Proceeding of The 4th JASTIP Symposium

"Biomass To Energy, Chemicals and Functional Materials"

3rd - 4th July, 2017

Venue: National Science and Technology Development Agency (NSTDA), Thailand

130th Anniversary of Japan-Thailand Diplomatic Relations 2017

130th Anniversary of Japan-Thailand Diplomatic Relations

JASTIP
Japan - ASEAN Science, Technology and Innovation Platform

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1. Introduction

Welcome Message

It is my great pleasure to welcome you all to the 4th JASTIP Symposium "Biomass to Energy, Chemicals and Functional Materials". JASTIP, the Japan-ASEAN Science, Technology and Innovation Platform, was established in October 2015 and officially launched in February 2016. Based on the long-term academic collaboration between Japan and ASEAN countries, we promote international, inter-disciplinary and inter-project collaborations and activate dialogues between researchers and non-academic stakeholders that include policy makers, administrators, the private sector and the general public.

We have experienced rapid economic growth and the transformation of society in the latter half of the 20th century. The main drivers of this development have been technology and the market economy. Technological development created and efficiently produced a wide range of new commodities, and these are now distributed to the most remote areas of the world through a global network founded on a market economy. We are making efforts to continue this trajectory in the 21st century, and this, of course, has been partially successful. However, it is also true that this development forces us to confront emerging issues that may entail crucial risks to the safe and peaceful life of both present and future generations. These include the deterioration of the global environment, unstable and unpredictable energy supplies, shortages of clean water, frequent extraordinary climatic events, and natural disasters. As these are common issues at the global level in general and at the regional level in particular, we share Sustainable Development Goals (SDGs) and have set up multi-layered collaboration frameworks to deal with them.

The eastern side of the Eurasian Continent, from Russian Siberia, the coastal zone of mainland China, Korea, Japan, and Taiwan to the ASEAN countries, forms the Asian Green Belt as named by the late professor Tamiji Inoue. This unique corridor connects the temperate zone and the tropics across a substantial stretch of terrain that overlaps with an active earthquake and volcano zone. This area enjoys rich nature, particularly in terms of biomass production and bio-diversity. We believe that the issue of how to coexist with nature and manage and effectively utilize the biomass is an issue that is relevant to every part of this region if we hope to achieve a sustainable future for our descendants.

I sincerely hope that all of you will enjoy the discussions in this symposium and gain fruitful benefits from this opportunity. Thank you again for joining us.

Yasuyuki Kono

Project Leader of JASTIP and Center for Southeast Asian Studies
Kyoto University

Purpose of the Symposium

JASTIP has established joint laboratories focusing on the three fields; energy & environment, bioresources & biodiversity, and disaster prevention in order to strengthen the cooperative researches into sustainable development.

This symposium is entitled “Biomass to Energy, Chemicals and Functional Materials” with regard to biorefinery research, which is an interdisciplinary research field beyond energy & environmental research, and bioresources & biodiversity research.

We introduce current situation and issues of biorefinery study and presenting case study about front line of relevant research activities, results, and future prospects in ASEAN countries.by some prominent researchers. Biorefinery research at National Science and Technology Development Agency (NSTDA, Thailand) and Indonesian Institute of Sciences (LIPI, Indonesia) which are the counter partner of JASTIP will be introduced. We will also invite private sectors who are promoting business in this field.

Biorefinery are biomass conversion processes to produce value-added chemicals including biofuels and bioplastic. It is a high potential research field that is strongly expected to contribute to the sustainable development goals especially for Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all, 13: Take urgent action to combat climate change and its impacts, and15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.

The purpose of this symposium, we are going to disseminate and share information and knowledge with stakeholders through poster presentations, exhibition booths, question and answer, not only unilateral activity reports by oral presentation, to further strengthening and promoting collaborative activities of biorefinery research and research network through JASTIP platform.

2. Program

3 July 2017 (Day 1)

09:15 – 09:45	**Registration**
09:45 – 10:15	**Opening Address** MC: Dr. Nuwong Chollacoop and Ms. Papitchaya Utanun, NSTDA **Dr. Natchanapong Vajiravongburi**, Inspector General, Ministry of Science and Technology of Thailand **H.E. Shiro Sadoshima**, Ambassador Extraordinary and Plenipotentiary of Japan to the Kingdom of Thailand **Dr. Narong Sirilertworakul**, President, NSTDA **Dr. Ir. Bambang Sunarko**, Director, Research Center for Biotechnology, LIPI **Mr. Osamu Kobayashi**, Director, Department of International Affairs, JST
10:15 – 10:20	**Photo Session**
10:20 – 10:35	**Introduction of JASTIP** **Prof. Yasuyuki Kono**, Project Leader of JASTIP, Director, Center for Southeast Asian Studies, Kyoto University *"JASTIP: Achievements and Challenges"*
10:35 – 11:15	**Special Speech** **Prof. Noboru Noguchi**, Program Director, Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries, Cross-ministerial Strategic Innovation Promotion Program (SIP) *"Smart Agriculture toward Society 5.0"*
11:15 – 13:00	**Keynote Speech** Chair: Assoc. Prof. Dr. Thumrongrut Mungcharoen, NSTDA
11:15 – 11:50	**Mr. Yongyuth Sawatdisawanee**, Deputy Director General, Department of Alternative Energy Development and Efficiency *"Thai Biomass to Energy Policy & Implementation"*
11:50 – 12:25	**Dr. Anucha Euapermkiati**, Division Manager - Frontier Research, PTT Global Chemical Public Company *"Thailand Bioeconomy: Current Status, Future Direction and Implication for Industrial Sectors"*
12:25 – 13:00	**Dr. Kinya Sakanishi**, Deputy Director-General, Fukushima Renewable Energy Institute, National Institute of Advanced Industrial Science and Technology *"Potentials of Global Biomass Energy and R&D of Biomass Refinery Technologies"*
13:00 – 14:00	**Lunch / Exhibition and Poster Session**
14:00 – 15:15	**Overview of Bioeconomy & Biorefinery Study in ASEAN** Chair: Prof. Keiichi Ishihara, Kyoto University
14:00 – 14:25	**Prof. Takashi Watanabe**, Director, Research Institute for Sustainable Humanosphere, Kyoto University *"The JASTIP Project and Joint Approaches toward Sustainable Utilization of Bioresources"*
14:25 – 14:50	**Assoc. Prof. Dr. Klanarong Srirod**, Director, Mitr Phol Sugar Corporation Ltd. / Head, Innovation and Research Development Institute, MPSC *"Thailand's Bioeconomy & Biorefinery Development and Roles of Mitr Phol R&D"*
14:50 – 15:15	**Prof. Atsushi Tsutsumi**, Research Supervisor of SATREPS / Institute of Industrial Science, the University of Tokyo *"Bioenergy for Mitigation of Global Warming"*

15:15 – 16:15	**ASEAN-Japan Collaboration Research 1** Chair: Dr. Puspita Lisdiyanti, LIPI
15:15 – 15:35	**Prof. Yoshihito Shirai**, Graduate School of Life Science and Systems Engineering, Kyushu Institute of Technology *"Promotion of Green Economy with Palm Oil Industry for Biodiversity Conservation in Malaysia"*
15:35 – 15:55	**Dr. Kajornsak Faungnawakit**, NANOTEC, NSTDA *"Production of Biofuels and Biochemicals: Heterogeneous Catalysis as a Green Approach"*
15:55 – 16:15	**Dr. Yopi**, Research Center for Biotechnology, LIPI *"Center of Excellence of Integrated Biorefinery in Indonesia"*
16:15 – 16:30	**Coffee Break**
16:30 – 17:10	**ASEAN-Japan Collaboration Research 2** Chair: Prof. Takashi Watanabe, Kyoto University
16:30 – 16:50	**Prof. Akio Nishijima**, Environmental Research Institute, Waseda University / e-ASIA Joint Research Program, AIST *"Feasibility Study on Social Implementation of Bioenergy in East Asia"*
16:50 – 17:10	**Dr. Sumittra Charojrochkul**, MTEC, NSTDA *"Bio-hydrogen"*
17:10 –18:10	**Networking Discussion** Chair: Prof. Mamoru Shibayama, Kyoto University

4 July 2017 (Day 2)

09.30 – 10:00	**Registration and Coffee Break**
10:00 – 11:00	**ASEAN-Japan Collaboration Research 3** Chair: Dr. Verawat Champreda, NSTDA
10:00 – 10:20	**Prof. Toshiaki Umezawa**, Research Institute for Sustainable Humanosphere, Kyoto University "*The SATREPS Project for Producing Biomass Energy and Material through Revegetation of Deteriorated Grasslands*"
10:20 – 10:40	**Dr. Auttapol Golaka**, Siam Cement Public Company Limited *"5-Years R&D of 1 ton/hour Torrefaction Pilot Plant at SCG"*
10:40 – 11:00	**Prof. Dr. I. Made Sudiana**, Research Center for Biology, LIPI *"The Potential of Developing Marginal Land for Biomass Sorghum Production to Support Biorefinery Project in Indonesia"*
11:00 – 12:00	**Presentation from Funding Agencies** Chair: Prof. Hideaki Ohgaki, Kyoto University
11:00 – 11:15	**Mr. Jun Takashima**, Unit Chief, Planning and Capacity Development Unit / Project Coordinator, AUN/ SEED-Net *"Overview of AUN/SEED-Net Project Phase III"*
11:15 – 11:30	**Prof. Kuniaki Yamashita**, Director, JSPS Bangkok Office *"JSPS and its International Programs with Special References to Collaboration with ASEAN Countries"*
11:30 – 11:45	**Mr. Yoshinori Furukawa**, Chief Representative, New Energy and Industrial Technology Development Organization (NEDO) Representative Office in Bangkok *"NEDO-NIA Collaboration Creation of Tech-base Startup Eco-system"*
11:45 – 12:00	**Mr. Masaki Sato**, Director, JST Singapore Office "*Introduction of Japan Science and Technology Agency (JST)*"
12:00 – 14:00	**Lunch / Exhibition and Poster Session**
14:00 – 15:00	**ASEAN-Japan Collaboration Research 4** Chair: Prof. Mamoru Kanzaki, Kyoto University
14:00 – 14:20	**Prof. Chiaki Ogino**, Graduate School of Enginering, Kobe University "*Bio-refinery Strategy for Fuel Production in Indonesia*"
14:20 – 14:40	**Dr. Puspita Lisdiyanti**, Research Center for Biotechnology, LIPI "*Microbial Resources as a Source for Development of Biorefinery*"
14:40 – 15:00	**Dr. Surawut Chuangchote**, King Mongkut's University of Technology Thonburi "*Innovative Conversion of Biomass Derivatives to High Value Chemicals by Photocatalysis*"
15:00	**Closing Remarks** Prof. Ohgaki Hideaki, Kyoto University

3. Oral Presentation

Speaker's Information

Shiro SADOSHIMA

Ambassador Extraordinary and Plenipotentiary of Japan to the Kingdom of Thailand

Biography

Mar 1977	Graduated from University of Tokyo, Faculty of Law
Apr 1977	Entered Ministry of Foreign Affairs
Jul 1994	Counsellor, Embassy of Japan in Vietnam
Jul 1996	Director, Loan Aid Division, Economic Cooperation Bureau
Sep 1998	Director, China Division, Asian Affairs Bureau
Aug 2000	Counsellor, Embassy of Japan in Australia
Jan 2001	Minister, the same Embassy
Aug 2002	Consul, Consulate-General of Japan at Hong Kong
Jul 2004	Deputy Director-General, Economic Cooperation Bureau
Aug 2004	Deputy Director-General, Economic Cooperation Bureau, Multilateral Cooperation Department
Jan 2006	Deputy Director-General, Asian and Oceanian Affairs Bureau
Aug 2006	Deputy Director-General, Asian and Oceanian Affairs Bureau, Southeast and Southwest Asian Affairs Department
Aug 2007	Director-General, Policy Coordination Department, Japan International Cooperation Agency (JICA)
Jul 2009	Vice-President, JICA
Jan 2010	Director-General, International Cooperation Bureau
Oct 2011	Ambassador Extraordinary and Plenipotentiary of Japan to the People's Republic of Bangladesh
Apr 2015	Ambassador Extraordinary and Plenipotentiary of Japan to the Kingdom of Thailand

Opening Address
3 July 2017, 09:45-10:15

Speaker's Information

Narong SIRILERTWORAKUL

Home Town / Country : Thailand

Affiliation : National Science and Technology Development Agency

Position : President

E-mail : narong@nstda.or.th

Biography

2008 Advanced Management Program (AMP174), Harvard Business School, USA.1990 - 1993 Doctor of Philosophy in Manufacturing Engineering, The University of Birmingham, Birmingham UK. 1984 - 1988 Bachelors of Engineering (Production Engineering) First class honors, King Mongkut's Institute of Technology Thonburi, Thailand.

Area of Interest

The automotive industry quality system program, quality system improvement to automotive parts manufacturers. Quality systems, namely the QS 9000 and the ISO/TS 16949

Research Activities and Achievements

Awards:
- Outstanding Student, King Mongkut's Institute of Technology Thonburi.
- Gold Medal Award, the Engineering Institute of Thailand.
- The Royal Thai Government Scholarship to pursue a Master and a Ph.D. degree in the U.K.

Selected Committee Member:
- Chair of the Working Committee for the Thailand-China Technology Transfer Center: TCTTC
- Subcommittee on Science and Technology, the National Legislative Assembly, Thailand.
- Subcommittee on Human Resources Development, Office of the National Economics and Social Development Board, Thailand.
- Board of Directors, National Innovation Agency (Public Organization).
- Board of Directors, Mahidol Wittayanusorn School (Public Organization).
- Board of Directors, Electronic Government Agency (Public Organization).
- Evaluation Committee, National Science Technology and Innovation Policy Office, Thailand.
- Technical Subcommittee, Thailand Quality Award.

Message

Opening Address
3 July 2017, 09:45-10:15

Speaker's Information

Bambang SUNARKO

Home Town / Country : Bogor, Indonesia

Affiliation : Indonesia Institute of Sciences (LIPI)

Position : Director of Research Center for Biotechnology-LIPI

E-mail : bambang.sunarko@lipi.go.id

Biography

2014 - : Director of Research Center for Biotechnology-LIPI; 2013 – 2014: Director of Research Center for Biology-LIPI; 2013 - : General Secretary of PBI (Indonesian Association of Biology); 2006 – 2012: Leader of Microbial Biochemistry Research Group, RC for Biology-LIPI; 2000 – 2005: Head of Dept. of Bioprocess, RC for Biotechnology-LIPI; 1995 – 1999: Leader of Environmental Microbiology Research Group, RC for Biology-LIPI; 1995: graduated from University of Bayreuth, Germany

Area of Interest

Management of bio(techno)logy research activities; Bioprocess & Biocataliyst research and development: applied Microbiology & bioprospecting; cyanide and nitrile microbial biotransformation and metabolism.

Research Activities and Achievements

Research Experiences:

1. Bioprospecting of Nitrile Degrading Bacteria from the Biological Diversity of Indonesia as the basis of biocatalyst development
2. Towards New Influenza Antivirals from Natural Products: The Development of a Bioassay based on Heterologous Expression of M2 Ion-Channel Protein
3. Identification of Degradation Pathway of Vinylacetate Using Bacterial Isolate V2 and Characterization of the involved Enzymes
4. Development of Biosensor for Detection of Nitrile/Cyanide Compound in aquatic environment
5. Enantioselective Biotransformation of (R,S)-Naproxen Nitrile into (S)-Naproxen using nitrile degrading bacteria

Message

Opening Address
3 July 2017, 09:45-10:15

Speaker's Information

Osamu KOBAYASHI

Home Town / Country : Saitama, Japan

Affiliation : Japan Science and Technology Agency (JST)

Position : Director, Department of International Affairs

E-mail : okobayas@jst.go.jp

Biography

Osamu Kobayashi is the current Director of Department of International Affairs, Japan Science and Technology Agency (JST).
He has worked for JST since 2001 and built his career mainly in the international related business, including Manager of Department of International Affairs from 2008 to 2012, Director of Singapore Office from 2012 to 2015 and Director of Office of International Strategy from 2016 to 2017.

Area of Interest

International Research Collaboration

Information of Organization

Japan Science and Technology Agency is an organization that leads Japan's science and technology (S&T) development as an innovation navigator and that contributes to the lives of people and the achievement of a sustainable society by promoting S&T for the purpose of opening up opportunities in innovation.

Since its foundation, JST's many outstanding achievements accomplished in collaboration with the government, universities, the industrial sector and public from all over the world have been recognized as a foundation of rich ecosystems to create innovation.

Message

Global issues affect more than a single country or region, and cannot be resolved without international collaboration. That is why more cooperation among various kinds of stakeholders in Asia region is very much expected more than ever.
"Japan-ASEAN Science and Technology Innovation Platform" can be a key driving force to boost it.

Introduction of JASTIP

3 July 2017, 10:20-10:35

Speaker's Information

Yasuyuki KONO

Home Town / Country : Kyoto, Japan

Affiliation : Center for Southeast Asian Studies, Kyoto University

Position : Professor, Director

E-mail : kono@cseas.Kyoto-u.ac.jp

Biography

2014-: Director, CSEAS, Kyoto University, 2005-: Professor, CSEAS, Kyoto University, 1998-2005: Associate Professor, CSEAS, Kyoto University, 1992-94: Assistant Professor, Irrigation Engineering and Management Program, Asian Institute of Technology, 1987-1998: Assistant Professor, CSEAS, Kyoto University, 1986-87: JSPS Postdoctoral Fellow, Graduate School of Agriculture, The University of Tokyo, 1986: Doctor of Agriculture, Graduate School of Agriculture, The University of Tokyo

Area of Interest

Sustainable humanosphere studies for re-organizing human-nature relationship and establishing sustainable agricultural system, Land and water resources management for achieving diverse development path of local societies, Livelihood transition studies for establishing mutually dependent rural-urban linkages

Research Activities and Achievements

1) Achievements

On sustainable humanosphere studies: Sugihara K., Kawai, S., Kono, Y. and Tanabe, A. eds. 2010. *Geosphere, Biosphere and Human Society*, Kyoto University Press (in Japanese), Yanagisawa, M., Kono, Y., Kozan, O. and Kanzaki, M. eds. 2012. *Potentiality of Geosphere and Biosphere*, Kyoto University Press (in Japanese). On land and water resources management, Leisz, S. J., Kono, Y., Yanagisawa, M. and Fox, J. eds. 2009. *Mechanisms of land use change in Mainland Southeast Asia*, Special Issue of Southeast Asian Studies 47(3), Dao Minh Truong, Yanagisawa, M. and Kono, Y. 2017. Forest Transition in Vietnam: A Case Study of Northern Mountain Region, Forest Policy and Economics 76: 72-80. On livelihood transition studies, Kono, Y., Badenoch, N., Tomita, S., Douangsavanh, L. and Nonaka, K. eds. 2010. *Agency, opportunity and risk: Commercialization and the human-nature relationships in Laos*, Special Issue of Southeast Asian Studies 47(4), Le Zhang, Yasuyuki Kono, Shigeo Kobayashi, Huabin Hu, Rui Zhou and Yaochen Qin. 2015. The expansion of smallholder rubber farming in Xishuangbanna, China: A case study of two Dai villages, Land Use Policy 42: 628-634.

2) Ongoing activities

- Humanities and social science-based interdisciplinary studies for the sustainable future
- Japan-ASEAN collaboration for science and technology development
- Boom cropping and livelihood diversification in the northern mountain region of Vietnam
- Labor mobility and spread of commercial cropping at the China-Myanmar borderland
- Cross-border and domestic migration and formation of local city in northern Laos
- Peatland ecosystem and livelihood transition in Riau, Indonesia with the emphasis on rubber and sago production

Message

What is necessary to achieve the sustainable society is collaboration rather than competition. JASTIP aims at promoting collective actions among researchers and between researchers and non-academic stakeholders for out common future.

JASTIP: Achievements and Challenges

Kono, Yasuyuki
JASTIP Project Leader, Kyoto University

Distinguished guests and colleagues, welcome to the 4th JASTIP Symposium "Biomass to Energy, Chemicals and Functional Materials". On behalf of the organizing committee, I would like to express my sincere appreciation to you all.

JASTIP, or Japan-ASEAN Science, Technology and Innovation Platform, was established in October 2015 and officially launched in February 2016. We held the opening ceremony at the ambassador's residence owing to the kind consideration of his Excellency Ambassador Sadoshima (Slide 1). The idea behind the launch of JASTIP was that Japan and ASEAN countries have a long history of academic collaboration, but most of this collaboration has been project-based. We are sure that each project has produced a fruitful outcome and has contributed to each of the disciplines, but these efforts are not so visible from outside the disciplinary community, even in academic society, or from outside academic society. Thus we need some sort of platform for working together that goes beyond single projects.

Slide 1. Launch of JASTIP

Based on this idea, we chose "environment and energy", "bio-resources and biodiversity" and "disaster prevention" as the major foci, all of which are a part of SDGs, Sustainable Development Goals, and are crucial issues for the future of this region. We then invited NASDA, National Science and Technology Development Agency, Thailand; LIPI, Indonesian Institute of Science; and MJIIT, Malaysia-Japan International Institute of Technology to be the core partners for setting up a platform to promote international, inter-disciplinary and

inter-project collaborations. We also emphasize the activation of dialogues between researchers and non-academic stakeholders, including policy makers, administrators, the private sector and the general public to transform research work from "science for science" to "science for society" (Slide 2).

Slide 2. Outline of JASTIP

Let me explain the outstanding characteristics of JASTIP. The first point is "research first". There are several region-based platforms for science, technology and innovation. ASEAN COST or ASEAN COST +3 is a platform of policy makers that holds regular meetings. STS Forum, Science, Technology and Society Forum, is a global gathering supported by the Japanese Government. It organizes ASEAN-Japan workshops as a part of its activity. The Ministry of Science and Technology, Thailand, has also organized an ASEAN STI Forum with a wide range of participants from the region and beyond. These are undoubtedly important mechanisms for promoting regional collaboration in science and technology, but I have never seen initiatives and platforms organized by researchers. I believe that JASTIP is the first trial in this regard. As it has been initiated by researchers, collaborative research is undoubtedly one of the core activities of JASTIP and the first priority.

The second point is open science and innovative collaboration. At the universities and research institutes in any countries, as you know, the world ranking is a crucial concern and there is huge pressure on us. We are strongly encouraged to publish articles in high impact-factor journals. Such a competition-based mechanism works as a strong motivation for researchers to conduct research, but I believe that it is not a unique mechanism. Finding new partners and working together with them is an equally important motivation, and this challenge has a much greater possibility for exploring new research agendas and approaches. I do not know the case in the private sector, but I will be happy if you understand our situation.

find a seed for new business and set up a collaborative effort with researchers.

The third point is that we think of diversity as a driver. We experienced rapid economic growth in the latter half of the 20th century. The main drivers of this development were technology and the market economy. Technological development produced various new commodities, and these are distributed all over the world through a global network founded on a market economy. One of the principles behind this development was that homogeneity and simplification are more effective. We thought that we could be economically more developed and upgrade our life happier and more peaceful if the whole world were covered with a single language, a single institution and a single governance. In the 21st century, however, we confront an era of uncertainty. We cannot precisely predict the future of the global environment. We are not sure whether we will be able to overcome shortages of resources such as energy and clean water. We are searching for a new regime of global politics, but we do not know what will be. Under such circumstances, what we need is diversity. We are trying to connect diverse players among academics and non-academics, from various counties and various sectors and have them collaborate.

Since our establishment, there are some things that we have done well and some thing we have not done so well. Let me explain what we have achieved during the almost two years up to now. First, we set up the central part of the platform, owing to the strong partnership with core institutes, and began collaborative research.

With NSTDA, we promote research and development of efficient biomass utilization technology in order to contribute stable energy supply. We are testing several technology including solvent treatment (Slide 3).

Slide 3. Research Activities of the Environment & Energy Joint Laboratory

With LIPI, we focus on tropical bio-resources. We develop tropical biodiversity database, investigate useful plants, and carry out research on tropical plant breeding and its conversion into fuel, functional materials and food. We also make efforts on high-strength, durable wood structures and materials (Slide 4).

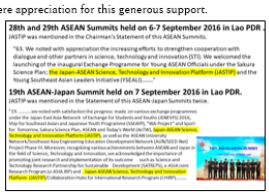
Slide 4. Research Activities of the Bio-resources & Biodiversity Joint Laboratory

With MJIIT, we focus on the mitigation of large-scale disaster risks through comprehensive approach to disaster prevention including the early warning systems. Our region suffers from various types of natural disasters that include typhoon, cyclone, earthquake, tsunami, volcano eruption, mud flow, forest fire and so on. Advance warning systems and international cooperation against regional disasters should be a strong tool for the disaster mitigation (Slide 5).

Slide 5. Research Activities of the Disaster Prevention Joint Laboratory

Second, we have been able to achieve wide publicity. JASTIP was referred to in the statements

of the 28th and 29th ASEAN Summits and 19th ASEAN-Japan Summit (Slide 6). I am also happy to tell you that Prof. Teruo Kishi, Scientific advisory to the minister of foreign affairs, the government of Japan, recently met several ministers of the government of Thailand. In the meeting, Prof. Kishi kindly referred to the symposium today. This suggests that JASTIP activities are well shared among the top-level policy makers in Japan and ASEAN. I would like to express my sincere appreciation for this generous support.



Slide 6. ASEAN Summit Statement 2016

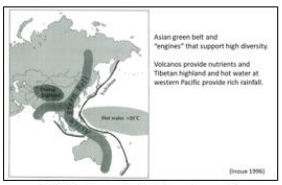
Third, we are expanding the network of collaboration in Japan and ASEAN. Since last year, we have set up a new program called JASTIP-Net. This is a program to invite researchers and non-academic stakeholders from various universities, research institutes and the private sector in Japan and ASEAN to join our research activities. About the detail, please visit our web site here (Slide 7). As the budget is limited, it may be difficult to do substantial research work under this program, but I believe this can be a seed money to form a new group for setting up a new project. JASTIP is now accepting the second round application for JASTIP-Net. You can see the details on our website. We are also making efforts to collect information on Japan-ASEAN collaborative research in the three target fields and disseminate this through the website. This is what we have achieved during the almost two years up to now.

Slide 7. Call for JASTIP-Net 2017

Next, let me explain where we have to make efforts. First, we have to further enhance the visibility of JASTIP. As I have mentioned already, JASTIP is more or less recognized among top-level policy makers, but publicity in the academic and private sector is still not so high. These are actually our potential partners in open science and innovative collaboration. Without their support, JASTIP cannot go forward in further development. Second, the linkage of our activities with the private sector is still weak. JASTIP is not only "science and technology", but "science, technology and innovation". For "innovation", the private sector is undoubtedly the key player. We are eager to establish strong links between academics and the private sector. Third, the connection of JASTIP with other funding schemes is still not sufficient. As I have suggested repeatedly, what JASTIP can provide is just a seed to the next step. Once the participants find a new partner, they should take the initiative to go forward. We will try our best to support their challenges through stronger connections with other funding schemes such as E-Asia and SATREPS.

We have organized today's symposium based on this self-evaluation. As you can recognize, this is not a gathering of the core members of JASTIP. I am happy to welcome many researchers from various institutes and many participants from the private sector and funding agencies. To provide a chance for a wide range of people to see and talk each other, to exchange ideas and to foster plans for the next step is the most important agenda of this symposium. In this regard, we have prepared 22 oral presentations, around 40 poster presentations and around 20 booths. I sincerely ask you to utilize this occasion to bring about fruitful outcomes for everyone attending.

Let me explain briefly the topic of this symposium. Our major focus is biomass. The eastern side of the Eurasian Continent, from Russian Siberia, the coastal zone of mainland China, Korea, Japan and Taiwan to the ASEAN countries, forms the Asian Green Belt, as named by the late professor Tamiji Inoue. This unique corridor connects the temperate zone and the tropics across a substantial stretch of terrain that overlaps with an active earthquake and volcano zone. This area enjoys an abundant nature, particularly in terms of biomass production and bio-diversity (Slide 8). This is the reason why we have chosen "biomass" as the topic today. We believe that the issue of how to coexist with nature to manage and effectively utilize biomass is an issue that is relevant to every part of this region if we hope to achieve a sustainable future for our descendants.



Slide 8. Biomass in the Asian Green Belt

Finally, I would like to express my sincere thanks to NSTDA, LIPI, Embassy of Japan, various government agencies and private companies, and Kyoto University to help us to organize this conference. I sincerely hope that all of you will enjoy the discussions in this symposium and gain rewarding benefits from this opportunity. Thank you again for joining us.

Speaker's Information

Noboru NOGUCHI

Home Town / Country : Sapporo, Japan
Affiliation : Cross-ministerial Strategic Innovation Promotion Program (SIP) "Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries" Bureau of Science, Technology and Innovation, Cabinet Office, Japan
Position : Program Director (Professor, Hokkaido University, Japan)
E-mail : noboru.noguchi.m7v@cao.go.jp

Biography

2016-: Program Director, Cross-ministerial Strategic Innovation Promotion Program (SIP) "Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries" Bureau of Science, Technology and Innovation, Cabinet Office, 2004- : Professor, Hokkaido university, 1997- : Associate Professor, Hokkaido university, 1990- : Assistant Professor, Hokkaido university, D. Agr.

Area of Interest

Agricultural robotics, vehicle dynamics, remote sensing, sensor development, machine vision, and GPS/GIS.

Research Activities and Achievements

1) Research experiences and achievements

Dr. Noguchi has made contributions to both industries and universities in the area of applications of advanced technologies to agricultural systems. He is highly recognized internationally for his contributions in robotic applications and remote sensing technology. He is the first researcher who developed a fully autonomous field robot in the world in 1997 with National Research Institute of Agricultural Machinery in Japan. In addition, he addressed UAV and satellite base remote sensing methods for modeling, mapping, and monitoring agricultural crops.

2) On-going activities

- Research

- Development of management system for multi-robots to enhance work efficiency.
- Effective safety system to ensure safe operations of robots.
- Remote sensing technology integrating ground-, aerial- and satellite-base.
- Extracting tacit knowledge from bigdata composed of farm work, weather and crop status.

- Administration of research activities

Director, Cross-ministerial Strategic Innovation Promotion Program (SIP) "Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries" Bureau of Science, Technology and Innovation, Cabinet Office, Japan.

Message

Agriculture in developed countries after the Industrial Revolution has tended to favor increases in energy input through the use of larger tractors and increased chemical and fertilizer application. Although this agricultural technology has negative societal and environmental implications, it has supported food for rapidly increasing human population. In western countries, "sustainable agriculture" was developed to reduce the environmental impact of production agriculture. At the same time, the global agricultural workforce continues to shrink; each worker is responsible for greater areas of land. Simply continuing the current trend toward larger and heavier equipment is not the solution. A new mode of thought, a new agricultural technology is required for the future. Smart agricultural technologies including robotics and ICT are one potential solution.

Smart Agriculture toward Society 5.0

SIP "Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries"

Noboru Noguchi
SIP program director and
Professor of Hokkaido Univ.

Outline

1. **What is SIP?**
   (Cross-Ministerial Strategic Innovation Promotion Program)
2. **SIP agriculture**
   (Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries)
3. **Smart Agriculture toward Society 5.0**
   (Utilization of IoT, Bigdata, AI and Robot)

1. What is SIP?

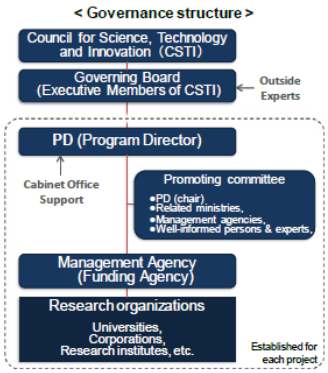
(Cross-Ministerial Strategic Innovation Promotion Program)

SIP (Cross-Ministerial Strategic Innovation Promotion Program)

- Realizing Science, Technology and Innovation through promoting R&D overlooking from basic research to application and commercialization by cross-ministerial cooperation.
- Council for Science, Technology and Innovation (CSTI) defined the themes to solve societal issues and achieve economic growth
- CSTI appoints Program Directors (PDs) for each project and allocates the budget by a top-down approach.

Established in 2013
Total ¥50B* (budget for FY2017)
*Of this amount, 35 percent(¥17.5 billion) was allocated to medical fields

< Governance structure >



11 Themes of SIP

Priority policy issues	Themes	Objective
Energy	Innovative Combustion Technology	Improving fuel efficiency of automobile engines
	Next-Generation Power Electronics	Integrating new semiconductor materials into highly efficient power electronics system
	Structural Materials for Innovation(SM^{4}I)	Developing ultra-strong and –light materials such as magnesium-, titanium-alloys and carbon fibers
	Energy Carriers	Promoting R&D to contribute to the efficient and cost-effective technologies for utilizing hydrogen
	Next-Generation Technology for Ocean Resources Exploration	Establishing technologies for efficiently exploring submarine hydrothermal polymetallic ore
Next-generation infrastructures	Automated Driving System	Developing new transportation system including technologies for avoidance accidents and alleviating congestion
	Infrastructure Maintenance, Renovation and Management	Developing low-cost operation & maintenance system and long life materials for infrastructures
	Enhancement of Societal Resiliency against Natural Disasters	Developing technologies for observation, forecast and prediction of natural disasters
	Cyber-Security for Critical Infrastructures	Development of technologies that monitor, analyze, and defend control and communication system as well as confirm integrity and authenticity of system components to protect critical infrastructures against cyber threats.
Local resources	Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries	Realizing evolutionary high-yield and high-profit models by utilization of advanced IT etc
	Innovative Design/Manufacturing Technologies	Establishing new styles of innovations arising from regions using new technologies such as Additive Manufacturing

2. SIP Agriculture

(Technology for Creating Next-Generation Agriculture, Forestry and Fisheries)

1 . Summary of the project plan

Current situation of agriculture, forestry and fisheries in Japan

- Decrease of core persons mainly engaged in farming
  (1.75 million, 15% decrease in 5 yrs)
- Aging of core persons mainly engaged in farming
  (65 yrs-old or older accounts for 65%)
- Rapid increase of large-scale farm
  (100ha or larger increased by 30% in 5 yrs)

Chance for agricultural structure reform

- Rapid progress of technologies related to smart agriculture and breeding
- Expansion of food market such as health function
- (Production value of agriculture- or food-related industries: about 100 trillion yen)

Science and technology innovation aimed by SIP (2 goals)

1. To develop a highly productive and labor-saving smart agriculture model by innovative technologies such as robotics, IT, and NBT <Realize Society 5.0 in agriculture>
2. To add high value to agricultural and forest products by differentiation focusing on functionality and developing new materials from unutilized resources

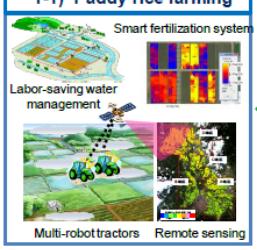
Future vision of agriculture, forestry and fisheries in Japan

- Strong agriculture competitive with foreign countries mainly by core farmers
- Market expansion of agri-food industry and regional development by enhancing the value of products

Goal 1: Development of smart agriculture models

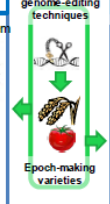
Develop ultra-laborsaving and highly productive smart agriculture model using innovative technologies such as robotics, ICT, and NBT

1-1) Paddy rice farming



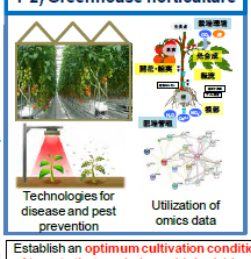
Reduce rice production cost by 40% by improving cultivation techniques by automation and intelligentization.

Japanese genome-editing techniques



Develop competitive Japan-made genome-editing techniques which produce high-yield and high-quality varieties.

1-2) Greenhouse horticulture



Establish an optimum cultivation condition of tomato that can balance high-yield and high-quality using omics data.
Reduce disease and pest damage substantially using new pesticide-free technologies.

Goal 2: Enhancing the value of agricultural and forestry products

Promote enhancing values of agricultural and forest products for example development of high-quality or **functional healthy foods** and **new materials from unutilized resources**

2-1) Development of functional health foods

Japanese genome-editing techniques

Epoch-making varieties

Functional healthy foods

Improvement of brain function

Cultivation of DHA-rich algae Aquaculture feed

DHA-rich seafood

Obtain evidences about new functions of foods such as brain function and body locomotion and **commercialize more than 15 foods** by cooperating with food companies and agricultural cooperatives.

2-2) Creation of new local industries by developing new materials

Take out forest residues

Modified lignin production plant

Electronic substrate

IC tag (tags for merchandise management)

Heat-resistant gasket

Slow-release fertilizer

Creating regional new industries by extracting modified lignin (biomaterial) from forest residues safely at lower cost, developing high-functioning products, and establishing a sales structure.

SIP

2-1) Development of functional health foods

1. Cognition activation
against mental stress
brain-gut coordination

4. Homeostasis maintenance

2. Locomotion improvement
Muscle
Bone

5. Seaweed

3. Food-sports synergism
chrono-nutrition

17 items for commercialization

- Lactoferrin (milk)
- Nobiletin (citrus fruits)
- γ-Oryzanol (brown rice)
- Procyanidin (apple)
- Quempherol (mulberry)
- Inulin (kikuimo)
- Rosmalinic acid (Herb)
- SAM・GPC (sake)
- High pressure-treated rice
- Oligosaccaride (mukago)
- Teaflavin (tea)
- DHA (eugrena)
- Fish muscle (fish)
- Muslinic acid (olive)
- Oleanolic acid
- Molin
- Tomatin (tomato)

SIP

3. Smart Agriculture toward Society 5.0

(Utilization of IoT, Bigdata, AI and Robot)

SIP

What is "Society 5.0"? (continued)

"Society 5.0" is a concept proposal of an advanced, future and human-centered society, in which the integration of cyber space and physical space(cyber-physical system: CPS) is to be realized through such state-of-the-art technologies as AI, IoT, robotics and big data.

By transforming the concept of "Society5.0" into reality, it is intended to achieve a super smart society in which necessary goods and services will be provided to anybody at any time and at any place regardless of region, age, gender, language or other limitations.

The goal of "Society 5.0" is to achieve economic growth/well-being and overcome societal challenges at the same time, contributing to the prosperity of global communities.

SIP

Realizing 'Society 5.0' by smart agriculture

- ✓ Create bigdata by collecting geospatial data and information by sensors and satellite, and analyze the bigdata using AI.
- ✓ Cooperate with SIP "Cyber security", national AI research centers, etc.

GNSS satellite

Various research results

Weather information (weather forecast & past weather data)

Farmwork planning simulation system

Production support system
Early warning & cultivation management system
Automated water management system
Farmwork information system

Growth information

Drone

Input farmland information, sales plan, etc.

Output optimum farming plan

Farmer

Inflow
Outflow
Reservoir storage

Reservoir bulb

Water management bulb (pouring)

Water management bulb (drainage)

Water temperature
Water depth
Underground water depth
Soil moisture and temperature

Plowed soil depth
Fertility
Real-time top-dressing
Growth
Real-time top-dressing
Yield

Multi-robot tractor

Smart rice transplanter

Smart top-dresser

Yield-sensing combine harvester

Data input from sensors etc.
Operation instructions to smart agricultural machines

SIP

Creation of crop status information using satellite

Using satellite imagery, prediction of protein content of grain before harvest become possible, and the appropriate timing for harvest can be provided. The technologies can contribute to improve the quality of rice in large production area. In addition, these available information can be acquired through a tablet PC or a smartphone using a WebGIS system.

Satellite imagery

Chlorophyll content of wheat growing stage

WebGIS

Uniform management from in-field to large production area

It easy to use in any time and any place

Mapping function

Quality and taste of rice improve in large scale area

N content of rice panicle formation stage

Protein content map

Map for appropriate timing of harvest

SIP

Meteorology

Crop status and disease/pest forecasting system

+

Nationwide weather prediction of 1 km-mesh

- Growers
- Extension center
- Private services

Decision support for farm management practice

- ✓ Hot/cold weather alert
- ✓ Foehn warming
- ✓ Crop disease warning
- ✓ Pest forecasting
- ✓ Advise for preventing from quality degradation of rice
- ✓ Prediction of start date for harvest
- ✓ Prediction of chemical application date
- ✓ Prediction of quality and yield

SIP

Smart water control system in paddy field

Cloud computing

1 km-mesh covered whole Japan

Crop growth prediction model

Weather information

Sensed data

- Water level
- Groundwater level
- Water temp.
- Moisture content

Sensed data

Control signal

Base Station

Control signal

Water supply valve

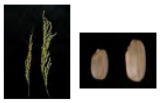
Drainage opening

New Rice Breeding System by Genome Editing Technique 【Super high-yielding rice】

The target yield is 12 t/ha as brown rice (by 2019).
If 12 ton/ ha has been achieved,
the production cost will be reduced by 60%, compared to current cultivars.
(154 yen/kg → 90 yen/kg)

Increase by genome editing technique
- the grain number
- the grain size


Current cultivar (*japonica*) (5 ton/ ha)


Selected line (crossed with *indica* line) (10 ton/ ha)

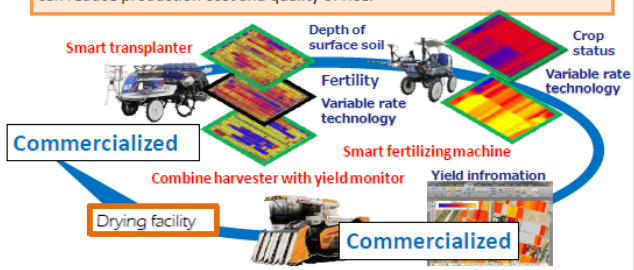
Genome editing


Genome-edited rice

Close Cooperation with Production system Group
→ Development of Growth Prediction Model for Precise Management and Low Cost Production

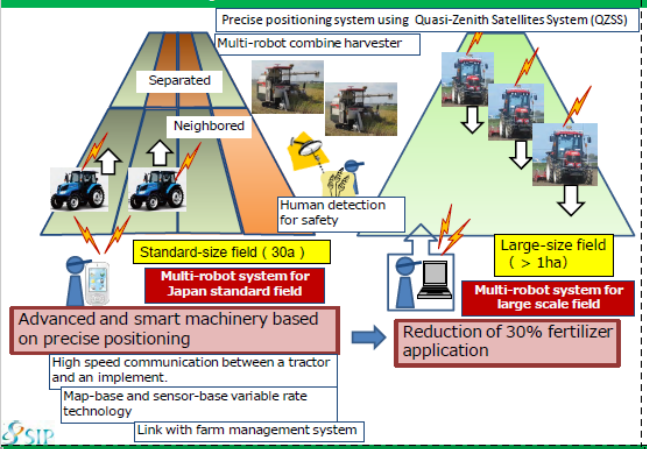
Optimal fertilizer application using smart machinery

Development of smart machineries including rice transplanter, fertilizing machine, top dressing machine and rice combine harvester. These machines can reduce production cost and quality of rice.

