesia*

[2]Corresponding author, aswa004@brin.go.id
[3]cutr001@brin.go.id

Abstract. Resin from Sumatran camphor (*Dryobalanops aromatica*) contains efficacious aromatic compounds for medicine, preservatives, perfumery, and others. Unfortunately, camphor production still relies on harvesting the crystallized resin, whereas essential oils and hydrosols production from leaves and resin extraction have never been applied domestically. The objective of the study was to calculate the essential oils and hydrosol productivity from the distillation of leaves and camphor resin. The material used was young leaves collected from Aek Nauli's experimental garden in North Sumatra, Indonesia, while crystallized resin was gathered from natural stands in Subulussalam, Aceh. Three replicates of each of two resin qualities and three levels of leaf youth were applied. Camphor crystals are traditionally harvested by cutting, splitting, or notching the trunk of standing trees and harvesting the liquid sap that oozes from the injured resin channel. This method produces 1.0–3.5 kg of crystals or 500–1,500 ml of oil. Liquid resin and leaf extraction can be applied for essential oils and hydrosol production. At the end of steam distillation, the resin produces 2.68–12.1% essential oil and 5.2-28.31% hydrosol. Leaf biomass also contains 0.24–0.76% essential oil. Considering that leaves have been underutilized, essential oils and hydrosol production are promising to optimize the productivity of this non-timber forest product.

Keywords: camphor, essential oil, hydrosol, leaves, steam distillation

Abstract R2-03

Forest essential oils formulation for acne treatments

Cut Rizlani Kholibrina [1,2], and Aswandi Aswandi [1,3]

[1]*Research Center for Biomass and Bioproduct, National Research and Innovation Agency, Indonesia*

[2]Corresponding author: cutr001@brin.go.id
[3]aswa004@brin.go.id

Abstract. Acne is one of the most common skin problems in adolescents and during puberty. The antimicrobial resistance that develops in some strains of acne-producing bacteria increases the severity of acne. Therefore, alternative anti-acne treatments based on natural ingredients have become a necessity. This study aims to assess the efficacy of essential oil formulations on acne patients. Some of the essential oils used are tamanu oil, benzoin, sandalwood, jojoba, and carrier oils. This simple experimental study tested three formulations on 15 volunteer patients divided into three groups of five patients each. Each formulation was applied daily for four weeks beginning in early 2022. Weekly examinations were performed to assess the improvement of the patient's facial skin in comparison to its condition prior to application. The results showed that all groups reported improvement in acne conditions, which ranged between 52% and 81% clearance of lesions compared to their previous condition. According to preliminary testing, all formulations are stable during treatment applications. Side effects such as burning sensations and skin redness are minimal and disappear within a few minutes after completing the application. This condition allows opportunities for the development of essential oil-based innovation products for facial skin treatments.

Keywords: tamanu oil, benzoin, sandalwood, anti-acne, formulation

Abstract R2-04

Solvent Effect on Revealing Antibacterial Potency of Lignin and Tannin

Alif Faturahman Hidayat[1,2,a)], Nissa Nurfajrin Solihat[2,b)], Deni Zulfiana[3,c)], Sita Heris Anita[3,d)], Maulida Oktaviani[3,e)], Maya Ismayati[2,f)], Widya Fatriasari[2,g)], and Wasrin Syafii[1,h)]

[1]*Department of Forest Products, Faculty of Forestry and Environment, IPB University, 16680 Bogor, Indonesia*

[2]*Research Center For Biomass And Bioproducts, National Research And Innovation Agency (BRIN), Jl Raya Bogor Km 46, 16911 Cibinong, Indonesia*

[3]*Research Center For Applied Microbiology, National Research And Innovation Agency (BRIN), Jl Raya Bogor Km 46, 16911 Cibinong, Indonesia*

Corresponding author: [b)]*nissa.nurfajrin.solihat@brin.go.id*
[a)]*aliffaturahman1812@gmail.com*
[c)]*deni.zulfiana@brin.go.id*
[d)]*sita.heris.anita@brin.go.id*
[e)]*maulida.oktaviani@brin.go.id*
[f)]*maya.ismayati@brin.go.id*
[g)]*widy003@brin.go.id*
[h)]*wasrinsy@indo.net.id*

Abstract. Lignin and tannins are polyphenolic materials that have the potential as natural antibacterial agents in many applications. The antibacterial properties of lignin and tannins vary depending on their chemical structure, such as the source of the plant, the type of solvent used, and bacteria. To date, no one has reported the effect of plant type and solvent on the antibacterial properties of lignin and tannin. The purpose of this study was to determine the antibacterial potential of lignin and tannins from *Acacia mangium* and *Acacia crasicarpa* in different solvents. Each lignin and tannin dissolved in five different solvents: DMSO, NaOH, ethanol, water, and ammonia. Antimicrobial analysis was done by the agar well diffusion method against four bacteria: *Propionibacterium acnes*, *Staphylococcus aureus*, *Bacillus subtilis*, and *Staphylococcus epidermidis*; the solubility by gravimetrical method and the difference of functional groups by FTIR. Overall, the type of bacteria, different species of *Acacia*, and type of solvent resulted in different bacterial activities. The result showed that the solubility was not always linear with antibacterial activities. Lignin and tannin were completely soluble in DMSO, ammonia, and NaOH, but the activity was only seen in DMSO about 0.4-1 cm of inhibition zone against all bacteria. Unlike lignin which had ~38% lignin solubility in water and did not give an inhibition zone for all bacteria, tannin had a solubility of ~80% in water and a 0.7-0.8 cm clear zone against the four bacteria. Both lignin and tannin in ethanol had a clear zone of 0.4-1 cm with a solubility of ~90%. The functional groups indicated that the difference in solvent affected the characteristics of lignin and tannins. The unique peaks of lignin only appear in DMSO and ethanol, while tannin appears in DMSO, ethanol, and water. However, according to the clear zone size, DMSO is the best solvent both for lignin and tannin.

Keywords: Antibacterial activity, different solvents, lignin, solubility, tannins.

Abstract R2-05

The potential of brown seaweed (*Sargassum* sp) as a source of antioxidant

Ina Winarni1,a) , Kustiariyah Tarman2) , and Joko Santoso2)

[1]Biomass and Bioproducts Research Center, National Research and Innovation Agency, Jalan Raya Jakarta Bogor KM 46 Cibinong Bogor, Indonesia
[2]Department of Aquatic Products Technology, Faculty of Fisheries and Marine Sciences, Institut Pertanian Bogor, Bogor 16680, Indonesia

a) Corresponding author : inaw002@brin.go.id

Abstract. Brown seaweed or Sargassum sp is one type of seaweed which is a biological resources that is widely found in Indonesian waters and contains several secondary metabolites that have the potential as a source of natural antioxidants. This study aims to determine the physicochemical properties, phytochemicals and antioxidant activity using the DPPH method (2,2-diphenyl-1-picrylhydrazyl). Brown seaweed from the thousand islands was extracted by maceration method with technical ethanol as solvent. The results showed water content (19.24%), ash content (77.72%), volatile matter (25.46%), silica content (3.02%), lignin content (26.99%) and cellulose (14.20%). The phytochemical analysis showed the sample only contain of flavonoid compound. Meanwhile, the antioxidant activity of the extract seaweed could reached 7.97 (µg/mL) value which indicates a very strong activity of antioxidant.