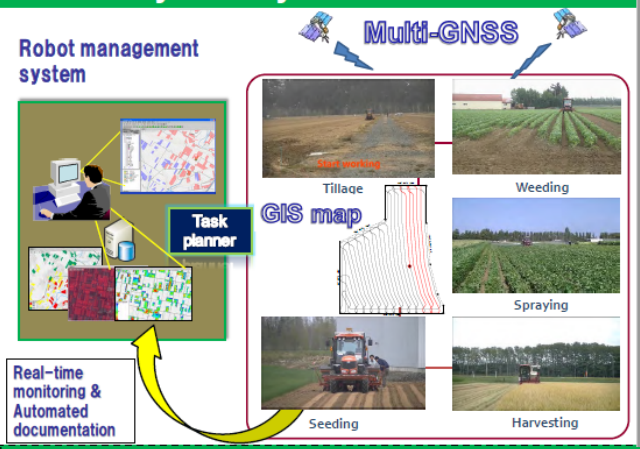


- 20% decrease of amount of fertilizer, and 15 % increase of ratio of perfect grains have been achieved. ⇒ **Reduction of production cost**
- Increased working efficiency by reducing lodging. ⇒ **Increase of quality**

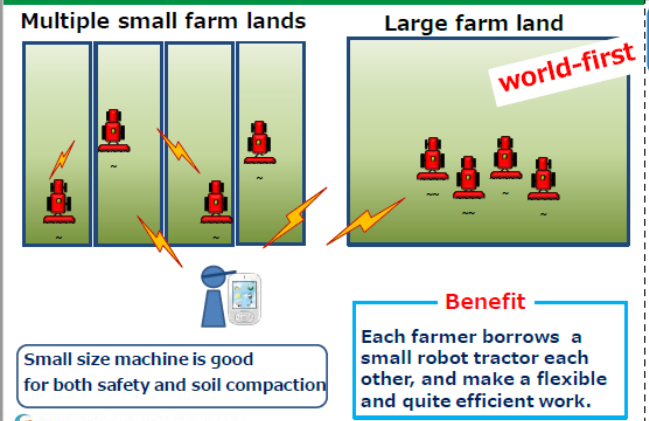
Farm work by robot



Robot system by remote observation

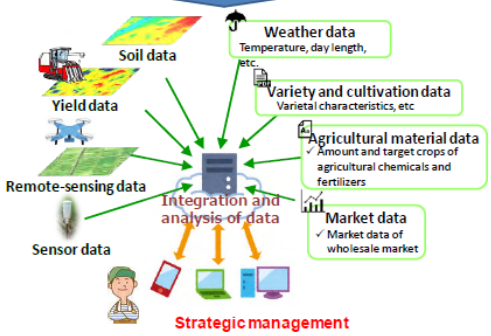


Multi-robot tractor



Agriculture data platform

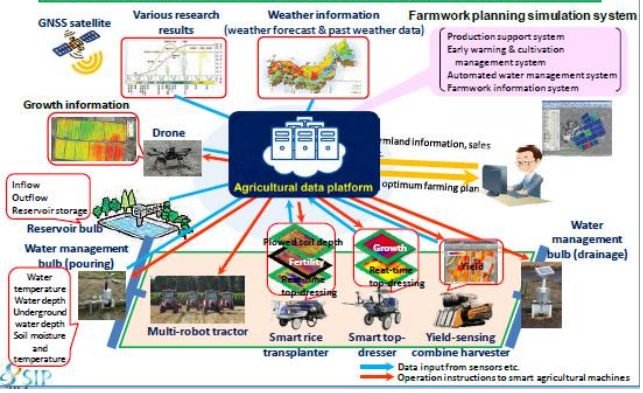
- Although various agricultural ICT services are recently coming out, there is no interconnectivity among the systems of ICT service providers.
- The useful data of administrative or research organizations scattered in various places, and it is not convenient to use at all.



Strategic management decision based on data

Realizing 'Society 5.0' by smart agriculture

- Create bigdata by collecting geospatial data and information by sensors and satellite, and analyze the bigdata using AI.
- Cooperate with SIP "Cyber security", national AI research centers, etc.



Chair's Information

Thumrongrut MUNGCHAROEN (Rutt)

Home Town / Country : Bangkok, Thailand
Affiliation : National Science and Technology Development Agency
Position : Chairman of Energy and Environment Cluster
E-mail : thumrongrut@nstda.or.th

Biography

Education Background: M.S. and PhD in Chemical Engineering from the University of Texas at Austin, USA. B.Eng.(Honors) in Chemical Engineering from Chulalongkorn University, Thailand.
Working Experience: Technical Engineer at Toray Nylon Thai Co. Ltd. (1977-1979), Lecturer at Chemical Technology Department, Institution of Technology and Vocational Education (1979-1981). Lecturer/ Asst. Prof./ Assoc. Prof. at Faculty of Engineering, Kasetsart University (1981-2015)

Selected Official Committee: 1. Vice President & Board Member, Asia Pacific Roundtable for Sustainable Consumption and Production (2012-present. 2. Expert in the Sub-committee on Promotion of Govt. Green Procurement Policy, Ministry of Natural Resources and Environment (2013-present). 3. Committee, Science Technology and Innovation on Climate Change, National Science Technology and Innovation Policy Office (2009-present). 4. Vice-chair, Carbon Footprint Promotion Committee (2009-present). 5. Advisory Committee, Federation of Thai Industries (2000-present).

Area of Interest

Energy and Environment, Life Cycle Assessment, Ecodesign, Cleaner Technology/ Pollution Prevention, Sustainable Consumption and Production, Green Growth/ Green GDP, Hazard Analysis and Risk Assessment

Research Activities and Achievements

More than 210 technical publications (in the form of journals, proceedings and books)
Selected Awards 1. PTIT Award by the Petroleum Institute of Thailand (1999-2000) 2. Outstanding Academic Award, Faculty of Engineering, Kasetsart University (1999) 3. Outstanding Academic Award, Kasetsart University (2000) 4. Outstanding Academic Service Award, Kasetsart University (2010) 5. International Publications Researcher Award, Kasetsart University (2010-2014) 6. Excellent Research Award on Alternative Energy: Promotion of Alternative Energy Use, Ministry of Energy (2015)

Message

Keynote Speech
3 July 2017, 11:15-13:00

Speaker's Information

Yongyuth Sawatdisawanee

Home Town / Country : Bangkok, Thailand

Affiliation : Department of Alternative Energy Development and Efficiency

Position : Director of Bioful Development Bureau

E-mail : yongyuth_s@dede.go.th

Biography

2015-Present Director of Bioful Development Bureau
2000-2014 Director of Solar Technology Analysis and Assesment Group

Area of Interest

Renewable Energy (Solar Energy/Biofuel)

Research Activities and Achievements

I am the director of Bureau of Bioful Development, which is part of Department of Alternative Energy and Efficiency, Mimisrty of Energy. My department is responsible for the policies of Biofuel as well as monitoring the developmnet in term of balance in demand and supply of biofuel as well as related reserch. At the moment, there are two main biofuel targets in Thailand energy plan in which my department works collaboratively with all the parties invovled, ranging from public sector such as Ministry of Agriculture and cooperative to private secter such as oil companies and car industry, Prior to working at Bureau of Biofuek development, i worked in Bureau of Solar energy development

Message

Keynote Speech
3 July 2017, 11:15-13:00

Speaker's Information

Anucha EUAPERMKIATI

Home Town / Country :

Affiliation : Frontier Research, PTT Global Chemical Public Company Limited

Position : Division Manager

E-mail :

Biography

Education background :

1986-1990: Ph.D. (Chemistry and Chemical Technology - Polymer Science & Tech) Bradford University, UK
1982-1986 : B.Sc. (Chemistry), Mahidol University, Bangkok

Work Experience:

Oct 1, 2015 – present : Manager Frontier Research, Corporate Innovation, PTTGC

Jun, 2013 – Sep 30, 2015:: Synthesis and catalysis, R&D Manager, Scientific Research Dept, Science & Innovation, PTTGC

Feb,2011- May, 2013: R&D1 Manager, Science & Innovation Dept, PTTGC

2008-2011: Deputy Managing Director, King Bag Co., Ltd. (KB) and King Pac Industrial Co. Ltd. (KPI)

2001-2007: Project Development Manager, Bayer Polymers Co., Ltd.

1998-1999: (Head of Department), School of Polymer Engineering, Institute of Engineer, Suranaree University of Technology

1998-1998 : Senior Product Manager, HMC Polymers Co., Ltd.

1995-1998: R&D Manager (polyolefins), Thai Petrochemical Industry (TPI) Public Company Limited.

1990-1995: Research Associate 2, National Metal and Materials Technology Centre (MTEC), National Science & Technology Development Agency (NSTDA), Ministry of Science and Technology

Area of Interest

Polymer Science & Engineering specifically in kinetic studies, computer modeling and simulation, polyolefins compounding, Formulation/application dev of cellular Polyurethane, Ziegler Natta catalyst for polyolefins, Technology/Innovation Management, Quality Management Systems, LEAN manufacturing, Production operation management, Cost management and Cost control, HRM and HRD.

Research Activities and Achievements

- Napawon Thongprachan, Nared Phetrak, Anucha Euapermkiati, Chaya Chandavasu, Enhancedthermal stability polyalkylene carbonate composition and a preparation method thereof, PCT Invention PCT/TH2013/000047, 13/9/2013
- Sutheerawat Samingprai, Tienkul Kangwanwong, Nared Phetrak, Anucha Euapermkiati, Chaya Chandavasu, A device for preparing and transferring reaction mixture, Korea Utility model 20-2013-0010719, 24/12/2013
- Sutheerawat Samingprai, Tienkul Kangwanwong, Nared Phetrak, Anucha Euapermkiati, Chaya Chandavasu, A device for preparing and transferring reaction mixture, China Utility model 201320878760.3, 27/12/2013
- Nattapol Samanukul, Supawan Tantayanon, Sutheerawat Samingprai, Worawat Chuencheep, Anucha Euapermkiati, Ziegler-Natta catalyst preparation techniques impact on the comonomer incorporation in Polyethylene-co-alpha-olefin, in preparation to publish in a polymer journal.

Message

Thailand Bioeconomy: Current Status, Future Direction and Implication for Industrial Sectors

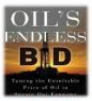
Anucha Euapermkiati, PhD
Manager Frontier Research

The 4th JASTIP Symposium, 3 July 2017

Agenda

- Bioeconomy in the Context of Thailand
- Biorefinery Complex
- EECi Biopolis
- Implication for Industrial Sectors

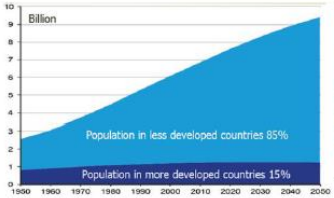
The World in Snapshot: What will Come Next?

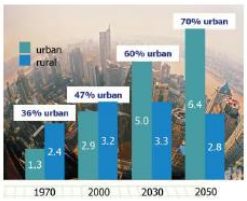


Supply Constraint

Climate Change

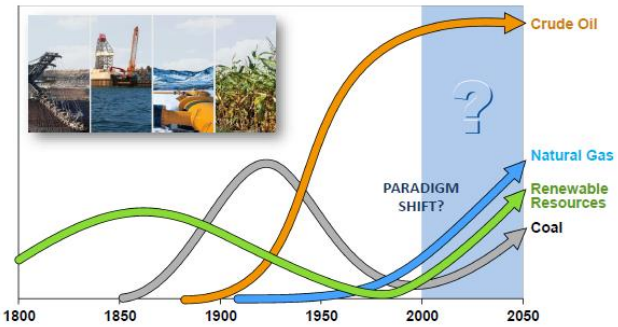
50% Original Forest Lost





Source: WRI and IEA

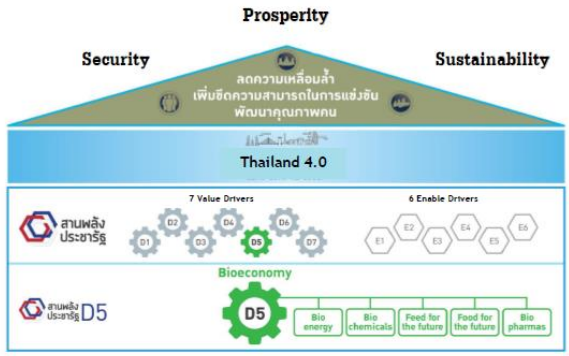
Raw Material Development



Source: Adapted from BASF

Bioeconomy in the Context of Thailand

Bioeconomy in the Context of Thailand



Opportunities and Challenges

Opportunities

Energy security

New Markets

Rural economic development

Challenges

Early stage of commercialization

Policies/ Mandates

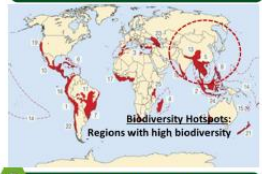
Biorefinery/ Biopharma ecosystem

Key success factors

- Leaders with common vision
- Research and Innovation
- Close collaboration with government & customers
- Inter-connection of industries in Bioeconomy value chain

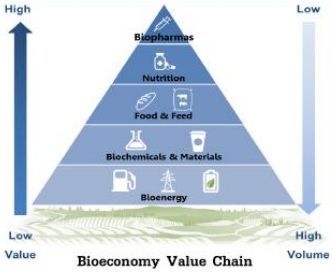
Bioeconomy – A New Economic Model

1 Biodiversity in Thailand is ranked as 8th in the World



2 Development of technologies on agricultural products

3 Strong technological and industrial base to support Bioeconomy



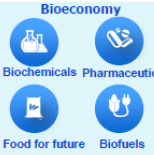
Bioeconomy is the next generation of agricultural based economy

From resource-based agriculture → **To knowledge-based value chain**

Agricultural based economy

Molecular breeding → Forecasting → Precision agriculture → Mechanization

Bioeconomy



	Agricultural based economy	Bioeconomy
GDP contribution	▪ 7% of GDP[1]	▪ ~8-11% of GDP[2]
Total value	▪ ~THB 950 bn total value[1]	▪ THB 1300-1700 bn total value[2] (~2x)
Core value	▪ Feedstock-based	▪ Processed food, biochemicals, biofuels
Employment	▪ ~ 20 million ppl, mainly in agriculture	▪ Employment throughout higher value sectors
GDP per capita in agri. sector	▪ ~THB 48K/capita	▪ ~THB 65-85K/ capita

1) 2014 GDP contribution from cereal and other crops
2) 2020 GDP contribution from rice, cassava, sugarcane, rubber and processed food only

SOURCE: Global Insight - Thailand real GDP forecast, team analysis

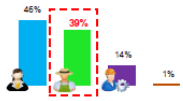
Thai's Agriculture Scenario

Agriculture - a backbone of Thailand's economic foundation

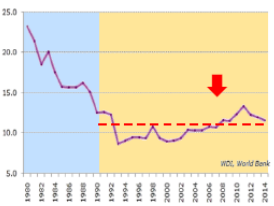
1 **Large number of labor - Less productivity Create poor GDP contribution**

2 **Declining trend of agricultural sector**

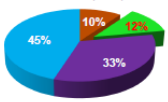
Thai's Labor Proportion



Agriculture, Value Added (% of GDP)



% Share on GDP (2013)

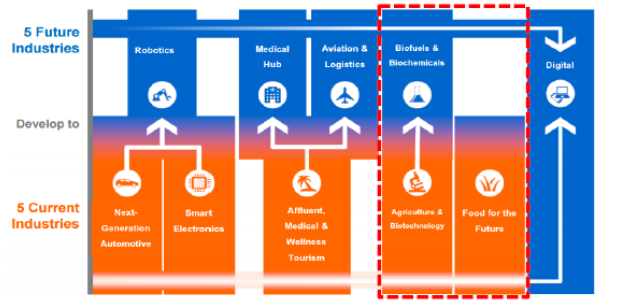


Services Agriculture Manufacturing Others

Source: 1) World Bank Data Report (www.worldbank.org), 2012
2) Emerging Markets: Analyzing Thailand's, August, 2015. (http://www.investopedia.com/articles/investing/081415/emerging-markets-analyzing-thailands-gdp.asp)

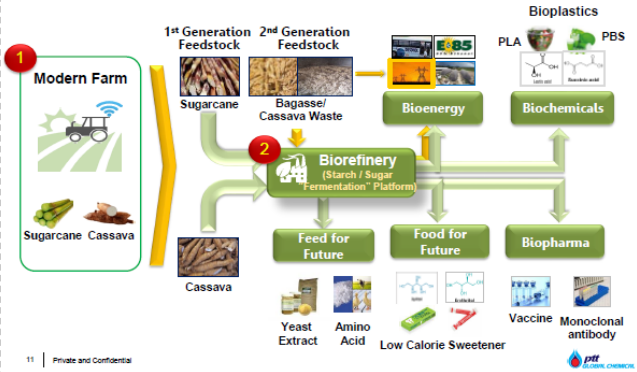
Bioeconomy will cover 3 of the 10 priority sectors of the government

Bioeconomy



Bioeconomy - Transformation's Game Changers

Two key elements: Modern farm and Biorefinery



Bioeconomy: 10-Year Roadmap

Goal: Total Investment ~ 400 Billion Baht in 10 years

1 | 2017-2018

- Further develop Bioenergy as a stepping stone for the Bioeconomy
- Study and prepare the investment of Biorefinery Complex
- Create demand for investment in biochemicals/ bioplastics and biopharma sectors
- Improve breeding and provide machinery

2 | 2019-2021

- Expand the plantation area
- Develop Biorefinery Complexes and Biopolis, the smart city based upon integrated innovations and bioeconomy
- Develop the value-added bio-based products

3 | 2022-2026

- Move towards the Regional Hub: a model for future industries
- Establish Biopharmaceutical pilot plant and commercial plant
- Implement domestic/ international full-scale Clinical Research

16 Investors

The Expected Outcomes from Bioeconomy within 10 years

Agriculture-based GDP **2x**	Create value from sugarcane **>3** M Baht/ year	Create value from Cassava **>1** M Baht/ year	Reduce CO_2 emission **>70** M tons [1]
Farmer's income **75,000** Baht/person/year	Create jobs >300,000 Households; >500,000 Households	Bio-based energy **>30** M tons of crude oil [1] (20 years)	
Invest in Biopharma **100,000** M Baht	Export of Biopharma products **75,000** M Baht	World-class Biopharma Products **>20** Items	Knowledge workers /High-tech labor **20,000** Positions

[1] The Alternative Energy Development Plan (AEDP) for 2015 – 2036)

Collaboration advances "Bioeconomy"

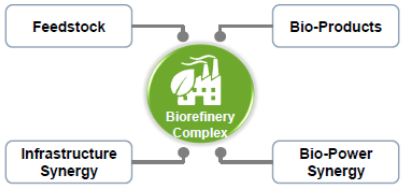
The Memorandum of Understanding Signing Ceremony in 23 January 2017

23 agencies from the public and private sectors and educational and research institutions

The beginning to drive investment for Bioeconomy of Thailand

Biorefinery Complex

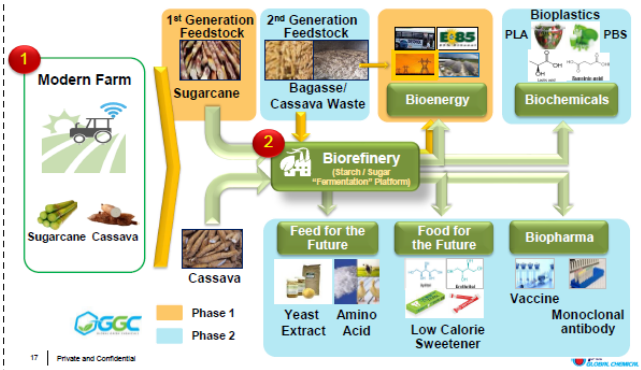
Why PTTGC Group is interested in Bioeconomy?



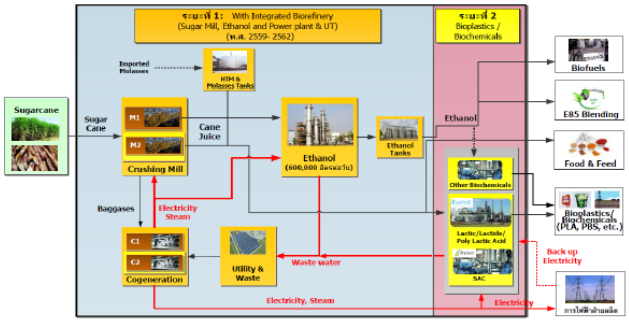
- Enhance competitiveness & value-added products
- Strengthen and expand product portfolio in Green Business
- Build full integration value chain with partnership with feedstock producers & professional biotechnology

PTTGC Group's Focus

GGC is the flagship of PTTGC Group to create value in Green Business



Biorefinery Complex Project

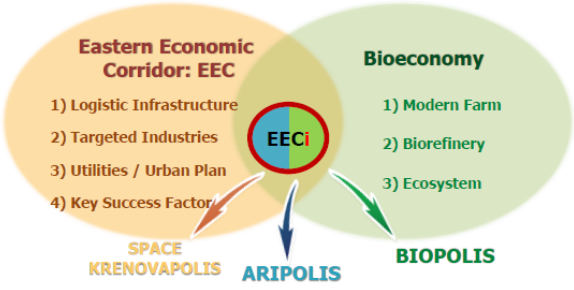


Phase 1: 2017-2019 : Ethanol Fuel Grade & Electricity

Phase 2: Develop Infrastructure i.e. Land, Utility, Feedstock for Biochemicals & Bioplastics

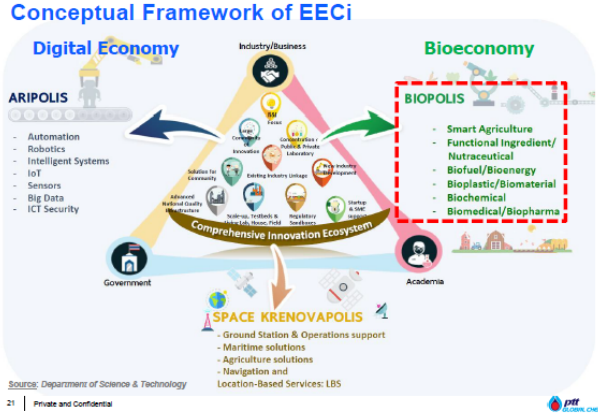
EECi Biopolis

Background : Eastern Economic Corridor of Innovation (EECi)

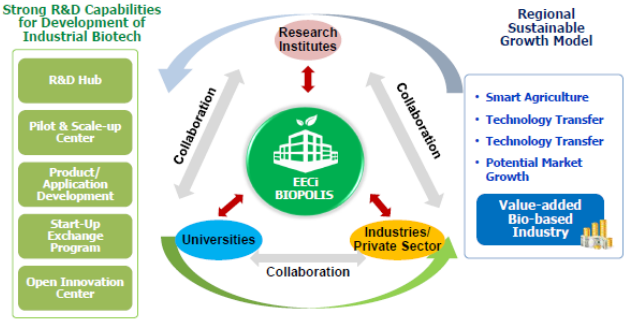


Eastern Economic Corridor of Innovation (EECi)

Conceptual Framework of EECi



Concept Master Plan of EECi BIOPOLIS

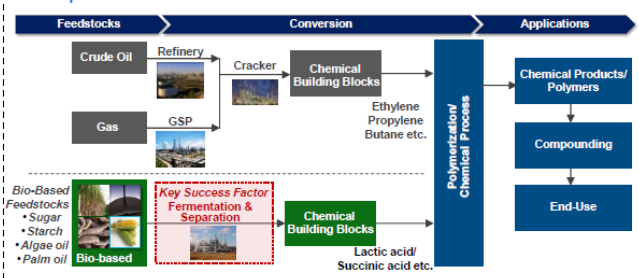


Innovation Center of Life Science & Biotechnology

The Expected Outcomes from EECi BIOPOLIS

Implication for Industrial Sectors

Comparison of Chemical Production from Petro-based vs. Bio-based route



Value Added (Estimated)			
Petro-based*	1X	5X	6X
Bio-based**	1X	7X	13X

Based Calculation: *1 ton of Naphtha produce 0.083 ton HDPE
** 1 ton of Sugar produce 0.5 ton PLA

Growth Potential of Bio-based Products

	Total Market Sales, USD	Biotech Today Sales, USD	Biotech Products Current Examples
Fuel	~ 500 billion	~ 20 billion	• Ethanol • Biodiesel — BP-DuPont Chevron PTT
Polymers and Petro-chemicals	~ 500 billion	~ 1 billion	• PLA, PBS • Glycols • Ethylene • Acrylic acid
Specialty Chemicals	~ 300 billion	~ 5 billion	• Enzymes • Flavors, fragrances • Oleochemicals — P&G, Cargill/Natureworks, ADM, DSM, DuPont, BASF
Fine Chemicals	~ 100 billion	~ 15 billion	• Pharma intermediates • Amino acids • Vitamins • Citric acid

Already 5% of Chemical sales depend on Biotech today

Key Growth Drivers

- Technology breakthroughs
- New bio-based building blocks
- Cheap biomass feedstock
- Regulatory push
- Recognized need for innovation
- Major private investments

Potential for Major Discontinuities

Source: McKensey

Chemicals from Renewable Feedstocks

Now 1 – 5 years


Sugarcane


Molasses


Palm


Cassava

5 -10+ Years


Bagasse


Cassava Waste

Advantages:

- Potential Low Cost
- Feedstock Diversification
- Reduced Environmental Impact
- Potential for Better Performance
- Expanded Business Models
- Growing Consumer Demand

Challenges:

- Complex Supply Chain
- Distributed Business Model
- In-kind Petrochemical Products
- Conversion Technologies
- Competitive Feedstocks e.g. Coal
- Cost

Biochemicals from Palm Oil-Based

Animal Feed:
- Nutritional supplements
- Emulsifiers for calf milk replacers

Personal Care:
- Shampoos
- Soaps
- Creams & lotions
- Make-up

Soaps & Detergents:
- Industrial and domestic

Leather:
- Softening, dressing, polishing and treating agents

Food:
- Emulsifiers & specialities for bread, cakes and pastries
- Margarine
- Ice cream and confectionery

Paints & Coatings:
- Alkyd and other resins
- Drying oils
- Protective coatings

Rubber Production:
- Vulcanising agents
- Softeners
- Mould release agents

Industrial Lubricants:
- General and specialty lubricants
- Base oils for non-toxic biodegradable lubricants

Electronics:
- Wire insulation
- Insulating varnishes
- Special-purpose plastic components

Plastics:
- Stabilisers & plasticisers
- Mould release agents
- Antistatic & antifogging aids
- Polymerisation emulsifiers

Printing:
- Printing inks
- Paper coatings
- Photographic printing

Metalworking & Foundries:
- Cutting oils
- Coolants
- Buffing and polishing compounds

Health Care:
- Tabletting aids
- Drugs

Paper Recycling:
- Removal of printing ink

Mining:
- Froth flotation of ores
- Surface-active agents for oil-well drilling muds

Waxes & Candles:
- Ingredients in waxes and polishes

Oleochemicals Based Products


Fatty Acids


Glycerin


Triacetin


Azelaic Acid


PVC Lubricants


Biodegradable Oilfield Esters

Candles, Soap, Shampoo	Moisturizer: Toothpaste	Plasticizer: Cigarette Filters	Jet Engine Lubricants	PVC Lubricants	Drilling Mud

PTTGC Sustainability Agenda

To simultaneously **drive profit** through sustainable growth, **advance social** and **minimize environmental impact**

ptt GLOBAL CHEMICAL

THANK YOU FOR YOUR ATTENTION

Speaker's Information

Kinya SAKANISHI

Home Town / Country : Fukuoka, Japan
Affiliation : Fukushima Renewable Energy Institute, AIST (FREA)
Position : Deputy Director-General
E-mail : kinya-sakanishi@aist.go.jp

Biography

2015- Deputy Director-General, Fukushima Renewable Energy Institute, AIST(FREA), 2013: Counselor, International Affairs Division, AIST, 2012: Supervisory innovation Coordinator, AIST, 2005: Director, Biomass Technology Research Center, AIST Chugoku, 2001:Senior Research Scientist, Energy Utilization Research Institute, AIST, 1999: Senior Researcher, National Institute of Resources and Environment, 1989: Dr.Eng. (Kyushu University), 1987: Assistant Professor, Kyushu University, 1985: Research Associate (Kyushu University), 1985 M.Eng.(Kyushu University), B.Eng.(Kyushu University)

Area of Interest

Coal Conversion Technologies, Heavy Oil Upgrading Technologies, Hydrogenation, Hydrocracking and Hydrodenitrogenation, Hydodesulfurization, Clean Fuel Chemistry, Carbon Materials, Catalyst Chemistry, Biomass Conversion Technologies on Bio-gas, Bioethanol, Synthetic Fuel and Chemicals Production

Research Activities and Achievements

1) Achievements;

N.Q.Diep, S.Fujimoto, T.Minowa, K.Sakanishi, N.Nakagoshi, Potential for rice straw ethanol production in the Mekong Delta, Vietnam. Renewable Energy 01/2015; 74:456–463
N.Q.Diep, K.Sakanishi, N.Nakagoshi, Potentials for ethanol production from rice straw in Vietnam, LAMBERT Academic Publishing, 2014.10
K.Koido, T.Hanaoka, K.Sakanishi, Pressurized gasification of wet ethanol fermentation residue for synthesis gas production, BIORESOURCE TECHNOLOGY, 131, pp.341-348 (2013).
N.Q.Diep, K.Sakanishi, N.Nakagoshi, S.Fujimoto, T.Minowa, X.D.Tran, Biorefinery: Concepts, current status, and development trends, International Journal of Biomass & Renewable, web issue (2012).
M.Gao, S.Yano, H.Inoue, K.Sakanishi, Efficient saccharification of potato pulp with the enzymes from Acremonium cellulolyticus for ethanol production, PROCESS BIOCHEMISTRY, 47, pp.2110-2115 (2012).
T.Hanaoka, K.Matsunaga, T.Miyazawa, S.Hirata, K.Sakanishi, Hot and dry cleaning of biomass-gasified gas using activated carbons with simultaneous removal of tar, particles, and sulfur compounds, Catalysts, 2, pp.281-298 (2012).
Y.Liu, R.Sotelo-Boyás, K.Murata, T.Minowa, K.Sakanishi, Production of Bio-Hydrogenated Diesel by Hydrotreatment of High-Acid-Value Waste Cooking Oil over Ruthenium Catalyst Supported on Al-Polyoxocation-Pillared Montmorillonite, Catalysts, 2-1, pp.171-190 (2012).

2) Ongoing activities;

In terms of recent biomass utilization in Japan, while the major concerns have been shifted to the power generation after the Eastern Japan Disaster in 2011, R&D in Asian countires should be more extensively focused on the utilization of lignocellulosic biomass resources, optimizing the production technlologies of clean fuels including hydrogen, methane, alcohols, dimethylether(DME), chemicals, and functional materials.

Message

The three regional models for sustainable biomass utilization models in Asian countries have been proposed as follows.
1) Model for ASEAN island countries: Palm complex model
2) Model for ASEAN continental countries: Rice and sugar complex model;
3) Model for China: Hybrid agricultural waste utilization model.
Such sustainable biomass utilization schemes can be widely applied to other regions of the world, especially Asian countires.

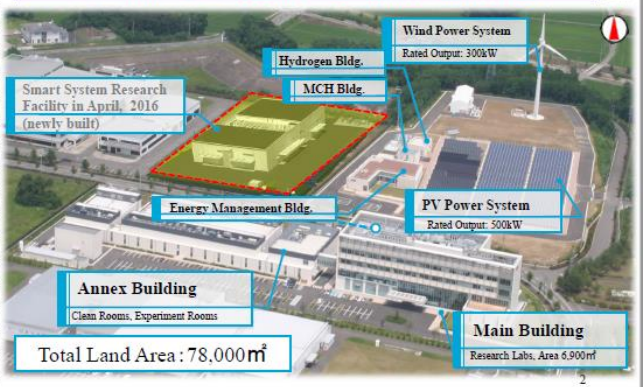
4th JASTIP Symposium "Biomass to Energy, Chemicals and Functional Materials" (NSTDA, Thailand, July 3rd and 4th, 2017)

Potentials of Global Biomass Energy and R&D of Biomass Refinery Technologies

Kinya Sakanishi
Deputy Director-General,
Fukushima Renewable Energy Institute,
AIST (FREA),
Koriyama, Fukushima 963-0298,
Japan

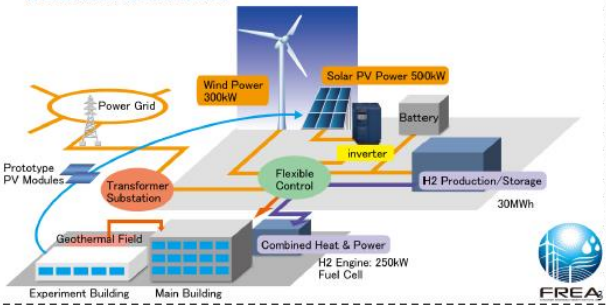
FREA(Fukushima Renewable Energy Institute, AIST)

(Established in Koriyama City, Japan , in April, 2014)



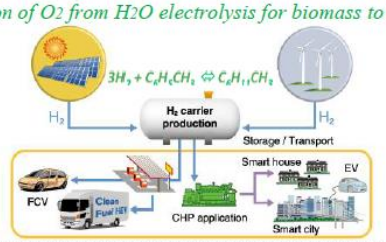
Renewable Energy Network at FREA

System R&D for renewable energies mass introduction
- MW PV, wind power integration with storage (batteries, hydrogen)
- ICT network for power generation forecast and system control
- Test bed for new technology (power electronics etc.), demonstration
- International standardization



Hydrogen Carrier Production / Application

- Hydrogen production from PV, wind turbine output
- Conversion to organic-hydrate (liquid at room temperature), large scale storage at high density for long term
- $3H_2 + C_6H_5CH_3 \leftrightarrow C_6H_{11}CH_3$ (methyl-cyclohexane)
  - Hydrogenation / dehydrogenation by catalytic reaction
- Combined heat and power application by engine / fuel cell
- *Utilization of O_2 from H_2O electrolysis for biomass to H_2 & fuels*



Major Developments of Biomass Policy in Japan

Ministry of Economy, Trade and Industry / Agency of Natural Resources and Energy

■After **the Great East Japan Earthquake and subsequent nuclear accident** happened, the biomass industrialization strategy was drawn as principle to create regional green industry and fortify an independent and distributed energy supply system.

Year	Policies
2002	Biomass Nippon Strategy
2005	Kyoto Protocol – Target Achievement Plan
2009	Basic Act for the Promotion of Biomass Utilization
2010	Basic Energy Plan (Revised)
2010	National Plan for the Promotion of Biomass Utilization
2011.3.11 Great East Japan Earthquake and Accident of Fukushima 1st Nuclear Power Plant	
2012	Biomass Industrialization Strategy <Feed-in Tariff started>
2014	Basic Energy Plan (Revised) ⇒ 2015 Revised FIT for Biomass Power Generation ⇒ 2016 Electricity Deregulation started from April

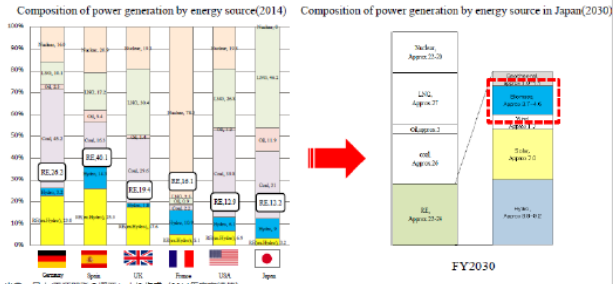
Source: Ministry of Agriculture,Forestry and Fisheries

Current State of Renewable Energy in Japan

Ministry of Economy, Trade and Industry / Agency of Natural Resources and Energy

Renewable energy（RE）accounted for approximately 12.2% of power generation in 2014.
More specifically, hydroelectric power generated by large-scale dams, etc., accounted for 9.0%, with solar PV, wind, geothermal and **biomass** power accounting for 3.2%.

Composition of power generation by energy source(2014) — Composition of power generation by energy source in Japan(2030)



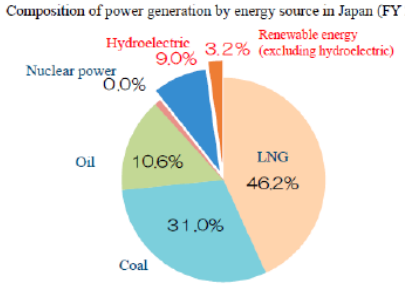
出典：日本「電源開発の概要」より作成（2014年度実績値）。
日本以外「2014年推計値データ」、IEA Energy Balance of OECD Countries (2015 edition)

Source:Ministry of Economy,Trade and Industry

Current Status of Renewable Energy in Japan

Renewable energy accounted for approximately 10.7% of power generation in 2013.
More specifically, hydroelectric power generated by large-scale dams, etc., accounted for 9.0
with solar PV, wind, geothermal and biomass power accounting for 3.2%.

Composition of power generation by energy source in Japan (FY 2014)

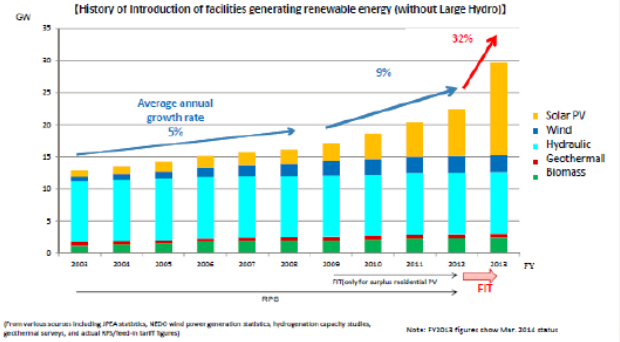


Source: Federation of Electric Power Companies of Japan, Composition of power generation by energy sour

History of Introduction of facilities generating renewable energy

■ The main driver shifted to RPS in 2003, and then, to Feed-in Tariff in 2009.
■ As business environment from the financial point of view was improved, investment in RE has been stimulated. In this surroundings, extension and upgrading of the grid and regulatory reform become more important than ever.

[History of Introduction of facilities generating renewable energy (without Large Hydro)]

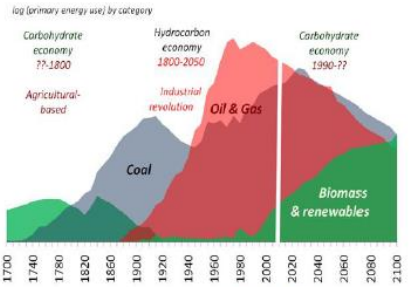


(From various sources including JPEA statistics, NEDO wind power generation statistics, hydrogeneration capacity studies, geothermal surveys, and actual RPS/feed-in tariff figures)

Note: FY2012 figures show Mar. 2013 status

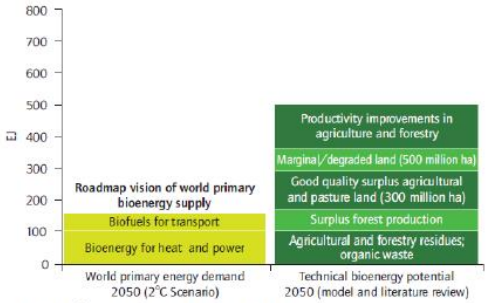
Current Situation of World Energy

Looking Back and Forward



Source : IEA Task39 Work Shop, September 2008

Biomass Supply Prospects – Uncertainties Remain



< Source: Based on IPCC SRREN, 2011 >

- Total biomass demand for heat, power and biofuels reaches 8-11 billion tons in 2050
- Intermediate targets should be adopted to enhance international biomass trade, and assess costs and impact on sustainability

IRENA
International Renewable Energy Agency

Biofuel Potential in Southeast Asia:

Raising food yields, reducing food waste and utilising residues

Table S-1 Residue potential for 2050 (PJ/year) – 25% collection of harvest residue

Country	Harvest Residue	Process Residue	Total Residue	Residue for Feed	Residue for Fuel	40% to Biofuel (Energy Content)	Share of Liquid Fuel Use in 2012
Indonesia	1 079	653	1 732	306	1 426	570	31%
Malaysia	104	59	163	87	76	30	5%
Philippines	393	288	680	303	377	151	44%
Thailand	641	578	1 220	226	993	397	51%
Viet Nam	508	353	861	426	435	174	37%
WORLD	49 278	29 730	79 008	32 877	46 131	18 452	19%

IRENA analysis (Appendix I)

[2] Projected yearly growth in food supply is globally 1.3% through 2030 (ranging from 0.8% in developed countries to 2.4% in Sub-Saharan Africa) and 0.7% from 2030 through 2050 (ranging from 0.3% to 1.9%).

[3] Projected annual growth in meat consumption is globally 1.4% through 2030 (from 0.6% in developed countries to 2.7% in Sub-Saharan Africa) and 0.9% from 2030 to 2050 (from 0.2% to 2.6%).

Table S-2 Residue potential for 2050 (PJ/year) – 50% collection of harvest residue

Country	Harvest Residue	Process Residue	Total Residue	Residue for Feed	Residue for Fuel (Primary Biomass)	40% to Biofuel (Energy Content)	Share of Liquid Fuel Use in 2012
Indonesia	2 158	653	2 811	306	2 505	1 002	55%
Malaysia	208	59	267	87	179	72	12%
Philippines	785	288	1 073	303	770	308	91%
Thailand	1 282	578	1 861	226	1 635	654	84%
Viet Nam	1 015	353	1 368	426	942	377	79%
WORLD	98 555	29 730	128 285	32 877	95 409	38 163	39%

IRENA analysis (Appendix I)

Table S-3 Biomass potential from higher yields in 2050 – yield gap closure case

Country	Land Freed (M ha)	Biomass Potential 150 GJ/ha (PJ/year)	40% to Advanced Biofuel (PJ/year)	Liquid Transport Fuel Use 2012 (PJ)	Potential Share of 2012 Fuel Use
Indonesia	4.26	638	255	1 822	14%
Malaysia	1.27	190	76	596	13%
Philippines	6.87	1 031	412	339	122%
Thailand	3.45	518	207	780	27%
Viet Nam	2.91	436	174	475	37%
WORLD	551.71	82 757	33 103	97 456	34%

IRENA analysis (Appendix II)

Table R-1a Residue potential for 2010 (PJ/year) – 25% collection of harvest residue

Country	Harvest Residue	Process Residue	Total Residue	Residue for Feed	Residue for Fuel
Indonesia	816	494	1 311	205	1 106
Malaysia	77	44	121	60	60
Philippines	297	218	515	193	322
Thailand	476	429	905	160	745
Viet Nam	384	267	651	270	381
WORLD	34 341	20 838	55 179	19 440	35 739

Table R-1b Residue potential for 2030 (PJ/year) – 25% collection of harvest residue

Country	Harvest Residue	Process Residue	Total Residue	Residue for Feed	Residue for Fuel
Indonesia	1 016	615	1 631	261	1 370
Malaysia	96	54	150	70	80
Philippines	370	271	641	259	382
Thailand	592	534	1 126	182	944
Viet Nam	478	333	811	363	447
WORLD	43 914	26 597	70 510	25 155	45 355

Table R-1c Residue potential for 2050 (PJ/year) – 25% collection of harvest residue

Country	Harvest Residue	Process Residue	Total Residue	Residue for Feed	Residue for Fuel
Indonesia	1 079	653	1 732	306	1 426
Malaysia	104	59	163	87	76
Philippines	393	288	680	303	377
Thailand	641	578	1 220	226	993
Viet Nam	508	353	861	426	435
WORLD	49 278	29 730	79 008	32 877	46 131

Table R-1d Residue potential for 2010 (PJ/year) – 50% collection of harvest residue

Country	Harvest Residue	Process Residue	Total Residue	Residue for Feed	Residue for Fuel
Indonesia	1 633	494	2 127	205	1 922
Malaysia	154	44	198	60	137
Philippines	594	218	812	193	619
Thailand	951	429	1 380	160	1 220
Viet Nam	768	267	1 035	270	766
WORLD	68 681	20 858	89 519	19 440	70 079

Table R-1e Residue potential for 2030 (PJ/year) – 50% collection of harvest residue

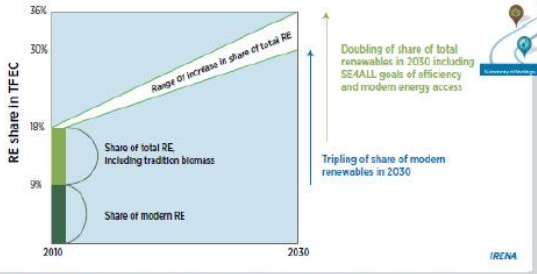
Country	Harvest Residue	Process Residue	Total Residue	Residue for Feed	Residue for Fuel
Indonesia	2 032	615	2 648	261	2 386
Malaysia	192	54	246	70	176
Philippines	740	271	1 011	259	752
Thailand	1 184	534	1 718	182	1 536
Viet Nam	956	333	1 289	363	926
WORLD	87 828	26 597	114 424	25 155	89 269

Table R-1f Residue potential for 2050 (PJ/year) – 50% collection of harvest residue

Country	Harvest Residue	Process Residue	Total Residue	Residue for Feed	Residue for Fuel
Indonesia	2 158	653	2 811	306	2 505
Malaysia	208	59	267	87	179
Philippines	785	288	1 073	303	770
Thailand	1 282	578	1 861	226	1 635
Viet Nam	1 015	353	1 368	426	942
WORLD	98 555	29 730	128 285	32 877	95 409

REmap 2030
A Renewable Energy Roadmap

Figure 1. Doubling the share of renewables by 2030

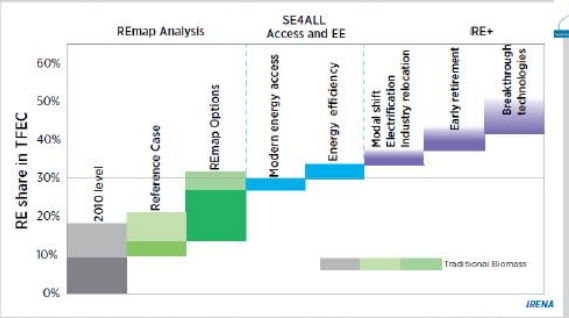


Doubling the share of renewable energy implies a tripling of the share of modern renewables.

Note: The world currently gets 18% of its energy from renewables, but only 9% is modern renewables, and the other 9% is traditional biomass, of which only part is sustainable. On the path towards a doubling of sustainable renewable energy, modern renewables therefore need to replace traditional biomass almost entirely. As a result, the share of modern renewables more than triples from 9% in 2010, to 30% or more by 2030.

RE = renewable energy; TFEC = total final energy consumption

Figure 4. The stepping stones towards a doubling of renewable energy

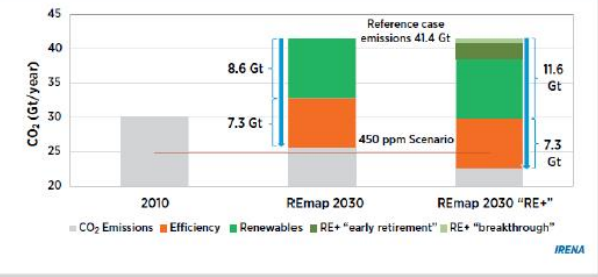


The world can double its share of renewable energy in total final energy consumption by 2030.

Note: The shaded areas indicate traditional biomass. The Reference Case represents the renewable energy share by 2030 based on the policies in place in the 26 REmap countries. The REmap Options show the additional growth by 2030 based almost entirely on modern renewables, with traditional biomass being reduced to less than 3% of the TFEC. The blue bars represent the SE4ALL objectives of modern energy access and energy efficiency (EE), which bring the share of renewables up to around 34% by 2030. The purple bars, RE+, represent other fields of action that can be pursued to take the share of renewables even further.

RE = renewable energy; TFEC = total final energy consumption

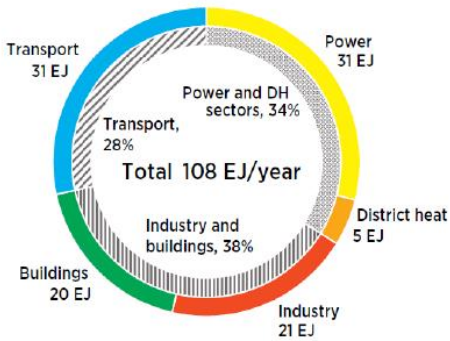
Figure 10. Carbon dioxide emissions under REmap 2030



Renewable energy can provide half of the CO_2 emission reductions needed in 2030 from the energy sector.

Note: Only emissions resulting from fossil fuel combustion are shown. CO_2 emission savings from energy efficiency are based on its share in total emissions in the IEA's World Energy Outlook (WEO) 2012 (IEA, 2012b). IRENA applies this share to the total Reference Case emissions of 41.4 Gt of CO_2 to estimate approximately 7.3 Gt of CO_2 emission savings related to energy efficiency in REmap 2030.

Figure 14. Global biomass demand by sector in REmap 2030 (in primary energy terms)



Biomass is versatile and can be used to provide power, transport and heat.

Target of biomass utilization by type (2020)

Ministry of Economy, Trade and Industry
Agency of Natural Resources and Energy

National target of average utilization ratio is set for each type of biomass to promote high utilization biomass based on their types and to clarify the necessary measures to be taken on the national level.

Type of biomass	Amount generated annually (2009)	Present and target utilization ratio 2009→2020
1 Animal waste	Approx. 88 million tones	90% → 90%
2 Sewage sludge	Approx. 78 million tones	77% → 85%
3 Black liquor	Approx. 14 million tones	100% → 100%
4 Waste paper	Approx. 27 million tones	80% → 85%
5 Food waste	Approx. 19million tones	27% → 40%
6 Sawmill wood residue	Approx. 3.4 million tones	95% → 95%
7 Wood waste from construction	Approx. 4.1 million tones	90% → 95%
8 Non-edible parts of food crops	Approx. 14 million tones	85% → 90%
9 Forest off-cuts	Approx. 8 million tones	0% → 30%

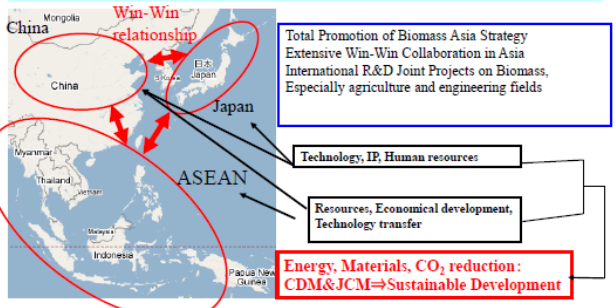
Note: 1 Black liquor, saw mill wood residue, forest off-cuts are dry-weight, all others are wet weight
2 Target for energy crops is 400,000 carbon tones produced by 2020.

Source: Ministry of Agriculture,Forestry and Fisheries

Scheme of Sustainable Asian Biomass Strategy

=> ASEAN+6 and Asia-Pacific Collaborations

Best Practice Scenario and System for Sustainable Biomass Utilization Models in East Asian Countries



Foresight of ASEAN Agricultural Residue in 2030

(Converted into Ethanol x1000 kL)

Type of Agriculture	Sugar cane	Cassava	Corn	Rice	Palm oil	Coconut	Total
Utilized part	Bagasse Filter cake	Laes Stems Leaves	Stems Leaves Cores Husks Fibers	Straw Husks	Shell Tuft	Shell Fiber	
Thailand	4,441	1,123	2,038	13,702	1,128	186	22,618
Malaysia	108	20	42	873	15,024	115	16,182
Indonesia	8,696	2,349	14,499	19,334	24,684	2,584	72,056
Philippines	2,555	187	5,572	6,265	32	5,186	19,797
Vietnam	1,319	388	3,906	12,696	0	137	18,446
Myanmar	1,392	20	1,421	7,161	0	132	10,126
Cambodia	16	40	400	2,436	0	16	2,908
Laos	72	12	327	1,511	0	0	1,922
Total	18,509	4,139	28,205	63,978	40,868	8,356	164,055

* The figures in yellow background are the promising quantities for producing ethanol

Source : NEDO Research Report in 2007

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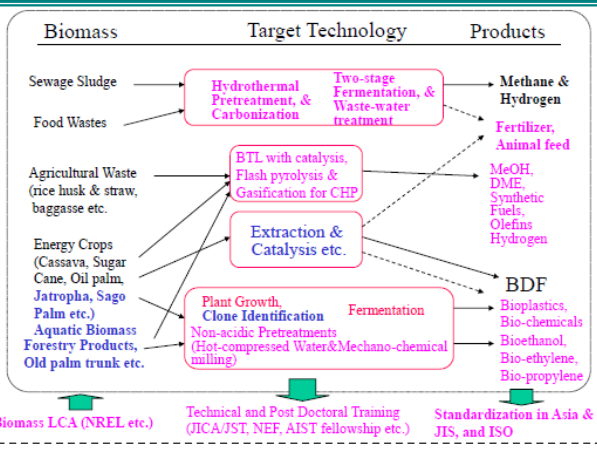
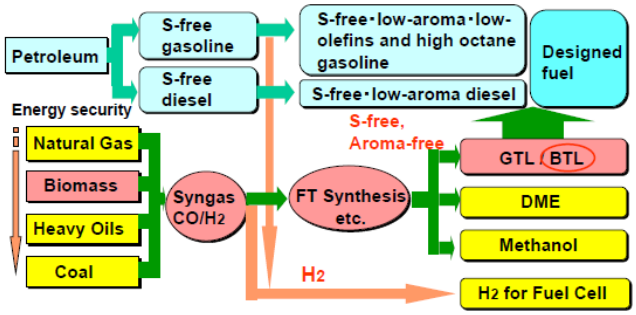
Target Technology & Products for Biomass Utilization

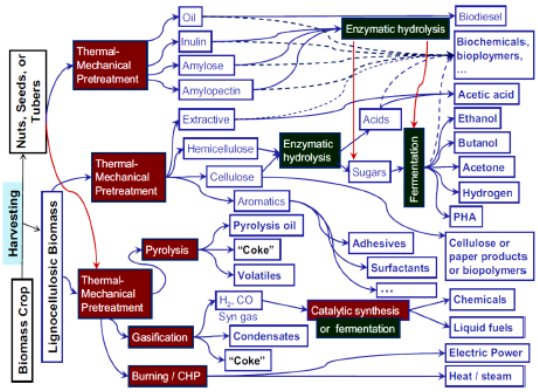


Future Needs for Alternative Transportation Fuel

2000-2010 Fuel technologies for urban environment	2010-2020 Fuel technologies for mini-minimizing fuel consumption	2020-
*PM,NOx reduction *Advanced end-of-pipe technologies	*CO_2 reduction *New engine system/new fuel	



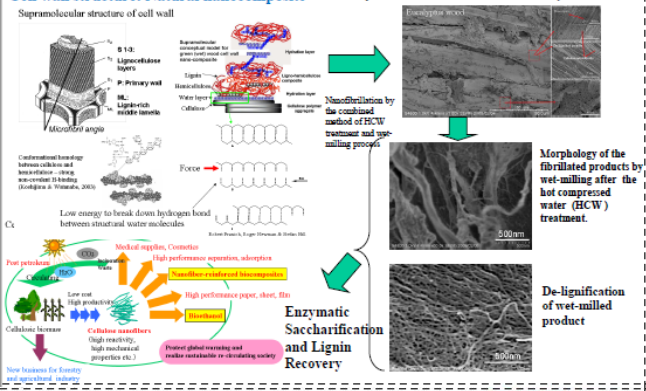
Overall Biomass Refinery Scheme



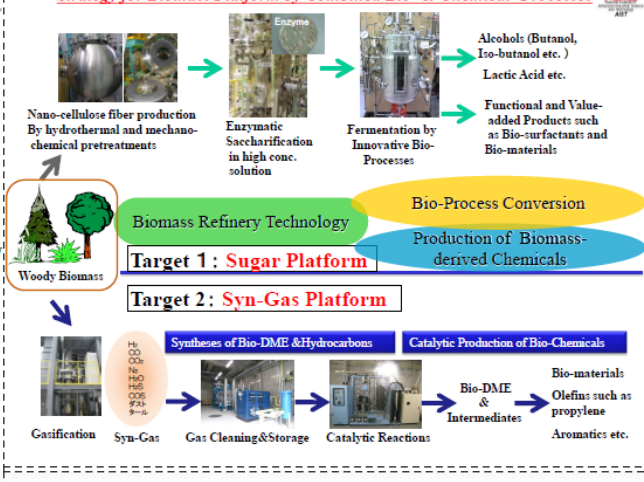
Principles of Biomass Refining Technology

To overcome "Biomass Recalcitrance": responsible for the high cost of lignocellulose conversion.

Cell wall structure: Natural nanocomposite



Strategy for Biomass Platform by Combined Bio- & Chemical- Processes



METI/NEDO's Current Projects of Biofuels

Ministry of Economy, Trade and Industry
Agency of Natural Resources and Energy

1. Element Technology Development for the 2nd Generation Biofuel

◆ Useful element technology development for biofuels

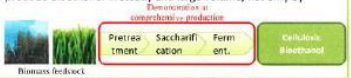
→ Aim to increase total productivity in integrated process of biofuel production from cellulosic biomass by developing and refining individual element technology such as improvement technology for plants growth and productivity in certain conditions, cutting-edge technology in saccharification and fermentation process, etc.

2. Development of Integrated Production System for the 2nd Generation Biofuel

◆ Development of an Innovative and Comprehensive Production System for Cellulosic Bioethanol

→ Aim to develop integrated production system to produce bioethanol in steady and large volume, not only by domestic production but by development import.

- ○improvement technology for feedstock cultivation, harvest, transport
- ○production technology demonstration at pilot plant
- ○study for sustainability of biofuels



3. R&D for the 3rd Generation Biofuels

◆ Strategic Development of Next-Generation Bioenergy Utilization Technology

→ Aim to further broaden and diversify biofuel resources which do not compete with food supplies by conducting technology R&D on Microalgae-derived biofuel production, biomass gasification and liquefaction, etc.

- ○Identify and develop high- oil producing strain
- ○High-efficiency culture, condensation, extraction technology

- ○low-cost gas refining technology
- ○High-efficiency synthesis/reforming technology in low pressure condition, etc.

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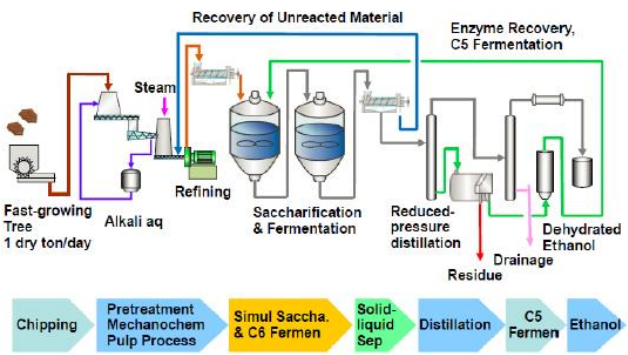
NEDO Project 2

Dev of a Comprehensive Bioethanol Production System From Fast Growing Trees Using Mechanochemical Pulping



Achievements – Pilot Plant in Hiroshima, Japan –

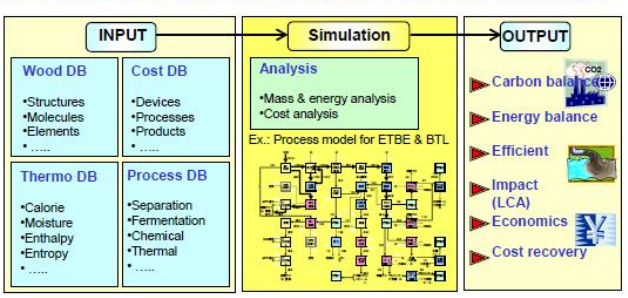
Development of a Comprehensive Bioethanol Production System From Fast Growing Trees Using Mechanochemical Pulping

Biomass System Analysis and Simulation

To establish economically feasible process for large-scale biomass conversion;

1. To develop biomass system simulation technology, Ground database (DB) should be constructed.
2. To design economic feasible total system for biomass.

The simulator can be used for optimization, economic & environmental analysis.



System simulation of BTL process

Steam reforming

WOOD + H_2O →

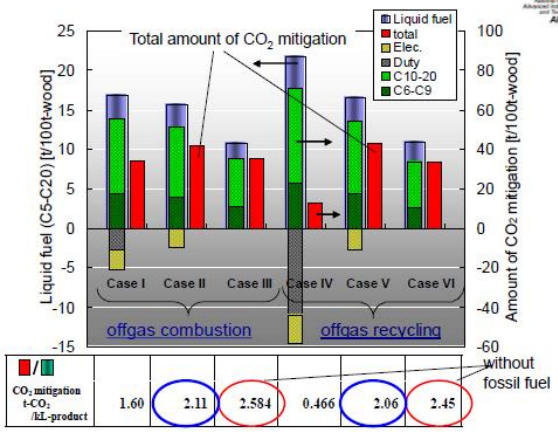
H_2 + CO+CO_2 + CH_4 + HCs + Tar + Char

Fischer-Tropsch(FT) synthesis

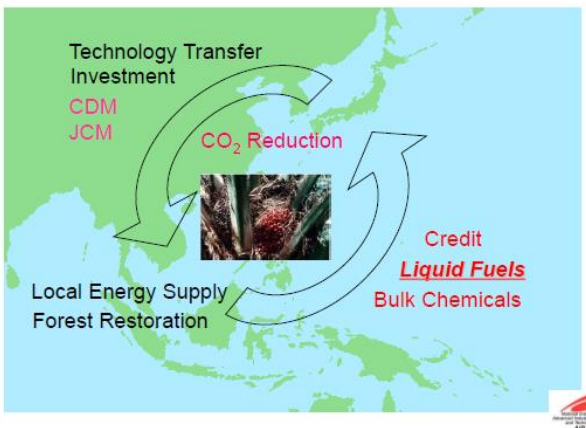
$nCO+(2n+1)H_2 \rightarrow C_nH_{2n+2}+nH_2O$ (paraffin)

$nCO+2nH_2 \rightarrow C_nH_{2n}+nH_2O$ (olefin)

BTL liquid fuel



Effective Utilization of Biomass with Asian Partners



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Thank you !

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Tel: +81 (0)24-963-1805

AIST

Chair's Information

Keiichi N. ISHIHARA

Home Town / Country : Osaka, Japan
Affiliation : Graduate School of Energy Science, Kyoto University
Position : Dean, Professor
E-mail : ishihara@energy.kyoto-u.ac.jp

Biography

2017- Vice-dean of Graduate School of Energy Science, 2002- Professor, Department of Socio-environment of Energy Science, Graduate School of Energy Science, Kyoto University, 1996-2002 Associate Professor, ibid., 1990-1996 Associate Professor, Faculty of Engineering, Kyoto University
1986-1990 Research Associate, 1986 PhD. Department of Metal Science and Technology, Graduate School of Engineering, Kyoto University

Area of Interest

Energy planning based on technology, Effectiveness of energy education
Energy Saving Materials, Waste Management, Synthesis of catalyst for energy and environment

Research Activities and Achievements

1) Achievements

Energy Science: Energy scenario after Fukushima NPP accident; Zhang, Qi; Mclellan, Benjamin C.; Tezuka, Tetsuo and Ishihara KN, An integrated model for long-term power generation planning toward future smart electricity systems; Source: Applied Energy, Vol.112 pp.1424-1437 (2013)

Waste Managements: Optimization of WEEE; Le, H.-L., Yamasue, E., Okumura, H., Ishihara, K.N. Improving sustainable recovery of metals from waste printed circuit boards by the primary copper smelter process, Journal of Material Cycles and Waste Management, 16 (2), pp. 298-305 (2014)

Energy Saving Materials:Developing nitrogen absorption materials for highly efficient thermal insulator; K.N. Ishihara, K. Irie, F. Kubo, E. Yamasue, H. Okumura Mechanical milling of Fe-Li and Cu-Li systems and their nitrogen absorption properties Materials Science and Engineering A, Vol.449-451, pp. 1067-70 (2007)

Synthesis of catalysts for energy and environment:Catalysis for decomposing carbon dioxide and environmental pollutant gas; Supawan Joonwichien, Eiji Yamasue, Hideyuki Okumura and Keiichi Ishihara: "Effects of Magnetic Field on Photodegradation of Methylene Blue over ZnO and TiO2 Powders using UV-LED as a Light Source", J. Chem. Chem. Eng. 5 (2011) 729-737

2) Ongoing activities

- LCA of Tomato plants produced in the greenhouse with OPV
- Successful key factors to promote community renewable energy in ASEAN

Message

In the graduate of Energy Science, we are promoting globalization in both education and research. As for the education, we are now conducting double degree programs with some universities in ASEAN region. Also, we are welcome to collaborate our research on energy and environment with global company.

Speaker's Information

Takashi WATANABE

Home Town / Country : Kyoto, Japan

Affiliation : Research Institute for Sustainable Humanosphere (RISH), Kyoto University

Position : Professor, Director, Deputy Executive Director

E-mail : twatanab@rish.kyoto-u.ac.jp

Biography

2017-: Deputy Executive Director, Kyoto Univ., 2016-: Director, RISH, Kyoto Univ., 2010-16: Vice Director, RISH, Kyoto Univ., 2010-08: Head, Center for Exploratory Res. on Humanosphere, RISH, Kyoto Univ., 2004-: Prof., RISH, Kyoto Univ., 2002-: Assoc. Prof., RISH, Kyoto Univ., 2002-1993: Assoc. Prof., Wood Res. Inst. (WRI), Kyoto Univ., 1993-87: Assist. Prof. WRI, Kyoto Univ., 1986-84: Researcher, Sanyo-Kokusaku Pulp Co. Ltd., 1989: Doctor, Agric. Kyoto Univ., 1984: Master, Agric. Kyoto Univ.

Area of Interest

Structural analysis and conversion of lignocellulosic biomass to biofuels, chemicals and bioactive compounds using biological, biochemical and chemical processes for establishing sustainable humanosphere. Analysis and development of biomimetic ligninolytic system of selective white rot fungi. Development of (bio)catalysts through control of interaction of polypeptides with lignin.

Research Activities and Achievements

1) Achievements

- S. Oshiro, A. Yamaguchi, T. Watanabe, Binding behaviour of a 12-mer peptide and its tandem dimer to gymnospermae and angiospermae lignins, *RSC Advances*, **7**, 31338 - 31341 (2017).
- Y. Ohta, R. Hasegawa, K. Kurosawa, A.H. Maeda, T., Koizumi, H. Nishimura, H. Okada, C. Qu, K. Saito, T. Watanabe, Y. Hatada, Enzymatic Specific Production and chemical functionalization of phenylpropanone platform monomers from lignin. *ChemSusChem*. **10**, 425 (2017).
- A. Kaiho, D. Mazzarella, M. Satake, M. Kogo, M., R. Sakai, T. Watanabe, Construction of di(trimethylolpropane) cross linkage and phenylnaphthalene structure coupled with selective β-*O*-4 bond cleavage for synthesizing lignin-based epoxy resins with controlled glass transition temperature. *Green Chem*. **18**, 6526 (2016) .
- A. Yamaguchi, K. Isozaki, M. Nakamura, H. Takaya, T. Watanabe, Discovery of 12-mer peptides that bind to wood lignin, *Sci. Rep.*, **6**, 21833 (2016).
- H. Okamura, H. Nishimura, T. Nagata, T. Kigawa, T, Watanabe, M. Katahira, Accurate and molecular-size-tolerant NMR quantitation of diverse components in solution. *Sci. Rep.*, **6**, 21742 (2016) .
- A. Kaiho, M. Kogo, R. Sakai, K. Saito, T. Watanabe, *In situ* trapping of enol intermediates with alcohol during acid-catalysed de-polymerisation of lignin in a nonpolar solvent. *Green Chem.*, **17**, 2780 (2015) .
- Y. Nishiwaki-Akine, T. Watanabe, Dissolution of wood in α-keto acid and aldehydic carboxylic acids and fractionation at room temperature. *Green Chem.*, **16**, 3569 (2014).

2) Ongoing activities;

- Production of value added products and fuels from biomass under the support of funding agencies.
- ASIA Research Node program to strengthen hub functions of RISH as a core of humanosphere science.

Message

Lignocellulosic biomass is important as a carbon neutral resource owing to its availability and potential as a platform for the production of green chemicals, fuels, and materials. The conversion of lignocellulosic biomass will afford the opportunity to renovate local community, especially in ASEAN region due to abundance of the bioresources. To realize the biomass-based society it is essential to predict social, economical, cultural, technological and environmental impact by sharing the knowledge among society and experts from various fields.

The JASTIP project and joint approaches toward sustainable utilization of bioresources

Takashi Watanabe

Research Institute for Sustainable Humanosphere (RISH)
Kyoto University

The 4th JASTIP symposium, Bangkok, July 3-4, 2017

JASTIP
Japan-ASEAN Science, Technology, Innovation Platform

- Implementation of advanced international joint research with high visibility
- Promotion of societal implementation of research results with high diversity
- Fostering human resources

JASTIP Head Office @ (Bangkok) — WP1

Support from Kyoto ASEAN Center
ASEAN Center Director · URA · Admin Staff · Local Staff

Joint Laboratories for Joint Research

Satellite Centers established at national research institutions in ASEAN countries, forming a hub for universities and research institutes in each country. Japanese researcher permanently stationed.

Environment · Energy | Bioresources · Biodiversity | Disaster Prevention

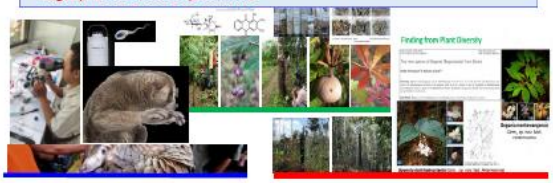
National Science and Technology Development Agency (Thailand) (NSTDA)	Indonesian Institute of Sciences (LIPI)	Malaysia-Japan International Institute of Technology (MJIIT)
WP2	WP3	WP4

Platform Connecting Japan and ASEAN
Bioresources and Biodiversity

Biodiversity Study in JASTIP WP3

- Biological resource research based on ownership of the bio-diversity
- Strengthening of the biological diversity information database

- Genome Resource Bank Centre as the Backbone of Future Indonesian Wildlife
- Plant diversity of Kalimantan: Profiling and Mapping of habitat loss
- Bioprospecting of plant resources in South East Asia to produce highly value-added products



Dissemination of Innovation in JASTIP WP3

- Development and Diffusion of Innovation for Conservation and Sustainable Utilization of Peat Lands in Indonesia: An Ecosystem-Based Approach

Bioresource Utilization: Creation of maximum values from the assembled structures of biomass

Keywords

Bioresources — Screening of useful
- Plant
- Microorganism

Macrostructure — Wood architecture with high safety and low cost

Microstructure — New wood and bamboo materials

Lignin grafting synthetic polymer

Nanostructure — New carbon materials

Cellulose nanofibers

Molecules — Aromatic chemicals

Bioactive compounds

Cellulase

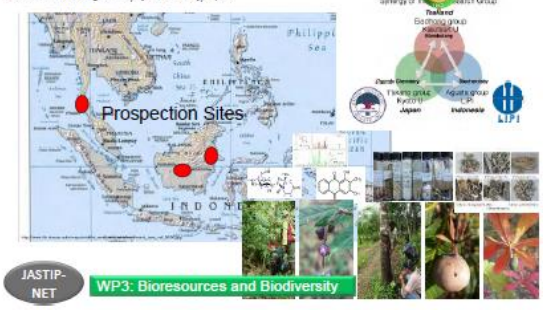
Energy — Bioethanol

Pyrolysis

Bioprospecting of plant resources in ASEAN countries to produce highly value-added products

Wichan Eiadthong[1], Andria Agusta[2], Toshiyuki Takano[3], Hiroshi Kamitakahara[3]

[1]Faculty of Forestry, Kasetsart University, Thailand
[2]Research Institute for Biology, Indonesian Institute of Sciences, Indonesia
[3]Graduate School of Agriculture, Kyoto University, Japan

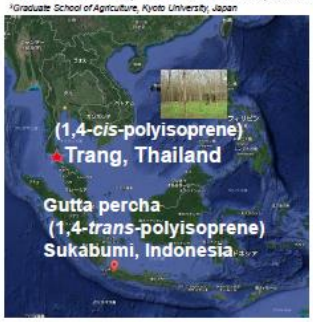


JASTIP-NET — WP3: Bioresources and Biodiversity

Structural analysis and chemical derivatization of 1,4-*trans*-polyisoprene and 1,4-*cis*-polyisoprene

Wichan Eiadthong[1], Andria Agusta[2], Toshiyuki Takano[3], Hiroshi Kamitakahara[3]

[1]Faculty of Forestry, Kasetsart University, Thailand
[2]Research Institute for Biology, Indonesian Institute of Sciences, Indonesia
[3]Graduate School of Agriculture, Kyoto University, Japan



Grafting of cellobiose acetate using thiol-ene reaction

Screening and Characterization Tropical Wood and Bamboo Species for Economical Utilization

Wahyu Dwianto, M.Agr.*, Danang Sudarwoko Adi, Teguh Darmawan, Eka Lestari, Adik Bahanawan, Dwi Ajias Pramasari, Darmawan, T., W. Dwianto, LIPI
Junji Sugiyama*, Kyoto Univ. and Takuro Mori, Hiroshima Univ.

- Identification and Characterization of Wood Species from Sumba and Simeuleu Island
- Density Prediction Model of Fast Growing Platinum Teak Wood Using NIR-Partial Least Squares Regression
- Natural Durability test of Fast Growing Teak Wood
- Performance of Bamboo Lamination as Construction Materials
- Development of Curve Shape Cross-section Bamboo Lamination

High Durable Wood Structure and Low Cost Wooden House

Agung Sumarno*, Eko Widodo *, Ananto Nugroho *, Triastuti *, Subyakto *, Takuro Mori**
*)Research Center for Biomaterials-Indonesian Institute of Sciences, Indonesia
**)Hiroshima University, Japan

This research develop fast growing wood in Indonesia as an anternative materials for high durable wood structure and low cost wooden house

Development of environmentally friendly wood-based composites using lignocellulose and natural adhesives

Subyakto, K. W. Praseiyo, F. A. Syamani, L. Astari, LIPI
K. Umemura, S. S. Kusumah, RISH, Kyoto Univ.

To develop particleboard using bamboo, waste of corn and citric acid adhesive.

Development of Advanced Composite Products Using Wood Charcoal

Subyakto[1], Y. Amin[1], J. Sulistyo[2], Y. Nurhamiyah[1], N. Indayanngsih[1]
T. Hata[3], Y. Onishi[3], I. Ide[4], T. Saito[5]
[1]LIPI, 2 Gadjahmada Univ., RISH, Kyoto Univ., Lygnite Co. Ltd., Osaka Pref. Univ.

Wood charcoal will be made from several Indonesian fast growing and community forest wood species, and agricultural wastes.

- Preparation of Charcoal:
  Carbonization temperatures: 600-900 °C
- Caharacterisation of Charcoal:
  - Morphological and crystaline properties of charcoal (SEM and XRD)
  - Chemicals and other properties (thermal properties, calorific values, etc.)
- Product Development:
  - Fire retardant material
  - Fuel Cell
  - Others

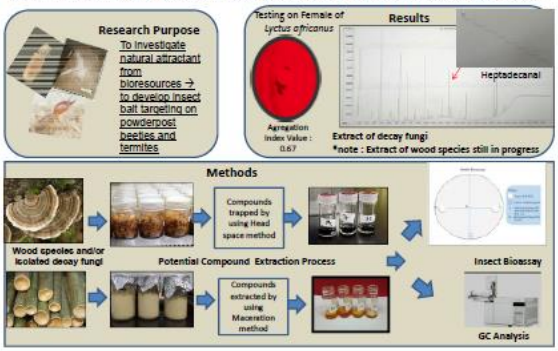
Bioresource Utilization: Creation of maximum values from the assembled structures of biomass

Keywords

Bioresources	Screening of useful · Plant · Microorganism
Macrostructure	Wood architecture with high safety and low cost
Microstructure	New wood and bamboo materials
Nanostructure	Lignin grafting synthetic polymer
Molecules	New carbon materials · Cellulose nanofibers · Aromatic chemicals · Bioactive compounds
Energy	Bioethanol · Cellulase · Pyrolysis

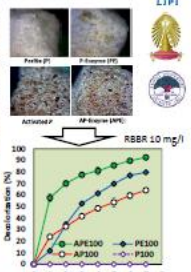
Bio-attractant and Bio-repellent from wood decay fungi for managing wood-attacking Insects

S. Yusuf, T. Kartika, D. Zulfana, T. Yoshimura, D. Zulfana, A. H. Prianto, A. Zulfiri, M. P. Ratna Ayu K., A. S. Lestari, B. Wikantyoso



Decolorization and detoxification of synthetic dyes by enzymes immobilized on activated perlite (APE)

Dede Heri Yuli Yanto[1,*], Wichanee Bankeeree[2], Takashi Watanabe[3], Raden Permana Budi Laksana[1], Hunsa Punnapayak[2], Maulida Oktaviani[1], Fahriya Puspita Sari[1], Sita Heris Anita[1], Hiroshi Nishimura[3], Satoshi Oshiro[3], Ruibo Li[3], Chen Qu[3], and Sehanat Prasongsuk[2]
[1]Research Center for Biomaterials, Indonesian Institute of Sciences (LIPI), Indonesia
[2]Plant Biomass Utilization Research Unit, Department of Botany, Faculty of Science, Chulalongkorn University, Thailand
[3]RISH, Kyoto University, Japan

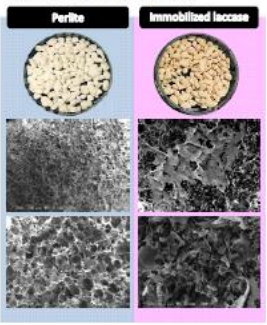


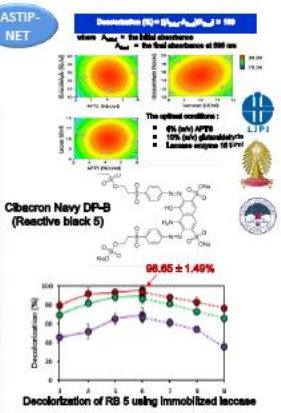
JASTIP-NET

WP3: Bioresources and Biodiversity

BIOREMEDIATION of textile dyes and PAHs using laccase immobilized by cross-linking on perlite

JASTIP-NET

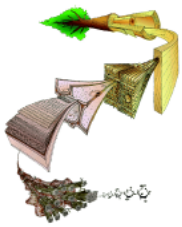




Bioresource Utilization: Creation of maximum values from the assembled structures of biomass

Keywords

Bioresources — Screening of useful
- Plant
- Microorganism



Macrostructure — Wood architecture with high safety and low cost

Microstructure — New wood and bamboo materials

Nanostructure — Lignin grafting synthetic polymer

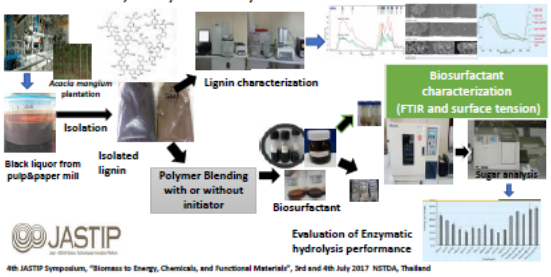
Molecules — New carbon materials
Cellulose nanofibers
Aromatic chemicals
Bioactive compounds

Energy — Bioethanol, Cellulase
Pyrolysis

Functionalization of Lignin Isolated from *Acacia mangium* Black Liquor by Polymer Blending and Grafting

Widya Fatriasari *, Euis Hermiati *, Triyani Fajriutami *, Nissa Nurfajrin S *, R.Permana Budi Laksana *, Muhammad Ghozali *, Deddy Triyono Nugroho Adi **, Takashi Watanabe***

*Research Center for Biomaterials LIPI, **Research Center for Chemistry LIPI, ***Lab. Conversion Biomass, RISH-Kyoto University



4th JASTIP Symposium, "Biomass to Energy, Chemicals, and Functional Materials", 3rd and 4th July 2017 NSTDA, Thailand

Bioresource Utilization: Creation of maximum values from the assembled structures of biomass

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Bioresources — Screening of useful
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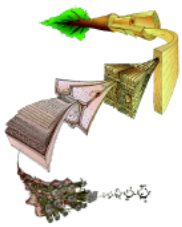

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Microstructure — New wood and bamboo materials

Nanostructure — Lignin grafting synthetic polymer

Molecules — New carbon materials
Cellulose nanofibers
Aromatic chemicals
Bioactive compounds

Energy — Bioethanol, Cellulase
Pyrolysis

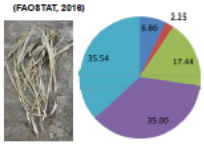
Development of Integrated Process for Conversion of Sugarcane Trash to Bioethanol and Value-Added Chemicals

E. Hermiati, W. Fatriasari, T. Fajriutami, S. H. Anita, M. Ghozali, RP B. Laksana
LIPI, Indonesia
V. Champreda, P. Kanokratana, P. Unrean, B. Bunterngsook, A. Poonsrisawat
NSTDA, Thailand
T. Watanabe, H. Nishimura, S. Oshiro, M. Katahira, T. Nagata, K. Kondo, H. Ohgaki
Kyoto University, Japan

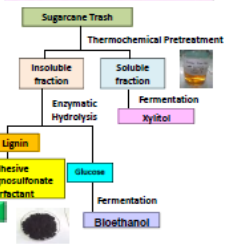
Sugarcane Production in million tonnes

Year	Indonesia	Japan	Thailand
2012	28.7	1.1	98.4
2013	28.4	1.2	100.0
2014	28.6	1.2	104.0

(FAOSTAT, 2016)



- Hydrothermolysis with organic acid
- Steam explosion
- Solvolysis (Glycerolysis)

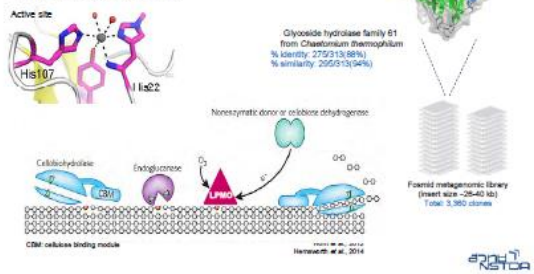


JASTIP-NET — WP3: Bioresources and Biodiversity; WP2: Environment and Energy

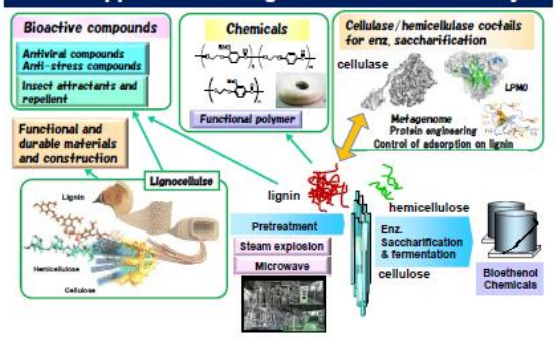
LPMOs: A NEW FACE FOR BIOMASS BREAKDOWN

LPMOs from bagasse metagenome

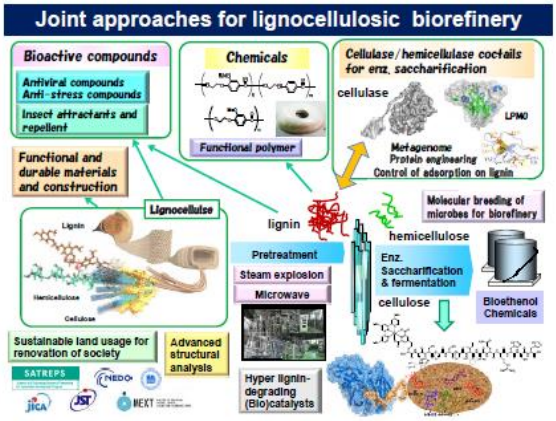
- Lytic polysaccharide monooxygenases (LPMOs) were classified into auxiliary enzyme family (AA9 and AA10)
- LPMOs have emerged as key enzymes utilized in biology for the degradation of biomass.



Joint approaches for lignocellulosic biorefinery



Joint approaches for lignocellulosic biorefinery



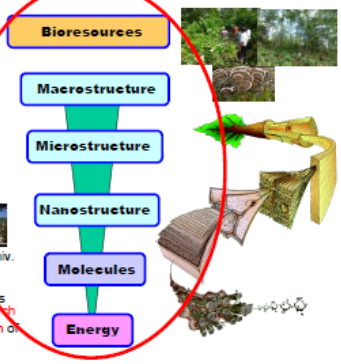
Bioresource Utilization: Creation of maximum values from the assembled structures of biomass

NSTDA

LIPI.

Kyoto Univ.

- Create maximum values from assembled structures of biomass through international joint research
- Promote societal implementation of the maximized research output with younger generations



Speaker's Information

Klanarong SRIROTH

Home Town / Country : Bangkok, Thailand
Affiliation : Mitr Phol Sugar Corp.,Ltd
Position : Director
E-mail : klanarongs@mitrphol.com

Biography

Present: Director, Mitr Phol Sugar Corp., Ltd., 1999-: Associate Professor, Biotechnology, Kasetsart University, 1993-1999: Assistant Professor, Biotechnology, Kasetsart University, 1986-1983: Doctor of Engineering (Biotechnology), Technical University of Berlin, Germany, 1983: Master of Engineering (Biotechnology), Technical University of Berlin, Germany, 1975-1976: Master of Science (Food Technology), University of The Philippines at Los Banos, The Philippines, 1970-1973: Bachelor of Science(Food Science), Kasetsart University, Thailand.

Area of Interest

Biotechnology, Food Carbohydrate, Starch and Sugar Technology, Biofuel, Biomass and Ethanol Production

Research Activities and Achievements

Assoc. Prof. Klanarong Sriroth has involved in sugar and starch industry for more than 35 years after his graduation "Doctor of Engineering in Sugar Technology/Biotechnology" from the Technical University of Berlin in 1986. He was one of the key persons who established the public awareness for the significant roles of Science & Technology to strengthen the competitiveness of Thai agro industry, in particular carbohydrate crops which are sugar cane and cassava. Consequently, with the collaboration between National Center for Genetic Engineering and Biotechnology (BIOTEC), National Science and Technology Development Agency (NSTDA) and Kasetsart University, Cassava and Starch Technology Research Unit, a specialized unit on cassava, starch and sugar technology, was established in 1995 and he has been active as the unit director since then. He is very prominent in starch and sugar processing. His expertise is further extended to bioethanol processing where cassava and sugar cane are preferably used as the promising feedstock. With a great demand of carbohydrate uses in many industries, he has been inquired to conducted many works, granted by the government agencies. He also set up Sugar and Ethanol Technology Program for factory personnel, which promotes academic and industrial networking. Through his long accumulated experience in academic researches and collaborative works with industrial sectors, he currently serves as a technical committee in many National Boards concerning cassava, sugar and bioethanol. He is also a director inMitr Phol Sugar Corp., Ltd.

Message

JASTIP

"Biomass to Energy, Chemicals and Functional Materials"

Date: 3 - 4 July 2017

"Thailand's Bioeconomy & Biorefinery Development and Roles of Mitr Phol R&D"

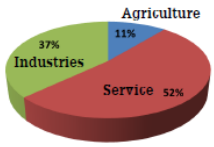
Assoc.Prof.Dr. Klanarong Sriroth,
Mitr Phol Sugar Corp., Ltd.
E-mail: klanarongs@mitrphol.com / aapkrs@ku.ac.th

Thailand: Facts and Figures

The world 16th largest food exporter with value of food exports 30,847,701,710.00 US dollars

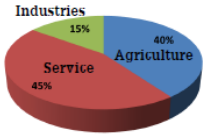
GDP: 180,000 Bath/head (2015)
Surface Area: 513,120 sq km
Agricultural area: 47% (2013)
Population: 67.2 million (2014)
Total Labor Force: 38.3 million (2013)

GDP Composition by Sector



Source: The World Bank (2014)

Labor Force by Occupation



Source: The World Bank (2014)

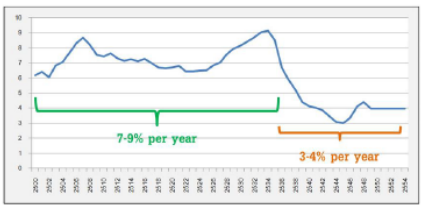
Thailand: Kitchen of the World

Product	Asean World Market Share (%)	Thailand World Market Share (%)
Palm Oil	86	1
Cassava Products	84	57
Rice	32	22
Shrimp	30	8
Sugar	11	11

Source : Global Trade Atlas,2014,Worldstopexport,2014

Thailand's Economy in Trouble

Thailand Gross Domestic Product (Thailand GDP)

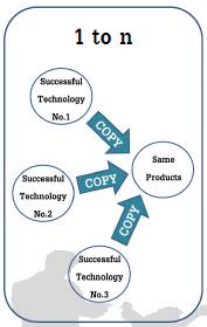


High Income Country
Strategy?
Middle Income Country
Middle Income Trap (MIT)
Thailand Lost decades

The Middle Income Trap (MIT)

-unable to compete against advanced economies with high levels of innovation and value-adding activities
-unable to compete with less developed economies that have cheaper labor.

Zero to One



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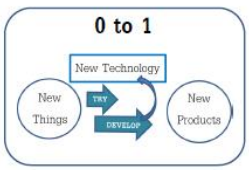
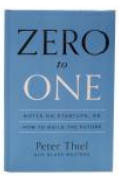
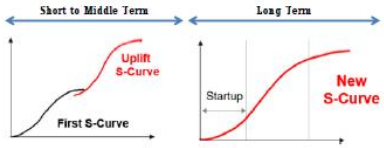


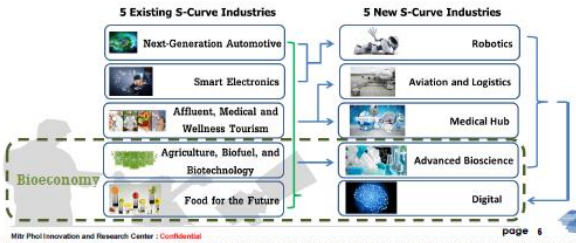


Zero to One: Notes on Start Ups, or How to Build the Future

"Technology is miraculous because it allows us to do more with less, ratcheting up our fundamental capabilities to a higher level."

New Engines of Growth: S-Curve and New S-Curve





Bioeconomy Value Chain

Agricultural Products are tap (or primary) root in Bioeconomic development for supporting National policy.