Abstract R2-06

Antioxidant Activity and Chemical Compound Analysis of Inoculated Agarwood Extract

Nurul Wahyuni[1] and Agus Sukito[2]

[1]Research Center of Biomass and Bioproduct, Research and Innovation Agency, Cibinong, Indonesia
[2]Research Center of Applied Microbiology, Research and Innovation Agency

nurul.wahyuni@brin.go.id & agus161@brin.go.id

Abstract. *Gyrinops versteegii* is an endemic plant in Nusa TenggaraBarat. The spesies have not been widely explored as a source of natural products. Biological activity screening of leaves, fruit barks, and stem barks from agarwood-producing plant have been investigated in 2016. The previous result revealed that beside of acetone extract from the leaves of the inoculated *G. versteegii* plant, the acetone extract from the trunk of agarwood showed high antioxidant activity. To complete the previous researches, an isolation of compounds that responsible for antioxidant activity from the extract of agarwood trunk is essential to study. Therefore, the purposes of this research are to obtain data and information of fraction having high bioactivity and to isolate antioxidant compounds from the trunk extract of agarwood. The isolation is conducted through extraction, fractionation and further analysis on antioxidant assay and GC-MS analysis. The research showed that etil acetate and methanol fractions had high antioxidant activity. Several compounds that may have potential as antioxidants from inoculated gaharu extract are *1-(benzyloxy)-8-Naphthol, 6-Methoxy-4-(methoxymethyl)-2-phenylquinoline, 5-hydroxy-4',7-dimethoxy-flavone, Stigmastan-3,5-dien, (24Z)-ethylidenechilesterol, 3-Nitro-1,2-benzenedicarboxylic acid, 3-β-hydroxy-androst-5,16-ene.*

Keywords: Gaharu, DPPH, methanol's extract, stem, fractionation

Abstract R2-07

Biocontrol activity of *Brevibacillus* sp. B1 isolated from fig stems against post-harvest chili fungal disease

Yuliar[1)], Nursaida Setiyowati[2)], Sri Pujiyanto[2)], Wijanarka[2)]

[1]Research Center for Applied Microbiology, National Research and Innovation Agency (BRIN) Jl. Raya Jakarta – Bogor, KM 46, Cibinong Science Center 16911, Indonesia
[2]Department of Biology, Faculty of Sciences and Mathematics, University of Diponegoro, Tembalang Semarang 50275, Indonesia

[1)]Corresponding author: yrivaie@yahoo.com; yuli003@brin.go.id

Abstract. Due to the increasing public awareness of the dangers of chemical fungicides and the demand for the safety of agricultural products, it is important to perform a study on post-harvest disease control of chili using antagonistic bacteria isolated from fig stems. This study aimed to obtain endophytic bacteria as biocontrol agent candidates from fig stems tissue and to determine their ability to inhibit the growth of post-harvest pathogenic fungi of *Colletotrichum* sp. Six bacterial isolates were obtained from fig plant stems and showed antagonistic activity with different interactions against *Colletotrichum* sp. on PDA media, isolate B1 was able to form a clear zone, while isolates B2 and B3 intermingled then their growth stopped, whereas isolates B4, B5, and B6 grow on the pathogenic fungus and the fungus was destroyed. Colony and cell morphology characterization of the six isolates were also observed. The highest inhibition activity *in vitro* test was indicated by isolate B1 which was 30.73% and the lowest was by isolate B3 of 6.27%. Furthermore *in vivo* test results revealed that isolate B1 was able to inhibit post-harvest *Colletotrichum* rot lesion on red chili pepper fruits by 69.02%. The identification results of isolate B1 by 16S rRNA sequence indicated 100% similarity with *Brevibacillus* sp.

Keywords: Antagonistic activity, *Brevibacillus* sp., *Colletotrichum* sp., fig stems, endophytic bacteria

Abstract R2-08

Anticancer Activity of *Saurauia vulcani* Extract on HeLa and MCF-7 Cell Line

Gunawan Pasaribu[1, a)] and Totok K. Waluyo[1, b)]

Author Affiliations
[1]Research Centre for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Republic of Indonesia, Kawasan Sains Teknologi Dr. (H.C.) Ir. H. Soekarno, Jl. Raya Bogor Km. 46, Cibinong- Indonesia 16911

Author Emails
[a)] Corresponding author: gun_pa1000@yahoo.com; guna016@brin.go.id
[b)] waluyo60@yahoo.com

Abstract. Research on *Saurauia vulcani* bioactivity has been widely reported as an antioxidant, anti-cholesterol, antidiabetic, antihyperlipidemic and antimicrobial. The traditional communities in North Sumatra usually used it as an antidiabetic remedy. Groups of compounds from the genus Saurauia are steroids, terpenoids and flavonoids. The aim of research was to determine the anticancer bioactivity of *Saurauia vulcani* extract in various solvents i.e., methanol, ethyl acetate, and n-hexane. The anticancer activity was checked in vitro using MTT assay on HeLa and MCF-7 cells. The results presented that the methanol, ethyl acetate, n-hexane and fractions revealed cytotoxic against HeLa cell line, with IC_{50} value 324,44; 457,18 and 2280,82 g/mL, respectively. Meanwhile, the cytotoxicity activity value against the MCF-7 cell lines was achieved at IC_{50} values of 320.77; 374.95, and 4405.35 g/mL, correspondingly with methanol, ethyl acetate, and n-hexane fractions, respectively. Those activity were classified as moderate cytotoxic activity.