Mitr Phol Group

Sugarcane Plantation & Sugar Business
- Phukiao
- Danchang
- Phuviang
- Singburi
- Kalasin
- Phuluang

Energy Business
- Ethanol
- Bio-Power
- Alternative Power

Wood Substitute Material & New Business
- Panel Plus
- Fertilizer

Offshore Business
- China
- Lao
- Australia

Innovation and Research Center

Typical Products from Sugarcane Industries

Panel Plus

Bagasse, 5 MT

Sugarcane 18 MT

Power Plant

Raw Sugar

Sugar Process

Refined Sugar

Total 2 MT

Molasses, 0.9 MT

Ethanol Plant

Medium Density Fibreboards, 300,000 m^3

Co-generation power, 428 MW

Ethanol, 400 MLitre

The Threats to Sugarcane Industries

1. Climate Change, Insect Pest, and Diseases

2. Saccharophobia

3. Disruptive Technology

- Solar Energy vs Co-generation Power

bagasse-based co-generation power

- Electric Vehicles (EV) vs Flexible-Fuel Vehicles (FEV)

molasses-based ethanol

Climate Change, Insect Pest, and Diseases

Insect Pest and Diseases

Climate Change on Drought

Brazil approves world's first commercial GM sugarcane: developer CTC REUTERS

By Ana Mano | SAO PAULO

Brazil has approved commercial use of a genetically modified sugarcane, seeking a welcome for the country's highly competitive sugar industry as this is the first time such permission has been granted anywhere in the world.

Authorization was obtained by CTC Centro de Tecnologia Canavieira SA, which developed the technology and made the application seeking approval in December 2015, Chief Executive Officer Gustavo Leite told Reuters in an interview.

CTNBio was not immediately available to comment on the approval.

Leite said it would take at least three years for the first shipments of sugar produced from GM crops to reach export markets because of the pace of propagation of new cane varieties.

Brazil has about 10 million hectares of sugarcane fields and potential to plant GM cane in up to 70 percent of this area, Leite said.

Sugarcane white leaf disease

Saccharophobia

Campaign Encourages Sugar Reduction

กระทรวงสาธารณสุข ร่วมกับ สสส. และภาคีเครือข่าย เร่งรณรงค์สร้างค่านิยม คนไทยอ่อนหวาน ไร้น้ำตาลซอง 4 กรัม

Saccharophobia

Reduce Sugar Consumption by Increasing Sugar tax

Bangkok Post E-PAPER

The Finance Ministry is set to trim the excise tax for refined sugar drinks in an attempt to encourage people to consume healthier products and prompt makers to reduce sugar content, says a source at the Finance Ministry.

Drinks that contain less sugar than the Finance Ministry's threshold will be levied a lower excise tax than that for drinks with higher sugar content, the source said.

The tax on sweet drinks is part of the amended excise tax act set to come into force from Sept 16.

Under the amended tax, the levy on drinks with sugar content that has been reduced to the level required by the Finance Ministry will be cut to four baht per bottle from five.

The source said drinks for which 10% of the content is fruit or vegetable juice with sugar content lower than the Finance Ministry's threshold will be exempted from the tax.

But the ministry will impose an excise tax if the drink's sugar volume exceeds the set mark.

Slim tax for healthy drinks on tap

Sugar tax for public health: Soft drinks 20-25% price rise from 16th September 2017

Disruptive Technology: Solar Energy vs Co-generation Power

Solar Energy

26 Seven opportunities: Thailand Solar Energy Update 2017

Walking on sunshine: Thailand's solar energy blueprint

Thailand is continuing its integrated energy blueprint, consisting of a gas plan, an alternative energy development plan (AEDP), and the Power Development Plan (PDP) with the Smart Grid Plan (SGP). The targeted percentage of renewable energy production seems to be increased in the future.

The political risk of a (retrospective) cancellation of renewable energy incentives is small, but not non-existing. Section 44 of the Interim Constitution ("SHMC") will be still in place in 2017 and gives the army-manned NCPO (National Committee for Peace and Order) full and uncontrolled authority to reshape the energy legislation and regulatory framework without grandfathering, loss compensation, legal or court protection.

Technical enhancements and cost reductions might bring governmental incentives to an end, should the production of photovoltaic and the solar energy production reach competitiveness with traditional power production. The legal impacts of such technological improvement have to be awaited with excitement.

Co-generation Power

Bagasse

bagasse-based co-generation power 428 MW/ year

Disruptive Technology: Electric Vehicles (EV) vs Flexible-Fuel Vehicles (FEV)

Electric Vehicles (EV)

Thailand preparing incentives for electric vehicles

Thailand is getting serious about green automobiles with the government preparing to launch a roadmap for development of the electric vehicle industry complete with incentives for investments by the private sector and cooperation from the Federation of Thai Industries (FTI), local and regional media reported last week.

"Having been successful as a global destination for pick-up truck and small car production, Thailand has been looking to jump-start the development of a green car industry churning out hybrid, electric and hydrogen vehicles. Things are progressing, and now a roadmap for the electric vehicle industry is expected to surface this month," a report on paultan.org, a Malaysia-based auto industry website, said last week.

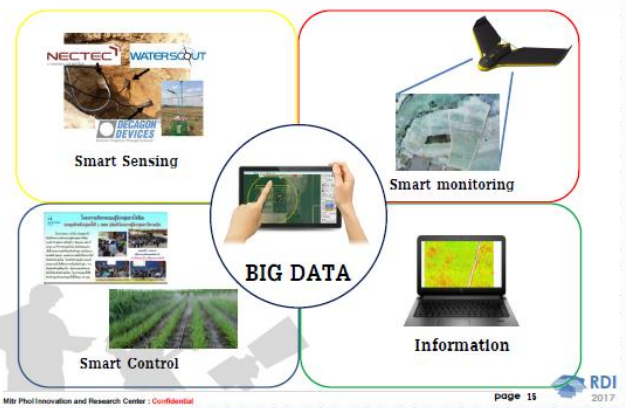
"Instead of waiting on its car production laurels, the 'Detroit of the East' is laying the groundwork for the future. Malaysia also has incentives for car companies to produce hybrids, but the privileges depend on direct negotiation with the government. In contrast, Thailand's automotive blueprints and requirements are clearly defined," the website wrote.

Flexible-Fuel Vehicles (FEV)

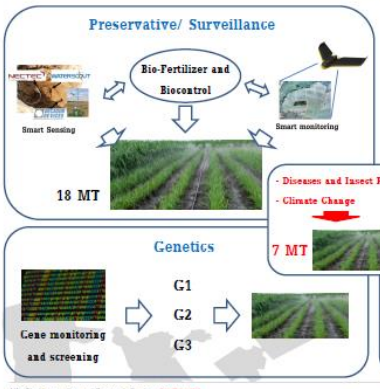
Molasses

molasses-based ethanol 400 Mlitre/ year

Smart Farming



Backup Plan



Mitr Phol Group

- Co-generation power, 428 MW
- Value-Added Products
  - Phenolic Compounds
  - Alternative Sweeteners
  - Xylooligosaccharides (X-O-S)

Low Glycemic Index (GI) Sweetener

The Glycemic Index (GI) is an indication of how quickly a specified amount of food will cause a rise in blood sugar level.

6 Types of sweeteners:

Type	Name	Glycemic Index (GI)	Example
1	Sugars	high	Sucrose, Glucose
2	Sugar Alcohols	very low	Xylitol, Erythritol
3	Natural Caloric Sweeteners	lower than sugar	Honey, Maple Syrup
4	Natural Zero Calorie Sweeteners	0	Luo Han Guo
5	Modified Sugars	high	Corn Syrup, Caramel
6	Artificial Sweeteners	0	Aspartame, Saccharin

to be announced

Healthy and Sustainable Sweetener

DFI uses an innovative electrochemical process to transform common sugars into healthy and sustainable products found in nature, but that are otherwise difficult to manufacture. Specifically, DFI has discovered a breakthrough process for the production of erythritol, methionine and formic acid.

DYNAMIC FOOD INGREDIENTS

Healthy Sugar Alcohol: Erythritol

Low GI Sugar Alcohol: Xylitol

DFI & Mitr Phol Partnership

DYNAMIC FOOD INGREDIENTS ANNOUNCE STRATEGIC PARTNERSHIP WITH MITR PHOL GROUP TO PRODUCE ERYTHRITOL AND XYLITOL SWEETENERS

Largest sugar producer in Asia will help to expand production of natural sweeteners and other products

Oligosaccharides from Hemi-Cellulose

Bagasse

National Chung Hsing University

- Hemicellulose
  - Xylooligosaccharides (low and high molecular weight)
    - Xylose
    - Arabinose
    - Acetic Acid
      - Furfural
      - Glycoaldehyde
      - Glyceraldehyde

Value-Added Products:

- **Prebiotics**
- **Animal Feed Additives**

Value-Added Products from Sugarcane Industries

Bagasse, 28%

Sugarcane 18 MT

Collaboration

- Electric power
- Polyphenols
- Cellulose
  - -Superabsorbent Polymer
  - -Animal Feed
- Hemi-Cellulose
  - -Prebiotics
  - -Animal Feed

Sugar Process

Molasses, 5%

- Raw Sugar
- Refined Sugar
- Medical Sugar
- Low GI Sugar
- Sugar to L-Lactic acid

- Ethanol
- Value-added products
  - -Prebiotics
  - -Food Yeast
  - -Amino Acids
  - -Phytochemicals

Medium Density Fibreboard (MDF)

Particle Board

Medium Density Fibreboard

Melamine Faced Panels

Thank you for your attention

Speaker's Information

Atsushi TSUTSUMI

Home Town / Country : Tokyo, Japan
Affiliation : Institute of Industrial Science, The University of Tokyo
Position : Project Professor
E-mail : a-tsu2mi@iis.u-tokyo.ac.jp

Biography

2014– : Visiting Professor, The Open University of Japan (OUJ), 2013- : Project Professor, Institute of Industrial Science, UT, 2013- : Program Officer, Japan Science and Technology Agency(JST), 2008-2012 : Director, Collaborative Research Center for Energy Engineering, UT, 2007- : Professor, Institute of Industrial Science, UT, 1994-2007 : Associate Professor, Department of Chemical System Engineering, UT, 1986 : Ph.D. Chemical Energy Eng., UT

Area of Interest

Exergy Recuperation Technology, Hydrogen and Power Coproduction by Exergy Recuperative Biomass Gasification-SOFC System, Innovative Energy Conservation by Self-Heat Recuperation, Fuel Cell/Battery (FCB) with Energy Sparkling, Novel Hydrogen Production by Water Decomposition Electrochemical Cycle, Particle and Fluidization Technology

Research Activities and Achievements

1. Exergy Recuperation Technology

We have advanced self-heat recuperation technology based on the exergy recuperative heat utilization principle, which can perfectly recirculate process heat by providing compression work without addition of heat generated by fuel combustion. The self-heat recuperation can recover not only latent heat but also sensible heat in the thermal process, leading to a considerable reduction in the energy consumption for almost all industrial thermal processes such as distillation, PSA gas separation, chemical absorption gas separation, air separation, drying, condensation, desalination, etc. Furthermore, we have applied to several energy-intensive chemical production processes such as methanol synthesis, DME synthesis, biodiesel fuel (BDF) production, and ammonium.

2. Hydrogen and Power Coproduction by Exergy Recuperative Biomass Gasification-SOFC System

A novel hydrogen and power coproduction system based on the exergy recuperative biomass gasification integrated with solid oxide fuel cell was proposed. In this system micro-tubular SOFC stacks are immersed in the internal circulating fluidized bed gasifier. The exothermic heat from SOFC is recuperated and utilized for endothermic heat of biomass steam gasification. This leads to a considerable improvement of the net power generation.

3. Energy Storage System

A novel electrochemical systems with a dual function of power generation and energy storage, referred to as fuel cell/battery (FCB) systems, have been suggested. In addition, we have proposed a novel water electrolysis system containing an intermediate electrode is proposed, which can generate oxygen and hydrogen gases separately through a two-step electrochemical cycle.

224 scientific publications, 379 proceedings in international journals and conferences and 28 books

Message

SATREPS is a collaboration between JST and JICA with the following aims.
1. International Cooperation
2. Addressing Global Issues and Advancing Science
3. Capacity Development

Bioenergy for Mitigation of Global Warming

Atsushi Tsutsumi

SATREPS, JST

Collaborative Research Center for Energy Engineering
Institute of Industrial Science
The University of Tokyo, Tokyo, Japan

Bioenergy for Mitigation of Global Warming

Contents

1. SATREPS Program
2. The Role of Bioenergy
3. Self-heat Recuperation Technology

   Bioethanol Distillation

   Biomass Drying

   Exergy Recuperative Biomass Gasification-SOFC System for Hydrogen and Power Coproduction

About SATREPS

- Environment and Energy
- Bioresource Utilization
- Disaster Prevention and Mitigation
- Infectious Diseases Control

Global issues need international collaboration.

"Strengthening S&T cooperation with developing countries for resolving the global issues"

Aims of SATREPS

1. Enhancing Cooperation in Science & Technology
   — Building win-win relationships between Japan and developing countries —
2. New Technology, New Knowledge, Innovations
   — Addressing global issues and advancing science —
3. Capacity Development
   — Boosting self-reliant R&D capacity and sustainable research systems, tackling human resources and coordinating networking between researchers —

Practical Utilization/Implementation of research outcomes

~ Expecting outcomes to make a real contribution to society ~

Science & Technology × Official Development Assistance (ODA)

Science and Technology	×	**International Cooperation**
Meeting Global Needs	×	**Meeting Local Needs**
Japan's Capabilities	×	**Developing Countries' Capabilities**

SATREPS program structure

Research Areas

4 fields 5 areas

- Environment and Energy
  - Global-scale Environmental Issues
  - Low-carbon Society/Energy
- Bioresource Utilization
- Disaster Prevention and Mitigation
- Infectious Diseases Control

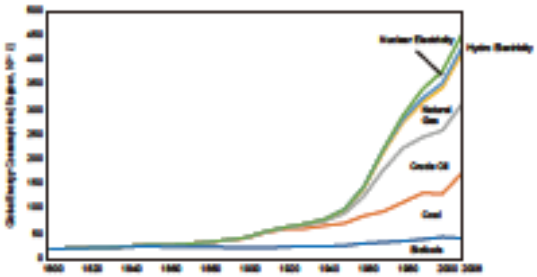
PRIDE → JST → AMED

SATREPS' s contribution for SDGs

Bioenergy for Mitigation of Global Warming

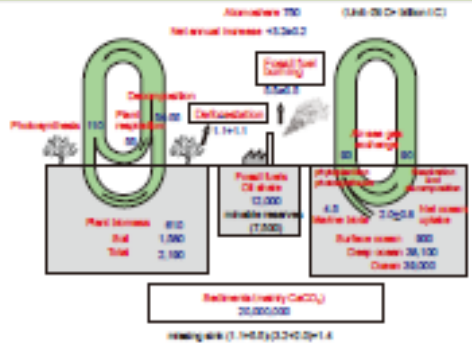
Contents

Global Energy Consumption



- We are consuming a huge amount of energy.
- The CO_2 emission due to the combustion of fossil fuels causes the global warming.

Carbon Cycle



Fossil fuel burning → Renewable energy

Deforestation → Forest conservation

Mitigation of Global Warming for Sustainable Society

Renewable Energy

- shift to low-carbon fuel
- renewable energy such as solar, wind, biomass

Energy Saving

- heat recovery and heat cascading
- high-efficient equipment
- energy efficient utilization

Carbon Capture and Storage (CCS)

- capturing waste CO2 from power plants, transporting it to a storage site, and geological sequestration.

Carbon Capture Storage (CCS)

- CCS process consists of CO_2 recovery section and storage section.
- In the CCS process, large amount energy consumes in CO_2 capture section in which consume 4.1 GJ/t-CO_2 using a chemical absorption process (ex. Monoethanol amine, MEA)
- As a result of increasing the energy consumption, the power generation efficiency is decrease by 8-10 point.

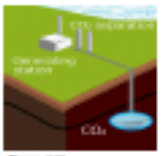


Figure. CCS process

Table. Carbon footprint in power generation section [Gt-CO2/year]

CCS contributes one-sixth of total CO2 emission reductions required in 2050.

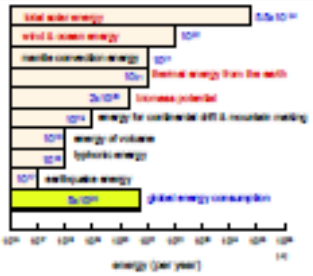
14% of the cumulative emissions reductions through 2050 against a business-as-usual scenario (IEA)

Renewable energy

Wind power

Solar photovoltaics

Terrestrial Energy Potential



A large amount of solar and wind energy use might cause the climate change.

More efficient use of bioenergy is essential.

Energy saving technology

Bioenergy for Mitigation of Global Warming

Contents

1. SATREPS Program
2. The Role of Bioenergy
3. Self-heat Recuperation Technology

   Bioethanol Distillation

   Biomass Drying

   Exergy Recuperative Biomass Gasification-SOFC System for Hydrogen and Power Coproduction

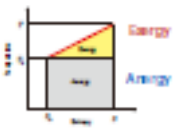
Exergy, Exergy Rate

$$\Delta H = H - H_0 = Ex + T_0(S - S_0)$$

Energy Exergy Anergy

Exergy *Ex*

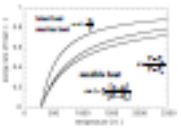
- the maximum useful work obtainable as a system comes into equilibrium with environment



Exergy rate ε

- rate of energy to energy(enthalpy)
- a measure of energy quality

$$\varepsilon = \frac{\text{exergy}}{\text{enthalpy}}$$

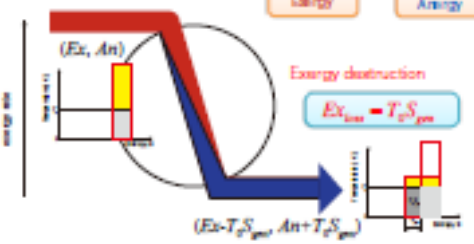


17

Exergy Destruction in Energy Conversion Process

$$-\Delta H = Ex + An = \left(Ex - T_0 S_{gen}\right) + \left(An + T_0 S_{gen}\right)$$

Energy Anergy



- Energy is conserved. (-ΔH=const.)
- Exergy destruction takes place due to the irreversibility
- Exergy is transformed into energy

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Exergy Destruction in Combustion Process

Combustion is an energy conversion process from chemical energy with higher exergy rate to thermal energy with lower exergy rate

Exergy destruction occurs in the combustion process because exergy rate of heat is lower than that of fuel

It is most essential for the energy saving and efficient utilization to reduce the exergy loss in combustion processes

- heat generation without fuel consumption
- reduction of exergy loss in fuel consumption

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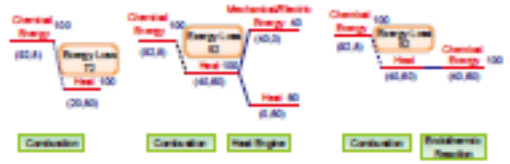
Energy Production and Utilization

Heat Use | Power Use | Material Production



In the initial stage of energy production, chemical energy is converted to heat through combustion, in which a large exergy destruction takes place.

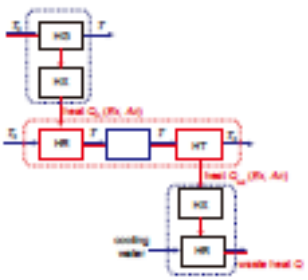
20

Heat Recycling for Heating and Cooling System

Heat Generation Module
Combustion Heating
Heat pump

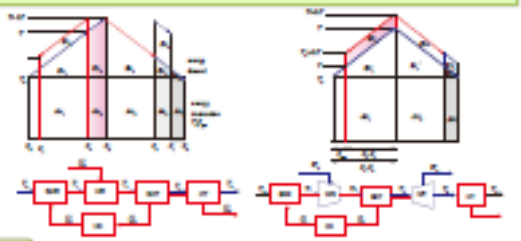
Heating and Cooling Cycle Process Module

Heat Removal Module



- Heat input is equal to heat output.
- No exergy destruction takes place in the heating and cooling cycle process.
- Exergy destruction takes place only in the heat generation and heat removal modules.

Self-heat Recovery vs Self-heat Recuperation



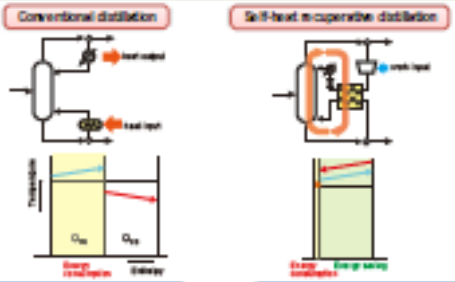
Combustion heating	Self-heat Recovery	Self-heat Recuperation
Q	$\frac{\Delta T}{T - T_0} Q$	$\frac{2\Delta T}{T + T_0}\left(1 - \frac{\Delta T}{T - T_0}\right) Q$
heat 100	heat 9.6	work 2.3

Innovative energy saving

Application of Self-heat Recuperation Technology to Distillation

About 40% of energy consumption in petrochemical industry is due to the distillation

Conventional distillation | Self-heat recuperative distillation



Heat supplied to reboiler is wasted in the condenser

Self-heat is recycled by adding work No adding heat

Energy consumption is reduced to 15% (85% saving)

Pilot Plant of Self-Heat Recuperative Bioethanol Distillation System

Feed rate: 400 kg/h
Feed: 10wt% ethanol
Distillate: 90wt% ethanol

	Steam Utility	Power (compressor)	%
Heat Recovery	4.6 MJ/L-EtOH	—	100
SHR (Simulation)	—	0.77 MJ/L-EtOH	17 (50)
SHR (Pilot plant)	—	0.65 MJ/L-EtOH	14 (43)

- () is calculated by Steam Utility = Power ×3
- Compression efficiency was estimated to 50% in simulation, but it was 50% in Pilot plant.

Nippon Steel Sumikin Engineering, Kitakyushu Environmental Technology Center

The energy required for distillation is reduced to about 14% of the conventional counter parts (86% energy saving)

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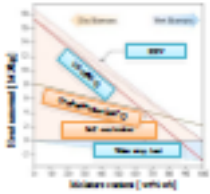
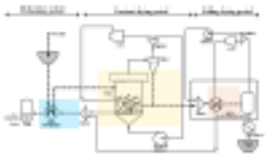
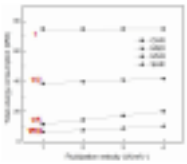
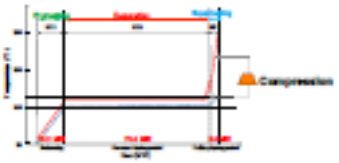
Self-Heat Recuperative Biomass Drying



Help energy demand for drying decrease or large latent heat of water evaporation







Energy consumption can be reduced to 1/12

Self-heat recuperation is adaptable for various unit operation

•Distillation	86% energy saving (reduced to 14%)
•Desulfurization Process	75% energy saving (reduced to 25%)
•Cryogenic Air Separation	40% energy saving
•Thermal Desalination	78% energy saving
•CO2 Chemical Absorption	68% energy saving
•Drying Process	86~92% energy saving
•Methanol Synthesis	85% energy saving
•BDF production	80% energy saving
•PSA (pressure swing absorption)	70% energy saving

Green Innovation: Paradigm Shift in the Heat Utilization

Energy Cascading	→	Exergy Recuperation
Combustion Heating		Heat Circulation by Self-heat Recuperation

- Heat is generated by the combustion of fuels, leading to a large exergy destruction.
- Heat is recovered and reused at lower temperature. But, heat addition is required.
- Large energy consumption

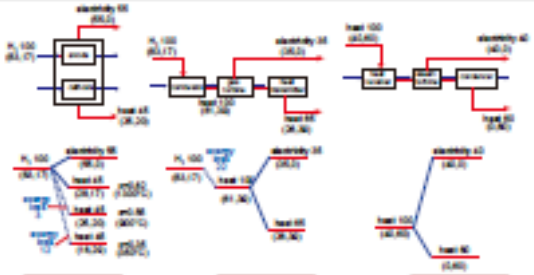
- No more combustion!
- Heat can be recuperated by adiabatic compression and be recycled with no addition of heat.
- Exergy loss is minimized to the minimum work for heat circulation

Self-heat recuperation applicable to all thermal processes

Energy consumption can be reduced to 1/5~1/25 (1/2~1/10)

No combustion leads to zero emission of CO_2

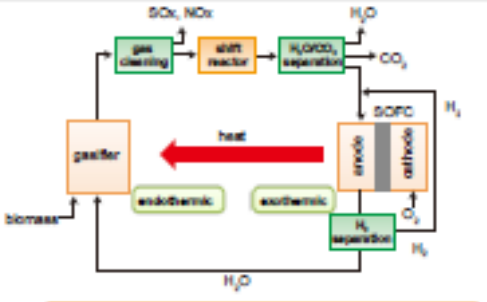
SOFC, Gas Turbine, Steam Turbine



SOFC | Gas Turbine | Steam Turbine

- In gas turbine and steam turbine power generation the exergy destruction takes place mainly during combustion.
- The exergy loss of SOFC is very small (3%) because of no combustion.
- The effective utilization of waste heat from SOFC is essential.

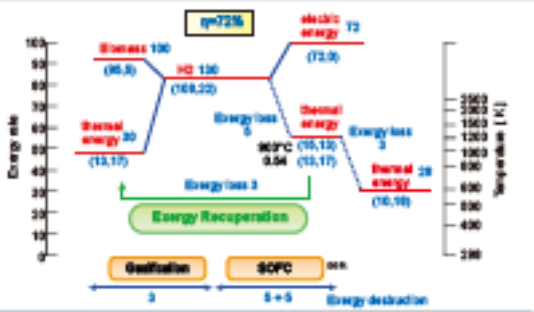
Exergy Recuperative Gasification Integrated with SOFC



- Stable SOFC performance (no carbon deposition issues)
- No air cooling of SOFC – only pure O_2 is fed to cathode
- Gas turbine can be eliminated

A. Tsutsumi, Chem. Eng., 75 (2011) 670-681 (in Japanese)

Integrated Exergy Recuperative Biomass Gasification SOFC System



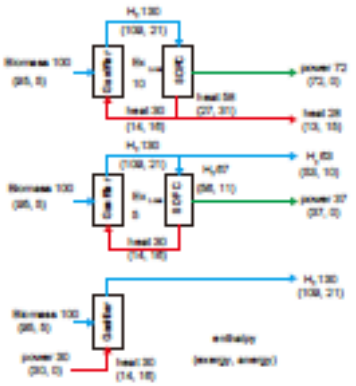
- In the gasification process waste heat from SOFC is recuperated to produce hydrogen (130%) because of endothermic biomass gasification, resulting in high power generation efficiency (72%).
- Gas and steam turbines can be eliminated from power generation system.

Super Integrated Biomass Gasification-SOFC

Power and Heat Cogeneration

Power and Hydrogen Coproduction

Power to Biomass Hydrogen



Green Innovation: Paradigm Shift in the Power Generation

Heat Engine	→	Fuel Cell
Heat Generation by Combustion		Exergy Recuperative Hydrogen Production

- Heat for heat engine is generated by the combustion of fuels, leading to a large exergy destruction.
- There is a limit to the power generation efficiency.

- No more combustion!
- Waste heat of fuel cell can be recuperated to use for the endothermic reaction (hydrogen production).
- High power generation efficiency over Carnot efficiency is expected.

There is no limit of Carnot efficiency

High power generation efficiency is expected (50-60%)

GHG can be reduced

Green Innovation: Paradigm Shift in Energy Science and Technology

the energy-throwaway society

- A huge amount of fossil energy is converted to thermal energy through combustion.
- In the combustion process a considerable exergy destruction takes place, in which the exergy is transformed to anergy.
- Although energy is conserved, all of energy is thrown away.

To reduce the energy consumption the technological innovation for energy utilization is essential.

- Self-heat Recuperation Technology
- Highly Efficient Power Generation
- Material and Energy Coproduction

sustainable society

low-carbon society

- No more combustion
- Energy can be recycled by the exergy recuperation to minimize exergy loss, leading to the drastic reduction of energy consumption

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The End

Chair's Information

Puspita Lisdiyanti

Home Town / Country : Bogor, Indonesia

Affiliation : Research Center for Biotechnology, LIPI

Position : Senior Researcher

E-mail : puspita.lisdiyanti@bioteknologi.lipi.go.id

Biography

1987-present: Researcher, RC Biotechnology, LIPI; **2015-2017**: Research Coordinator of LIPI Priority Program on Food Security and Drug Discovery; **2006-2014**: Head of Division, RC Biotechnology LIPI; **2002-2004**: Research Associate, Tokyo Univ. Agriculture (TUA); **1999-2002**: Doctor of Agriculture Chemistry (TUA); **1997-1999**: Master of Agriculture Chemistry (TUA); **1988-1992**: Bachelor of Agriculture Chemistry (Tokyo Univ. Agric. & Techonol.)

Area of Interest

Exploring the microbial diversity and Elucidating the potential uses of microbes. Food Biotechnology

Research Activities and Achievements

Research Experiences and Achievements

1. **LIPI-JBA**, Japan: Exploration of Lactic Acid Bacteria and Acetic Acid Bacteria from Indonesia (1996-2000). Five scientific publications described new species & genera and 200 isolates were obtained .
2. **LIPI-NITE**, Japan: Taxonomy and Ecological Studies of Fungi and Actinomycetes from Indonesia and Japan (April 2003-March 2009). were obtained. Several scientific publications and around 6.000 isolates were obtained.
3. **ITSF RESEARCH GRANT**: Ecological Study of Rare Actinomycetes (2004). Research Fund from Indonesia Toray Science Fundation (ITSF). One scientific publications was obtained.
4. **LIPI COMPETITIVE RESEARCH PROGRAM**: Screening of Actinomycetes Producing an ATPase Inhibitor of Japanese Encephalitis Virus RNA Helicase (2004-2006), funded by LIPI. Two scientific publications were obtained.
5. **LIPI COMPETITIVE RESEARCH PROGRAM**: Oil Degrading Bacteria: Exploration and Application (2007-2009), funded by LIPI. Two scientific publications were obtained.
6. **LIPI COMPETITIVE RESEARCH PROGRAM**: Biogrouting: Exploration and Application (2010-2012), funded by LIPI. Two scientific publications and 20 potential strains were obtained.
7. **SATREPS PROJECT**: Development of Internationally Standarized Microbial Culture Collection in Indonesia, LIPI-JICA-JST-NBRC, April 2011-March 2016. Microbial resources center in Indonesia for supporting reaseach and utilization of tropical bioresources and promoting taxonomy and biotechnology was established. More 2000 microbes were deposited in InaCC (Indonesian Culture Collection).

Ongoing activities

1. **SATREPS PROJECT**: Innovative Bio-production in Indonesia (ibioI): Integrated Bio-refinery Strategy to Promote Biomass Utilization using Super-microbes for Fuels and Chemicals Production, LIPI-JICA-JST-Kobe Univ., April 2013-March 2018.
2. **SATREPS PROJECT**: Searching Lead Compounds of Anti-malarial and Anti-amebic Agents by Utilizing Diversity of Indonesian Bioresources, BPPT-JICA-JST-Tsukuba Univ., April 2014-March 2019
3. **SATREPS PROJECT**: Revegetation of alang-alang (Imperata cylindrica) field combined with sustainable production and utilization of biomass (for energy solution), LIPI-JICA-JST-Kyoto Univ., April 2015-March 2020.
4. **BIODIVERSITY OF HEALTH**: Isolation of new antibiotics compounds from unknown actinomycetes (Indonesia-Germany Collaboration Research). June 2015-31 May 2018.

Message

From the research results of exploring microbes in ASEAN Countries, especially from Indonesia in my case, it is revealed that the richness of microbial diversity in the regions. The uses of microbes for better of life of human being is needed. The collaboration research is necessary.

Speaker's Information

Yoshihito SHIRAI

Home Town / Country : Kitakyushu/Japan & Kuala Lumpur/Malaysia
Affiliation : Graduate School of Life Science and Systems Engineering and MSSC in UPM, Kyushu Institute of Technology
Position : Professor
E-mail : shirai@life.kyutech.ac.jp

Biography

Director, Kyushu Institute of Technology Malaysia Super Satellite Campus (MSSC) in UPM 2013 – to date. Director, Kyushu Institute of Technology Eco-Town Research and Development Center 2005 - to date. Professor, Graduate School of Life Science and Systems Engineering. Kyushu Institute of Technology 2001- to date. JICA Expert, Department of Biotechnology, University Putra Malaysia. 1994, 2000. Associate Professor, Faculty of Computer Science and Systems Engineering, Kyushu Institute of Technology 1992-2001. Assistant Professor, Department of Chemical Engineering, Faculty of Engineering, Kyoto University 1984-1992.

Area of Interest

Biomass utilization including palm biomass, kitchen garbage, palm oil mill effluent(POME) to value added products including green plastics. Chemical recycle of poly-lactate. Baseline study of GHG emission from palm oil industry and power generation for CDM. Zero-discharge from Palm oil mills. Proposing any Win-Win situation between palm oil industry and the environment.

Research Activities and Achievements

1) Achievements

Biodegradable plastic, PHA was successfully produced from POME and Prof Ali who is my current collaborator had been awarded Ph D under my supervision based on the JICA project in 1997. Poly-lactate and ethanol were successfully produced from kitchen garbage and partly commercialized by a Japanese company. Baseline study of GHG (methane) emission from anaerobic ponds in palm oil mills was successfully accomplished to achieve the first CDM project in Malaysia by FELDA, the cooperate giant in the world in 2009. Currently they expanded the biogas system for POME treatment and power generation into more 12 mills. We, I and Prof Ali have successfully developed high quality-compost from palm biomass, EFB and sludge from POME treatment sponsored by FELDA.

2) Ongoing activities

We are now challenging any Win-Win situation between palm oil industry and the environment including bio-diversity in Sabah because their major business is palm oil industry and their future promising business is eco-tourism thanks to biodiversity, We are now installing a zero-discharge system which never discharge wastes but yields value added things including green energy and green products by using not-used biomass and wasted energy effectively. We are now discussing with several companies people and the Sabah Governmental people for the implementation in the real society.

3) Others

We have yielded 29 Ph D awarders based on our collaborative research works through our joint-supervision and published more than hundred co-authored research papers in these 23 years' collaboration.

Message

We have now 29 Ph D awarders in the field of biomass and bioenergy. They are now young lecturers and an associate professor in universities in Malaysia and their home countries. Then we have excellent human resources in these research field mentioned above. We encourage young researches who join this symposium to collaborate with them to develop and to make progress in these fields.
Terima Kasih, Thank you.

JST/JICA SATREPS

4th JASTIP Symposium

PROMOTION OF GREEN ECONOMY WITH PALM OIL INDUSTRY FOR BIODIVERSITY CONSERVATION IN MALAYSIA

(Kyutech) ○Yoshihito Shirai*, (UPM)Mohd Ali Hassan

3rd July, 2017
NSTDA

Kyutech Kyushu Institute of Technology | KYUSHU UNIVERSITY | National Institute of Advanced Industrial Science and Technology AIST | UPM | UNIVERSITI PUTRA MALAYSIA

1

Background & Purposes

Kyutech | AIST

JICA Borneo Biodiversity Ecosystems Conservation Program Phase II (BBECII)

...iversity conservation around the Kinabatangan, Sabah
...f new green innovative industries. Ramsar Wet land as litmus paper!

Our Goals

- Modernization of Palm Oil Industry !
- Conservation of the Environment and Biodiversity !
- Promotion of Green Industry with Palm Biomass & Biodiversity !
- To Propose to Achieve the above Goals !

Sabah State
- Nature
Eco-tourism
Promising Income
- Palm Oil
Greatest Income

Palm Oil mill ⇒ POME

Anaerobic Pond ⇒ Treated Water COD >1000ppm BOD<100ppm

NABATANGAN

Pollution STOP! | Zero Discharge | Bio-diversity | Brand & Green Industry

2

ADVANTAGES

of Palm Oil Industry as Green Industry!!

Business as Usual
(key word: BaU)

No logistics issues as BaU

Constant collection of biomass through whole the year as BaU

Resources

Energy

Lagoons for POME treatment

Even only one mill yields averagely no less than 40,000 tons of standardized biomass (they are not waste but resource!!) as BaU.

3

Our Showcase Mill **Our Research Strategy**

Location of Keningau Palm Oil Mill Sdn. Bhd.(KPOM)

Highest Value ← → Low End

Micro-composite

Nano-composite | Activated carbon ← → Bio-char, bio-compost

Chemicals like 2,3 butanediol ← Sugars → Ethanol, Pellets, Briquets

Zero Discharge Concept: Nothing Discharged from the mill except valued materials.

4

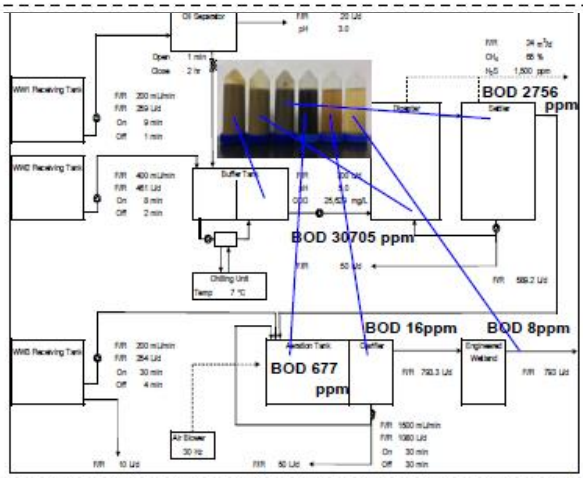
Our Pilot Plants in KPOM

POME Treatment System

Carbonization System

Compost System

5



6

Mass and Energy flows and A Condition for the Creation of New Green Business

FFB 250,000 t/y
Water 280,000 t/y (Steam 160,000 t/y)
(Palm Biomass from FFB 58,000 t/y)
to yield 1MW (only a few % current P.G.E.)

CPO 50,000 t/y
PK 12,500 t/y
Palm Biomass 127,500 t/y
Wasted Steam 140,000 t/y
POME 200,000 t/y

Anaerobic Treatment

Biogas Power Generation 1MW For Mill Operation

How about the best mix?

Excess Palm Biomass 127,500 t/y + Available Steam 90,000 t/y + POME (water, sludge) 200,000 t/y

Zero!!

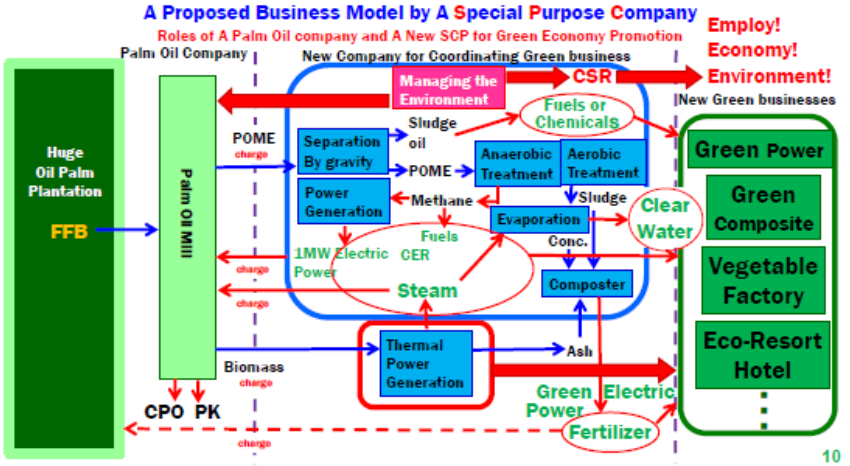
= High Values (Nano-composite, Chemicals for medicines etc.) + Middle Values (Bio-composite, Chemicals, Activated Carbon etc.) + Low Values (Compost, Char, Liquid Fuel, Solid Fuel :Energy!)

7

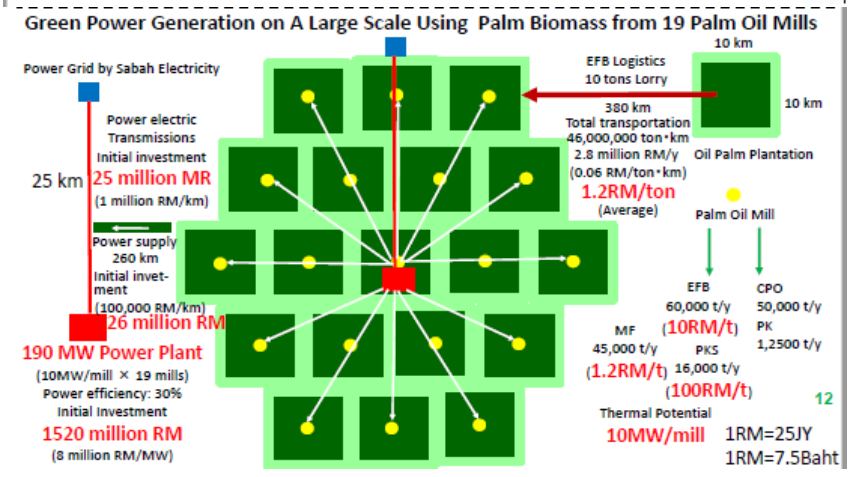
Evaporator

8

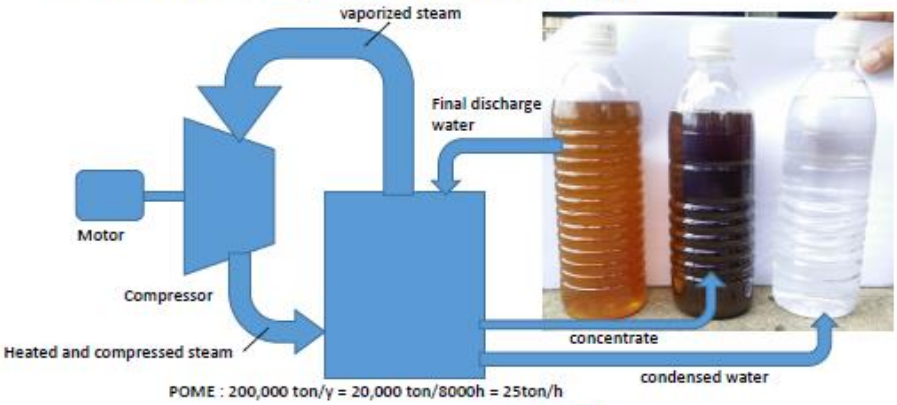

ADVANTAGES
of Palm Oil Industry as Green Industry!!
Business as Usual
(key word: BaU)
No logistics issues as BaU
Constant collection of biomass through whole the year as BaU
Resources
Energy
Lagoons for POME treatment
Even only one mill yields averagely no less than 40,000 tons of standardized biomass (they are not waste but resource!!) as BaU.
9


A Proposed Business Model by A Special Purpose Company
Roles of A Palm Oil company and A New SCP for Green Economy Promotion
Employ!
Economy!
Environment!
Palm Oil Company
New Company for Coordinating Green business
New Green businesses
Huge Oil Palm Plantation
FFB
Palm Oil Mill
POME
charge
Separation By gravity
Sludge
oil
POME
Anaerobic Treatment
Aerobic Treatment
Power Generation
Methane
Sludge
Evaporation
Clear Water
Conc.
Fuels
1MW Electric Power
CER
Steam
Composter
Managing the Environment
CSR
Fuels or Chemicals
Green Power
Green Composite
Vegetable Factory
Eco-Resort Hotel
Thermal Power Generation
Ash
Biomass
charge
CPO PK
Green Electric Power
Fertilizer
10


Oil Palm Tree and Fresh Fruit Bunch
Kyutech
Oil Palm Plantation Area in Malaysia 5 million ha (Malaysia: 35 million ha. 14% of Malaysia
Oil yield: 3 – 5 tones/(ha·year)
Number of Palm Oil Mills: 500 (10.000 ha-plantation/mill)
40.000 tones CPO/(mill·year)
11


Green Power Generation on A Large Scale Using Palm Biomass from 19 Palm Oil Mills
Power Grid by Sabah Electricity
Power electric Transmissions
Initial investment
25 km
25 million MR
(1 million RM/km)
Power supply
260 km
Initial invet-ment
(100,000 RM/km)
26 million RM
190 MW Power Plant
(10MW/mill × 19 mills)
Power efficiency: 30%
Initial Investment
1520 million RM
(8 million RM/MW)
EFB Logistics
10 tons Lorry
380 km
Total transportation
46,000,000 ton·km
2.8 million RM/y
(0.06 RM/ton·km)
1.2RM/ton
(Average)
10 km
10 km
Oil Palm Plantation
Palm Oil Mill
EFB
60,000 t/y
(10RM/t)
CPO
50,000 t/y
PK
1,250 t/y
MF
45,000 t/y
(1.2RM/t)
PKS
16,000 t/y
(100RM/t)
Thermal Potential
10MW/mill
1RM=25JY
1RM=7.5Baht
12

Self-Heat Recuperation Technology



POME : 200,000 ton/y = 20,000 ton/8000h = 25ton/h

Latent heat for water evaporation : 25 ton × 0.65MWh/ton ≒ 16 MWh

Energy for compressor : 25 ton × 0.175 MWh/10 ton (cited from Kimura Chemical Plant Co. Ltd) ≒ 0.44 MWh

13

Power generation business

Key simulation conditions

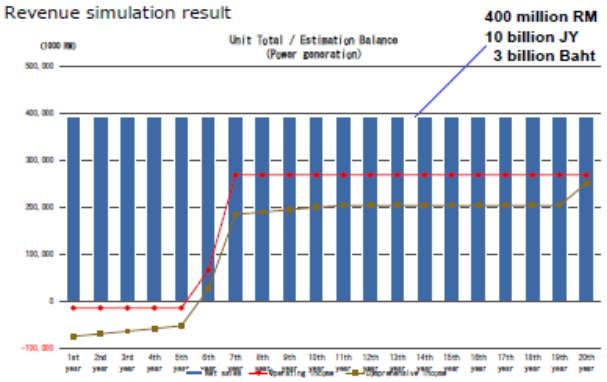
(1) Power generation business		
Item	Setting condition	Contents
Amount of input biomass	2,280,000t / year 120,000t/year ×19	Estimated amount of excess biomass residue
Capacity of power generator	190,000 kW / year	
Power generation efficiency	15%	
Working days X Hours	330days X 24hours	
In-house electric power use	15% of generate	
Return power to Palm oil mill	For sale	
Initial investment amount	1571 million RM	Main body, incidental equipment including transmission and power supply
Power sale unit price	0.31 RM/kWh	Feed in tariff scheme in Malaysia
Steam sales unit price	For Sale	
Biomass residue purchase unit price	Mentioned previously	Free supply from Palm oil mill

Simulated by a cost benefit analysis

14

Power generation business

Revenue simulation result



IRR : 5.96%

15

The Effect of change in Initial investment on the IRR

1,200 million RM (main body)
320 million RM (accessories)
25 million (Transmission: 25km)
+) 26 million (Power supply: total 260km)
1,571 million RM

IRR = 5.96%

1,200 million RM (main body)
320 million RM (accessories)
100 million (Transmission: 100km)
+)100 million (Power supply: total 1,000km)
1,720 million RM

IRR = 4.40%

1,200 million RM (main body)
320 million RM (accessories)
250 million (Transmission: 250km)
+)250 million (Power supply: total 2,500km)
2,020 million RM

IRR = 1.63%

Speaker's Information

Kajornsak FAUNGNAWAKIJ

Home Town / Country : Nakhon Si Thammarat / Thailand
Affiliation : National Nanotechnology Center (NANOTEC), National Science and Technology Development Agency (NSTDA), Thailand
Position : Principal Researcher / Research Unit Director
E-mail : kajornsak@nanotec.or.th

Biography

Dr. Kajornsak Faungnawakij is currently a director of Nanomaterials and Nanosystems Engineering Research Unit at NANOTEC. He has published >80 research articles (h-index = 24) in peer-reviewed journals, and filed >30 domestic/international patents related to his R&D on catalysis and biomass. During 2005–2007, he had worked as a Researcher at Japan Science and Technology Agency (JST), Japan, on the hydrogen and fuel cell project.

Area of Interest

Chemical Engineering, especially Nanomaterials&Particle Technology, Heterogeneous Catalysis, and Biorefinery (Biofuels/Biochemicals/Bio-based Materials Production and Purification)
R&D topics: ・Spinel Complex Metal-Oxides, Acid/Base Catalysts and their Composites.
・Chemical Reaction Engineering, Kinetics and Thermodynamic Analysis. ・Process scaling-up

Research Activities and Achievements

Ongoing activities: R&D projects on catalysts and systems development for biorefinery applications.
・Production of furans, organic acids, carbon materials ・Production of advanced biofuels ・Membrane

Awards

2017 A 2017 TRF-OHEC-SCOPUS Researcher Award from the Thailand Research Fund (TRF), the Office of the Higher Education Commission (OHEC), and the Elsevier
2016 A Runner-Up Young Technologist Award 2016 from the Foundation for the Promotion of Science and Technology under the Patronage of H.M. the King
2015 A 2015 NRCT Research Awards from the National Research Council of Thailand (NRCT)
2015 A Newton Fund Professional Development Programme 2015/2016 from the Newton Fund incorporated with the British council and the Thailand Research Fund
2013 A Wiley-CST Award for Contributions to Green Chemistry 2012 from the Chemical Society of Thailand (CST) under the Patronage of Her Royal Highness Princess Chulabhorn Mahidol
2012 An S&T Research Grant of TTSF from the Thailand Toray Science Foundation (TTSF)
2011 A 2011 Outstanding Royal Golden Jubilee Alumni Award from the Thailand Research Fund (TRF)
2011 A Young Scientist Award 2011 from the Foundation for the Promotion of Science and Technology under the Patronage of H.M. the King
2010 A CST Distinguished Young Chemist Award 2010 from the Chemical Society of Thailand (CST) under the Patronage of Her Royal Highness Princess Chulabhorn Mahidol
2009 An Asia Nanotech Camp Fellowship from Asia Nano Forum (ANF)
1999 A Gold Medal Honor Award for the Outstanding Engineering Student from the Engineering Institute of Thailand under H.M. the King's Patronage

Message

Many research projects on biochemical production and purification are on-going. The material development for catalyst and membrane applications is the key. Also the information of bio-based feedstocks such as properties, potential uses, sourcing area is really important.

Speaker's Information

Yopi

Home Town / Country : Cibinong Bogor, Indonesia
Affiliation : Research Center for Biotechnology,
Indonesian Institute of Sciences (LIPI)
Position : Researcher
E-mail : yopi001@lipi.go.id, yopisunarya@gmail.com

Biography

April 1990 ~ present : Research Scientist, Bioprocess Division, Research Center for Biotechnology, Indonesian Institute of Sciences (LIPI). 2013-2018 : Project Manajer of JST-JICA SATREPS Integrared Biorefinery. 2010 ~ 2015 : Head of Bioprocess Division, RC Biotechnology LIPI. 2012 ~ present : Head of Biocatalyst and Fermentation Laboratory. 2002 : Ph.D in Applied Biological Chemistry / Biotechnology, Tokyo University of Agriculture and Technology, Japan.

Area of Interest

Enzimology, Glycoscience, Biochemistry, Fermentation, Bioprocess Engineering

Research Activities and Achievements

2006: Studies on substrate specificacy of mannanase enzyme to produce the functional food components (Program Ministry of Research & Technology Research Grant as Principal researcher)
2006~2008: Utilization of waste palm kernel cake for production manno-oligosakarides as functional food components (Program Competitive LIPI Research Grant as principal researcher).
2008, 2009, 2011, 2013, 2016, 2017 : Research grant from Toray Science Foundation ITSF Research Grant
2009~2013: Utilization of Porang Potato for oligosaccharides production (Program Competitive LIPI Research Grant as Principal researcher)
2010-2013 : JSPS-LIPI Bilateral project : development of cell-surface engineering yeast displaying mannanase for ethanol production from lignocellulose biomass
2010-2016 : Study of marine microbes for bioremediation, and analysis of poly-aromatic hydrocarbon degrading enzyme from marine microbes (Supported by JST-JICA SATREPS project "Development of Internationally Standardized Microbial Resources Center As A Core of Biological Resources Center to Promote Life Science Research and Biotechnology"
2015-2018 : Research on nutraceutical compound production from cellulose-biomass using biocatalyst from indigenous microbes (Program Competitive LIPI Research Grant as Principal researcher)
2013-2018 : JST-JICA SATREPS project "Innovative Bio-production Indonesia, development integrated biorefinery strategy for biofuel and biochemical production using microbes" (as Project Manager and Research Coordinator)
2016-2018 : Center of Excellence for Integrated Biorefinery (as Project Manager, supported by Ministry of Research, Technology and Higher Education)

Message

We are focusing to establish the integrated Biorefinery program in Indonesia, especially with Biotechnology approach combined with utilization of local biomass, microbial collection and its genetic resources. Application and dissemination of the integrated biorefinery technology become the first priority, therefore, Improvement of the communication for sharing informations/experiences among researcher, company side and related stakeholders need to be accelerated.

LEMBAGA ILMU PENGETAHUAN INDONESIA
(INDONESIAN INSTITUTE OF SCIENCES)

LIPI

Center of Excellence : Integrated Biorefinery in Indonesia

"Innovative Bioproduction Indonesia (iBioI)"

YOPI
Research Center for Biotechnology, LIPI
yopi001@lipi.go.id

JASTIP Symposium
3-4 July 2017, Bangkok Thailand

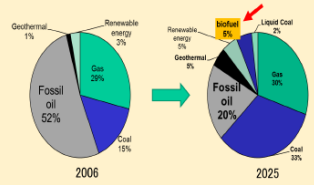
www.lipi.go.id

3

How Important is the Integrated Biorefinery for Indonesia ?

Government Regulation on Energy Production

Strategy of Target of Energy Mix



⇒ Government Planning untill 2025 : reduce utilization of fossil oil 20% & support to increase utilization of biofuel (bioethanol, biodiesel) 5%

Presidential Regulation No.5 of 2006 "Utilization of Biofuel"

- ✓ *Stock of fossil oil is decreasing*
- ✓ *Supply and distribution of energy demand : still a constraint*
- ✓ *Goverment Regulation related to utilization of fossil oil, biofuel etc.*
- ✓ *Potency of local resources : biomass materials*
- ✓ *Bio-refinery instead of Oil-refinery*
- ✓ *Need to apply of Integrated Biorefinery technology*

4

The Potential Cellulose (non-starch) Biomass in Indonesia

Biomass	Place	Production [million t/year]	Energy [million GJ/year]
Rubber wood (ゴムの木)	Sumatera, Kalimantan, Java	41	120
Logging residues (広木)	Sumatera, Kalimantan	4.5	19
Sawn timber residues (製材残渣)	Sumatera, Kalimantan	1.3	13
Plywood and veneer production residues (合板残材)	Kalimantan, Sumatera, Java, Irian Jaya, Maluku	1.5	16
Sugar residues (サトウキビ残渣)	Java, Sumatera, Sulawesi, Kalimantan, Bali, NTB	Baggasse : 10 Cane tops : 6 Cane leaves: 9.6	78
Rice residues (籾もみ殻、稲藁)	Java, Sumatera, Sulawesi, Kalimantan, Bali, NTB	Husk: 12 Straw : 2.5 Straw : 49	150
Coconut residues (ココナッツ残渣)	Sumatera, Java, Sulawesi	Shell: 0.4 Husk: 0.7	7
Palm oil residues (パーム油残渣)	Sumatera new areas: Kalimantan, Sulawesi, Maluku, Nusa Tenggara, Irian Jaya	Empty fruit bunch (EFB): 3.4 Fibres: 5.6 Palm shells (PSC): 1.2	67

⇒ Need to search microbial source and appropriate biomass
⇒ Screening microbes for bioctalyst production that suitable or degrading the biomass.

- ✓ As a biomass feedstock, the ligno-cellulosic materials are better for utilization because there are non-edible and no competition problems between foods
- ✓ *There are abundant Cellulosic materials from agricultural waste fraction in Indonesia*
- ✓ Cellulose-based biomass can be degraded by microbe and convert into valuable & functional product for human life
- ✓ *Need Effeciency process : Biotechnology approaches will be focused on the development of microbes "cell factory" for production of chemicals and fuels from cellulosic materials*

• Source: ZREU (Zentrum fur rationell Energieanwendung und Umwelt GmbH), 2000. Biomass in Indonesia-Business Guide

POTENCY OF MICROBIAL RESOURCES (INDONESIA)

LIPI

JST-JICA SATREPS PROJECT FY 2010-2015
International Standardized Microbial Resource Center to Promote Life Science Research and Biotechnology
Establisment of *Indonesia Culture Collection* (InaCC)

- ✓ Microbes Collection : More than 10.000 Strains (Bacteria, Actinomycetes, Fungi, Yeast, Bacteriophage)
- ✓ Need to be explore : bioprospective
- ✓ Need collaborative work : multi-disciplinary
- ✓ Access and Benefit Sharing of Local Microbes

✓ Key-point : How to utilize this collection of microbes to support research on Integrated Biorefinery ?

Prospect of Research Related to Bio-Process, Biorefinery and Bioproduct based on biomasses (celllulose and microbes)

LIPI

Source of microbes and enzymes	Indonesian Culture Collection (InaCC) : Collection of microbes & genetic resources	Biodiesel, Biohydrogen Bioethanol ect.
Sources and diversity of biomass	Biomass waste of horticulture, agriculture Collection of Plant	Functional food, Enzymes, Potential Microbes etc
Sources of Technology	Microbiology, Biology Moleculer, Biochemistry, Bioprocess/Biorefinery Engineering, Biomaterial	Biomaterial, Bioplastic, Nano-material etc
Source of researcher and facilities	Laboratorium, equipment for integrated research	

LIPI has been developing research topics on Bioprocess-Biorefinery technology

Supporting Research on Integrated Biorefinery Technology based on Biotechnology Approach

No	Topics	Fiscal Year	Project
1	Utilizaton of palm kernel cake for functional food production	2006-2008	*Indonesian Institute of Sciences (LIPI)*
2	Utilization of Indigenous potato (Porang ; Amorphophallus onchophyllus) for manno-oligosaccharides production using mannanase	2007-2013	*ITSF Toray grant, RistekDikti, LIPI*
3	Analysis of polyaromatic hydrocarbon-dioxygenase gene from Indonesia Marine Bacteria	2010	*Research Grant, ITSF Toray*
4	Utilization of carbohydrate from local potato : Umbi Kentang Hitam (*Coleus Tuberosus* Benth.), Ubi Kayu (*Manihot Esculenta*) & Tacca (*Tacca Leontopetaloides*)	2011-2013	*Indonesian Institute of Sciences (LIPI)*
5	Utilization of cellulose-based biomass for bioethanol production	2013-2103	*ITSF Toray grant, LIPI*
6	Production of xylo-oligosaccharides from xylan baggase, manno-oligosaccharides from sugar palm	2016-2018	*Indonesian Institute of Sciences (LIPI)*
7	Development of integrated biorefinery technology based on Biotechnology approach for potential microbes, biocatalyst and biofuels production	2013-now	*Research Center for Biotechnology LIPI*

**internal collaborotion Research at Indonesian Institute of Sciences Managed by researcher from Research Center for Biotechnology LIPI*

International Collaborative Work : Supporting Research on Integrated Biorefinery Technology

No	Topics	Fiscal Year	Project
1	*Isolation of indigenous microbes fron Indonesia Environment*	2002-2010	*NBRC-NITE*
2	*Isolation and characterization of crude oil-degrading bacteria from Indonesian seawater*	2005-2009	*NEDO*
3	*Development of Consolidated Bio-Proccesing (CBP) for Bioethanol and Manno-Oligosaccharides Production by Yeast Cell Surface Engineering*	2011-2013	*JSPS-LIPI Bilateral Project*
4	*Development of Internationally Standarized Microbial Culture Collection in Indonesia*	2010-2015	*JST-JICA SATREPS Project*
5	*Innovative Bio-Production Indonesia (iBioI): Integrated Bio-Refinery Strategy to Promote Biomass Utilization using Super-microbes for Fuels and Chemicals Production*	2013-2018	*JST-JICA SATREPS Project*
6	*Producing Biomass Energy and Material Through Revegetation of Alang-Alang (Imperata cylindrica) Fields*	2015-2020	*JST-JICA SATREPS Project*

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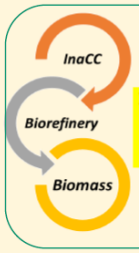
Research Supported by JST-JICA SATREPS Program



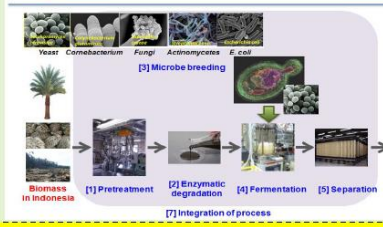
- ➢ *Satreps I : Development of Internationally Standardized Microbial Resources Center As A Core of Biological Resources Center to Promote Life Science Research and Biotechnology (JFY2010-2015)*
- ➢ *Satreps II : Innovative Bio-Production in Indonesia (iBioI): Integrated Bio-Refinery Strategy to Promote Biomass Utilization using Super-microbes for Fuels and Chemicals Production (JFY 2013-2018)*
- ➢ *Satreps III : The Project for Revegetation of Alang-alang (Imperata Cylindrica) Field Combined with Sustainable Production and Utilization of Biomass for Food and Energy Solution (JFY 2015-2020)*

Lembaga Ilmu Pengetahuan Indonesia
Indonesian Institute of Sciences

JST-JICA SATREPS PROJECT JFY2013-2018

Innovative Bio-Production Indonesia (iBioI) :
Integrated Bio-Refinery Strategy to Promote Biomass Utilization using Super-microbes for Fuels and Chemicals Production

Five Key Technologies



- ✓ *Effeciency process : focus on the development of microbes "cell factory" for production of chemicals and fuels from lignocellulosic materials*
- ✓ *There are five key technologies will be developed in this project to Development of Integration system : Consolidated Bio-Processing (CBP)*

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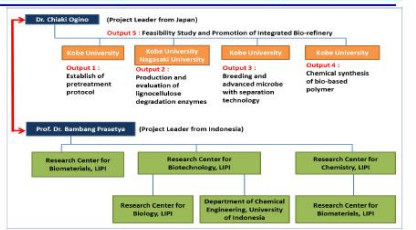
Main Activities & Structure of Integrated Bio-Refinery Research

[1] Establishment of pretreatment protocol
[2] Screening of degradation enzymes for ligno-cellulosic degradation
[3] Microbe breeding for chemical and fuel fermentation
[4] Establishment of efficient separation technology
[5] Challenging of chemical synthesis of bio-based polymer from separated chemicals
[6] Feasibility study of integrated process
[7] Promotion of bio-refinery platform into industry etc.



Purpose of the Project
Establishment of *Bio-refinery research center in Indonesia*, especially for utilization of lignocellulose biomass to produce bio-fuels and bio-chemicals product using super-microbes

Current Progress on Establisment of Integrated Biorefinery Project

- ✓ *Developing of Cell factory for Biocatalyst production and Fermentation of biomass are in progress*
- ✓ *Once we got the Cell factory based on indigenous microbes, we can produce several type of biocatalyst that can be utilized in many industries*
- ✓ *Construction of Cell Factory (microbe-breeding) will be continuesly conducted since the number of biomass type and biodiversity of microbes increase*
- ✓ *Making alliances among multidisciplinary scientists are important to proceed the implementation of this integrated technology*
- ✓ *For disseminate the integrated technology into industry, we should make special effort and expand the linkage among researchers, stakeholders and industries*

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Supporting Activites for Integrated Biorefinery Project

- ✓ *Workshop, businees meeting Indonesia and Japan Company : implementation of Biorefinery technology*
- ✓ Full Supported by Japan Science & Technology, JICA, LIPI

March 2016

January 2017

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Supporting Activites for Integrated Biorefinery Project

Sakura Exchange Program in Science

- ✓ The Japan-Asia Youth Exchange Program in Science (SAKURA Exchange Program in Science: SSP) is a program to invite Asian young people to Japan for a short-term visit to encourage their dreams and enhance their levels in science and technology through exposure to Japanese science and technology.
- ✓ 10 young researcher/student from LIPI, RistekDikti, IPB, ITB and UI
- ✓ The purpose of this Sakura Program is "Promoting and Introduction of Biomass Utilization Advanced technology for Producing Valuable Bio-product to Young (Candidates) Researchers"

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Supporting Activites for Integrated Biorefinery Project

Research Center for Biotechnology LIPI accepted an certificate as *Center for Excellence on Integrated Biorefinery in Indonesia* from Ministry of Research, Technology and Higher Education

Indonesian *Center of Excellence (CoE)*
Ministry of Research, Technology and Higher Education

- ➢ *An effort to improve nations's competitiveness through the quality of the research institutions*
- ➢ *Developing research institutions to produce innovative research for the benefit and welfare of the people*
- ➢ *Supporting for making a core research center in specific fields*

CoE for Palm Oil (2011)
CoE for Coffee and Cocoa (2013)
CoE for Tropical Horticulture (2013)
CoE for Rubber (2014)
CoE for Legumes and Tuber Crops (2014)
CoE for Biotechnology and Bioindustry (2014)
CoE for Rice Crops (2015)
CoE for Coconut Palm (2016)
CoE for Lignocellulose (2016)
CoE for Integrated Biorefinery (2016)

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Acknowledgement

日本学術振興会 Japan Society for the Promotion of Science
KOBE UNIVERSITY
JST
JICA
LIPI
Bioproduction Improvement Indonesia iBioI
PUI Biorefineri Terpadu
RISTEKDIKTI

Chair's Information

Takashi WATANABE

Home Town / Country : Kyoto, Japan

Affiliation : Research Institute for Sustainable Humanosphere (RISH), Kyoto University

Position : Professor, Director, Deputy Executive Director

E-mail : twatanab@rish.kyoto-u.ac.jp

Biography

2017-: Deputy Executive Director, Kyoto Univ., 2016-: Director, RISH, Kyoto Univ., 2010-16: Vice Director, RISH, Kyoto Univ., 2010-08: Head, Center for Exploratory Res. on Humanosphere, RISH, Kyoto Univ., 2004-: Prof., RISH, Kyoto Univ., 2002-: Assoc. Prof., RISH, Kyoto Univ., 2002-1993: Assoc. Prof., Wood Res. Inst. (WRI), Kyoto Univ., 1993-87: Assist. Prof. WRI, Kyoto Univ., 1986-84: Researcher, Sanyo-Kokusaku Pulp Co. Ltd., 1989: Doctor, Agric. Kyoto Univ., 1984: Master, Agric. Kyoto Univ.

Area of Interest

Structural analysis and conversion of lignocellulosic biomass to biofuels, chemicals and bioactive compounds using biological, biochemical and chemical processes for establishing sustainable humanosphere. Analysis and development of biomimetic ligninolytic system of selective white rot fungi. Development of (bio)catalysts through control of interaction of polypeptides with lignin.

Research Activities and Achievements

1) Achievements

- S. Oshiro, A. Yamaguchi, T. Watanabe, Binding behaviour of a 12-mer peptide and its tandem dimer to gymnospermae and angiospermae lignins, *RSC Advances*, **7**, 31338 - 31341 (2017).
- Y. Ohta, R. Hasegawa, K. Kurosawa, A.H. Maeda, T., Koizumi, H. Nishimura, H. Okada, C. Qu, K. Saito, T. Watanabe, Y. Hatada, Enzymatic Specific Production and chemical functionalization of phenylpropanone platform monomers from lignin. *ChemSusChem*. **10**, 425 (2017).
- A. Kaiho, D. Mazzarella, M. Satake, M. Kogo, M., R. Sakai, T. Watanabe, Construction of di(trimethylolpropane) cross linkage and phenylnaphthalene structure coupled with selective β-*O*-4 bond cleavage for synthesizing lignin-based epoxy resins with controlled glass transition temperature. *Green Chem*. **18**, 6526 (2016) .
- A. Yamaguchi, K. Isozaki, M. Nakamura, H. Takaya, T. Watanabe, Discovery of 12-mer peptides that bind to wood lignin, *Sci. Rep.*, **6**, 21833 (2016).
- H. Okamura, H. Nishimura, T. Nagata, T. Kigawa, T, Watanabe, M. Katahira, Accurate and molecular-size-tolerant NMR quantitation of diverse components in solution. *Sci. Rep.*, **6**, 21742 (2016) .
- A. Kaiho, M. Kogo, R. Sakai, K. Saito, T. Watanabe, *In situ* trapping of enol intermediates with alcohol during acid-catalysed de-polymerisation of lignin in a nonpolar solvent. *Green Chem.*, **17**, 2780 (2015) .
- Y. Nishiwaki-Akine, T. Watanabe, Dissolution of wood in α-keto acid and aldehydic carboxylic acids and fractionation at room temperature. *Green Chem.*, **16**, 3569 (2014).

2) Ongoing activities;

- Production of value added products and fuels from biomass under the support of funding agencies.
- ASIA Research Node program to strengthen hub functions of RISH as a core of humanosphere science.

Message

Lignocellulosic biomass is important as a carbon neutral resource owing to its availability and potential as a platform for the production of green chemicals, fuels, and materials. The conversion of lignocellulosic biomass will afford the opportunity to renovate local community, especially in ASEAN region due to abundance of the bioresources. To realize the biomass-based society it is essential to predict social, economical, cultural, technological and environmental impact by sharing the knowledge among society and experts from various fields.

Speaker's Information

Akio NISHIJIMA

Home Town / Country : Tokyo Japan
Affiliation : Environmental Research Institute, Waseda University
Position : Invited researcher
E-mail : akio-nishijima@aist.go.jp

Biography

2013-: Chair, Biomass Asia project team in Engineering Academy of Japan (EAJ), 2011-2016: Thailand-Japan SATREPS project for bioenergy, 2006-: Visiting professor of Waseda university and invited researcher of Advanced Industrial Science and Technology (AIST), Japan, 2001-2006: AIST, Japan, 1975-2001: National Chemical Laboratory in MITI, Japan, B.S., M.S. and Ph.D. (1975) degrees in applied chemistry from the University of Tokyo

Area of Interest

1. Environment and energy (Low carbon society, Renewable energy, Biomass utilization)
2. Region wide collaboration (among ASEAN countries and Japan)
3. Fostering of young researchers in East Asia

Research Activities and Achievements

1. Air pollution prevention (Flue gas DeNOx, DeSOx)

2. Clean fuel production (Hydro desulfurization of petroleum)

3. Advanced characterization for material design (Construction of synchrotron radiation beam line)

4. Alternative and renewable energy (Coal liquefaction, Bioenergy)

   (More than 200 papers have been published and 14 patents have been filed for above activities.)

4. Fostering of young researchers (Doctor, Postdoctoral fellow)

5. International collaboration (Secretary-general of EU-Japan collaboration on environmental catalyst, e-Asia bioenergy- Bilateral and multilateral collaboration)

6. Proposal, workshop and etc. (2016: Policy proposal of bioenergy to ASEAN countries, 2010-14: International policy dialogue, 2003-: Biomass Asia workshop, 2000: Biomass Asia strategy)

Message

Feasibility Study on Social Implementation of Bioenergy in East Asia (e-ASIA JRP)

Akio Nishijima (Waseda Univ.)

<Participating countries and research representatives>

Japan, Prof. Masafumi Katsuta, WASEDA University
Thailand, Prof. Paritud Bhandhubanyong, Panyapiwat Institute of Management
Vietnam, Prof. Tuan Le Anh, Hanoi University of Science and Technology
Indonesia, Dr. Anugerah Widiyanto, Agency of the Assessment and Application of Technology (BPPT)
Myanmar, Assoc. Prof. Ei Ei Htwe, Ministry of Education
LAO P. D. R., Prof. Bounmy Keohavong, Souphanouvong University

Feasibility Study on Social Implementation of Bioenergy in East Asia (Goal)

1. Database and priority setting for social implementation of bioenergy in East Asia
2. Feasibility study (economic evaluation LCA and Social acceptability) on bioenergy
3. Region wide networking for the utilization of biomass in East Asia
4. Understanding of local needs and sustainable supply of feedstocks
5. Optimization of local production for local consumption and international market
6. Sustainable Development Goals (SDGs)

Feasibility Study on Social Implementation of Bioenergy in East Asia (Approach)

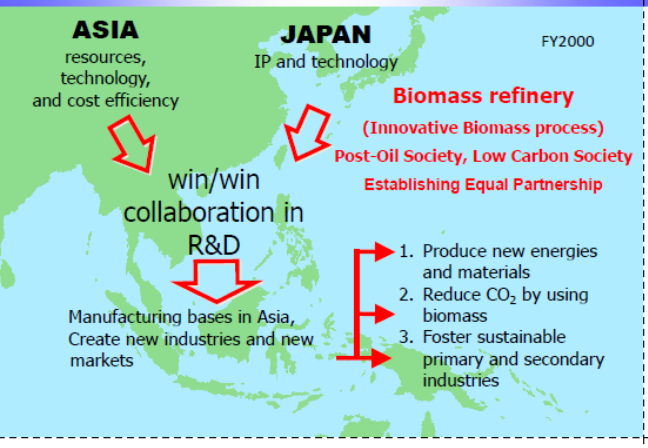
1. Discuss and exchange information regarding research potential of each countries in the field of biomass utilization
2. Identify significant specific research areas to be jointly examined in light of future utilization in the ASEAN region
3. Form international research groups among six countries according to the research potential for meaningful results
4. Jointly confirm the progress chart of the consultation process of the groups in order to identify the critical paths and issues, thereby to make agreed modification in the activities
5. Arrange to foster young researchers' activities through the participation of this Program

ASEAN-Japan Collaboration on Biomass Energy (Background and Strategy)

1. Biomass-Asia Strategy (2000) and Biomass-Asia workshop (2003-)
2. Thailand-Japan collaboration(2006-), SATREPS Project; High quality BDF production, (FY2009- FY2015);
3. International policy dialogue of science and technology in East Asia (2010-), Open innovation research center in Asia (2012), Biomass forum in Bangkok (Nov. 2013) , ASEAN-Japan collaboration
4. Biomass Asia Project at EAJ (Engineering Academy of Japan) (FY2013-), Policy proposal of biomass energy to ASEAN (Jan. 2016)
5. Multilateral (e-ASIA, ERIA, NEF, ASEAN secretariat) and Bilateral (JICA /JST/NEDO, JCM) collaboration
6. Social implementation of biomass energy; Entrance strategy (Biomass feedstock, Breeding), Technological strategy (Process optimization), Exit Strategy (Creation of demand & market),

Concept of Biomass Asia Strategy

AIST



Background and future direction

AIST

ASIA

- need to diversify energy resources and maintain security
- foster sustainable primary industries
- existence of abundant biomass resources
- cost efficiency in biomass accumulation and transportation
- need to introduce advanced technologies and to foster human resources
- existence of promising genetic resources
- adoption of biomass fuel and reduction of greenhouse gas emissions
- environmental conservation (cities & forests)

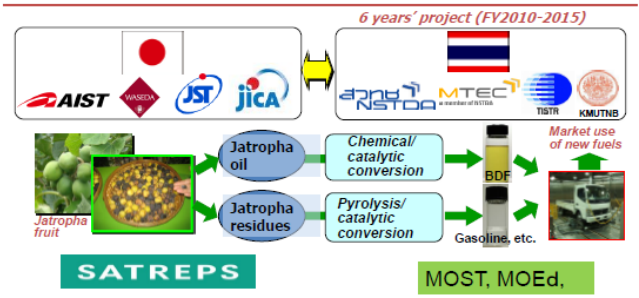
6

ASEAN-Japan Collaboration on Biomass Energy

Akio Nishijima (Waseda Univ.)

1. Biomass-Asia Strategy (2000) and Biomass-Asia workshop (2003-)
2. Biomass related SATREPS projects in ASEAN (10 projects)
3. Thailand-Japan collaboration, SATREPS Project; High quality BDF production, (FY2009- FY2015); ASEAN-Japan collaboration
4. Social implementation of biomass energy; Entrance strategy (Biomass feedstock), Technological strategy (Process optimization), Exit Strategy (Creation of demand & market),
5. International policy dialogue of science and technology in East Asia (2010-), Open innovation research center in Asia (2012), Biomass open innovation forum in Bangkok (Nov. 2013)
5. Biomass Asia Project at EAJ (Engineering Academy of Japan) (FY2013-), Policy proposal of biomass energy to ASEAN (2016)
6. Multilateral (e-ASIA, ERIA, ASEAN secretariat) and Bilateral (JICA /JST/NEDO, JCM) collaboration

Thailand-Japan collaboration (JST-JICA project)

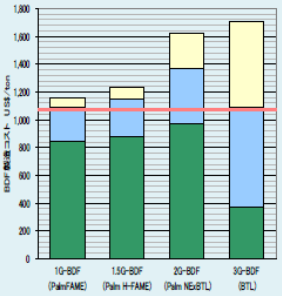


Innovation on production and automotive utilization of biofuels from non-food biomass

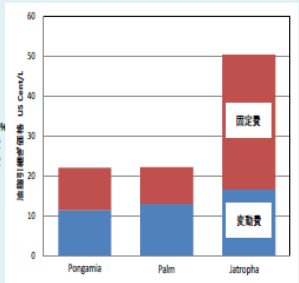
Dr. Paritud and Dr. Yoshimura

8

Production Cost of BDF and Oil Cost of Pongamia, Jatroha and Palm
(Waseda Univ.)



Production cost of BDF



Oil cost of Pongamia, Jatroha and Palm

Challenges to be Addressed !

1. Practical Application of BDF

- **Entrance Strategy (Procurement of feedstock)**
  - Sustainable supply of raw materials at lower cost
  - Development of high-yield energy crops (Pongamia and etc.)
- **Exit Strategy (Creation of demand & market)**
  - Economics (market) and environment (collaboration among industry, research institute and government)
  - Feed-in Tariff scheme, Tax reduction, Carbon credit system, JCM
- **Technological Strategy (Technological development)**
  - Optimization of the manufacturing process

2. Collaboration among East Asia countries

- Thailand, Vietnam, Indonesia, Myanmar, Laos (e-ASIA)
- Pongamia plantation in Australia, India and Thailand (Indonesia)

The Biomass Industrialization Strategy

Basic policies for biomass industrialization

1 Technological Strategy (Technological development)

- Accelerate development of **Next-generation technologies** such as liquid fuel (cellulosic ethanol fermentation) and solid fuel (torrefaction)
- Process optimization, Simultaneous production of fuels and chemicals

2 Exit Strategy (Creation of demand & market)

- **Fully utilize Feed-in Tariff scheme** introduced in July first, 2012
- **Tax reduction** such as property and corporation tax
- **Utilize carbon credit system**
- Price reduction by downcycling
- **Create biomass-related industries with high-value added goods** such as carbon fiber and highly-functional resin

3 Entrance Strategy (Procurement of feedstock)

- **Establish an agricultural and forest management system to supply biomass resources** to manifucturers in a stable manner
- **Establish an efficient and integrated biomass utilization systems**
- **Develop high-yield energy crops and plants**
- **Fully utilization waste-related biomass** such as food, animal and human waste

Joint Crediting Mechanism (JCM)

- To facilitate diffusion of leading low carbon technologies, and contributing to sustainable development of ASEAN
- To appropriately evaluate contributions to GHG emission reductions or removals from developed countries in a quantitative manner
- To contribute to the ultimate objective by facilitating global actions for emission reductions or removals
- MOE and METI are now promoting JCM in Japan
- COP21 (Paris Agreement; US and China)
- Conversion from coal to biomass (power generation)
- Thailand-Japan JCM project on Torrefaction (industry and research organization)

Entrance Strategy

Development of high-yield energy crops and plants

Pongamia pinnata plantation in Indonesia (Dr. Hideo Samura, EAJ)

Cascade utilization of oil seeds

Rubber seeds ➡ Bioethanol, Vitamine E, Chemicals (Metal soap), and BDF

Seminar on Biomass in VNU Hanoi (Prof. Maeda, Osaka Prefecture Univ.)

Basic Concept of Biomass Asia Project at EAJ

(Multilateral Collaboration on Biomass Utilization in East Asia towards Low Carbon Society)

1. East Asia is an Engine of global economy.
2. East Asian countries share many common issues such as shortage of energy and environmental problems.
3. East Asia region is rich in biomass resources.
4. Biomass utilization is one of the most feasible approach toward sustainable development of the region.
5. While no single country can address these common issue alone.
6. So, bilateral and region wide collaboration on biomass utilization is essential for our sustainable development.
7. Human development of young researchers (engineers)
8. Policy proposal for international collaboration (2016)

Akio Nishijima, EAJ, Biomass-Asia Project Team

Asia needs collaboration and innovation

(International policy dialogue, Biomass open Innovation forum)

(Background)

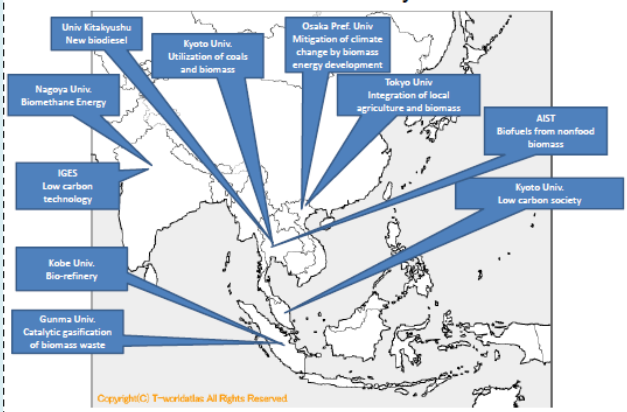
- S&T investment in ASEAN is ca. one tenth of Germany
- S&T investment in all Asia is almost equal to the US or EU.
- Researchers in ASEAN is ca. one eighth of Japan
- Researchers in all Asia is much more than the US or EU.

(What is open innovation)

- Uses of inflows and outflows of knowledge to accelerate innovation
- In order to effectively use the open innovation strategy, we need to build a networks of various R&D entities and platforms of various technologies.
- We also need roadmaps for the implementation of biomass technology to recognize technology gaps.

Dr. Norio Ohto, Takeda Foundation

Biomass related SATREPS Projects in ASEAN



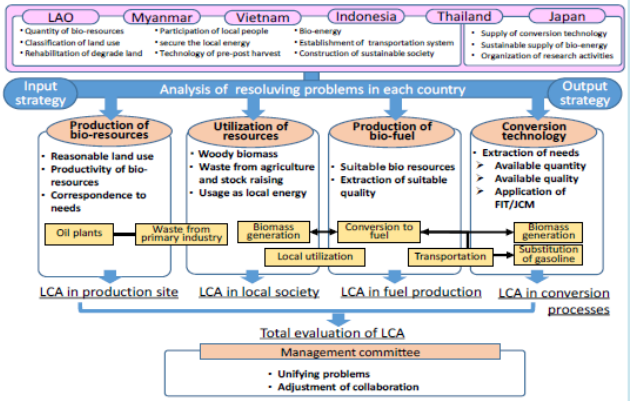
Norio Ohto, Takeda Foundation

Possible collaboration projects in East Asia

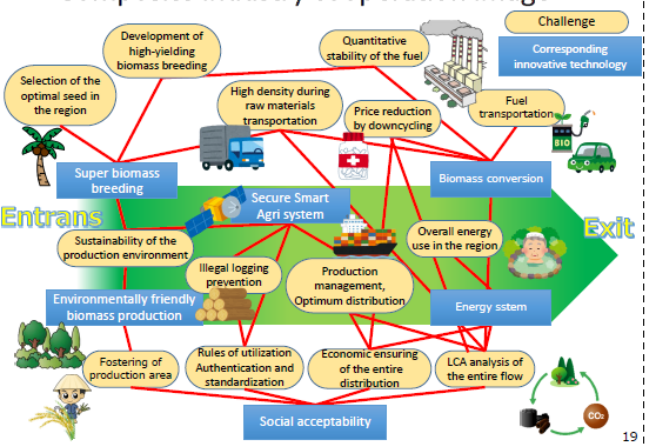
1. Fertilizer and Feed, Breeding and Plantation, On-site Power and Heat, Biofuels (gas, liquid and solid), Materials for Bio-refinery
2. Priority setting of Research and Development → Solid and Liquid Biofuels, Power generation and Transportation
3. Establishing Equal Partnership
4. Human Development of young engineers (researchers)
5. Low cost production technology, Quality and standard
6. First, second and third generation biofuels (Market, Value Added, Time development)
7. Integrated process from the inlet (biomass feedstock) to the outlet (end product)
8. Asian biomass consortium → Biomass open innovation research centers in East Asia (BORC in Thailand, Indonesia and Vietnam)

Akio Nishijima, EAJ, Biomass-Asia Project Team

ASEAN Region Wide Collaboration (e-ASIA)



Composite industry cooperation image



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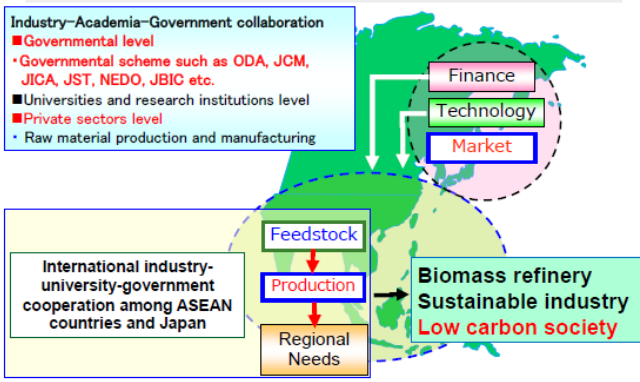
Asia Biomass Community (ABC) for Sustainable Development Goals (SDGs)



Speaker's Information

Sumittra CHAROJROCHKUL

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Affiliation : National Metal and Materials Technology Center, MTEC/NSTDA
Position : Materials for Energy Research Unit Director
E-mail : sumittrc@mtec.or.th

Biography

2010- present : Materials for Energy Research Unit Director (RUD), 2007-2014: Head of Electrochemical Materials and System Laboratory, 2001-2012: Head of Optical Microscopy and Metallography Laboratory, 1998: joined MTEC, 1994-1998: PhD study at Department of Materials, Imperial College, London, 1991-1994: BEng study in Materials Science and Engineering, Imperial College, London, and 1990-1991: A-level study at Brooke House Sixth Form College, Market Harborough, UK.

Area of Interest

Solid Oxide Fuel Cells, Hydrogen production, Development of catalyst, Ceramic films deposition and powder fabrication, Flame Assisted Vapour Deposition.

Research Activities and Achievements

- Bronze medal from The 35th International Exhibition of Inventions, New Techniques and Products of Geneva, 22 April, 2007, Geneva, Switzerland, "DC 4-point Van der Pauw Sample Holder".
17 patents pending and filing
Some recent publications:
N. Laosiripojana, W. Sutthisripok, S. Charojrochkul, S. Assabumrungrat, "Conversion of biomass tar containing sulphur to syngas by Gd-CeO_2 coated Ni-Fe bimetallic-based catalysts", **Applied Catalysis A:General**, 478, 9-14, 20 May 2014.
N. Laosiripojana, W. Sutthisripok, S. Charojrochkul, S. Assabumrungrat, "Development of Ni-Fe bimetallic based catalysts for biomass tar cracking/reforming:Effects of catalyst support and co-fed reactants on tar conversion characteristics", **Fuel Processing Technology**, 127, 26-32, November 2014.
J. Yeyongchaiwat, K. Nonthawissarut, S. Charojrochkul, N. Sukpirom, "Compatibility and conductivity of $La_2Ni_{1-x}Fe_xO_{4+\delta}$ and $LaNi_{0.6}Fe_{0.4}O_{3-\delta}$ with GDC electrolyte", **Advances in Applied Ceramics**, 114, 1, 1-8, January 2015. (1.163)
J. Yeyongchaiwat, K. Nonthawissarut, S. Charojrochkul, N. Sukpirom, "Compatibility and conductivity of $La_2Ni_{1-x}FeO_{4+\delta}$ and $LaNi_{0.6}Fe_{0.4}O_{3-\delta}$ with GDC electrolyte", **Energy Materials: Materials Science and Engineering for Energy Systems**, 10(2), 1-8, 2015.
P. Tepamatr, E. Buarod, N. Laosiripojana, S. Charojrochkul, "Study of water gas shift reaction over ceria based catalysts in solid oxide fuel cells", **ECS Transactions**, 68(1), 1207-1217, 2015.
P. Tepamatr, N. Laosiripojana, S. Charojrochkul, "Water gas shift reaction over monometallic and bimetallic catalysts supported by mixed oxide materials", Applied Catalysis A: General 523 (2016) 255-262.
C. Siriruang, S. Charojrochkul, P. Toochinda, "Hydrogen production from methanol-steam reforming at low temperature over Cu-Zn/ZrO2-doped Al2O3", Monatsh Chem 147 [7] (2016) 1143-1151.

Message

Energy is always a 'global demand'.

5-Year R&D of 1 ton/hr Torrefaction Pilot Plant at SCG

Dr. Auttapol Golaka

Cementhai Holding, Co., Ltd. – SCG Investment

4th JASTIP Symposium Biomass to Energy, Chemicals and Functional Materials

4 July 2017, NSTDA, Pathum Thani , Thailand.

Contents

@ SCG 2017

1. Introduction to SCG

- Established in 1913
- 3 core business units

Cement-building materials

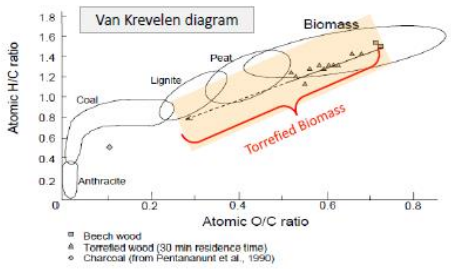
Chemical

Packaging

Visit www.scg.co.th for more information

@ SCG 2017

2. Overview of Torrefaction : Advantage

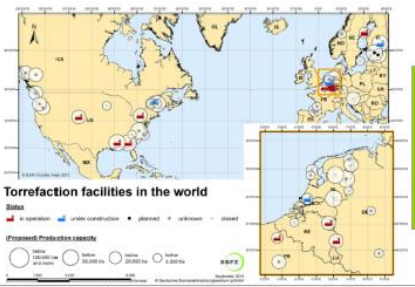


Advantage of Torrefaction Process – Upgrading biomass into coal-like property

Mark, J.P., 2005 " Thermodynamics analysis of biomass gasification and Torrefaction "

@ SCG 2017

2. Overview of Torrefaction : Current Situation



Worldwide activity of biomass torrefaction facilities with different status

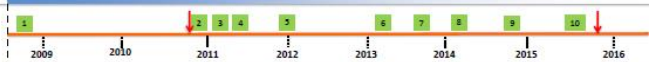
Thran, D., et al. 2016. Biomass and Bioenergy, Vol. 89, p.184-200

SCG first stepped into torrefaction technology in 2009.