Abstract R2-09

The Utilization of Agarwood (*Gyrinops versteegii* (Gilg.) Domke) Leaves for Herbal Tea

Kanti Dewi Rizqiani[1, a)] and Agus Sukito[2, b)]

[1]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Cibinong, Indonesia*
[2]*Research Center for Applied Microbiology National Research and Innovation Agency, Cinbinong, Indonesia.*
[3]*You would list an author's second affiliation here.*

[a)]kantidewirizqiani@gmail.com
[b)]agus.sukito@brin.go.id

Abstract. *Gyrinops versteegii* is one of the endemic agarwood-producing plants in West Nusa Tenggara. Not only concentrated in resin but the leaves are also potentially processed into herbal tea. Herbal tea is a type of functional food made from a natural ingredient with many advantages. The purpose of this study was to investigate the bioactivity of agarwood leaf extracts as well as herbal tea safety. Agarwood leaves are separated into young and mature leaves. Bioactivity tests performed included antioxidant tests (DPPH), total phenol, toxicity tests (BSLT) also raw materials, and product safety tests. Agarwood young and mature leaves showed antioxidant (IC_{50}), total phenol, and toxicity (LC_{50}) values of 55.42 ppm; 12.26%; 315.70 ppm, and 51.34 ppm; 1973%; 183.42 ppm, respectively. The safety test results on raw materials, for both young and mature agarwood leaves, showed the ash content, acid-insoluble ash content, water-soluble extract content, and ethanol-soluble extract content of 2.54%; 0.45%; 6.54%; 2.19%, and 1.95%; 0.22%; 6.36%; 2.33%, respectively. Organoleptic tests showed a characteristic aroma and green color, with no heavy metal content of Pb and Cd detected, while in young agarwood leaf tea TPC and Mold/Khmer were detected, yet it still meets the requirements of Regulation of The Drug and Food Control Agency Number 32: 2019.

Abstract R2-10

Neem Cake Fractions and Its Bioactivity against *Spodoptera litura*

Faizatul Falah[1, a)], A. Pratama[2, b)], I. G Rivo [1, c)], A. Heru Prianto[1, d)],

[1]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Jl Raya Bogor KM 46 Cibinong 16911, Indonesia*
[2]Polytechnic of AKA, Bogor*, Indonesia*

Corresponding author: [d]*aher001@brin.co.id*
[a]fayzaa_falah@yahoo.com
[b]fiera_hp@yahoo.com
[c]ikhsan.guswenrivo@biomaterial.lipi.go.id

Abstract. Neem cake is a by-product of the extraction process of neem seeds, exhibiting insecticidal properties. Azadirachtin is the main component of the neem oil and known as an anti-insecticide compound in more than 300 species of insect pests. This work reports the azadirachtin content of neem cake fractions and its bioactivity against *Spodoptera litura*. In the phytochemical testing, the n-hexane fraction contains triterpenoids and saponins. The ethyl acetate fraction contains alkaloids, flavonoids, saponins, triterpenoids, and tannins. The residue fraction contains alkaloids, flavonoids, saponins, steroids, and tannins. HPLC analysis showed that the ethyl acetate fraction had the highest azadirachtin content (132,684 ppm) while the n-hexane fraction was 20,299 ppm. The highest bioactivity was obtained in the residual fraction (100%) at a concentration of 2.5%.

Keywords: neem cake, azadirachtin, extraction, antifeedant activities

Abstract R2-11

Fungal Producing Lignolytic and Cellulolytic Enzyme from the Various Habitat of Natural Forest in East Kalimantan

Riki Ruhimat1,a), Tirta Kumala Dewi1,b), Tiwit Widowati1,c), Rahayu Fitriani Wangsa P1,d), Nani Mulyani1,e), Entis Sutisna1,f) and Sarjiya Antonius1,g)

[1]Research Center for Applied Microbiology, National Research and Innovation Agency (BRIN), Jl. Raya Jakarta Bogor KM 46 Cibinong 16911, Indonesia

Corresponding author: a ruhimatriki@gmail.com
bTirta.kdewi@gmail.com
ctiwidowati@gmail.com
drahayufwputrie@gmail.com
enani150576@gmail.com
fsutisna91@yahoo.com
gsarj.antonius@gmail.com

Abstract. Fungi have important role in the forest soil because of their ability to produce lignolytic and cellulolytic enzymes. The aim of this study was to study the population of fungal producing lignolytic and cellulolytic enzymes from various habitat of two natural forest in East Kalimantan. Soil and litter samples were obtained from the Sungai Wain and Gunung Lumut Natural Forest using purposive random sampling method. The fungi were cultured by spread plate method on agar media containing Poly-R, CMC agar media, and PDA media with 0.05% guaiacol. Lignolytic and cellulolytic enzymes-producing fungi were identified based on the clear zone formed on the media and laccase-producing fungi were identified based on reddish-brown color changes on the surface of the media. The cellulolytic fungal population in the litter sample of Gunung Lumut was the highest (2,85 x 105 CFU/mL) and followed by litter sample of Sungai Wain (2,44 x 105 CFU/mL), whereas at soil sample and sediment of Gunung Lumut and Sungai Wain were 1,02 x 105; 5,13 x 104; 1,55 x 105 and 1,3 x 104 CFU/mL, respectively. The highest Lignolytic fungal population in Sungai Wain was 8 x 103 CFU/mL. The highest population of laccase enzyme-producing fungi is 3.73 x 103 CFU/mL.

Keywords: fungi, natural forest, east Kalimantan, soil, litter.

Abstract R2-12

Nutritional Value of Red and Brown Seaweeds from Indonesia

Ratih Pangestuti[1,*], Lisman Suryanegara[2], Puji Rahmadi[3], Dedy Kurnianto[1].

[1]Research Center for Food Processing and Technology, National Research and Innovation Agency (BRIN), Jl. Jogja-Wonosari Km. 31.5 Kec. Playen, 174 WNO, DI Yogyakarta 55861, Indonesia
[2]Research Center for Biomass and Bioproducts. National Research and Innovation Agency (BRIN). Jl. Raya Bogor Km.46 Cibinong. Bogor Indonesia
[3]Research Center for Oceanography, National Research and Innovation Agency (BRIN), Jl. Pasir Putih 1, Ancol Timur, Jakarta Utara 14430, Indonesia

*Email: rati008@brin.go.id

Abstract. This study investigated nutritional value of four seaweed species from two classes (Red and Brown seaweeds) from Indonesia. The brown seaweeds, *Sargassum polycystum* contained 63.32, 10.5, 2.10, 18.99, 5.09 % of carbohydrate, protein lipid, ash, and moisture respectively. Compared to *Gracilaria* sp, *Hypnea musciformis and Sargassum polycystum*; *Padina australis* contained lowest levels of carbohydrates (48.98 %). In this study we found that Palmitic acid (C16:0) was the most prevalent saturated fatty acid (SFA) in red and brown seaweeds. Interestingly, only *Gracilaria* sp contain DHA (C22:6n3) at 6.16 %. The total phenolic, flavonoid and saponin contents showed that brown seaweeds contain higher levels compared to red seaweeds. Hence, the findings of this study showed that brown and red seaweeds were nutritious and can be regarded as a dietary component for good health.

Keyword: nutritional, red, brown, seaweeds, Indonesia

Abstract R2-13

The Utilization of Sodium Chloride (NaCl) as A Natural Preservative in Gewang Petioles (*Corypha utan* LAMK.) Against Subterranean Termites Attacks

Sigit Baktya Prabawa

Research Center for Biomass and Bioproducts, National Research and Innovation Agency Jl. Raya Bogor KM 46, Cibinong, Bogor, Indonesia 16911

sigit.baktya.prabawa@brin.go.id

Abstract. Gewang (Corypha utan LAMK) is a palm-like forest plant. Its distribution covers India, Indochina, Malaysia, Indonesia, Philippines, Papua New Guinea to Australia. In the distribution areas, Gewang is widely used differently by local people, for example, in Timor-Indonesia, the young petioles are made into Bebak as a material for walls and ceiling of houses. However, Bebak contains lignocellulose material which is susceptible to attack by subterranean termites. For the benefit of people living in remote areas who use Bebak, it is necessary to find preservatives that are cheap and easy to obtain. There is information that NaCl can be used as a natural preservative for various types of food, partly because of its hygroscopic nature which causes microorganism cells to die due to dehydration. The purpose of this study was to determine the effect of NaCl concentration applied to Bebak against subterranean termites. Preservation was carried out by immersing Bebak in to NaCl solution with a concentration (gram/liter) of 0 (control), 4, 16, 25, and 36 respectively for 24 hours at room temperature. The results showed that the application of NaCl had a very significant effect on reducing the attack and increasing the mortality of termites compared to the control.

Abstract R2-14

Development of MASARO Compost Formula Based on Yard Waste (Dried Acacia Leaves) and Cow Manure

Reni Yuniarti[1, a)], Aldillah Herlambang1, b), Ahmad Husein Fatta Suherman1, c) Anggi Pratiwi1, d) and Akhmad Zainal Abidin2, e)

Author Affiliations
[1]Department of Chemical Engineering, Institut Teknologi Sumatera, South Lampung, Indonesia
[2]Department of Chemical Engineering, Institut Teknologi Bandung, Bandung, Indonesia

Author Emails
a)reni.yuniarti@tk.itera.ac.id
b)aldillah.herlambang@tk.itera.ac.id
c)ahmad.118280077@student.itera.ac.id
d)anggi.118280029@student.itera.ac.id
e)zainal@che.itb.ac.id

Abstract. Organic waste is the largest contributor to waste and must be managed correctly because its presence can have a negative impact on the environment if allowed to rot. Compost is produced by decomposing organic waste (animals and plants) into products with high economic value as part of efforts to reduce organic waste. The zero-waste management technology (MASARO) provides a method for composting organic waste by implementing a MASARO biocomposter that can accelerate the composting process. Therefore, this study aimed to investigate the effect of the addition of MASARO biocomposter on the composting process with a mixture of yard waste (dried acacia leaves) and cow manure. Composting was carried out on sack media with a mixing ratio of cow manure and acacia leaves, namely 1:1, 1:2, and 1:3 (w/w). Based on the results, each variation of the formulation produced mature compost at 10 days of composting. This is indicated by the physical appearance of the compost, which resembles soil in that it is blackish brown in color, has a mild odor, and has a lumpy texture. At that time, the mature compost had a temperature of 27.3–30.66oC, pH 6.8– 7.12, and a total population of microorganisms of 2.7x106–6.26x106 Cfu/mL. The results of the composting in this study showed maturity according to SNI 19-7030-2004, namely the variation of MASARO compost formula 1:1, 1:2, 1:3 with C-organic content of 42.38-46.59%-w, N-Total of 1.96-2.43%-w, P2O5-Total of 0.17-0.38%-w, K2O-Total of 0.63-1.78%-w and a C/N ratio of 19.07-21.99.

Keywords: Organic waste, acacia leaves, cow manure, MASARO biocomposter, compost.

Abstract R2-16

RAGU (porang-sagu) Biscuits as an Alternative *Superfood*

Raden Esa Pangersa Gusti[1], Ina Winarni[1], and Gunawan Pasaribu[1]

[1]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Republic of Indonesia*

Abstract. This study was presented as a form of thought to support the government's program on Food and Nutrition Sufficiency. It is stated that one of the indicators of achieving food and nutrition sufficiency is by diversifying food and improving community nutrition. Indonesia still faces health problems in the form of obesity and stunting. Current data shows that there are around 28 toddlers who suffer from stunting out of 100 toddlers. Biscuits are the type of food product selected in this study. The food ingredients used in this study were porang, sago, and sugar palm. The nutritional content of sago in the form of protein, calcium, iron and teonine is still lower than rice and dry corn. To fulfill a better nutritional content, fortification is carried out with porang, which is known for its high content of calcium and glucomannan. The biscuits were made with seven (7) formula variants (B1-B7) with different levels of each main ingredient. Proximate analysis and organoleptic tests were conducted to determine the nutritional value and level of preference of respondents to the research product. The results show there was one formula that did not meet the nutritional standards based on the reference from the National Standards Agency (BSN). The results of the organoleptic test showed that formula of B2 were the most preferred variants.

List of Abstracts-Parallel Session 6 – Biopolymer*

Abstract R4-01

Utilization of Extracted Lignin from Pulp Industry Waste for Mulch UV Retardant

Della Apriyani Kusuma Putri [1] , Mersi Kurniati [1] , and Firda Aulya Syamani [2]

[1]Department of Physic, Faculty of Mathematics and Science, IPB University
Darmaga IPB Campus, Bogor, West Java 16680, Indonesia
[2]Research Center for Biomass and Bioproducts, National Research and Innovation Agency
Jalan Raya Bogor Km. 46, Cibinong, West Java 16911, Indonesia

Corresponding author: firda.aulya.syamani@brin.go.id

Abstract. Mulch made from Low Linear Density Polyethylene (LLDPE) has quite good mechanical properties that can be translucent, flexible, waterproof, and easily printed into thin sheets. However, besides having advantages, LLDPE also has disadvantages when applied in the field. LLDPE Mulch is easily degraded due to ultraviolet (UV) radiation from the sunlight and is also difficult to decompose in the soil. The purpose of this study was to analyze the resistance of LLDPE-based mulch to UV light degradation by the addition of lignin and coconut fibers which have high lignin content. The mulch was in form of a thin sheet plastic composite. LLDPE and lignin or coconut fibers powder were compounded with rheomixer at a temperature of 120 ° C, and 80 rpm for 6 minutes. The proportion of lignin or coconut fibers powder was 1%, 5%, and 9% of total weight. Thereafter, the compound produced was hot-pressed into a thin sheet of plastic. Characterization of thin sheet of plastic was carried out using FTIR spectroscopy, Universal Testing Machine, XRD, and UV Vis spectrophotometer.

Keyword: LLDPE mulch, lignin, coconut fibers powder, UV absorber

* Several abstracts are copied from the unrevised version of the associated paper and will be different with the published version after the copy-editing and typesetting following the standards of the publisher.