We are the first pioneer of South East Asia in this technology!

@ SCG 2017

3. SCG Torrefaction Process Development : Milestones



		Period (Months)	Activities	Key Achievement / Event
1	July 09 – June 10	11	Characterization of selected Thai biomasses	Laboratory scale experiment at JGSEE
2	Nov 10 – Apr 11	4	Prototype development	Technical information for 1 ton/hr pilot plant design
3	Mar 11 –June 11	5	Engineering design	Engineering drawing for construction
4	June 11– Nov 12	18	Pilot plant construction	CHC Pilot Plant (version 1)
5	Dec 12 – Jan 13	2	1st operation for process testing	Operation failure, explosion caused damage to reactor
6	Feb 13 – Sep 13	6	Improvement for process safety	Installation of the redesigned reactor (version 1.1)
7	Oct 13 – Feb 14	5	2nd operation for process testing	Operation failure, due to instability of HGG2
8	Feb 14 – Sep 14	7	Re-design for process improvement	New design of piping system and new equipment in HGG2 (version 1.2)
9	Nov 14 – Apr 15	6	Installation of the redesigned equipment	Completion of process modification
10	May 15 – Oct 15	6	3rd operation for process testing / Production experiment	Successful operation to produce torrefied product 1.8 ton/hr

5-year development of the SCG Torrefaction process

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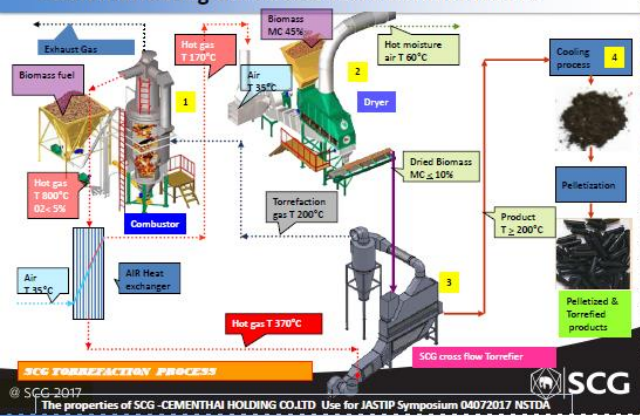
3. SCG Torrefaction Process Development : Schematic Diagram of SCG Torrefaction Process



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3. SCG Torrefaction Process Development : Prototype Development

Air flow investigation of reactor prototype for process improvement

Hot gas generator conceptual design experiment

Completed on 26/4/2011

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3. SCG Torrefaction Process Development : Pilot Plant Construction

3. SCG Torrefaction Process Development : Torrefaction pilot plant V.1 (2012)

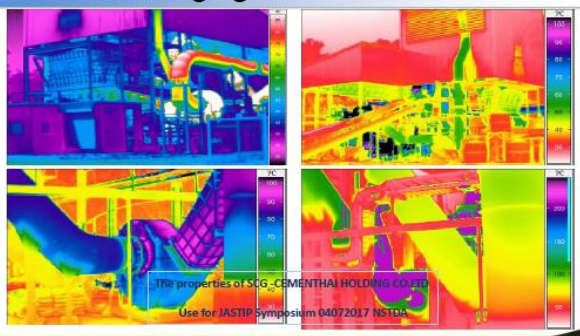
18-month construction (06/2011 - 12/2012)

3. SCG Torrefaction Process Development : Torrefaction pilot plant V.2 (2015)

3. SCG Torrefaction Process Development : Process Temperature Monitoring

- 3 - 6 MW_{th} could be achieved by our hot has generator at 800-1,000°C with less than 5% O_2
- Reactor temperature could be controlled within the range of 250-340°C whereas torrefaction temperature is generally maintained at 250-300°C

3. SCG Torrefaction Process Development : Thermal Imaging



Thermal images present the surface temperature of equipment for inspecting the thermal expansion and heat loss in the process.

3. SCG Torrefaction Process Development : Preliminary Results

	Raw Eucalyptus	Torre product @1.8 ton/hr @ 300°C	Torr product @280°C (lab experiment By JGSEE)
C	47.6	63.43	51.7
H	5.47	4.64	5.3
N	0.3	0.24	0.3
O	43.5	29.11	42.7
Ash	3.01	2.52	1.8
O/C	0.91	0.45	0.6
HHV* (MJ/ kg)	18.21	24.23	20.12
Weight loss %	-	19.16	16.18

4. Conclusions

- The SCG torrefaction technology has successfully been developed. The system mainly consists of hot gas generator, drying process and closed loop torrefaction reactor. All are synchronized and able to operate under controlled conditions.
- Preliminary results show that the SCG Torrefaction Pilot Plant is capable of producing torrefied Eucalyptus chips at 1.8 ton/hr.
- At the torrefaction temperature of 300°C, the process yields 81% of torrefied Eucalyptus chip which high heating value increases approximately 30% .

5. Next move

- Technical Improvement of previous version for the 2,000-ton torrefied biomass production – in progress
- Economic analysis and technical evaluation of the pilot plant

Acknowledgements

SCG Torrefaction Team

Thank you for your attention

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CHC, HO2, 6th floor, Bangsue, Bangkok.
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M. 083 008 7439

@ SCG 2017

Chair's Information

Mamoru SHIBAYAMA

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Affiliation : Kyoto University ASEAN Center
Center for Southeast Asian Studies, Kyoto University
Position : Director, Professor Emeritus, Kyoto University
E-mail : sibayama@cseas.kyoto-u.ac.jp

Biography

1980: Dr. Eng. Kyoto University, 1983: Assistant Professor, Center for Southeast Asian Studies, Kyoto University, 1988: Associate Professor and Professor, Osaka International University, 1995: Professor, Osaka City University, 2003: Professor, Center for Southeast Asian Studies, Kyoto University, 2012-: Professor, Center for Integrated Area Studies, Kyoto University, 2017-: Professor, Center for Southeast Asian Studies, Kyoto University

Area of Interest

Area Informatics : Exploring new research paradigm on informatics approach in area studies with emphasis on the region of Southeast Asia.; Computer Humanities: Applying informatics to archaeological and historical studies.; Geographical Information Science : GIS-based historical studies and analysis.; Ontology-based Text Analysis : Applying advanced ICT to analysis for archaeological and historical document and data.

Research Activities and Achievements

1) Research and/or educational experiences and achievements
-Yoneo Ishii, Mamoru Shibayama, and Aroonrut Wichienkhiew : The Computer Concordance to the Law of the Three Seals, Amarin Publications, Thailand, 5 Vols, 3698 pages. 1990.
-Mamoru Shibayama: Hanoi's Urban Transformation in the 19th and 20th Centuries: An Area Informatics Approach, Journal of Southeast Asian Studies, Vol.46, No.4, pp.496-518, 2009.
-Mamoru Shibayama, "An Examination of the East-West Cultural Corridor. Paper presented at the First SEAMEO SPAFA International Conference on Southeast Asian Archaeology, 7-10 May, 2013, Burapha University, Chonburi, Thailand, 2013(5).
2) On-going research and/or educational activities
-Project on the East-West Cultural Corridor for Medieval Communication Network in Mainland Southeast Asia (FY2014-)
-Project on Building Ontology-oriented Archaeological Site Knowledge-Base in Mainland Southeast Asia" (April 2014 – March 2018, Leader: Prof. Mamoru Shibayama, JSPS).
-Activities on Japan Consortium for International Cooperation in Cultural Heritage (JCICCH)

Message

Message from Kyoto University ASEAN Center: The vision for the Kyoto University ASEAN Center is to cultivate En (縁) — a sense of connectedness, and Wa (輪), the concept of human relationships, throughout the ASEAN region in order to enrich ASEAN's potential and produce a global academic center of excellence.

Chair's Information

Verawat CHAMPREDA

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Affiliation : National Center for Genetic Engineering and Biotechnology (BIOTEC)
Position : Director Microbial Biotechnology and Biochemicals Research Unit
E-mail : Verawat@biotec.or.th

Biography

Dr.Verawat finished his Ph.D. from Imperial College London, UK in 2003 in biocatalysis. He is now working as the director of the BIOTEC's Microbial Biotechnology and Biochemicals Research Unit and as the head of Enzyme Technology Laboratory and the coordinator of the BIOTEC-JGSEE Integrative Biorefinery Laboratory. To date Dr.Verawat has more than 70 publications in international journals with awards from local and international institutions, including the Young Scientist award 2010 from the Foundation for the Promotion of Science and Technology under Patronage of His Majesty the King, Thailand.

Area of Interest

His research interest is focused on enzyme discovery using metagenomic technology, biomass conversion, and enzyme applications in biorefinery. His research also extends to integrative bio/catalytic approach for production of biofuels, commodity chemicals, and bioplastics.

Research Activities and Achievements

Dr.Verawat has strong experience on conducting R&D projects with governmental and private sectors with research grants from NSTDA and leading companies on biorefinery development in Thailand including the PTT Group, PTT Global Chemicals, and Mitrphol Group. Several projects have been finished with impacts on R&D advancement in the field of enzymes and biomass industry. The focused research topics are as follows:

- Exploration of enzymes from uncultured microbial bioresources
- Industrial enzyme development for green industry
- Development of pretreatment and fractionation technology for local agricultural by-products

He also joins the JASTIP renewable energy program on the B2EC project and JASTIP Net project on utilization of bioresources with leading scientists from Kyoto University. He is also taking part on planning the NSTDA research roadmap on Biochemical and Biorefinery and as one member in the BIOTEC working team on the EECi Biopolis project.

Message

Biorefinery is a promising new industry for Thailand and is placed as one of the new S-curve industry to drive the country's economy in the next decades. Strong international collaboration for researchers working on multi-disciplinary disciplines on bioresource utilization is necessary for technology break-through in order to make economic impact to the country.

Speaker's Information

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Position : Professor
E-mail : tumezawa@rish.Kyoto-u.ac.jp

Biography

2005- : Prof., RISH, Kyoto Univ., 2016- : Director, Res. Unit Global Sustainability Studies, Kyoto Univ., 1993-2005: Assoc. Prof., RISH/WRI, Kyoto Univ., 1982-1993: Instructor, WRI, Kyoto Univ., 1987: Dr. of Agric. Sci. (Kyoto Univ.), 1982: Master of Agric. Sci. (Kyoto Univ.); 2000- : Fellow of International Academy of Wood Science, 1999 : Visiting Scientist at Michigan Technol. Univ., USA, 1989-1990 : Research Scientist at Virginia Polytech. Inst. State Univ., USA

Area of Interest

Organic chemistry, biochemistry, and metabolic engineering of lignin biosynthesis; Organic chemistry, biochemistry, and molecular biology of lignans, norlignans, and related phenylpropanoid compounds; Molecular breeding of grass biomass plants which are adaptable to biorefinery; Chemical conversion of lignins

Research Activities and Achievements

1) Research experiences and achievements
Organic chemistry, biochemistry, and molecular biology of lignans, norlignans, and related phenylpropanoid compounds:
- T. Umezawa, S.K. Ragamustari, T. Nakatsubo, S. Wada, L. Li, M. Yamamura, N. Sakakibara, T. Hattori, S. Suzuki, V.L. Chiang, A lignan *O*-methyltransferase catalyzing the regioselective methylation of matairesinol in *Carthamus tinctorius*, Plant Biotechnology, 30, 97-109 (2013)
- M. Yamamura, S. Suzuki, T. Hattori, T. Umezawa, Subunit composition of hinokiresinol synthase controls enantiomeric selectivity in hinokiresinol formation, Org. Biomol. Chem., 8, 1106-1110 (2010)
- T. Nakatsubo, M. Mizutani, S. Suzuki, T. Hattori, T. Umezawa, Characterization of *Arabidopsis thaliana* Pinoresinol Reductase, a new type of enzyme involved in lignan biosynthesis, J. Biol. Chem., 283, 15550-15557 (2008)
- S. Suzuki, M. Yamamura, T. Hattori, T. Nakatsubo, T. Umezawa, The subunit composition of hinokirsinol synthase controls geometrical selectivity in norlignan formation, Proc. Natl. Acad. Sci. USA, 104, 21008-21013 (2007)
Molecular breeding of grass biomass plants which are adaptable to biorefinery
- T. Koshiba, N. Yamamoto, Y. Tobimatsu, M. Yamamura, S. Suzuki, T. Hattori, M. Mukai, S. Noda, D. Shibata, M. Sakamoto, T. Umezawa, MYB-mediated upregulation of lignin biosynthesis in *Oryza sativa* towards biomass refinery, Plant Biotechnol, 34, 7-15 (2017)
- Y. Takeda, T. Koshiba, Y. Tobimatsu, S. Suzuki, S. Murakami, M.Yamamura, Md. M. Rahman, T. Takano, T. Hattori, M. Sakamoto, T. Umezawa, Regulation of CONIFERALDEHYDE 5-HYDROXYLASE expression to modulate cell wall lignin structure in rice, Planta, in press (2017)
2) Ongoing activities
The SATREPS Project for Producing Biomass Energy and Material through Revegetation of Alang-alang (*Imperata cylindrica*) Fields, the international collaboration with Indonesian Institute of Sciences.

Message

Large parts of deforested areas of Southeast Asia are dominated by *Imperata cylindrica*. The conversion of *Imperata* grasslands into biomass crop farmland would be valuable for renewable resource production in a global context, which would contribute to the welfare and socio-economic improvement of the local communities and therefore may provide long-term sustainable economic benefits to the nations.
In addition, the conversion of *Imperata* grasslands to biomass crop farmland and/or plantation forests of fast-growing trees may lead to restoration of biodiversity; the crops or fast-growing trees may be replaced by diverse local flora, providing benefits for global environmental conservation and restoration as well as increase of CO_2 fixation increase. Thus, the deteriorated grassland control is a critically important subject.

Speaker's Information

Auttapol GOLAKA

Home Town / Country : Rayong, Thailand
Affiliation : Siam Cement Group (SCG)
Position : Manager of Torrefaction Process Development
E-mail : auttapog@scg.co.th

Biography

2008 – present	Siam Cement Group
2006	PhD (Energy Technology), The Joint Graduate School of Energy and Environment, KMUTT
1999	MSc (Energy Technology), King Mongkut's University of Technology Thonburi
1997	GradDip (Energy Technology), King Mongkut's University of Technology Thonburi

Area of Interest

Thermochemical processes (gasification, combustion, pyrolysis, torrefaction), biomass upgrading for fuel application, pilot plant development, computational fluid dynamics, solar thermal process, process optimization, radiative heat transfer

Research Activities and Achievements

2010 – 2015
* Development of the CHC Torrefaction pilot plant
  - Completion of conceptual process design
  - Prototype development of the CHC Torrefaction reactor and heat integration system for torrefaction process
  - Completion of engineering design of the 1-ton/hr CHC Torrefaction pilot plant
  - Successful commissioning of the 1-ton/hr CHC Torrefaction pilot plant

2017 -
* Technical Improvement of previous version for the 2,000-ton torrefied biomass production
* Economic analysis and technical evaluation of the pilot plant

Message

Speaker's Information

I Made Sudiana

Home Town / Country : Bali, Indonesia

Affiliation : Research Center for Biology-LIPI

Position : Professor

E-mail : i.made.sudiana@lipi.go.id; imadesudianalipi@gmail.com

Biography

2009 Professor in Microbial Ecology; 2005 Post doct in Biodiplomacy, UNU, Yokohama Japan; 2004 Post Doct in plant phytopatology, JIRCAS, Okinawa, Japan; Graduated Doctor from Department of Urban and Environmental Engineering, University of Tokyo, Japan; 1992, Graduated M.Sc from University of Ghent, Belgium

Area of Interest

Development of microbial based biofuel; revegetation of degraded land, development of adaptation and mitigation on the effect of climate change

Research Activities and Achievements

1) Awarded best productive scientist 2014, by Indonesian Ministry of Science and Technology
2) Development of revegetation technology for post mining, and marginal land through innovation of microbial entrapment system, and soil conditioner
3) Development of adaptation technology in water shortage area to increase crop productivity in dry land
4) Development of microbial based biofuel especially oleaginous microbes and hydrolytic microbes
5) Decolorization of synthetic dye using biofilter
6) Reduction of methane emission from rice field using methanothrophic microorganism
7) Exploration biofuel microbes from natural environment
8) Development of phytase and lipase for environmentally friendly wastewater treatment system
9) Development of biofertilizer using indigenous microorganism
10) Life cycle assessment of revegetation in marginal land
11) Development of biocontrol especially on Fusarium that attack sorghum and Ganoderma that attack palm oil
12) Development monogastric animal feed
13) Metagenomic analyses of degraded land and Sorghum bicolor
14) Microbial community analyses of forest fire soil ecosystem
15) Hydrogel and zeolit formulation as soil conditioner for revegetation of ultisol and entisol soil

Message

Message, proposal, new ideas, expectations or others related to international cooperation and interdisciplinary research.

We are facing tremendous environmental challenges caused by human activities as well as natural disaster, and those challenges should be solved through research collaboration and partnership of interdisciplinary scientists. The sooner the better.

The 4th JASTIP Symposium " Biomass To Energy, Chemicals and Functional Materials"

The Potential of Developing Marginal Land for Biomass Sorghum Production

I Made Sudiana[1], Atit Kanti[1], Puspita Lisdiyanti[2], Yopi[2], Didik Widyatmoko[3], Arwan Sugiharto[1], Maman Rahmansyah[1], Reni Lestari[2], Shigeto Otsuka[4], Masaru Kobayashi[5], Toshiaki Umezawa[5]

[1] Research Center for Biology-LIPI, [2]Research Center for Biotechnology-LIPI, [3]Center for Plant Conservation LIPI, [4]University of Tokyo, [5]RISH, Kyoto University, Japan

Outline

What is the main challenges of revegetation

- Soil physico-chemical analyses
- Soil biological diagnosis
- Climate and irrigation status

Strategy for revegetation

- Marginal land tailing area, and post mining
- Marginal land ultisol soil
- Marginal land entisol soil

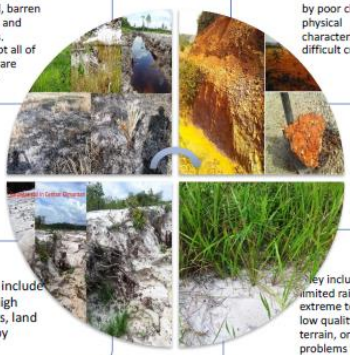
Potential biomass production

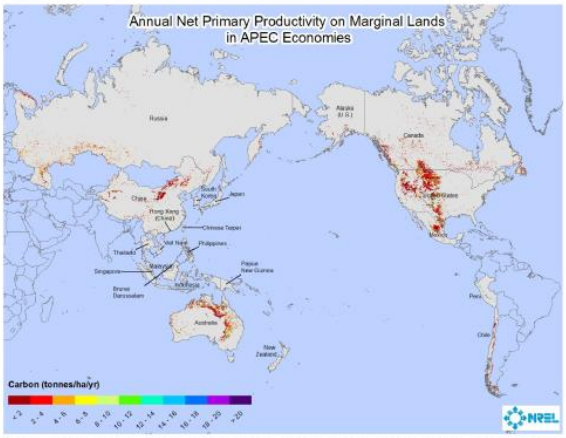
- Energy and materials
- Biorefinery

SATREPS PROJECT (2016-2021)
Project for Producing Energy and Materials Through Revegetation of Alang-alang (*Imperata cylindrica*) Fields

Marginal lands (ML)

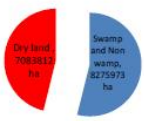
- waterlogged or marshy land, barren rocky areas, and glacial areas. Evidently, not all of these areas are suitable for agriculture
- ML are characterized by poor climate, poor physical characteristics, or difficult cultivation.
- Examples include deserts, high mountains, land affected by salinity,
- ...ey include areas with ...imited rainfall, extreme temperatures, low quality soil, steep terrain, or other problems for agriculture.



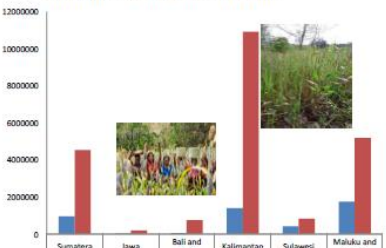


Marginal Land in Indonesia

Herman Subagio dan Muh. Aqil. 2014. Perakitan dan Pengembangan Varietas Unggul Sorgum untuk Pangan, Pakan, dan Bioenergi. IPTEK TANAMAN PANGAN VOL. 9 NO. 1 2014. Page 39. Source: Badan Penelitian dan Pengembangan Pertanian (2007).



Marginal land In Indonesia in 2007



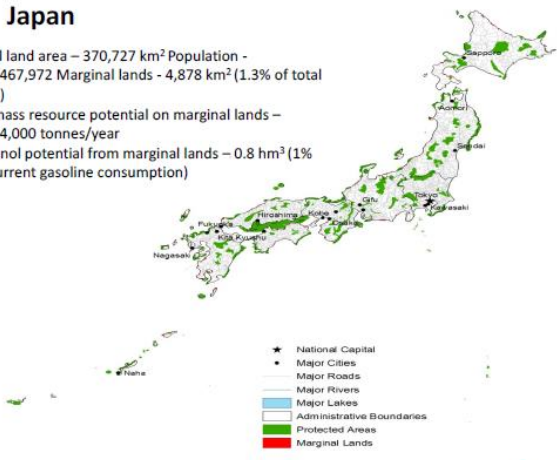
	Sumatera	Jawa	Bali and NTT	Kalimantan	Sulawesi	Maluku and Papua
Swamp and Non wamp	961050	14398	48922	1395939	422972	1738978
Dry land	4533856	197497	747824	10911452	816632	5179951

Indonesia

Total land area – 1,847,033 km² Population - 234,693,997 Marginal lands - 37,123 km² (2% of total area) Biomass resource potential on marginal lands – 15,494,000 tonnes/year Ethanol potential from marginal lands - 6 hm³ (23% of current gasoline consumption)

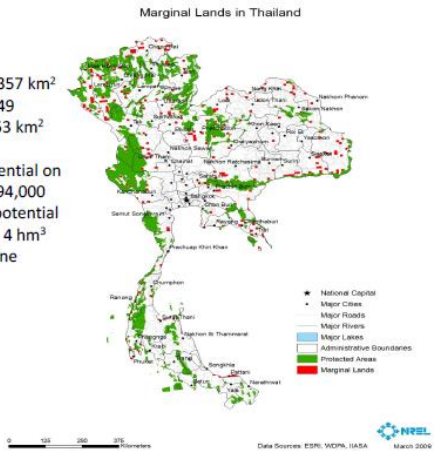
Japan

Total land area – 370,727 km² Population - 127,467,972 Marginal lands - 4,878 km² (1.3% of total area)
Biomass resource potential on marginal lands – 1,924,000 tonnes/year
Ethanol potential from marginal lands – 0.8 hm³ (1% of current gasoline consumption)



Thailand

Total land area – 515,357 km² Population - 65,068,149 Marginal lands - 17,253 km² (3.3% of total area)
Biomass resource potential on marginal lands – 10,394,000 tonnes/year Ethanol potential from marginal lands – 4 hm³ (38% of current gasoline consumption)



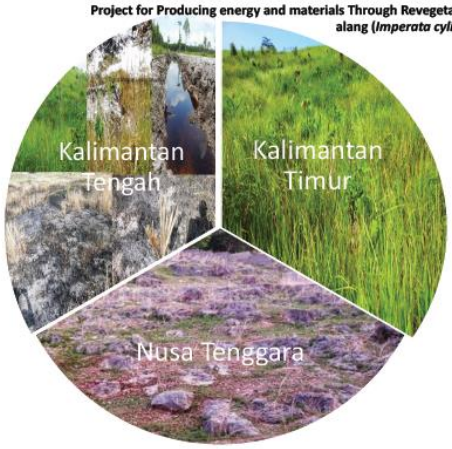
REVEGETATION

FIELD SURVEY

REVEGETATION DESIGN

PROJECT IMPLEMENTATION

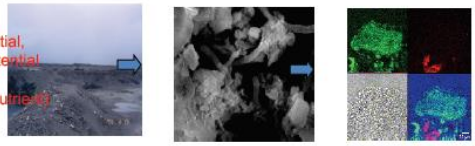
SATREPS PROJECT (2016-2021)
Project for Producing energy and materials Through Revegetation of Alang-alang (*Imperata cylindrica*) Fields



Strategy design for Revegetation

Improvement of Biological and chemical properties of tailing?

Redox potential, CEC, EC potential profile, soil properties (nutrient)



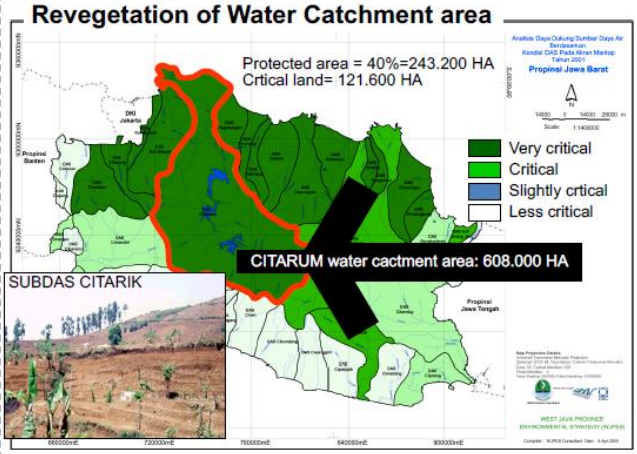
To enhance the capability of plant to grow in critical condition

Plant microbes association

SATREPS PROJECT (2016-2021)
Project for Producing energy and materials Through Revegetation of Alang-alang (*Imperata cylindrica*) Fields

Katingan Soil

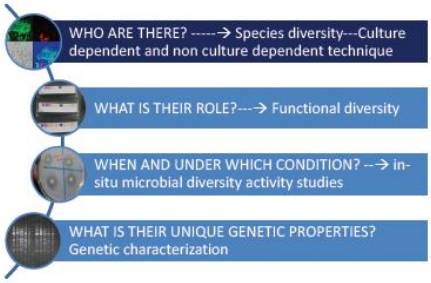
Revegetation of Water Catchment area



WJEMP/ BPLHD/ 200

MICROBIAL ECOLOGY

Estimated value of Global 'Ecosystem Processes' $654b a year. (UNEP, 1998)



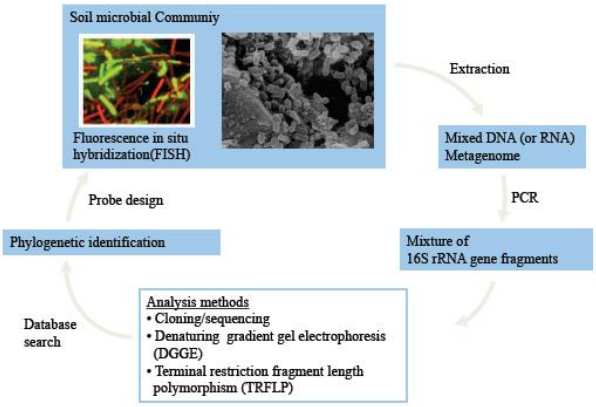
NIES-University of Tokyo-LIPI

THE ROLE OF SOIL MICROORGANISM IN ECOSYSTEM RECOVERY AFTER AFFECTED BY INTENS FIRE

Otsuka S, IM Sudiana, A Komori, K Isobe, S Deguchi, M Nishiyama, H Shimizu and K Senoo. 2008. Community Structure of Soil Bacteria in a Tropical Rainforest Several Years After Fire. Microbes Environ. Vol. 23. No.1: 48-56.

Izobe K, Otsuka S, Sudiana IM, Nurkanto A, and K Senoo. 2009. Community Composition of Soil Bacteria nearly a decade after a fire in a tropical rain forest in East Kalimantan, Indonesia. J. Gen. Appl. Microbiol. 55, 329-337

Molecular phylogenetic framework



CULTURE NON DEPENDENT

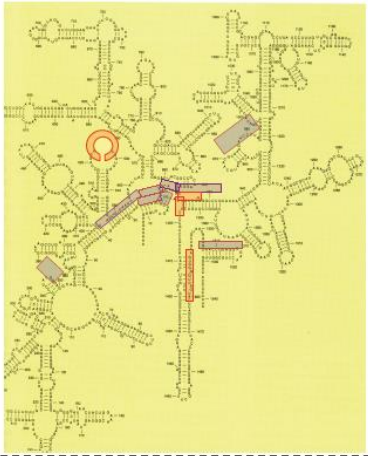
16S rRNA structure

E. coli: 1541 nucleotides

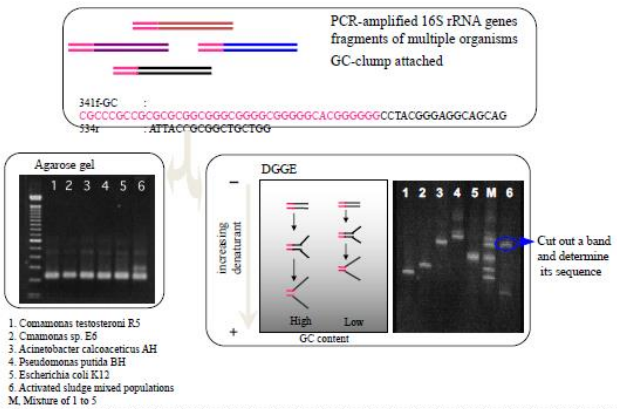
Conserved regions: used for designing uviversal primers

- Universal
- Bacteria specific
- Archaea specific

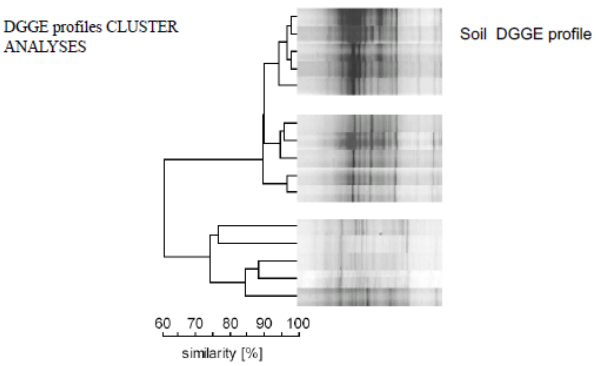
Variable regions: specific sequence for each species used for designing specific primers



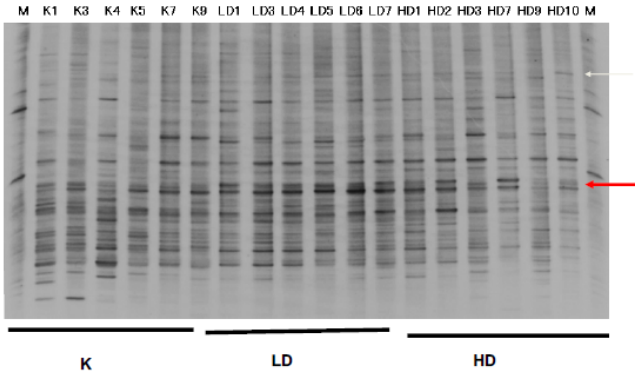
Denaturing gradient gel electrophoresis (DGGE)



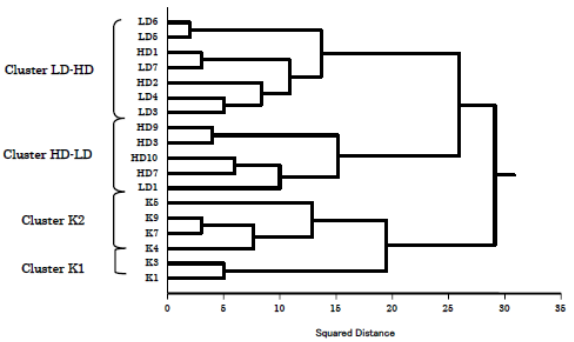
Cluster analysis of DGGE profiles



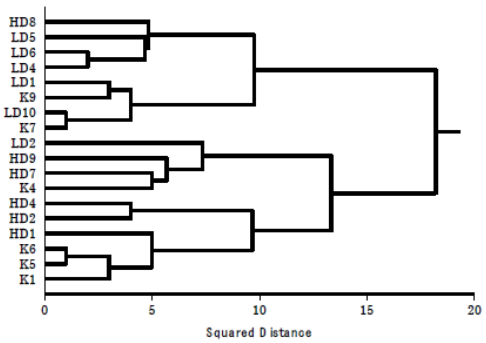
Total Bacteria



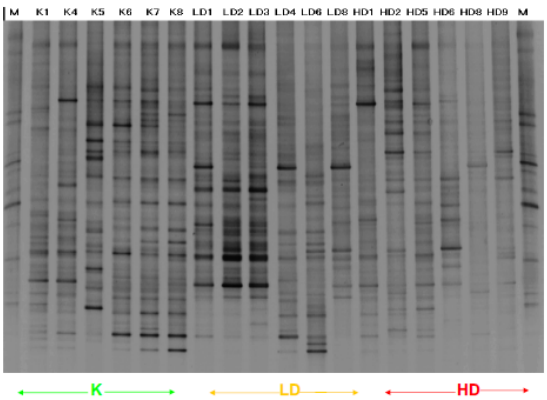
Total Bacteria



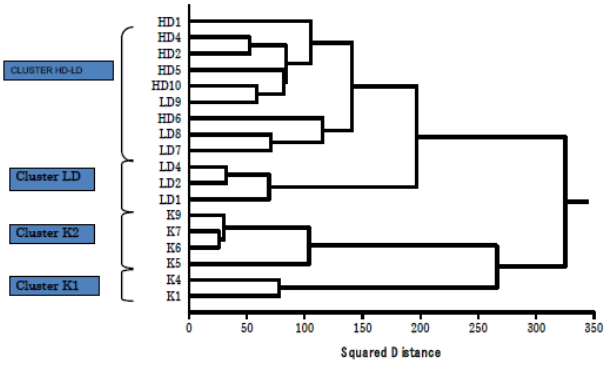
Actinomycetes



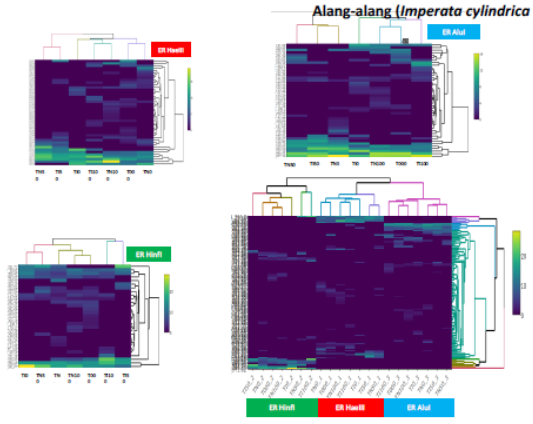
Ammonia Oxidizing Bacteria



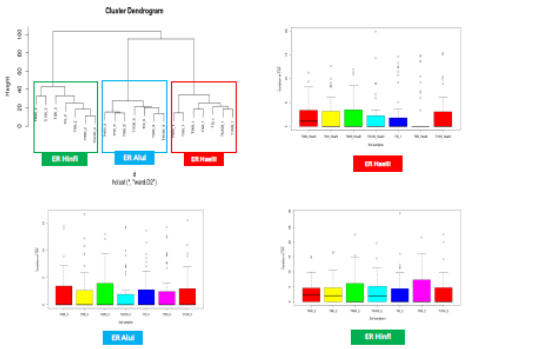
Ammonia Oxidizing Bacteria



SATREPS PROJECT (2016-2021)
Project for Producing energy and materials Through Revegetation of Alang-alang (*Imperata cylindrica*) Fields



SATREPS PROJECT (2016-2021)
Project for Producing energy and materials Through Revegetation of Alang-alang (*Imperata cylindrica*) Fields



Ecologically and Economically Importance Plants

Why Sorghum?

Monti, A., & Venturi, G. (2003). Comparison of the energy performance of fibre sorghum, sweet sorghum and wheat monocultures in northern Italy. *European Journal of Agronomy*, *19*(1), 35-43
Almodares, A., & Hadi, M. R. (2009). Production of bioethanol from sweet sorghum: A review. *African Journal of Agricultural Research*, *4*(9), 772-780.
Almodares, A., Taheri, R., Chung, M., & Fathi, M. (2008). The effect of nitrogen and potassium fertilizers on growth parameters and carbohydrate contents of sweet sorghum cultivars. *J. Environ. Biol*, *29*(6), 849-852.

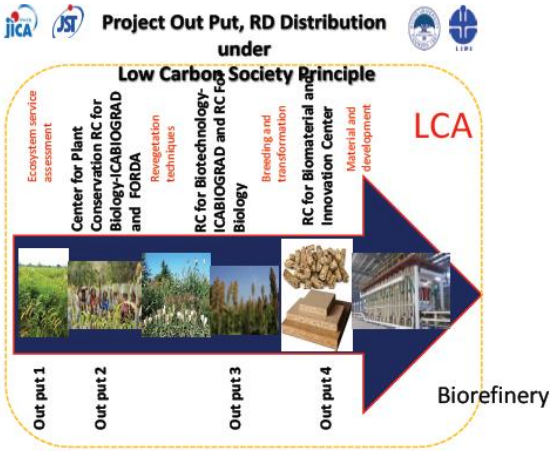
Table 1. Comparison of sugarcane, sugar beet and sweet sorghum in Iran.

	Sugarcane	Sugar beet	Sweet sorghum
Crop duration	About 7 months	About 5 - 6 months	About 4 months.
Growing season	Only one season	Only one season	One season in temperate and two or three seasons in tropical area.
Soil requirement	Grows well in drain soil	Grows well in sandy loam; also tolerates alkalinity	All types of drained soil.
Water management	36000 m^3/h	18000 m^3/h	12000 m^3/h
Crop management	Requires good management	Greater fertilizer requirement; requires moderate management	Little fertilizer required; less pest and disease complex; easy management.
Yield per ha	70 - 80 tons	30 - 40 tons	54 - 69 tons.
Sugar content on weight basis	10 - 12%	15 - 18%	7 - 12%.
Sugar yield	7 - 8 tons/ha	5 - 6 tons/ha	6 - 8 tons/ha.
Ethanol production directly from juice	3000 - 5000 L/ha	5000 - 6000 L/ha	3000 L/ha.
Harvesting	Mechanical harvested	Very simple; normally manual	Very simple; both manual and through mechanical harvesting.

Institute for energy usefulness

SATREPS PROJECT (2016-2021)
Project for Producing energy and materials Through Revegetation of Alang-alang (*Imperata cylindrica*) Fields

Gmelina arborea (Jati putih) -→ 8 months after plantation in Banjaran, West Java



Conclusion

- Biomass could be produced in marginal land
- Revegetation technology should be evaluated according the soil type, climate, beneficial microbial community status
- Gene expression analyses in soil will help us to estimate the level of abiotic and biotic stress in marginal land
- Plant selection should be based on sustainable biomass production rate
- Recovering Biodiversity are important project goal to obtain sustainable biomass for biorefinery project in Indonesia
- Research partnership is crucial for obtaining most fruitful result

iBiol (Innovative Bio-Production in Indonesia LIPI)

LIPI

東京大学 THE UNIVERSITY OF TOKYO

KYOTO UNIVERSITY RISH

JASTIP

JICA

JST

Chair's Information

Hideaki OHGAKI

Home Town / Country : Kyoto/Japan

Affiliation : Institute of Advanced Energy, Kyoto University

Position : Professor

E-mail : ohgaki.hideaki.2w@Kyoto-u.ac.jp

Biography

2016. 6- Program Officer of JST: 2007.12- Professor, IAE, Kyoto University: 2006.8 - 2014.9 Program Officer, Strategic Research Promotion and International Division, Kyoto University: 2001.5 - 2007.11 Associate Professor, IAE, Kyoto University: 1999.11 - 2000.2 Guest Researcher, Duke University:1997.4 - 2001.4 Group Leader, AIST:1994.10 - 1995.9 Guest Researcher, LBNL: 1989.4 - 1997.3 Electrotechnical Laboratory: 1988.4 - 1989.3 Researcher, Kyushu University: Dr. Eng., Kyushu University, 1988

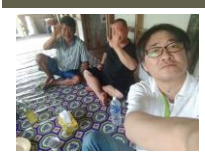
Area of Interest

His main interests are electron accelerators and quantum radiations, such as free electron lasers and laser Compton backscattering gamma-rays. On the other hands, he has strong interest in new and renewable energy system and implementation toward sustainable development in ASEAN.

Research Activities and Achievements

He has been working on the Nuclear Engineering field, especially for development of compact Synchrotron Radiation sources from 1989 and MIR-FEL machines. Besides, he has been working as a coordinator of international cooperation between South-East Asian countries and Kyoto University in the field of new and renewable energy since 2006.
His interests are electron accelerators and quantum radiations, such as free electron lasers and laser Compton backscattering gamma-rays. One of the application research of LCS gamma-rays, he has been working on Nuclear Resonance Fluorescence experiment which has been applied to detect hidden special nuclear materials, as well. Since 2009, he and his colleagues have developed a hybrid SNM interrogation system consisted of an Inertial Electrostatic Confinement devise with D-D nuclear fusion, and NRF measurement with LCS gamma-rays for a sea cargo under the financial support from JST program. He is a member of Asian Committee for Future Accelerators.
As for the new and renewable energy activities, he has been acting as a coordinator of Sustainable Energy and Environment Forum (SEE Forum) which is an Asia-Pacific academic and science and technological forum that brings forward the dialogue on global climate and energy security issues of common concern. He has been cooperated with UNESCO Jakarta as a consultant of the COMPETENCE program in the energy field since 2010 as well. In this connection, he has conducted UNESCO assist programs to promote energy education in Vietnam(2011), Laos(2012), Cambodia(2013), and Myanmar(2014). He is also serving as a support member of the energy engineering field of AUN/SEED-Net program promoted by JICA since 2014. He has been appointed as a representative of JASTIP-WP2 (Energy and Environment field) promoted by JST since 2015.
So far, he published 188-international reviewed papers, 168-proceedings papers of international conferences, 14-patents, and more than 50-invite/plenary lectures.

Message



One of the most important activity to contribute to the SDGs is a social implementation which is also one of the missions of JASTIP. For this, we are conducting collaboration research in rural and community renewable energy in ASEAN countries, not only in technological aspect but also in socio-economic and policy issues.

Speaker's Information

Jun TAKASHIMA

Home Town / Country : Yokohama/Japan

Affiliation : JICA Project AUN/SEED-Net

Position : Unit Chief (Planning and Capacity Development Unit)

E-mail : takashima@aun-seed.net

Biography

Aug 2015 : Unit Chief (JICA Project AUN/SEED-Net),
Nov 2012: JICA SATREPS Project Coordinator (CGS &CSIR, South Africa), Aug 2009: Volunteer Coordinator (JICA Tanzania Office), Sep 2005: DM/Livelihood Delegate (Japanese Red Cross Society Banda Aceh Office, Indonesia), Oct 2002: Lecturer (Witan International College, UK), 1996-1998: MA in Peace Studies (University of Bradford, UK)

Area of Interest

Development Studies, Human Rights, Conflict Resolution

Information of Organization

Due to the need for sustainable development after the economic downturn in ASEAN region in 1997, AUN/SEED-Net was officially established as a sub-network under the auspices of ASEAN University Network (AUN) in 2001.

Full operation of the project started in 2003, and AUN/SEED-Net has contributed to enhancing capacity of Member Institutions as well as addressing regional common issues in all dimensions through research funding which extensively helps to promote science and technology in the region. The network consists of 26 ASEAN universities and 14 Japanese Supporting Universities as of June 2017.