Abstract R4-02

Inventory and testing of *Rhizobium* bacteria in roots and soil area of East Kalimantan on the growth of Soybean (*Glycine max* L) in greenhouse

Sri Purwaningsih[1a,] Tirta Kumala Dewi[1,] Entis Sutisna[1,] and Agung Adi Nugroho[1]

[1a]*Research Center for Applied Microbiology, National Research and Innovation Agency, Indonesia*
Jl. Raya Jakarta- Bogor Km 46, CSC Cibinong, West Java

[a)]Corresponding author: : sipur2005@yahoo.co.id

Abstract. Plant Growth-Promoting Rhizobacteria (PGPR) are microorganisms that can boost and promote plant growth; selecting an efficient PGPR is crucial for biofertilizers. On primarily *Rhizobium*-growing media, 21 samples of soil and rhizosphere were cultivated. The results showed that the number of *Rhizobium* bacteria ranged from 15 - 95 X 10^5 CFU/g soil; 21 isolates were obtained, all of which indicated *Rhizobium* bacteria; 2 isolates belonged to the slow-growing group, and 19 isolates belonged to the fast-growing group. Eleven isolates were capable of producing IAA hormone, 11 isolates were capable of producing protease enzymes, 16 isolates were nitrogen-fixing, and 10 isolates could solubilize phosphate. The greenhouse tests indicated that the dry weight of the canopy was highest in plants inoculated with isolate number 2 KY (2.79 g) and that the dry weight of the root was highest in plants inoculated with isolate numbers 3 KY, 9 KY, and 15 KY (0.88 g), that the dry weight of root nodules was highest in plants inoculated with isolate number 2 KY (0.36 g), and that the dry weight of total plants was highest in plants inoculated with isolate number 15 KY (4.11 g). Isolate number 15 KY gave the best growth results of all the parameters observed.

Keywords: Inventory, Rhizobium, Biofertilizer, *Glycine max* L

Abstract R4-03

Comparison of Lighting Simulation Tools with Focus on Daylighting for Sustainable Building in Tropical Climate

Dany Perwita Sari[1,a)], Agung Sumarno[1,b)], Agus Mudo Prasetyo[1,c)], Maidina[1,d)], Luna Ngeljaratan[1,e)]

[1]*Research Center for Structural Strength Technology, National Research and Innovation Agency, Indonesia*

[a]Corresponding author: dany.perwitasari@gmail.com ; dany003@brin.go.id
[b)] agun025@brin.go.id
[c)] agus108@brin.go.id
[d)] luna001@brin.go.id
[e)] maid002@brin.go.id

Abstract. With rising concern for global warming and COVID-19 pandemic, reducing electricity consumption and promoting healthier living condition are among the top priorities in residential buildings. Indonesia is a tropical country with a year-round sunny climate. As opposed to that, lighting accounts for the majority of energy consumption in residential buildings. The failure to maximize daylighting was largely due to a limited understanding of the design of openings. Simulator tools today are often used by designers to predict and analyze their openings. There are, however, a variety of lighting simulation software programs available today to achieve daylighting goals. Architectural and building designers use these tools to gain a better understanding of the complexities of opening designs. It is mandatory to analyze and evaluate the software tools constantly in order to create value driven lighting, especially in tropical climates. The main objective of this paper is to assess the ability of different lighting simulation tools to simulate lighting quality specifically for daylight. The comparison indicators are determined according to he accuracy to develop model, input quality, and output analysis. These research results summarize the potential and limitations of several simulation tools.

Abstract R4-04

The Application of Indonesia Green Building Rating System for Sustainable Buildings

Dany Perwita Sari[1,a)], Maidina[1,b)], Agung Sumarno[1,c)], Agus Mudo Prasetyo[1,d)], Luna Ngeljaratan[1,e)]

[1]*Research Center for Structural Strength Technology, National Research and Innovation Agency, Indonesia*

[a)]Corresponding author: dany.perwitasari@gmail.com ; dany003@brin.go.id
[b)] maid002@brin.go.id
[c)] agun025@brin.go.id
[d)] agus108@brin.go.id
[e)] luna001@brin.go.id

Abstract. According to Indonesia's National Guidelines on Green Buildings (Kemen PUPR No,21,2021) called *Penilaian Kinerja Bangunan Gedung Hijau* (BGH), green buildings are mandatory for new and existing buildings. As environmental concerns grow, the Government uses these ratings to control energy consumption. A government initiative aims to increase demand for environmentally friendly buildings. Nevertheless, designers and architects may have difficulty incorporating this rating systems into their designs. BGH is evaluated in this paper for application to simple residential buildings. An evaluation of BGH ratings and sustainability analysis can be performed with building information modeling and a conceptual framework is presented toward the end of this paper.

Keywords: Building performance analysis, Sustainable building, Indonesia green building rating system, BGH, Residential building

Abstract R4-05

Comparison of Green Concrete Performance using Digital Image Correlation Algorithm based on Video Camera and Smartphone Data

Agus Mudo Prasetyo[1], Agung Sumarno[1], Dany Perwita Sari[1], Maidina[1], Luna Ngeljaratan[1,2], and MA. Moustafa[2]

[1]Research Center for Structural Strength Technology, National Research and Innovation Agency, Indonesia
[2]Department of Civil and Environmental Engineering of University of Nevada, Reno, USA

Corresponding author email: luna001@brin.go.id

Abstract. The investigation of composite material behavior like green concretes creates an important laboratory study in assessing their mechanical behavior, specifically when they are designed for an earthquake resistance structure. Usually, monitoring the specimen and recording the data were conducted using mechanical sensors such as string potentiometer, accelerometer, LVDT, or strain gages that were attached or embedded into the specimen. These sensors are contact-type and their placements are time-consuming with the possibility of disengagement under large amplitude loading test. Therefore, a remote and a non-contact type of sensor such as vision-based monitoring using Digital Image Correlation (DIC) algorithm is proposed in this study as a full-field measurement technique. The local behavior of a green concrete specimen subjected quasi-static loads is monitored and quantified using the DIC technique. The objective of this study is to offer the practical application of DIC as a fast and efficient technique with high-accuracy that is also comparable to the existing instrumentation measurement. Two vision-based systems equipped with camera are proposed, i.e. a commercial video camera and a smartphone that measures the two-dimensional behavior of the concrete specimen during the test. A set of compression test is conducted and the displacement time histories as well as the full-field strain measurement of the specimen are computed by image processing using a 2D DIC algorithm. The results from the image acquisition are then compared to the ones collected from the DAQ. The results show a good agreement between the two vision systems with respect to DAQ data which provide great application potential of the DIC technology in measuring the mechanical behavior of green concrete in the laboratory scale.

Keywords: green concrete, performance, digital image correlation, video camera, smartphone.