1) During the period from 2001 to 2017, 1,285 scholarships for master's and doctorate degree were provided to beneficiaries of ASEAN Member Institutions. 3 types of Research Fund (Collaborative Research Program for Alumni, Collaborative Research Program for Common Regional Issues, Collaborative Research Program with Industry) were available for the researchers who belong to ASEAN Member Institutions, and 211 research projects were implemented.
2) Ongoing programs include scholarship programs (PhD Japan, PhD Singapore, PhD Integrated, PhD Sandwich, and Master's), research programs (CRA, CRC, CR, and RF), mobility and networking programs (Regional Conference, JPDP, SVAS, SRJP, and ASEAN Engineering Journal), and university–industry linkage program (The Directory for Engineering, Intensive Course on Management of Technology)

Message

On behalf of AUN/SEED-Net, I sincerely appreciate for kind support and cooperation from project partners to the project. I am wishing a continuous and fruitful partnership with JASTIP.

Speaker's Information

Kuniaki YAMASHITA

Home Town / Country : Fukuoka, JAPAN

Affiliation : JSPS Bangkok Office

Position : Director

E-mail : jspsbkk@jsps-th.org

Biography

July 2012 to Present	Director of JSPS Bangkok Office
April 2003 – March 2012	Professor, Faculty of Languages and Culture (FLC) Kyushu University (Dean of FLC 2005-2008, 2010-2012) (Executive Adviser to President 2009-2010)
May 1994 –March 2003	Program Specialist of UNESCO (Paris, France)

Area of Interest

Information of Organization

Title: JSPS and its International Programs with special references to collaboration with ASEAN countries

Japan Society for the Promotion of Science (JSPS) is the oldest and biggest Japanese funding agency for academic and scientific research.

My presentation is to introduce;

1. Japanese government's policy on science and technology
2. What JSPS is
3. JSPS international programs
4. What and How JSPS can help Japan-ASEAN academic collaboration

Message

JSPS founded in 1932, is an independent administrative institute for the purpose of contributing to the advancement of science in all fields of the natural and social sciences and the humanities.

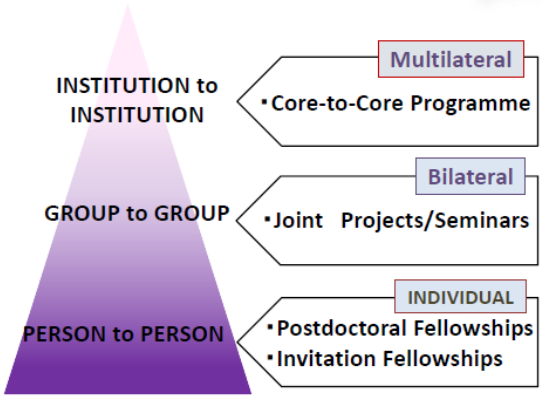
JSPS and its International Programs with Special References to Collaboration with ASEAN Countries

Kuniaki Yamashita
Director of JSPS Bangkok Office
Japan Society for the Promotion of Science

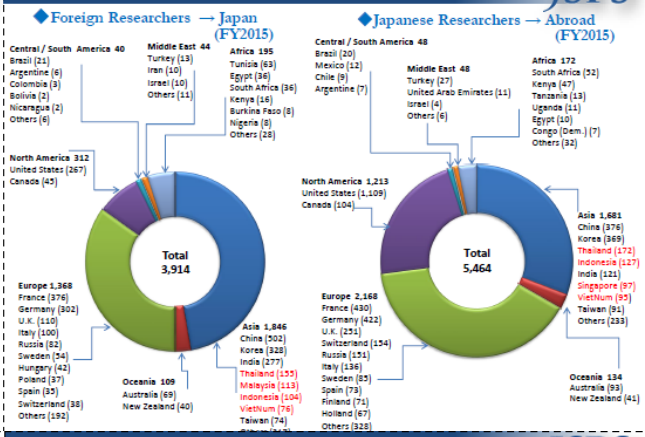
JSPS: A Funding Agency for "Science"

- JSPS supports
  curiosity-driven researches in all disciplines:
  natural/medical/social sciences, mathematics, engineering and humanities.
- JSPS funds
  - Research Grants～ $2 Billion for ～70,000 projects
    - for researchers at Japanese Institutions, regardless of their nationality.
  - Fellowships for ～6,000 pre-/post-docs.
  - Mobility Programs for ～10,000 researchers (from pre-docs to professors)
  - International Collaborations (Bi- and Multi- lateral)

International Collaboration Programs



Number of Researchers Exchanged under JSPS Programs



Creating Research Hubs – Core-to-Core Program–

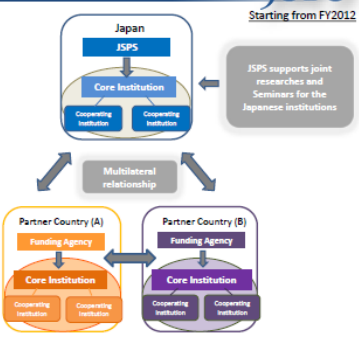
Starting from FY2012

A. Advanced Research Networks

- Target: Any country in the world
- Objective:
- Promote international collaboration in cutting edge fields by creating world-class research hubs
- Foster new generations of talented young researchers in Japan and other countries
- Grants: Up to JPY 18 million /year from JSPS
- *Partner institutions are required to cover their own expenses. (cf. international exchange fees etc.)
- Project Duration: 5 years

B. Asia-Africa Science Platforms

- Target: Asian and/or African countries / regions
- Objective:
- Japanese research institutions take the lead in building research hubs and fostering young researchers to contribute to Asian/African region
- Grants: Up to JPY 8 million /year from JSPS
- Project Duration: 3 years

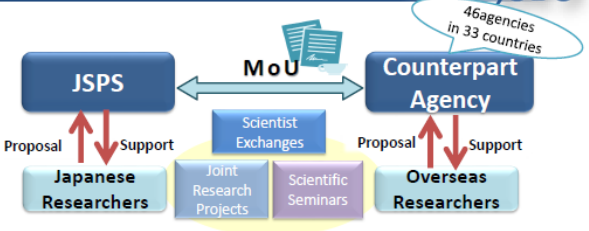


Number of applications/selected proposals

	FY2013		FY2014		FY2015		FY2016		FY2017	
	App.	Sel.	App.	Sel.	App.	Sel.	App.	Sel.	App.	Sel.
A. Advanced	34	8(*1)	41	8(*2)	45	7(*1)	54	7(*2)	55	8(*2)
B. Asia-Africa	80	11	56	10	41	10	77	12	70	12

(*) number of projects which includes ASEAN countries as one of the partner countries

Bilateral Cooperation Based on MoUs



Purpose: To promote and support academic cooperation between highly qualified Japanese and overseas researchers

Practice: Equal cost sharing for implementing cooperative activities

With ASEAN Countries

THAILAND (1978: NRCT), INDONESIA (1978: DG-RTHE, LIPI), Philippines(1979:DOST)
SINGAPORE (1983: NUS), VIETNAM (1996: NCST/VAST, 2012: MOST)

Bilateral Cooperation Based on MoUs

Number of Joint Research Projects and Seminars in FY 2017

Countries	Agency	Joint Research/ Seminar	♯ of adoption	♯ of applications submitted	% of adoption	# of ongoing	Total
Indonesia	DG-RSTHE	Joint Research	3	18	17%	6	9
	LIPI	Joint Research	1	4	25%	2	3
Philippines	DOST	Joint Research	1	12	-	0	1
Singapore	NUS	Joint Research	3	27	11%	2	5
		Seminar	1	3	33%	-	1
Thailand	NRCT	Joint Research	3	44	7%	4	7
Vietnam	MOST	Joint Research	-	-	-	2	2
	VAST	Joint Research	2	13	15%	4	6
Total			14	121	12%	20	34

Bilateral Cooperation without MoUs: Open Partnership Joint Projects/Seminars in 2017

In FY 2013, JSPS started a program of bilateral joint projects and seminars with countries that haven't concluded MoUs.

Open Partnership Joint Projects/Seminars

Number of joint research projects in FY 2016-2017

countries	FY2016		FY2017	
	# of application	# of adoption	# of application	# of adoption
Brunei	0	0	0	0
Cambodia	2	0	1	0
Indonesia	1	0	4	1
Laos	0	0	2	1
Malaysia	5	1	9	2
Myanmar	3	0	7	2
Philippines	2	1	4	0
Singapore	0	0	1	0
Thailand	0	0	1	0
Vietnam	4	0	5	0
Total	17	2	34	6

Open Partnership Joint Projects/Seminars

Number of joint seminars in FY 2016-2017

countries	FY2016		FY2017	
	# of application	# of adoption	# of application	# of adoption
Brunei	0	0	0	0
Cambodia	0	0	0	0
Indonesia	0	0	0	0
Laos	0	0	0	0
Malaysia	0	0	0	0
Myanmar	0	0	1	0
Philippines	1	0	0	0
Singapore	0	0	0	0
Thailand	1	1	3	0
Vietnam	0	0	0	0
Total	2	1	4	0

Fellowship Programs to Japan

Career Stages of Researchers

Ph.D. — 6 years after Ph.D. — Mid career — Professor — Nobel Prize level

Postdoctoral Fellowships (Standard)
1 - 2 years
About 350

Invitation Fellowships for Research in Japan

(Long-Term)	(Short-Term)	(Short-Term S)
2 -10 months	14-60 days	7-30 days
About 70	About 190	A Few

Number of invited fellows

		2014	2015	2016
Postdoctoral Fellowships		1,257	1,197	1,146
Invitation Fellowships	Short	265	267	258
	Long	107	98	97

Ronpaku (Dissertation PhD) Program

Aim:
- Giving opportunities for young Asian/African researchers to obtain PhD degree from Japanese universities by submitting dissertation
- About 25 fellows are newly selected every year from Asia and Africa
- Fellows are invited every year to visit their Japanese host researchers for 3 years
- Their host Japanese researchers are also allowed to visit the candidates in their countries

Eligibility:
- Hold a full-time position as a researcher in a university or research institution in his/her home country
- Under age 45

Duration of Fellowship :
- Up to 3 years

Successful Ronpaku fellow with her host researcher

# of fellows successfully received PhD (1978-2016)

Country	#	Country	#
1 Thai	216	7 India	33
2 Indonesia	145	8 Malaysia	28
3 Philippines	89	9 Bangladesh	17
4 Korea	79	10 Mongolia	7
5 China	72	11 Singapore	4
6 Viet Nam	40	TOTAL (including other countries)	757

HOPE Meetings with Nobel Laureates

Outline
- Give opportunities for excellent PhD students and young researchers in the Asia-Pacific and Africa to engage in interdisciplinary discussions with Nobel Laureates and their own peers.
- Foster future scientific leaders in the region.
- Cultivate participants' wider perspectives and deepen their knowledge through various programs with the Laureates and their peers.

9th HOPE Meeting with Nobel Laureates

Date& Place:
February 27-March 2, 2017, Tokyo
Theme: Physics, Chemistry, Physiology/ Medicine and related fields
Participants :
110 PhD students and young researchers from Japan, Australia, Bangladesh, China, Egypt, India, Indonesia, Israel, Kenya, Korea, Malaysia, Mongolia, Myanmar, Nepal, New Zealand, Philippines, Singapore, South Africa, Taiwan, Thailand, Turkey, Vietnam

Participated Nobel Laureates
Prof. Klaus von Klitzing (Physics 1985)
Prof. Makoto Kobayashi (Physics 2008)
Prof. Takaaki Kajita (Physics 2015)
Prof. Ryoji Noyori (Chemistry 2001)
Prof. Jean-Pierre Sauvage (Chemistry 2016)
Prof. Edvard I. Moser (Physiology/Medicine 2014)

Support for Outbound Young Japanese Researchers

Overseas Research Fellowships <Individual Support> Since 1982

FY 2014: 456 persons / 22 countries

FY 2015: 433 persons / 24 countries

Tenure: 2 years
Financial Support:
3.8 - 5.2 million Japanese yen / year / person

Program for Advancing Strategic International Networks to Accelerate the Circulation of Talented Researchers <Organizational Support> Since 2014

	2011	2012	2013	2014	2015
Projects	96	124	84	80	64
Countries	47	55	46	48	48
Dispatched	414	530	387	782	758
Invited				88	220

Duration of Projects: 1 - 3 years
Financial Support:
Up to 40 million Japanese yen / year / project
(*however, the first year 25 million Japanese yen / year / project)

Support for Outbound Young Japanese Researchers

Overseas Challenge Program for Young Researchers <Individual Support> New program From FY2017

- Give doctoral students in Japan an opportunity to go overseas to challenge a new research environment where they engage in joint research with researchers in other countries
- Period: 3 to 12 months
- Financial Support: 1 - 1.4 million Japanese yen / person

Grants-in-Aid for Scientific Research (KAKENHI)

"Fund for the Promotion of Joint International Research"

Fostering Joint International Research New program From FY2015

- Japanese researchers selected for Grant-in-Aid funding advance international research for set periods in collaboration with overseas universities and research organizations.
- International joint research is strengthened by rigorously selecting participants (e.g. professors, assistant professors) who can drive its advancement into the future.

- Period: about 6 months to one year
- Support: up to 12 million yen (about 100,000 US dollars)

About 400 KAKENHI grantees in Japan → Dispatched → Collaboration with overseas researchers

Program Committee is established within JSPS.
World's top-level Japanese researchers laboring overseas are members of the committee to carry out the application screening (7 members).
The working group for the screening is established under the committee.

Other new categories under this program
- International Group
- Returning Researcher Development Research

JSPS Alumni Associations

18 Alumni Associations and **7,394** of JSPS fellows join their activities.

17

JSPS Bangkok Office

Overview

- Established in 1989
- Director: Prof. Kuniaki YAMASHITA
- Covers ASEAN region, Bangladesh and Nepal

JSPS Program briefing at Burapha University, Thailand, 2016

Main Roles

- Collaborate with academic institutions in ASEAN region.
- Provide information about fellowship programs in Japan for researchers in the region.
- Organize academic seminars.
- Maintain and strengthen relationships with former JSPS fellows.
- Assist Japanese researchers and university administrators who visit ASEAN region.

JSPS- NRCT-JAAT Seminar in Bangkok, 2017

Thank you for your kind attention.

Crowing Rooster
Harbinger of new knowledge
that promises a brilliant future
for humankind

Speaker's Information

Yoshinori FURUKAWA

Home Town / Country : Japan

Affiliation : New Energy and Industrial Technology Development Organization (NEDO)

Position : Chief Representative

E-mail : furukawaysn@nedo.go.jp

Biography

1991 Joined the New Energy and Industrial Technology Development Organization (NEDO)
1996 Visiting Scholar, Massachusetts Institute of Technology (MIT)
2000 Chief Officer, Biotechnology Development Division, Advanced Technology Development Department, NEDO
2001 Bio-industry Division, Manufacturing Industries Bureau, Ministry of Economy, Trade and Industry(METI)
2003 Chief Officer, Biotechnology and Medical Technology Department, NEDO
2008 Director, Biotechnology and Medical Technology Department, NEDO
2012 Director, Smart Community Department, NEDO
2015/5 Chief Representative, NEDO Representative Office in Bangkok

Information of Organization

<u>About NEDO</u>

Japan has a unique technological capability

Following the two oil crises of the 1970s, the need for energy diversification increased. Against this backdrop, the New Energy and Industrial Technology Development Organization (NEDO) was established as a governmental organization in 1980 to promote the development and introduction of new energy technologies. Research and development of industrial technology was later added, and today NEDO is active in a wide variety of areas as one of the largest public research and development management organizations in Japan.

NEDO's Missions

NEDO plays an important part in Japan's economic and industrial policies as one of the largest public research and development management organizations. It has two basic missions: addressing energy and global environmental problems, and enhancing industrial technology.

■ Addressing energy and global environmental problems

NEDO actively undertakes the development of new energy (e.g., photovoltaic, wind power, biomass and waste, geothermal power, thermal utilization, and fuel cells) and energy conservation technologies. It also conducts research to verify technical results. Through these efforts, NEDO promotes greater utilization of new energy and improved energy conservation. NEDO also contributes to a stable energy supply and the resolution of global environmental problems by promoting the demonstration of new energy, energy conservation, and environmental technologies abroad based on knowledge obtained from domestic projects.

■ Enhancing industrial technology

With the aim of raising the level of industrial technology, NEDO pursues research and development of advanced new technology. Drawing on its considerable management know-how, NEDO carries out projects to explore future technology seeds as well as mid- to long-term projects that form the basis of industrial development. It also supports research related to practical application.

Message

NEDO Bangkok Office will start new activities to create Tech-base Startup Eco-system in Thailand.

<u>Goal: Setup the Tech-base Startup Eco-System</u>

1. Creation of "Thai-Accelerator"
2. Creation of success case as "Role Model"
3. Establish and/or Revision of Regulation and Standard

If you have interesting tech seeds Agri Tech or Health Tech fields and Japan - Thailand (+other country is OK) collaborative research, please contact us!

The 4th JASTIP Symposium

NEDO-NIA Collaboration Science-based Startup Eco-system

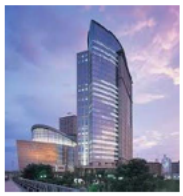
July 4th, 2017 @NSTDA

Asian Representative Office in Bangkok
NEDO

New Energy and Industrial Technology Development Organization (NEDO)

Outline of NEDO

- NEDO is Japan's Largest Public R&D Management Organization:
  - *Promotion of the Innovation*
  - *Research and Development for Energy and Industrial Technology*
  - *Dissemination of Energy and Industrial Technology*
- NEDO's GOAL:
  - *Addressing energy and global environmental problems*
  - *Facilitating Japan's industrial technologies*
- Chairman: Mr. Kazuo Furukawa
- Organization:
  - *Incorporated administrative agency under the METI (Ministry of Economy, Trade and Industry) of the Japanese government*
  - *Established in 1980*
- Location: Kawasaki City, Japan
- Personnel: About 800
- Budget: US$ 1.5 Billion



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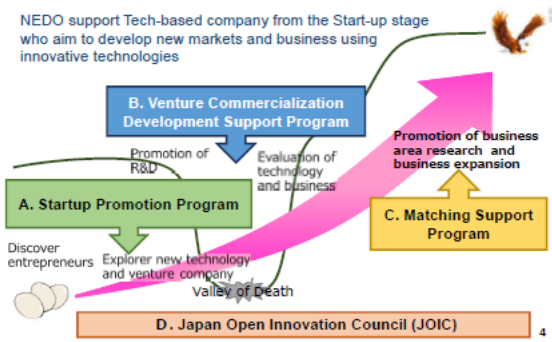
Activity Filed of NEDO

3

NEDO Open Innovation Platform

NEDO support Tech-based company from the Start-up stage who aim to develop new markets and business using innovative technologies



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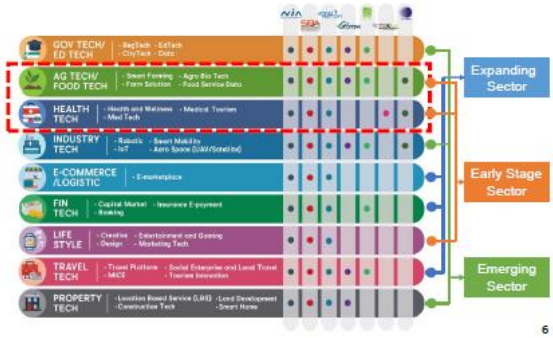
9 Startup Sectors in Thai



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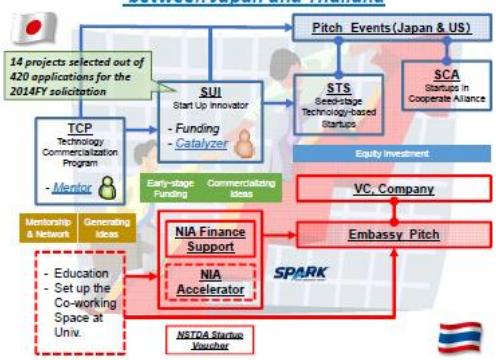
Comparison of Startup Support System between Japan and Thailand



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Objective of Collaboration Work

Setup the Science-based Startup Eco-System

1. Creation of "Thai Accelerator"
2. Creation of success case as "Role Model"
3. Establish and/or Revision of Regulation and Standard

8

The Concept of Activity

9

http://www.nedo.go.jp/english

Thank you very much for your kind attention!

Speaker's Information

Masaki SATO

Home Town / Country : Japan (Singapore)

Affiliation : Japan Science and Technology Agency (JST)

Position : Director, Singapore Offfice

E-mail : m5sato@jst.go.jp

Biography

Masaki Sato is Director, JST Singapore Office. He became a director from September, 2015. Since its establishment in 2009, the Office has supported research programs which foster and strengthen scientific ties between Japan and the countries in the region to address those problems mainly through joint research activities including enhancement of research capacity and human resource development, etc., for achieving mutual benefit and co-prosperity.

During his tenure at JST since 2001, he has worked in the Scientific and Technological Information Division. He firstly worked in information service department as a service technical staff, and assigned to the project for the information service that JST and Chemical Abstract Service (CAS), USA launched in 2003. Then, he moved to Moscow, Russia in 2004 to work at International Science and Technology Center (ISTC) as Senior Technology Coordination Manager until the end of 2007. ISTC is an intergovernmental organization connecting scientists from Russia, Kazakhstan, Armenia, Tajikistan, Kyrgyzstan, and Georgia with their peers and research organizations in the EU, Japan, Republic of Korea, Norway and the United States. ISTC facilitates international science projects and assists the global scientific and business community to source and engage with CIS and Georgian institutes that develop or possess an excellence of scientific know-how. Then he returned to JST in 2008 and worked in STI division until 2015.

Prior to joining JST, he worked at NEC Telecom System Ltd. where he was mostly in charge of integrated circuit design for telecommunication equipment. His most important achievement at the time is described in the paper “A Jitter and Data Duty Distortion Tolerated PLL Circuit for 156-Mbps Burst-Mode Transmission”, 1998 Symposia on VLSI technology and Circuits, sponsoring by the IEEE Electron Devices Society and Solid-State Circuits Society, and the Japan Society of Applied Physics. He holds a master’s degree of Electric Engineering from Kogakuin University.

Information of Organization

Japan Science and Technology Agency (JST) is one of the core institutions responsible for the implementation of science and technology policy in Japan*1, including the government’s Science and Technology Basic Plan*2. From knowledge creation—the wellspring of innovation—to ensuring that the fruits of research are shared with society and Japan’s citizens, JST undertakes its mission in a comprehensive manner. JST also works to provide a sound infrastructure of science and technology information and raise awareness and understanding of science and technology-related issues in Japan.

Mission: We contribute to the creation of innovation in science and technology as the core implementing agency of the fourth phase of the Science and Technology Basic Plan.

Visions:

1) To achieve innovation in science and technology through creative research and development.
2) To maximize research outcomes by managing research resources on the virtual network.
3) To develop the nation’s infrastructure for science and technology to accelerate innovation in science and technology.

About JST Singapore Office

JST established its Singapore Office in July 2009 which has taken over the function of our South-East Asia regional office from Kuala Lumpur, Malaysia. JST Singapore Office focuses on strengthening cooperation as well as promoting mutual understanding between JST and our counterpart organizations, scientists and researchers in South and Southeast Asian countries.

Introduction of JST

Singapore Office,
Japan Science and Technology Agency

July 4, 2017

科学技術振興機構

About JST

On April 1, 2015, the government of Japan established the National Research and Development Agencies by transforming the former Independent Administrative Agencies for R&D, including JST.

Fundamental goal : Maximize research achievements

- greater flexibility in institutional management based on the characteristics of R&D agencies
- greater responsibility to maximize research achievements

Mission Contribute to the creation of innovation

Vision

I. Achieving innovations in science and technology through creative research and development
II. Maximizing research outcomes by managing research resources on a virtual network
III. Developing Japan's infrastructure for science and technology so as to accelerate innovation in science and technology

http://www.jst.go.jp/EN/about/message.html

STI Funding Bodies

Major funding bodies in Japan

	JSPS Japan Society for the Promotion of Science	JST Japan Science and Technology Agency	NEDO New Energy and Industrial Technology Development Organization	AMED Japan Agency for Medical Research and Development
Presiding Ministry	MEXT	MEXT	METI	MEXT, METI, MHLW
Mission	Promotion of academic research and STI human resource development	Promotion of STI and development of its environments and infrastructures	Development of new energy resources and energy conservation technologies	Promotion of medical R&D and development of its environments and infrastructures
Budget of FY2015 (Million USD*)	3,014 (FY2014)	1,208	1,319	1,248
Employees	148	1,247	≈ 800	≈ 300

* 1 USD = 100 JPY

Major Operation of JST

R&D Strategy	Strategic Basic Research	Innovative Research	Commercialization R&D
R&D Strategy Planning	Promoting Creation of Science, Technology and Innovation		
Center for R&D Strategy (CRDS)	Strategic Promotion of Basic Researches		
China Research and Communication Center (CRCC)	R&D based on University-Industry Collaboration		
Center for Low Carbon Society Strategy (LCS)	Promotion of International S&T Joint Projects		
	R&D System Reform		
	Promotion of ImPACT, SIP		

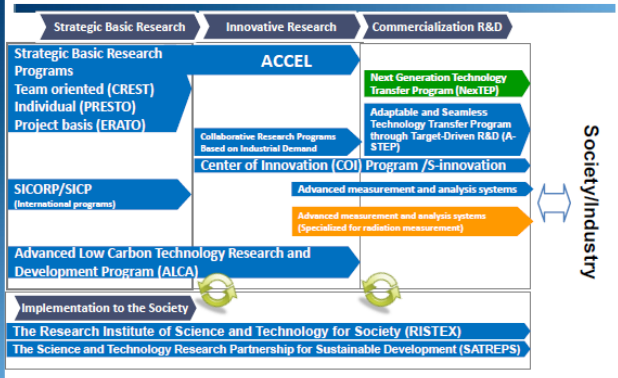
Total budget is about **100 billion yen**

S&T Infrastructure

Establishing an infrastructure to drive the generation of innovation
- Soft infrastructure to support innovation -

Knowledge Infrastructure | Next-Generation Development | Science Communication

Overview of Major Funding Programs of JST



About Strategic Basic Research Programs

Strategic Objectives designated by the Government

Development and Operation of Virtual Networking Research Institutes

- Program Director oversees the overall system and considers management direction
- Establishment of Research Areas and Program Officers (Research Supervisors, etc.)best suited for achieving objectives
- Identification of researchers with exceptional pioneering qualities and originality, based on the Program Officers judgment
- Flexible, dynamic decision-making on research plans and research funding allocation in accordance with research progress achieved and other factors.

<Research Programs>

Creating the Seeds for New Technology (CREST, PRESTO, ERATO, ACCEL)

Advanced Low Carbon Technology Research and Development Program (ALCA)

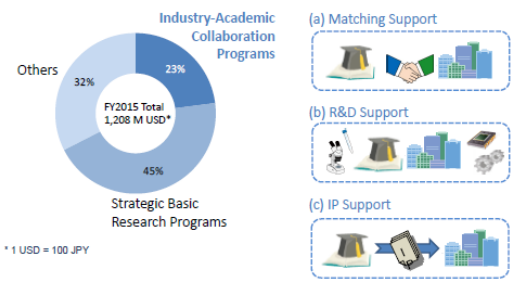
Research Institutes of Science and Technology for Society (RISTEX)

Prioritized Area: Green Innovation | Life Innovation | Nanotechnology and Materials Science | ICT | S&T for Society and Social Infrastructure

Towards Science and Technology Innovation

Industry-Academic Collaboration Programs

JST's budget & support



* 1 USD = 100 JPY

Remarkable Achievements of JST's Industrial-Academic Collaborative ProjectS

1960 | 1970 | 1980 | 1990 | 2000 | 2010

1959- Artificial quartz

1972-1976 GaAlAsRed LED

1980- Natural interferonβ

1991-1996 Bi-Based superconducting

2001-2004 Water- ^{18}O for PET (positron-emission tomography)

Since 1958

1978-1980 Magnetic material Amorphous metals

1986- GaN Blue LED

1991- ・1998- NOYORI catalyst

2005- Producing antibodies for therapeutic and industrial use

2006- Low-cost ultrasmall satellite with short-term R&D

The total sales of these products are estimated to be upward of 6.8 billion USD from 1958 to 2013.

Nobel Prize in Physics (2014)

Nobel Prize in Chemistry (2001)

Our Recent Top Achievements



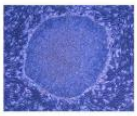

Prof. I. Akasaki
Prof. H. Amano
Prof. S. Nakamura

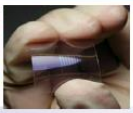
Blue Light-emitting Diode
The Nobel Prize 2014

Prof. Shinya Yamanaka

iPS Cell
The Nobel Prize 2012

Discovery that mature cells can be reprogrammed to become pluripotent

Prof. Hideo Hosono

IGZO Oxide Semiconductor TFT

Invention of thin film oxide semiconductor transistor for high-resolution low-power consumption display

Global Activities of JST

Promote Science &Technology Diplomacy

Bilateral Joint Funding (SICP)
More than 400 projects
since 2003 with 23 countries/area

SATREPS
e-ASIA JRP
BELMONT FORUM
CONCERT-JAPAN

Maximize R&D outcomes through global activities

Bilateral Joint Funding (SICORP)
23 projects since 2009
with 6 countries and area

Globalization of Strategic Basic Research program
CREST さきがけ

Contribute to global platforms of funding agencies

GLOBAL RESEARCH COUNCIL

Funding Agency Presidents' Meeting In Kyoto


SATREPS

Aims of SATREPS

- Enhancing Cooperation in Science & Technology
- New Technology, New knowledge, Innovations
- Capacity Development

Practical Utilization/Implementation of research outcomes

SATREPS program structure

MEXT, JST, AMED — collaboration — MOFA, JICA

Competitive Fund — Technical Cooperation

International Joint Research

Japan: Research Institutions — Research Partnership — Counterpart Country: Research Institutions

Research Areas

- Environment and Energy
- Bio resource Utilization
- Disaster Prevention and Mitigation
- Infectious Diseases Control

FY2015～ JST → AMED

※AMED: Japan Agency for Medical research and Development

Research Period
3-5 years

Research Funding
Approx. JPY96 million / project / year
(USD* 960,000)

SATREPS

Number of the projects by ASEAN countries and research fields

		Environment	Low-carbon	Bio resources	Disaster Prevention and Mitigation	Infectious Diseases
Indonesia	16 ※2	4 ※2	4	3	2	3
Thailand	13 ※1	4	3	3 ※1	1	2
VietNam	10※1	2	2	4 ※1	1	1
Philippines	7 ※2	1 ※2		1	2	3
Malaysia	4		2	1	1	
Cambodia	2 ※2	1		1 ※1		
Myanmar	2			1	1	
Laos	1					1
Total	52 projects	12	11	14	8	10

※1) Collaborative research among VietNam/Cambodia/Thailand
※2) Collaborative research between Philippines/Indonesia

In total (since 2008) : **125 projects with 47 countries**

SATREPS

2016 selected projects with ASEAN

Country	Project Title	Research Field
Indonesia	The Project for Development and Implementation of New Damage Assessment Process in Agricultural Insurance as Adaptation to Climate Change for Food Security	Environment
Indonesia	The Project for Marine Techno Park Computing System for Food Security and Sustainabilities (MARITEP-COMSYSS)	Bioresources
Indonesia/ Philippines	The Project for Comprehensive Assessment and Conservation of Blue Carbon Ecosystems and Their Services in the Coral Triangle (Blue CARES)	Environment
Philippines	The Project for Development of Extreme Weather Monitoring and Alert System	Disaster Prevention and Mitigation
Thailand	The Project for Comprehensive Conversion of Biomass and Waste to Super Clean Fuels by New Solid Catalysts	Low-carbon

SATREPS

2017 new projects with ASEAN

Country	Project Title	Research Field
Vietnam	"The Project for Establishment of Environmentally Sound Management of Construction and Demolition Waste and Its Wise Utilization for Environmental Pollution Control and for New Recycled Construction Materials"	Environment
Thailand	"The Project for e-Integrated Smart Transport to Dually Achieve CO2 Reduction and People's Well-Being to Support THAILAND 4.0"	Low-carbon
Myanmar	"The Project for ASEAN Network System for Rice Genomic Breeding"	Bioresources
Thailand	"The Project for Integrated Research on Resilience Enhancement of Industry Complexes Through Establishment of Area-BCM Operations and Development Toolkits for Disaster Risk Analysis and Information Sharing for the Wellbeing of Population at Risk"	Disaster Prevention and Mitigation
Philippines	"The Project for Development of an Improved Laboratory Surveillance System for Rabies Elimination"	Infectious Diseases (AMED)

e-ASIA Joint Research Program (e-ASIA JRP)

Objective

To develop a Science &Technology community
to promote innovation and
to resolve shared challenges in the East Asian region
through Research Cooperation

e-ASIA Joint Research Program (e-ASIA JRP)

Brief Summary

1) Formally inaugurated on June 28, 2012

2) Like a consortium of funding agencies ('Member Organizations')

3) Supporting/funding international joint-research projects as well as facilitating researcher interaction in the East Asian region on a multilateral basis

4) Projects are selected through open Joint Call for Proposals (competitive funds)

e-ASIA Joint Research Program (e-ASIA JRP)

Current Member Organizations

- As of April 2017, we now have 19 Member Organizations from 13 countries

Australia NHMRC	Cambodia MOH	Indonesia RISTEKDIKIT	Japan MEXT(JST) AMED	Lao PDR MOST MOH	Malaysia MOSTI	Myanmar MOE
New Zealand HRC	Philippines DOST	Russia RFBR	Thailand NSTDA TRF TCELS ARDA	USA NIAID(NIH) NCI(NIH)	Vietnam MOST	Prospective Guest Partner: Sri Lanka NSF

e-ASIA Joint Research Program (e-ASIA JRP)

Calls for Proposals

	Participating Countries	Call	Topics	Award	Appl.
1st	JP, TH, VN	May, 2012	Nanotechnology / Materials	2	11
			Biomass and Plant Science	1	3
2nd	JP, VN, PH	Feb, 2013	Infectious Diseases	2	8
3rd	10 Orgs from 9 countries (JP, KH, ID, LA, MN, NZ, PH, TH, US)	Feb-Mar, 2014	Infectious Diseases	5	22
4th	JP, TH, PH	Apr-May, 2014	Nanotechnology / Materials	1	2
5th	15 Orgs from 11 countries (KH, ID, JP, LA, MN, NZ, PH, RU, TH, US, VN)	Aug-Oct, 2015	Intelligent Infrastructure for Transportation	1	3
			Disaster Risk Reduction	2	10
			Bioenergy	2	9
			Health Research	4	17
6th	12 Orgs from 10 countries (KH,ID, JP, MN, NZ, PH, RU, TH, US, VN)	Dec 2016 - Feb 2017	Health Research	Under selection Process	16
		Jan-March 2017	Functional Bio-Nanotechnology for Innovative Materials System		18
			Intelligent Infrastructure for Energy		3

e-ASIA JRP (e-ASIA Joint Research Program)

Advancement of Asian Cassava Molecular Breeding by Cutting-edge Technologies

FINISHED FY2012-2015

Advancement of molecular breeding by cutting-edge technologies

Dr. Motoaki Seki
RIKEN Plant Science Center
Japan

Molecular breeding and transcriptome study of Cassava disease

Dr. Ham Huy Le
Institute of Agricultural Genetics
Vietnam

Molecular breeding and transcriptome analysis for improving disease-resistant Cassava

Dr. Jarunya Narangajavana
Mahidol University
Thailand

Now Continuously Supported as part of a SATREPS Project (2016-)

Outline of SSP in 2016

Country name	open application	high school	STI officers	total
Brunei Darussalam	6	0	3	9
Cambodia	68	12	3	83
Indonesia	258	60	4	322
Lao PDR	34	12	3	49
Malaysia	280	36	3	319
Myanmar	181	36	3	220
Philippines	88	23	3	114
Singapore	73	13	3	89
Thailand	493	48	3	544
Vietnam	343	36	3	382
ASEAN total	1824	276	31	2131
SSP total	4,215	1062	242	5519

Ex:

Functionality sitology program, at Hiroshima University

Visiting Shinkansen Tunnel, at Nagasaki University

Items	Contents
(1)Eligible youth to be invited	①Youth who are basically under 40 years of age ②Youth who have never stayed in Japan before
(2)Term of visits	1 week ～ 3 weeks
(3)Sub-Programs	①Open Application Program (**with Japanese Partner**) ②Sakura Science High School Program (hosted by JST) ③Special Sakura Programs (ex. **ASEAN Secretariat special Program**)
(4)Cost	covered by JST (Int'l airfare, Accommodation, Meals, etc.)

ASEAN-JAPAN Workshop on Science, Technology, and Innovation

Brief presentations and Group discussion were held to exchange information and views for addressing common challenges and more effective promotion of STI cooperation between ASEAN and Japan.

【Japanese Presentations by 8 inst.】
- Council for Science, Technology and Innovation, Cabinet Office (CSTI)
- Ministry of Foreign Affairs of Japan (MOFA)
- Ministry of Education, Culture, Sports, Science and Technology (MEXT)
- National Institute of Science and Technology Policy(NISTEP)
- Japan Science and Technology Agency(JST)
- Japan Society for the Promotion of Science (JSPS)
- Japan Agency for Medical Research and Development(AMED)
- New Energy and Industrial Technology Development Organization(NEDO)

【Theme of Group discussion】
1. STI Policy of Each member country including international collaboration
2. Funding policy in the field of STI of each country
3. Human resource development and higher education

Impression of workshop

From Thailand

It was a valuable experience that I got the opportunity to learn in many fields, including application of Japanese S&T.
I learned a lot such as Collaboration between universities and companies in and outside of Japan , Collaboration in the science and technology innovation field , How to strengthen the academy and Social problems accompanying development.
It was a precious opportunity to be able to expand the network with participants from ASEAN countries and people in Japan. Thank you very much for making such a really wonderful program.

At the workshop

Chair's Information

Mamoru KANZAKI

Home Town / Country : Hokkaido, Japan

Affiliation : Graduate School of Agriculture, Kyoto University

Position : Professor

E-mail : mkanzaki@kais.Kyoto-u.ac.jp

Biography

2013- Professor, Graduate School of Agriculture, Kyoto University.
1999: Associate Professor, Graduate School of Agriculture, Kyoto University.
1995: Lecturer, Faculty of Science, Osaka City University.
1985 : Research Associate, Faculty of Science, Osaka City University.
1985: Dr. Sci. (Osaka City University), 1982: M. Sci. (Chiba University), 1979: B.Sci.(Tokyo University of Agriculture and Technology).

Area of Interest

Tropical Forest Ecology, Biodiversity of Tropical Forests, Sustainable Forest Management, Canopy Plants Ecology, Impact of Shifting Cultivation and other Agricultural Activities on Forest Vegetation, Coexistence of Forests and Society.

Research Activities and Achievements

1) Achievements;

Aye Aye Saw, Mamoru Kanzaki, 2015. Local Livelihoods and Encroachment into a Mangrove Forest Reserve: A Case Study of the Wunbaik Reserved Mangrove Forest, Myanmar. Procedia Environmental Sciences 28: 483-492. http://dx.doi.org/10.1016/j.proenv.2015.07.058.

Inada, Tomoya, Kaoru Kitajima, Mamoru Kanzaki, Widiyatno Ano, Suryo Hardiwitono, Ronggo Sadono, Priyo Eko Setyanto and Saminto 2015. Neighboring tree effect on the survival and growth of Shorea johorensis under a line planting system in a Bornean dipterocarp forest. TROPICS 24 (1) 23-31.

Bo Sann, Mamoru Kanzaki and Seiichi Ohta 2016. Vegetation patterns and species-filtering effects of soil in secondary succession in a tropical dry forest in central Myanmar, Journal of Tropical Ecology 32(2):116-124. doi:10.1017/S026646741600002X.

Nakanishi, Akira, Witchaphart Sungpalee, Kriangsak Sri-ngernyuang, Mamoru Kanzaki 2016. Large variations in composition and spatial distribution of epiphyte biomass on large trees in a tropical montane forest of northern Thailand. Plant Ecology 217(9):1157-1169. DOI 10.1007/s11258-016-0640-7

Bo Sann, M Kanzaki, M Aung & KM Htay. 2016. Assessment of the recovery of a secondary tropical dry forest after human disturbance in central Myanmar. Journal of Tropical Forest Science 28(4): 479–489.

Izuno, Ayako, Mamoru Kanzaki, Taksin Artchawakom, Chongrak Wachrinrat, Yuji Isagi 2016. Vertical Structure of Phyllosphere Fungal Communities in a Tropical Forest in Thailand Uncovered by High-Throughput Sequencing. PLoS ONE 11(11): e0166669.

Inada,T. Widiyatno, S Hardiwitono, S Purnomo, IBW Putra, K Kitajima1 & M Kanzaki 2017. Dynamics of forest regeneration following logging management in a Bornean lowland dipterocarp forest. Journal of Tropical Forest Science 29(2): 185–197.

2) Ongoing activities; JASTIP Work Package 3, Bioresources and Biodiversity

Message

Search and effective utilization of bioresources from tropical forests and increase the economical benefit from the forests are the key points to save the remaining tropical forests which are facing to the high risk of conversion to the plantation of oil palm, fast growing tree species or other commercial crops. In on going JASTIP project, therefore, I am willing to support the exploration of biodiversity and the effective utilization of it in the ASEAN region.

Speaker's Information

Chiaki OGINO

Home Town / Country : Kobe, Japan

Affiliation : Graduate School of Engineering, Kobe University

Position : Professor

E-mail : ochiaki@port.kobe-u.ac.jp

Biography

2016-: Professor, GSE, Kobe University, 2007-2016: Associate Professor, GSE, Kobe University, 2002-2007: Assistant Professor, Graduate School of Natural Science and Technology, Kanazawa University, 2002: Doctor of Engineering (Kobe University), 1999–2001: Assistant professor, Department of chemistry and chemical engineering, Kanazawa University, 1999: JSPS Research Fellowships for Young Scientists, 1997: Master of Engineering (Kobe University)

Area of Interest

Yeast breeding for bio-refinery, Ethanol fermentation from cellulosic material, Metabolic engineering in *Streptomyces* , Protein expression by fungi and *Streptomyces*, Application of AFM to bimolecular interaction assessment, and Application of nanoparticle to cancer therapy

Research Activities and Achievements

1) Achievements

A., Prima, Hara, Y. K., A. C. Djohan, Kashiwagi, N., P. Kahar, Ishii, J., Nakayama, H., Okazaki, F., B. Prasetya, Kondo, A., Yopi, **Ogino, C.** Glutathione production from mannan-based bioresource by mannanase/mannosidase expressing *Saccharomyces cerevisiae*, *Bioresource Technology*, in press

Kashiwagi, N., **Ogino, C.,** Kondo, A. Production of chemicals and proteins using biomass-derived substrates from a Streptomyces host, *Bioresource Technology*, in press

Amoah, J., Ishizue, N., Ishizaki, M., Yasuda, M., Takahashi, K., Ninomiya, K., Yamada, R., Kondo, A., **Ogino, C.** Development and evaluation of consolidated bioprocessing yeast for ethanol production from ionic liquid-pretreated bagasse, *Bioresource Technology*, in press

Teramura, H., Sasaki, K., Kawaguchi, H., Matsuda, F., Kikuchi, J., Shirai, T., Sazuka, T., Yamasaki, Y., Takumi, S., **Ogino, C.,** Kondo, A. Differences in glucose yield of residues from among varieties of rice, wheat, and sorghum after dilute acid pretreatment. *Bioscience Biotechnology and Biochemistry*, in press

N. Rahmani, Kashiwagi, N., Lee, J., Niimi-Nakamura, S., Matsumoto, H., P. Kahar, Lisdiyanti, P., Yopi, Y., Prasetya, B., **Ogino, C.,** Kondo, A. Mannan endo-1,4-ß-mannosidase from *Kitasatospora sp.* isolated in Indonesia and its potential for production of mannooligosaccharides from mannan polymers, *AMB Express*, in press

Kawaguchi, H., Katsuyama, Y., Danyao, D., P. Kahar, Nakamura-Tsuruta, S., Teramura, H., Wakai, K., Yoshihara K., Minami, H., **Ogino, C.,** Ohnishi, Y., Kondo, A. Caffeic acid production by simultaneous saccharification and fermentation of kraft pulp using recombinant *Escherichia coli*, *Appl Microbiol Biotechnoliol.*, in press

Amoah, J., Quayson, E., Hama, S., Yoshida, A., Hasunuma, T., **Ogino, C.,** Kondo, A. Simultaneous conversion of free fatty acids and triglycerides to biodiesel by immobilized *Aspergillus oryzae* expressing *Fusarium heterosporum* lipase., *Biotechnology Journal*, in press

2) Ongoing activities

I am project leader of SATREPS project in Indonesia: Innovatiove Bio-production in Indonesia (IBioI). This project mainly focused on the utilization of biomass for bio-fuel and bio-chemicals production. Especially, we focused on the waste biomass in palm industry and sugarcane industry for utilization. In addition, I also have other intends regarding a lignin separation from feedstock biomass with specific extraction, and microbial breeding for phenol-derivative chemicals synthesis by metabolic engineered microbes.