Abstract R4-06

The Effect of Stand Age and Sampling Position on Solar Drying Performance and Post-Drying Quality of Oil Palm Lumber

Fahriansyah[1], Karnita Yuniarti [1, a)], Efrida Basri[1], Jamaludin Malik[1] and Jamal Balfas [1]

[1]*Research Center for Biomass and Bioproduct, BRIN, Cibinong Science Center - Botanical Garden, Jl. Raya Jakarta-Bogor No.KM. 46, Cibinong, Bogor Regency, West Java 16911*
National Research and Innovation Agency of Indonesia

[a)]Corresponding author: karn005@brin.go.id

Abstract. This study investigated the solar drying performance and post-drying qualities of 25- and 32-year-old oil palm wood sampled from different parts of the trunk. Vertical (from the bottom to the top parts of the trunk) and horizontal (along the transversal surface of the trunk, i.e., the inner and outer zones) sampling positions were applied. The results show that the stand age and the vertical sampling position (along the trunk length) significantly affected the drying rate, the drying period, and the post-drying shrinkage. The horizontal sampling position (along the transversal surface of the trunk) also significantly affected the post-drying shrinkage. On average, the 25-year-old oil palm wood had the fastest drying rate (approximately −0.06%/hour) and the shortest drying period (approximately 232 hours). As the stand age increased, the tendency to develop external checks decreased, but the depth of all the distortion defects and the tendency to collapse increased. The inner-zone samples shrank more than the outer-zone samples and were more prone to develop external check, bowing, cupping and collapse than the outer-zone samples.

Keywords: oil palm wood, solar drying, drying performance and quality

Abstract R4-07

Properties of Bio-Based Non-Isocyanate Polyurethane Resins Derived from Viscous Tannin of *Acacia Mangium* Bark, Dimethyl Carbonate, and Hexamethylenediamine

Manggar Arum Aristri[1,2)], Muhammad Adly Rahandi Lubis[1,3a)], Rita Kartika Sari[2b)], Raden Permana Budi Laksana[1)], Maya Ismayati[1)], Efri Mardawati[3,4)] and Apri Heri Iswanto[5,6)]

[1]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Cibinong Science Center, Cibinong, 16911, Indonesia*
[2]*Department of Forest Product, Faculty of Forestry and Environment, IPB University, Bogor, 16680, Indonesia*
[3]*Research Collaboration Center for Biomass and Biorefinery Between BRIN and Universitas Padjadjaran, Jatinangor, 4, Indonesia*
[4] *Department of Agro-industrial Technology, Universitas Padjadjaran, Jatinangor 40600, Indonesia*
[5] *Department of Forest Product, Faculty of Forestry, Universitas Sumatera Utara, Medan, North Sumatera, 20155, Indonesia*
[6]*JATI-Sumatran Forestry Analysis Study Center, Universitas Sumatera Utara, Medan North Sumatera, 20155, Indonesia*

Corresponding authors:
[a)]muha142@brin.go.id
[b)]rita_kartikasari@apps.ipb.ac.id

Abstract. The increased industrial demand for polyurethane (PU) resins and the enhanced environmental awareness related to the unsustainable consumption of fossil-derived resources have ledd to a new indictment that connects with the development of 'green', eco-friendly materials from renewable feedstocks. This study aims to synthesize bio-based PU resins derived from viscous tannins extract of *Acacia mangium* bark, dimethyl carbonate (DMC), and hexamethylenediamine (HMDA). *A. mangium* bark powder was extracted using hot water at a temperature of 60°C then concentrated using a rotary evaporator with a vacuum of 63 mbar and a rotation speed of 150 rpm, resulting in a viscous extract of tannin with a solids content of 93.0%. The Bio-based non-isocyanate PU (Bio-NIPU) resins were synthesized via carbonation of tannin and DMC at a temperature of 50 °C for 15 minutes, and then cross-linking reaction between the carbonyl groups with HMDA to form the urethane linkages (−NCO). Analysis of rheology, chemical, and thermo-mechanical properties of Bio-NIPU resins were carried out to determine the properties of the tannin-based Bio-NIPU resins. The formation of the −NCO group was confirmed by FTIR which showed a shift in the carbonyl peak from 1752 cm^{-1} in carbonated tannin to 1694 cm^{-1} in tannin-based Bio-NIPU resins. This study showed that the Bio-NIPU resins could be prepared using viscous tannin of *A. mangium*, DMC, and HMDA.

Keywords: bio-polyurethane, carbonated tannin, dimethyl carbonate, hexamethylenediamine, non-isocyanate

Abstract R4-08

Performance of Fortified Noodle Made from Konjac and Palm Sago Flour

Raden Esa Pangersa Gusti[1] and Gunawan Pasaribu[1]

Author Affiliations
[1]Research Centre for Biomass and Bioproducts, National Research and Innovation Agency (BRIN), Republic of Indonesia, Kawasan Sains Teknologi Dr. (H.C.) Ir. H. Soekarno
Jl. Raya Bogor Km. 46, Cibinong- Indonesia 16911

Author Emails
[a)] Corresponding author: gun_pa1000@yahoo.com; guna016@brin.go.id
[b)] resapangersag@gmail.com

Abstract. This study aims to enhancement nutrition value of noodle's product by fortification method using konjac and palm sago flour. There are five noodles' formulas tested with various level concentration of konjac and palm sago flour. Organoleptic test was carried out to measure the preference level to the products. The parameters assessed were colour, aroma, taste, and texture. In addition, proximate parameters including water content, ash content, total amount of fat, protein content, carbohydrate and crude fibre content were tested as well. The result shows wet noodles fortified by konjac and palm sago flour met the standards quality of wet noodles in Indonesia (SNI 01-2897-1992). In addition, Formula number 2 (wheat: palm sago: konjac = 80:10:10) come up as the most preferred formula. Increasing the proportion of fortification could increase the carbohydrate, fat, and crude fibre contents of the noodle. The calcium content was doubled with addition of sago palm and konjac flour. The konjac-sago palm noodle production cost IDR 33,581 per kilogram.

Abstract R4-09

Formulation and Characterization of Bioresin Made from Oil Palm Bark Extract for Wood Adhesive

Adi Santoso and Jamaludin Malik

Research Cntre for Biomass and Bioproducts, National Research and Innovation Agency (BRIN) Indonesian, Cibinong 16911, Indonesia

Email: adi.santoso.1@brin.go.id

Abstract. An effort to reduce formaldehyde emission from wood adhesives is to replace them with alternative bio-adhesives that have similar properties and adhesive qualities. The ingredients used are derived from the bark extract of the palm trunk (Elaeis guineensis Jacq.). The best formulation for adding phenol formaldehyde (PF) resin in bioadhesive synthesis was carried out by characterizing the physical and chemical properties of the bioadhesive to be applied to laminated wood. These characteristics are in the form of appearance, pH, solids content, specific gravity, viscosity, and total phenolic content as well as the components of the compounds contained in the bioadhesive. Characterization of the resulting Sen-gon laminated wood was carried out to determine the optimum formulation with delamination test parameters, moisture content, and formaldehyde emission. The results showed that the best formulation of bioadhesive from palm bark was the addition of 7.5% (w/w) PF resin.

Keywords: Formulation, bioresin, oil-palm bark extract, wood adhesives, glulam.

Abstract R4-10

Influence of Different Organic Acids Hardener on Performance of Ultra-Low Molar Ratio Urea-Formaldehyde Resins Adhesive

Raden Permana Budi Laksana[1a)], Muhammad Adly Rahandi Lubis[1,2b)], Fazhar Akbar[1)], Sukma Surya Kusumah[1)], Ika Juliana[3)], Rahmawati Putri[3)], Efri Mardawati[2,4)]

[1]Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Cibinong Science Center, Cibinong, 16911, Indonesia
[2] Research Collaboration Center for Biomass and Biorefinery Between BRIN and Universitas Padjadjaran, National Research and Innovation Agency, Sumedang, 45363, Indonesia
[3]PT. Greenie Alam Indonesia, Jl. Letnan Sutopo, Banten, 15310, Indonesia
[4]Department of Agro-industrial Technology, Faculty of Agro-industrial Technology, Universitas Padjadjaran, Sumedang, 45363, Indonesia

Corresponding authors:
[a)]rade028@brin.go.id
[b)]muha142@brin.go.id

Abstract. Conventional wood adhesives are formaldehyde-based adhesives, isocyanates, and epoxy, accounting for nearly 90%–95% of the world demand in 2021. Among them, urea-formaldehyde (UF) resins dominate the global wood adhesives market because of low prices, fast curing, and short pressing time. However, the main drawback associated with the use of UF resins is the formaldehyde emission from UF-bonded products. Therefore, this study aimed to synthesize ultra-low formaldehyde emission UF resin adhesive by tuning the final formaldehyde to urea (F/U) mole ratio at 0.8/1.0. Three types of organic acids (20% w/v) were added at a 3% level based on the solids content of UF resins as the hardener, namely acetic acid (AA), maleic acid (MA), and citric acid (CA). Basic properties such as non-volatile solids content, viscosity, gelation time, and free-formaldehyde (HCHOfree) of ultra-low molar ratio UF resins were affected by adding different organic acids. Generally, incorporating organic acids hardener reduced the solids content, viscosity, gelation time, and HCHOfree of UF resins. Markedly, the HCHOfree decreased by 14.2% by adding CA. Only a small reduction of HCHOfree by 7.0% was obtained with an addition of MA and AA. This could be due to the reaction between carboxylic groups of the organic acids with the free aldehyde groups of UF resins. This work showed that the addition of CA hardener increased the adhesion strength of UF resins in plywood as indicated by the result of tensile shear strength. This study suggested incorporating CA as the hardener for ultra-low molar ratio UF resins for plywood adhesive in the future.

Keywords: acetic acid, citric acid, free-formaldehyde, maleic acid, ultra-low molar ratio, urea-formaldehyde

Abstract R4-11

Termite and Decay Resistance of Three Sorghum (*Sorghum Bicolor*) Accessions Bonded with Maleic Acid Adhesive

Jajang Sutiawan[1], Dede Hermawan[2], Yusuf Sudo Hadi[2], Deded Sarip Nawawi[2], Sukma Surya Kusumah[3, 4]*, Deni Zulfiana[3], and Dwi Ajias Pramasari[3]

[1]*Forest Products Department, Faculty of Forestry, Universitas Sumatera Utara, Medan, 20155, Indonesia*
[2]*Forest Products Department, Faculty of Forestry and Environment, IPB University, Dramaga, 16680, Indonesia*
[3]*Research Center for Biomass and Bioproducts, National Research and Innovation Agency, Cibinong, 16911, Indonesia*
[4]*Research Collaboration Center for Marine Biomaterials, Cibinong, 16911, Indonesia*

Corresponding author: sukm002@brin.go.id/sukma.surya@biomaterial.lipi.go.id

Abstract. The earlier research used three accession sorghum as an alternative raw material for manufacturing particleboard with maleic acid adhesive. Maleic acid (MA) performed better than phenol-formaldehyde (PF) adhesive in terms of the bonded particleboard's physical properties. In addition, the particleboard bonded with MA was comparable with those bonded with citric acid. However, termite and decay resistance at various sorghum accession is unknown. Consequently, this study examined the effect of sorghum accessions on the particleboard's termite and decay resistance. The manufacture of particleboard required the utilization of three sorghum accessions such as 4183A, Super 1, and Pahat. Particleboard manufacturers employed the 20 % MA adhesive. The board was 30 x 30 x 0.9 cm^3 in size, and the target density was 0.8 g/cm^3. The particle mat was pressed at a maximum pressure of 6.5 MPa for 10 minutes at 200 °C. SNI 7207-2014 was employed for termite resistance, and JIS K 1571-2004 assessed the particleboard's resistance to decay. The weight loss of particleboard against a termite attack in this study ranged from 13.87-47.21%. The weight loss of particleboard bonded with MA against termite attack was lower than the control. In addition, control samples had a higher weight loss (42.16-44.60%) than particleboard bonded with MA (11.06-12.39%) after 12 weeks of brown rot and white-rot fungi. The increased resistance to decay is probably due to the high acidity of MA and the particleboard's lower moisture content. Sorghum accession had no significant effect on termite and decay resistance due to the chemical components of the three sorghum accessions used to have uniform chemical components.

Abstract R4-12

Preliminary Study of Effect of Palm Oil as Secondary Plasticizer on Flow Behavior of Hydroxyl Terminated Polybutadiene (HTPB)

Afni Restasari[1, a)], Yeyen Nurhamiyah[1, b)], Retno Ardianingsih[2, c)], Luthfia Hajar Abdillah[2, d)], Kendra Hartaya[2, e)]

[1]*Research Center for Biomass and Bioproducts, National Agency for Research and Innovation (BRIN), Cibinong, Indonesia.*
[2]*Research Organization for Aeronautics and Space, National Agency for Research and Innovation (BRIN), Bogor Regency, Indonesia.*

[a)]afni.restasari@brin.go.id
[b)]yeye001@brin.go.id
[c)]retno.ardianingsih@brin.go.id
[d)]luthfia.hajar@brin.go.id
[e)]kendra.hartaya@brin.go.id

Abstract. Flow properties modifier is crucial in highly filled polymer composite, such as composite solid propellant, to ease the manufacturing process. Based on Hansen Solubility Parameter, palm oil-dioctyl adipate (DOA) mixture is hypothesized to be a compatible plasticizer to HTPB. This research aims to investigate the effect of palm oil-DOA mixture on flow behavior of HTPB. Viscosity at various shear rate and temperature of 40 ˚C, 50 ˚C, 60 ˚C were measured by using viscometer with rotational disc spindle to obtain flow index, molar volume and free energy of flow activation. The results show that viscosity of HTPB decreases from 80 to 30 Poise by using palm oil-DOA mixture as plasticizer. This effect is similar to HTPB-DOA. However, the mixture decreases around 3% of flow index of HTPB at various temperature. It is better than DOA. The molar volume and free energy of flow activation of HTPB-palm oil-DOA is 3.17 x 10^{-6} m^3/mole, and 24.95 KJ/mol, respectively. In conclusion, palm oil-DOA mixture has significant effect over DOA on flow index of HTPB. Long hydrocarbons chain in palm oil is suggested to be the origin.

Abstract R4-13

Cacao (*Theobroma cacao* L.) Shells: Optimization of Carboxyl Methyl Cellulose (CMC) Using Respond Surface Methodology

Woro Setiaboma[1*], Atia Fizriani[2], Djagal Waseno Marseno[3], Supriyanto[3]

[1]*Research Center of Food Processing and Technology, National Research and Innovation Agency, Yogyakarta, Indonesia*
[2]*Faculty of Agriculture, Universitas Garut, Garut, West Java, Indonesia*
[3] *Food Technology Department, Gadjah Mada University, Yogyakarta, Indonesia*

*Correspondent: wrboma@gmail.com / woro002@brin.go.id

Abstract. Cacao shells as by product in cacao industry contained cellulose that is not dissolved in water so that its limited application in industry, especially in the food industry. Cellulose could be synthesized being carboxymethyl cellulose that be applied as hydrocolloid. The objective of this study was optimization of carboxyl methyl cellulose (CMC) resulted in degree of substitution (DS) according to respond surface methodology (RSM) design. Result showed that more increase of DS, more increase of NaOH, Na MCA, and temperature. The experimental value of CMC was recommended to conduct in addition 12.84% NaOH, addition 4.9 g Na MCA, and temperature 53.94^{o} C, with 1 of desirability value**.** The DS value of the optimum condition had 0.79, while the DS value of verification had 0.83. In additionally, the characterization of the optimum condition revealed that the degree of substitution, moisture, purity, solubility, and pH were 0.79, 12.43%, 85.06%, 71.83% db., and 6.74, respectively. The effectively synthesized of cellulose into CMC was confirmed by flourier transform infrared (FTIR) and X-ray Diffraction (XRD).

Keywords: cacao, cacao shells, carboxymethyl cellulose, degree of substitution (DS), respond surface methodology (RSM)

Abstract R4-14

Application of Near-Infrared (NIR) Spectroscopy for Predicting Changes of Water Content and Rind Colour of Red Delicious Washington Apple (*Malus domestica*) in Room Temperature Storage

Dyah Ayu Agustiningrum[1], Imran Arra'd Sofianto[1, a)], Ratih Damayanti[1], Djarwanto[1], R. G. Hadi Rahmanto[1], Rohmah Pari[1], Listya Mustika Dewi[1], Adik Bahanawan[1], Dimas Triwibowo[1], Teguh Darmawan[1], Danang Sudarwoko Adi[1], Yusup Amin[1], Wahyu Dwianto[1], Sudarmanto[1], Narto[1], and Prabu Satria Sejati[1]

[1]*Research Center for Biomass and Bioproducts BRIN, KST Soekarno, Jalan Raya Bogor KM.46, Cibinong, Bogor, Indonesia*

[a)]Corresponding author: imra003@brin.go.id

Abstract. Water content and rind colour of an apple affect people of Indonesia in choosing and buying this fruit. NIR (near-infrared) spectroscopy was applied to predict precisely the best "before date" of fruits in industries by predicting the changes of water content and rind colour. Thirty apples of Red Delicious Washington species bought from supermarket served as research materials. Water content data were obtained by six times weighing within two months and simultaneously measured their L*, a*, and b* coordinates (CIE) for rind colour in two places using ColorReader CR-10 Plus and NIR spectrometer. 288 data changes of water content and rind colour were combined with their NIR spectra for analysis using CV-PLSR (cross-validation partial least squares regression) as chemometrics to produce the prediction. The changes of water content in the samples were 0.8%, while the rind colour changes were 5.9 (∆E*) within two months research. The application of NIR to predict changes of water content and rind colour in apple resulted 0.72 and 0.42 of R^2CV, respectively, as the best prediction result from their original NIR spectra data. NIR spectroscopy could predict sufficiently for the changes of water content and rind colour of apple fruit in room temperature during storage.

Keywords: ColorReader, fruit freshness, PLSR, prediction, room storage

Abstract R4-15

Protease Stability of Indigenous Lactobacillus satsumensis EN38-32 and Fructobacillus fructosus EN17-20 at Cold and Freezing Temperatures

Tatik Khusniati[1a)] Dwi Oktaviani[2b)] Ade Heri Mulyati[2b)] and Sulistiani[1c)]

[1]*Research Center for Applied Microbiology, National Research and Innovation Agency (BRIN), Jl. Raya Jakarta-Bogor Km46, Cibinong 16911, Bogor, West Java, Indonesia.*
[2]*Chemistry Department, Faculty of Mathematic and Natural Sciences, Pakuan University, Bogor, West Java, Indonesia.*

[a)]Corresponding author: tatikkhusni@gmail.com
[b)]adeherimulyati@yahoo.com
[c)]sulis_lipi@yahoo.com

Abstract. Protease as a hydrolyzer protein is imported enzyme To reduce import of protease, indigenous protease-producing lactic acid bacteria can be used as an alternative. This study aimed to determine the stability of the proteases *L. satsumensis* EN38-32 and *F. fructosus* EN17-20 at cold and freezing temperatures at various storage times of 0, 7, 14, 21, and 28 days. The protease activity was tested using the tyrosine method, while the protease was stated stable if the relative activity of protease was ≥ 50%. Data were analyzed statistically using ANOVA. The results showed that at 7-28 days of storage the stability of the protease *L. satsumensis* EN38-32 was reached at cold temperature with protease relative activity values between 85.04-95.01% and at freezing temperature between 85.22-96.31%, while the stability of the protease *F. fructosus* EN17-20 reached at cold temperature ranged from 68.11-89.71% and at freezing temperature between 95.25-98.42%. Based on the protease activity, protease stability of *L. satsumensis* EN38-32 was better than that of *F. fructosus* EN17-20 at cold temperature, whereas at freezing temperature it was the opposite. It is recommended to use *L. satsumensis* EN38-32 at cold temperature as a protease source, while at freezing temperature to use *F. fructosus* EN17-20.

Keywords: *Fructobacillus fructosus* EN17-20, *Lactobacillus satsumensis* EN38-32, protease, stability, storage