1

4th JASTIP Symposium "Biomass to Energy, Chemicals, and Functional Materials"
3rd and 4th July 2017@NSTDA, Thailand

Bio-refinery Strategy for Fuel Production in Indonesia

Chiaki Ogino,[1] Prihardi Kahar,[1] Yopi,[2] Bambang Prasetya,[3] and Akihiko Kondo[1]

[1]*Department of Chemical Science and Engineering, Graduate School of Engineering, Kobe University, 1-1 Rokkodaicho, Nada-ku, Kobe 657-8501*

[2]*Research Center for Biotechnology, Indonesian Institute of Sciences, Komplek CSC-LIPI, Jl. Raya Bogor Km.46, Cibinong 16911, West Java, Indonesia*

[3]*National Standardization Agency of Indonesia, Gedung I BPPT Jl. M.H. Thamrin No.8, Kebon Sirih, Jakarta Pusat 10340*

2

About Kobe and our University

3

Kobe University
Bio-production Research Group
(Team Leader: Prof Akihiko Kondo)

Many Thanks to all member in our Lab.
32 academic staffs including post-doc
43 students including PD candidate
35 technical assistants
Many other peoples Total 140 (?)

4

Integrated Biorefinery Research Institute in Kobe University

Only research institute in Japan

→ Collaborations with more than 20 Japanese Companies.

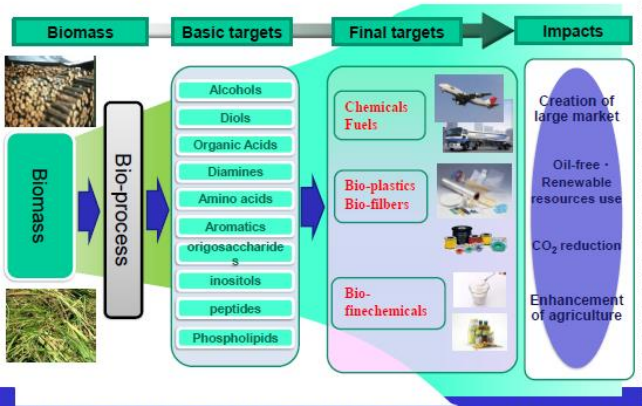
Research equipment

Bioreactor (2L – 100L)
Pretreatment equipment
DNA sequencer
Metabolite analysis equipment

Collaboration with LIPI (2011～)
→ We focused on the utilization possibility of Indonesian's biomass for biorefinery

5

Systemized bio-refinery process



6

Utilization possibility of Indonesian's Biomass

→ Most of waste cellulosic biomass have been burned

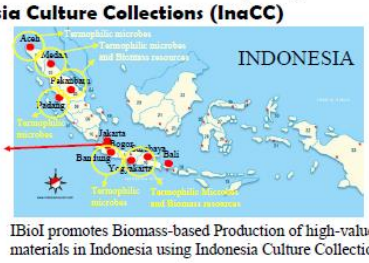
Biomass	Generated Place	Productivity [million t/year]	Energy potential [million GJ/year]
Rubber wood (ゴムの木)	Sumatera, Kalimantan, Java	41 (5年間隔で置換)	120
Logging residues (伐木)	Sumatera, Kalimantan	4.5	19
Sawn timber residues (製材残差)	Sumatera, Kalimantan	1.3	13
Plywood and veneer production residues (合板残材)	Kalimantan, Sumatera, Java, Irian Jaya, Maluku	1.5	16
Sugar residues (サトウキビ残渣)	Java, Sumatera, South Kalimantan	Bagasse (バガス): 10 Cane tops: 4 Cane leaves: 9.6	78
Rice residues (稲わら残渣)	Java, Sumatera, Sulawesi, Kalimantan, Bali/Nusa Tenggara	Husk: 12 Bran 2.5 Stalk: 2 Straw: 49	150
Coconut residues (ココナッツ残差)	Sumatera, Java, Sulawesi	Shell: 0.4 Husk: 0.7	7
Palm oil residues (パームオイル残差)	Sumatera new areas: Kalimantan, Sulawesi, Maluku, Nusa Tenggara, Irian Jaya	Empty fruit bunch (EFB): 3.4 Fibres: 3.6 Palm shells (PKC): 1.2	67

→ There are various kinds of biomass for bio-refinery industry

Source: ZREU (Zentrum fur rationell Energieanwendung und Umwelt GmbH), 2000, Biomass in Indonesia–Business Guide

7

Innovative Bio-Production in Indonesia(iBioI) and Indonesia Culture Collections (InaCC)



IBioI promotes Biomass-based Production of high-valued materials in Indonesia using Indonesia Culture Collection.

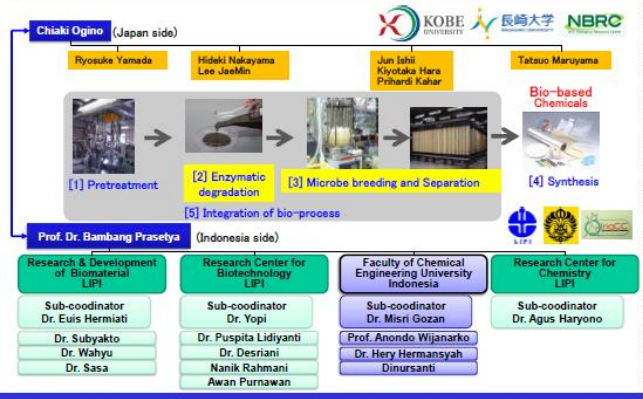
InaCC Building in LIPI Cibinong

IBioI members

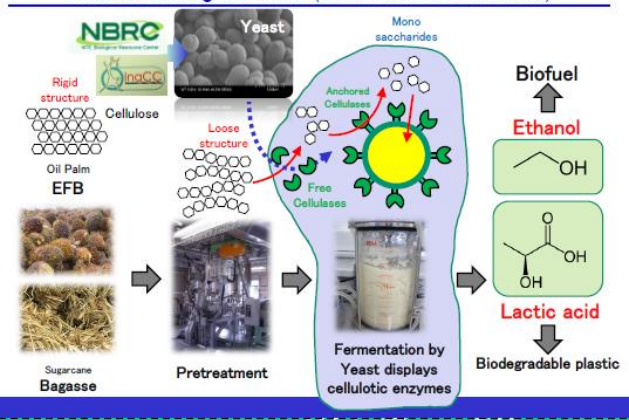
8

Five Key Technologies in SATREPS project

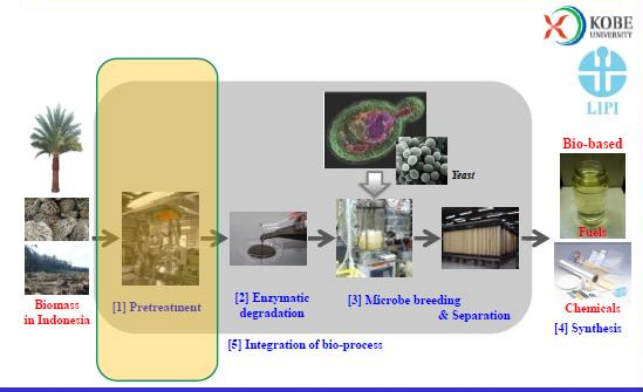
Innovative Bio-production in Indonesia (iBioI) from 2012



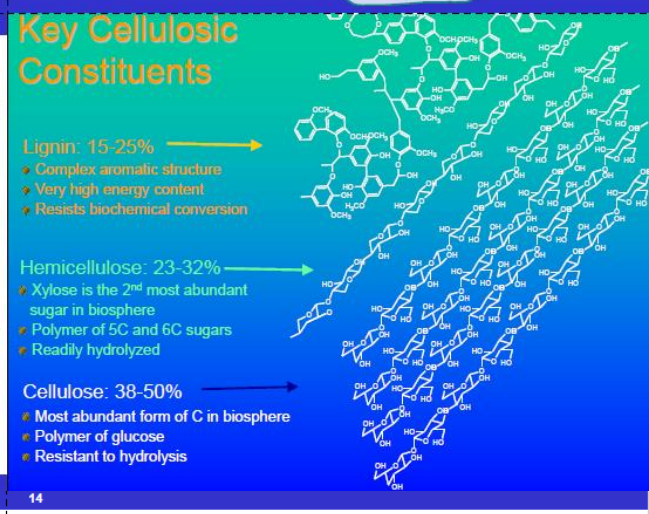
Consolidated Conversion of Lignocellulosic Biomass into High-Valued Starting Materials (Ethanol and Lactic Acid)



Five Key Technologies in SATREPS project



Key Cellulosic Constituents

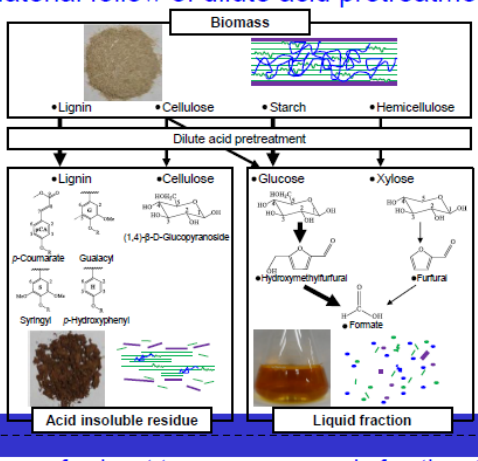


Lignin: 15-25%
- Complex aromatic structure
- Very high energy content
- Resists biochemical conversion

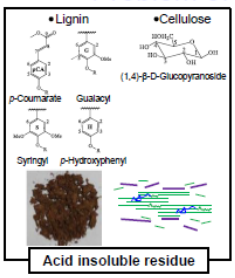
Hemicellulose: 23-32%
- Xylose is the 2nd most abundant sugar in biosphere
- Polymer of 5C and 6C sugars
- Readily hydrolyzed

Cellulose: 38-50%
- Most abundant form of C in biosphere
- Polymer of glucose
- Resistant to hydrolysis

Material follow of dilute acid pretreatment



Problem of dilute acid pretreatment



Dilute acid pretreatment can not separate cellulose and lignin.

Lignin inhibit enzymatic hydrolysis of cellulose.

Organosolv pretreatment can separate cellulose and lignin. But, this method require high amount of organic solvent.

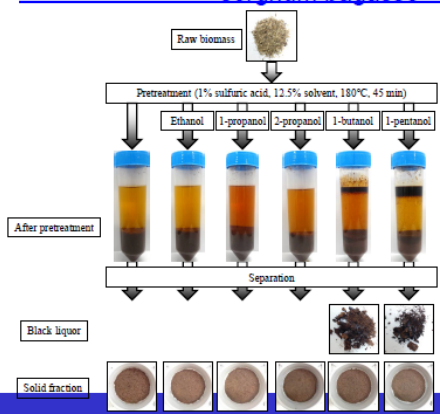
II

High cost.

Decreasing the concentration of organic solvent is necessary to reduce the pretreatment cost.

Which of the organic solvent is suitable for pre-treatment?

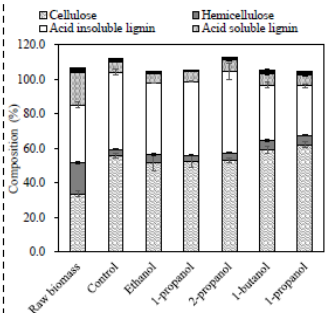
Influence of solvent type on organosolv fractionation of sorghum bagasse



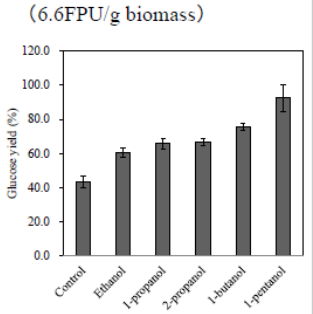
Three fractions (solid, liquid, and black liquor) were obtained with 1-butanol or 1-pentanol as the solvent.

Analysis of Cellulose-enriched solid fraction

Composition of solid fraction



Enzymatic saccharification (6.6FPU/g biomass)



Lignin removal from solid fraction was higher when 1-butanol or 1-pentanol was used as the solvent. And, lignin removal enhance the enzymatic saccharification efficiency.

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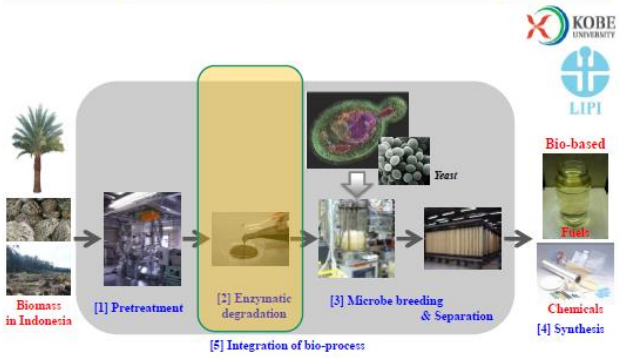
Five Key Technologies in SATREPS project



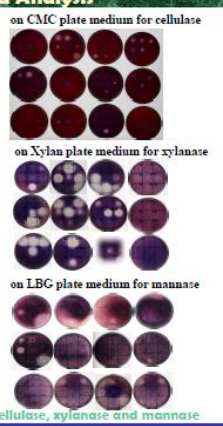
The sources of Actinomyces Isolates in Indonesia

The kinds of Actinomyces Isolates in Indonesia

The genus *Streptomyces, Kitasatospora, Streptacidhiphilus*

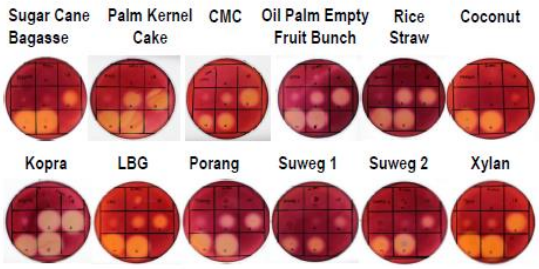
The genus *Actinoplanes, Micromonospora, Nocardia, Gordonia, Dermatophilus*

Screening of Indonesia Rare Actinomycetes Isolates based on Halo-formation and Congo Red Analysis



Many kinds of actinomycetes isolates show high activities of cellulase, xylanase and mannase

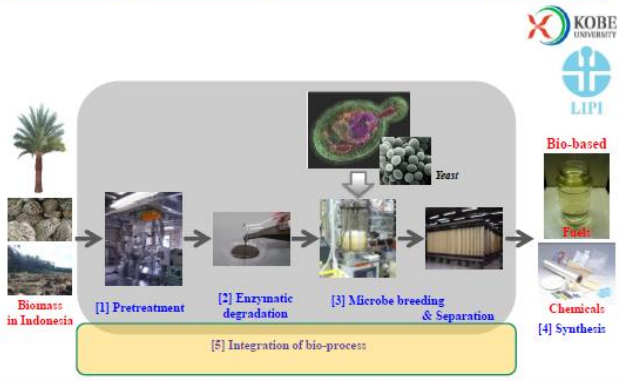
Production of Cellulase from Actinomycetes from many kinds of practical biomass



Isolate (No. 18) could produce Cellulase at high concentration and high enzyme activity from many kinds of practical biomass such as sugarcane bagasse, palm kernel cake, oilpalm empty fruit bunch, rice straw, etc, more better than that from CMC.

22

Five Key Technologies in SATREPS project



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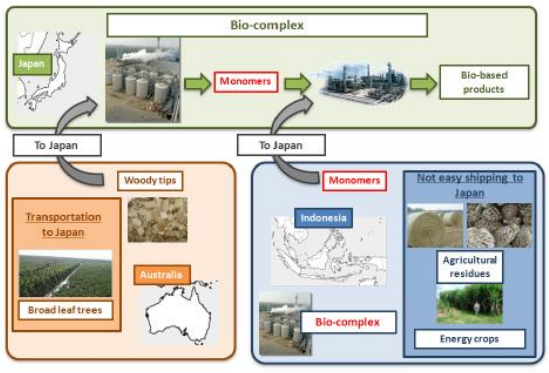
Establishment of Bio-Complex and biomass supply



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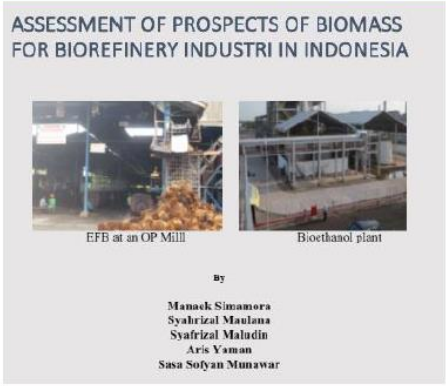
White paper of biomass in Indonesia



25

Business meeting between Japan and Indonesia

26

Process Development

Bench-scale plant in Kobe University

50 kg/h presser

100 kg/batch steamer

100 L liquefaction reactor

50 L fermentation reactor

30 L fermentation reactor (x3)

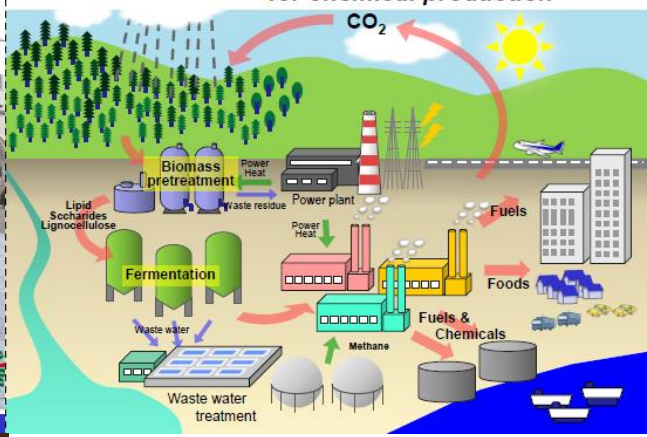
Cell recycling system

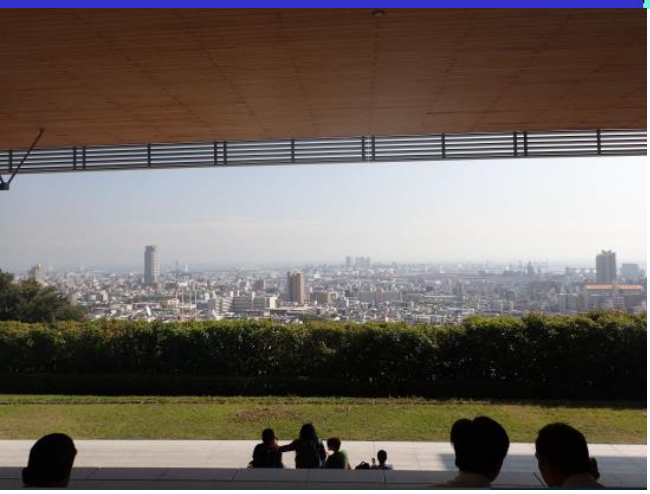
27

January 2017

Acknowledgement to SATREPS member

Biomass complex strategy for chemical production





Speaker's Information

Puspita Lisdiyanti

Home Town / Country : Bogor, Indonesia

Affiliation : Research Center for Biotechnology, LIPI

Position : Senior Researcher

E-mail : puspita.lisdiyanti@bioteknologi.lipi.go.id

Biography

1987-present: Researcher, RC Biotechnology, LIPI; **2015-2017**: Research Coordinator of LIPI Priority Program on Food Security and Drug Discovery; **2006-2014**: Head of Division, RC Biotechnology LIPI; **2002-2004**: Research Associate, Tokyo Univ. Agriculture (TUA); **1999-2002**: Doctor of Agriculture Chemistry (TUA); **1997-1999**: Master of Agriculture Chemistry (TUA); **1988-1992**: Bachelor of Agriculture Chemistry (Tokyo Univ. Agric. & Techonol.)

Area of Interest

Exploring the microbial diversity and Elucidating the potential uses of microbes. Food Biotechnology

Research Activities and Achievements

Research Experiences and Achievements

1. **LIPI-JBA**, Japan: Exploration of Lactic Acid Bacteria and Acetic Acid Bacteria from Indonesia (1996-2000). Five scientific publications described new species & genera and 200 isolates were obtained .
2. **LIPI-NITE**, Japan: Taxonomy and Ecological Studies of Fungi and Actinomycetes from Indonesia and Japan (April 2003-March 2009). were obtained. Several scientific publications and around 6.000 isolates were obtained.
3. **ITSF RESEARCH GRANT**: Ecological Study of Rare Actinomycetes (2004). Research Fund from Indonesia Toray Science Fundation (ITSF). One scientific publications was obtained.
4. **LIPI COMPETITIVE RESEARCH PROGRAM**: Screening of Actinomycetes Producing an ATPase Inhibitor of Japanese Encephalitis Virus RNA Helicase (2004-2006), funded by LIPI. Two scientific publications were obtained.
5. **LIPI COMPETITIVE RESEARCH PROGRAM**: Oil Degrading Bacteria: Exploration and Application (2007-2009), funded by LIPI. Two scientific publications were obtained.
6. **LIPI COMPETITIVE RESEARCH PROGRAM**: Biogrouting: Exploration and Application (2010-2012), funded by LIPI. Two scientific publications and 20 potential strains were obtained.
7. **SATREPS PROJECT**: Development of Internationally Standarized Microbial Culture Collection in Indonesia, LIPI-JICA-JST-NBRC, April 2011-March 2016. Microbial resources center in Indonesia for supporting reaseach and utilization of tropical bioresources and promoting taxonomy and biotechnology was established. More 2000 microbes were deposited in InaCC (Indonesian Culture Collection).

Ongoing activities

1. **SATREPS PROJECT**: Innovative Bio-production in Indonesia (ibioI): Integrated Bio-refinery Strategy to Promote Biomass Utilization using Super-microbes for Fuels and Chemicals Production, LIPI-JICA-JST-Kobe Univ., April 2013-March 2018.
2. **SATREPS PROJECT**: Searching Lead Compounds of Anti-malarial and Anti-amebic Agents by Utilizing Diversity of Indonesian Bioresources, BPPT-JICA-JST-Tsukuba Univ., April 2014-March 2019
3. **SATREPS PROJECT**: Revegetation of alang-alang (Imperata cylindrica) field combined with sustainable production and utilization of biomass (for energy solution), LIPI-JICA-JST-Kyoto Univ., April 2015-March 2020.
4. **BIODIVERSITY OF HEALTH**: Isolation of new antibiotics compounds from unknown actinomycetes (Indonesia-Germany Collaboration Research). June 2015-31 May 2018.

Message

From the research results of exploring microbes in ASEAN Countries, especially from Indonesia in my case, it is revealed that the richness of microbial diversity in the regions. The uses of microbes for better of life of human being is needed. The collaboration research is necessary.

Microbial Resources as a Source for Development of Biorefinery

4th JASTIP Symposium, 4 July 2017, Bangkok, Thailand

For further information:
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Outline

- Microbial Diversity and Culture Collection
- Screening and Cloning of Microbial Collection for Biorefinery Development
- Networking and Linking of Culture Collections

Microbial Diversity and Culture Collection (1996-2016-Present)

- Research Center for Biotechnology LIPI
- Research Center for Biology LIPI
- LIPI – JBA Project (FY 1996-2001)
- LIPI – NITE Project (FY 2003-2008)
- Satreps InaCC (FY 2010-2015)

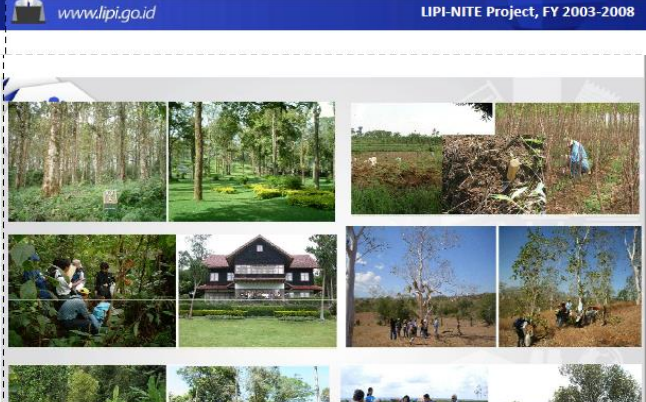
Joint Collaboration Research with Japan

Six Years Collaboration with Japan (April 2003-March 2009)

→Isolation and Identification of Actinomycetes, Fungi, and Yeasts from Indonesia

→ Isolation and Identification of oil degrading bacteria from Indonesian environments

Sampling sites in Indonesia



Number of Identified Microorganisms

PA-1	Total isolates	Total genera
Fungi	2518	205
Yeast	525	27
Actinomycetes	3193	64
Total	6211	296

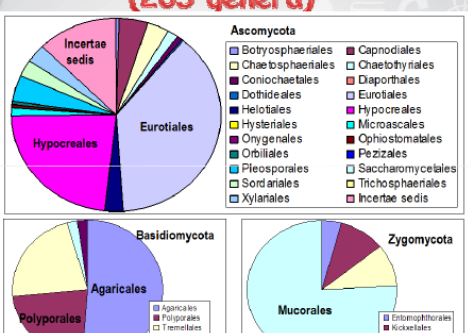
PA-2	Total isolates	Total genera
PAHs degrading bacteria	750	

Number of Indonesian Fungi

Year	Isolated	Selected	Discarded	Storage
2003	1,376	425	2	423
2004	1,363	300	4	296
2005	1,317	824	17	807
2006	775	411	8	403
2007	742	486	146	340
2008	1,914	250	3	247
Total	7,487	2,696	180	2,516

205 genera

Taxonomic Position of Fungi Isolates (205 genera)



Abundantly Fungi Isolated Group (>10 strains; 44 genera / 205 genera: 21.5%)

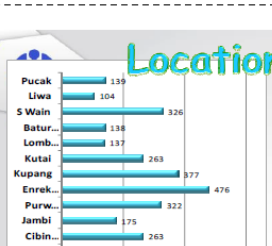
Genus	strains	Genus	strains	Genus	strains
Penicillium	341	*Lecanicillium*	24	*Humicola*	16
Aspergillus	194	*Phoma*	24	*Coprinellus*	16
Trichoderma	132	*Pestalotiopsis*	24	*Pseudocercospora*	14
Paecilomyces	92	*Chloridium*	23	*Myrothecium*	12
Fusarium	58	*Talaromyces*	21	*Mariannaea*	11
Cladosporium	55	*Gliocladium*	21	*Pochonia*	11
Acremonium	38	*Ochroconis*	21	*Staphylotrichum*	11
Clonostachys	37	*Colletotrichum*	20	*Cylindrocarpon*	10
Eupenicillium	35	*Nodulisporium*	20	*Stachybotrys*	10
Scytalidium	30	*Absidia*	18	*Monodictys*	10
Verticillium	30	*Mucor*	18	*Scolecobasidium*	10
Gonytrichum	29	*Phialophora*	17	*Triscelophorus*	10
Curvularia	27	*Pseudobotrytis*	17	*Mortierella*	10
Metarhizium	25	*Chaetomium*	17	*Gongronella*	10
Cunninghamella	25	*Scopuraliopsis*	16		

Actinobacteria:

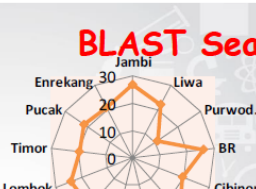
Currently, order Actinomycetales consist of 13 suborders, 42 families, and 198 genera; while order Rubrobacterales consist of 5 families (Zhi et al., 2009).

Indonesian Actinobacteria:
12 suborders, 27 families, and 65 genera for 3,193 isolates

Location



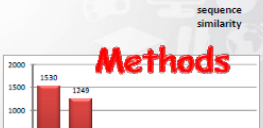
BLAST Search



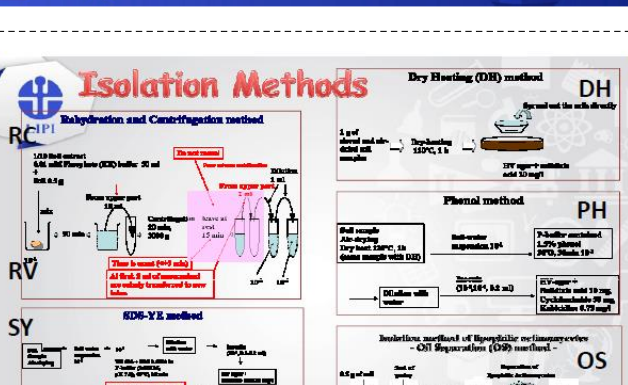
97-96% sequence similarity

Source

Methods



Isolation Methods



Diversity of Indonesian Actinobacteria

No.	Suborder	Litter	Soil	Total	%
Order Actinomycetales					
1	*Catenulisporineae*	0	2	2	0.06%
2	*Corynebacterineae*	1	105	106	3.32%
3	*Frankineae*	14	26	40	1.25%
4	*Glycomycineae*	1	0	1	0.03%
5	*Kineosporiineae*	83	9	92	2.88%
6	*Micrococcineae*	4	22	26	0.81%
7	*Micromonosporineae*	324	392	716	22.42%
8	*Propionibacterineae*	3	40	43	1.35%
9	*Pseudonocardineae*	24	49	73	2.29%
10	*Streptomycineae*	184	1702	1886	59.07%
11	*Streptosporangineae*	0	207	207	6.48%
Order Rubrobacterales					
12	*Patulibacteraceae*	1	0	1	0.03%
		638	2558	3193	100%

Description of New Taxa

1. Otoguro, M., Ratnakomala, S., Lestari, Y., Hastuti, R. D., Triana, E., Widyastuti, Y., & Ando, K. 2009. *Streptomyces baliensis* sp. nov., isolated from Balinese soil. Int. J. Syst. Evol. Microbiol., 59: 2158-2161
2. Yamamura, Y., Lisdiyanti, P., Ridwan, R., Ratnakomala, S., Sarawati, R., Lestari, Y., Triana, E., Kartina, G., Widyastuti, Y., & Ando, K. 2010. *Dietzia timorensis* sp. nov., isolated from soil. Int. J. Syst. Evol. Microbiol., 60: 451- 5 454
3. Lisdiyanti, P., Otoguro, M., Ratnakomala, S., Lestari, Y., Hastuti, R. D., Triana, E., Ando K., & Widyastuti, Y. 2010. *Actinokineospora baliensis* sp. nov., *Actinokineospora cibodasensis* sp. nov., and *Actinokineospora cianjurensis* sp. nov. isolated from Indonesia. Int. J. Syst. Evol. Microbiol., in press.
4. Otoguro, M., Yamamura, H., Tamura, T., Irzaldi, R., Ratnakomala, S., Ridwan, R., Kartina, G., Triana, E., Nurkanto, A., Lestari, Y., Lisdiyanti, P., Widyastuti, P., & Ando, K. 2011. *Actinophytocola timorensis* sp. nov. and *Actinophytocola corallina* sp. nov., isolated from soil in Indonesia

InaCC (Indonesian Culture Collection)

InaCC Inauguration Ceremony
11 September 2014

Indonesian Culture Collection (InaCC)
Pusat Penelitian Biologi
Lembaga Ilmu Pengetahuan Indonesia

InaCC Facilities

- 2 Storeys Laboratory Building, 2800 M²

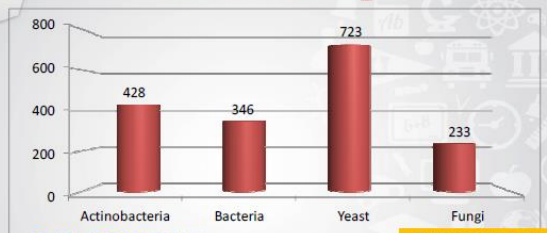
Multimode Microplate reader

L-Drying Apparatus

High Performance Liquid Chromatography

Matrix Assisted Laser Desorption/Ionizing Time Of Flight – Mass Spectrometry (MALDI TOF – MS)

InaCC Holdings*



Total: 1730 Strains

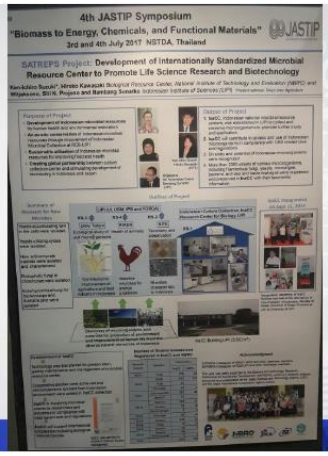
(*) Online catalogue: , 2016
http://inacc.biologi.lipi.go.id/

Herbarium Bogoriense

- Botany Collection
- > 2.000.000 specimens :
  - o Wet collections
  - o Dry Collections
  - o Karpologi
  - o Fossil
  - o Artefact Etnobotany

Museum Zoologicum

Taksa	Indonesia		Koleksi di MZB
	Minimum	Maksimum	
Mamalia	681	800	450 (66%)
Burung	1.540	1.600	1.200 (78%)
Reptilia	600	2.000	340 (57%)
Amphibia	1.000	1.500	150 (10%)
Ikan	7.000	8.500	1.200 (17%)
Moluska	4.000	6.000	2.400 (60%)
Invertebrata lain	5.000	10.000	700 (14%)
Serangga	1.000.000	5.000.000	10.000 (1%)



Linking SATREPS

1. April 2011-March 2016 SATREPS PROJECT: Development of Internationally Standarized Microbial Culture Collection in Indonesia LIPI-JICA-JST-NBRC (NITE), Japan
2. April 2013-March 2018 SATREPS PROJECT: Innovative Bio-production in Indonesia (ibioI): Integrated Bio-refinery Strategy to Promote Biomass Utilization using Super-microbes for Fuels and Chemicals Production LIPI-JICA-JST-Kobe University
3. April 2014-March 2019 SATREPS PROJECT: Searching Lead Compounds of Anti-malarial and Anti-amebic Agents by Utilizing Diversity of Indonesian Bioresources BPPT-LIPI-JICA-JST-Tsukuba University
4. April 2015-March 2020 SATREPS PROJECT: Revegetation of alang-alang (Imperata cylindrica) field combined with sustainable production and utilization of biomass (for energy solution), LIPI-JICA-JST-Kyoto University

Screening & Cloning of Microbial Collection for Biorefinery Development (2011-present)

- Research Center for Biotechnology LIPI
- JSPS-LIPI Bilateral Project (FY2011-2013)
- Satreps Biorefinery (FY2013-2018)
- Center of Excelent, Ministry of Research, Technology, and Higher Education (December 2016)

Research on Utilization of Hetero-mannan biomass

Palm kernel cake : Galactomannan

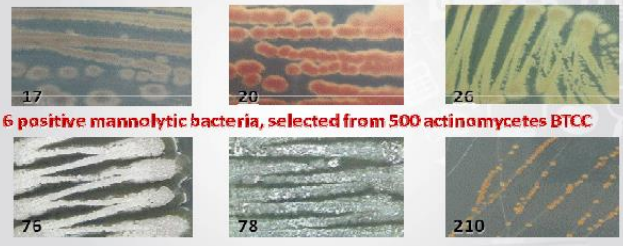
Porang potato : Glucomannan

JSPS-LIPI Bilateral Project (RC-Biotechnology - Kobe Univ.)

Competitive Project (LIPI)

Main Acivity :
Utilization of Palm kernel cake to produce bioethanol and Porang potato to produce oligosaccharides enzimatically (using mannanase, mannosidase from actinobacteria)

Several types of mannolytic microbes from Actinobacteria

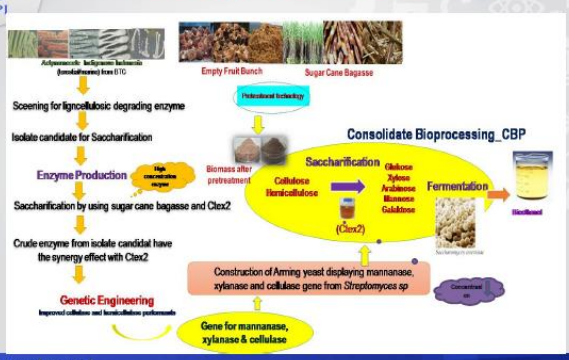


6 positive mannolytic bacteria, selected from 500 actinomycetes BTCC

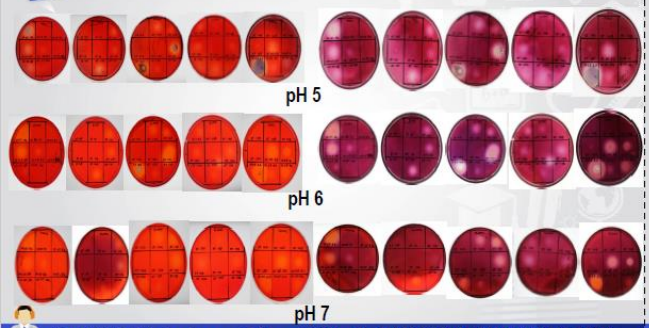
Satreps Biorefinery Activities

Activity
2.1. Production of lignocellulose hydrolyzing enzymes
2.1.1. Screening and optimizing of cellulase and hemicellulase producing microbes from Indonesia Culture Collection (InaCC) and Biotechnology Culture Collection (BTCC)
2.1.2. Cloning of cellulase and hemicellulase genes from microbes in InaCC and BTCC
2.1.3. Construction of the expression system for enzyme production
2.1.4. Purification and characterization of recombinant enzymes
2.2. Evaluation of lignocellulose hydrolyzing enzymes
2.2.1. Lignocellulose degradation by produced enzymes

Strategy for Research



Result of Congo Red & Acetic acid Analysis of 44 Isolates on CMC plate medium, pH 5, 6 and 7



Isolate with diameter clear zone > 1.5 cm : isolates No. ID 05 76, S T131, ST134, ID05 53, ID 0562

Rahmani et al. AMB Expr (2017) 7:169
DOI 10.1186/s13568-017-0471-6
AMB Express
ORIGINAL ARTICLE
Open Access

Mannan endo-1,4-β-mannosidase from *Kitasatospora* sp. isolated in Indonesia and its potential for production of mannooligosaccharides from mannan polymers

Narik Rahmani[1], Norimasa Kashiwagi[2], JaeMin Lee[3], Saroko Nilmi-Nakamura[3], Hana Matsumoto[3], Priharti Kahar[4], Puspita Lisdiyanti[4], Yopi[4], Bambang Prasetya[1], Chiaki Ogino[2] and Akihiko Kondo[2,3*]

Abstract

Mannan endo-1,4-β-mannosidase (commonly known as β-mannanase) catalyzes a random cleavage of the β-o-1,4 mannopyranosyl linkage in mannan polymers. The enzyme has been utilized in biofuel production from lignocellulose biomass, as well as in production of mannooligosaccharides (MOS) for applications in feed and food industries. We aimed to obtain a β-mannanase, for such mannan polymer utilization, from actinomycetes strains isolated in Indonesia. Strains exhibiting high mannanase activity were screened, and one strain belonging to the genus *Kitasatospora* was selected. We obtained a β-mannanase from this strain, and an amino acid sequence of this *Kitasatospora* β-mannanase showed a 58–71% similarity with the amino acid sequences of *Streptomyces* β-mannanases. The *Kitasatospora* β-mannanase showed a significant level of activity (944 U/mg) against locust bean gum (0.5% w/v) and a potential for oligosaccharide production from various mannan polymers. The β-mannanase might be beneficial particularly in the enzymatic production of MOS for applications of mannan utilisation.

Keywords: Mannan endo-1,4-β-mannosidase, Mannooligosaccharides (MOS), Screening, *Kitasatospora* sp., *Streptomyces lividans* 1326

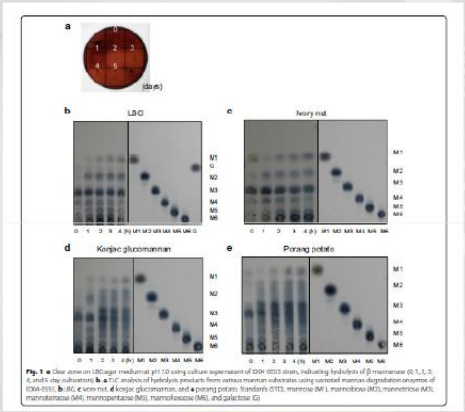


Fig. 1 a Clear zone on LBG agar medium at pH 10 using culture supernatant of ID04-0553 strain, indicating hydrolysis of β-mannanase (0, 1, 2, 3, 4, and 5 day cultivations). b–e TLC analysis of hydrolysis products from various mannan substrates using secreted mannan degradation enzymes of ID04-0553. b LBG, c ivory nut, d konjac glucomannan, and e porang potato. Standards (STD): mannose (M1), mannobiose (M2), mannotriose (M3), mannotetraose (M4), mannopentaose (M5), mannohexaose (M6), and galactose (G)

Networking and Linking of Culture Collection

ACM

The Asian Consortium for the Conservation and Sustainable Use of Microbial Resources

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25 institutes from 14 countries/area participate in the ACM

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Annual Meeting

- 14th (2017)
- 13th (2016)
- 12th (2015)
- 11th (2014)
- 10th (2013)
- 9th (2012)
- 8th (2011)
- 7th (2010)
- 6th (2009)
- 5th (2008)
- 4th (2007)
- 3rd (2006)
- 2nd (2005)
- 1st (2004)

The ACM held annual meeting in autumn every year.

	DATE	HOST	VENUE
14th	Nov. 28-30, 2017	BCRC	Taipei
13th	Nov. 8-10, 2016	MTCC	Chandigarh, India
12th	Oct. 8-10, 2015	LIPI	Jakarta & Bogor, Indonesia
11th	Oct. 30-31, 2014	KCTC	Seoul, Korea
10th	Sep. 22, 2013	IMCAS	Beijing, China
9th	Oct. 25-27, 2012	BIOTEC	Chiang Mai, Thailand
8th	Oct. 10-11, 2011	MARDI	Malaysia
7th	Oct. 13 and 15, 2010	NBRC	Tokyo&Chiba, Japan
6th	Nov. 27-28, 2009	VTCC	Hanoi, Vietnam
5th	Oct. 29-30, 2008	KCTC and KACC	Seoul, Korea
4th	Nov. 22-23, 2007	LIPI and BPPT	Bogor, Indonesia
3rd	Oct. 31-Nov. 1, 2006	IMCAS	Beijing, China
2nd	Nov. 2-3, 2005	BIOTEC and TISTR	Bangkok, Thailand
1st	Oct. 9&15, 2004	NBRC	Tsukuba, Japan

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- Asian BRC Network (ABRCN)
- Human Resource Development (HRD)
- Management of Material Transfer (MMT)
- Mutual Aid Association (MAA)

Task Forces (TF)

ACM has established 4 Task Forces to discuss the specific items:

- Asian BRC Network (ABRCN)
- Human Resource Development (HRD)
- Management of Material Transfer (MMT)
- Mutual Aid Association (MAA)

The ACM prompts active discussions to settle Asian regions' opinions for international standardized measures in accordance with the CBD (Convention on Biological Diversity), NP (Nagoya Protocol) and ABS (Access and Benefit Sharing).

The ACM also encourages microbiology researches for the purposes of solving discover the balance between the global environmental problems and human welfare.

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FORKOMIKRO

FORKOMIKRO

FORKOMIKRO = Communication Forum of Indonesia Culture Collection Curators established in 20th March 1996

The forum represents a medium for members:

1. **to exchange ideas and experiences**
2. **to solve common problems on CC management**
3. **to assist the authorities in the implementation of the CBD with respect to microorganisms**

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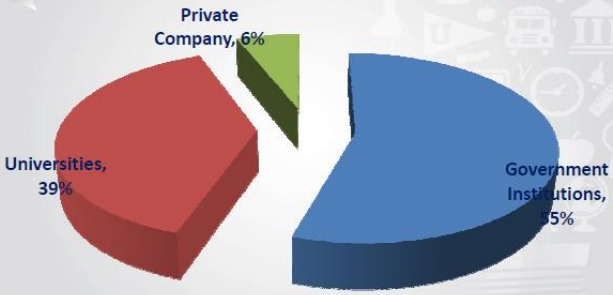
Member of Forkomikro June 2016 (19 CCs)

FORKOMIKRO



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Networking

FORKOMIKRO

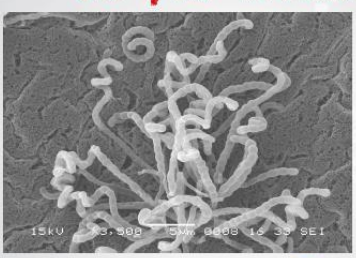
WFCC World Federation for Culture Collections

Asian Consortium For the Conservation and Sustainable Use of Microbial Resources (ACM)

WDCM World Data Center for Microorganisms

www.lipi.go.id

Thank you very much for your attention



NBRC nite KOBE UNIVERSITY JICA JST

www.lipi.go.id

Speaker's Information

Surawut CHUANGCHOTE

Home Town / Country : Bangkok, Thailand

Affiliation: King Mongkut's University of Technology Thonburi (KMUTT)

Position : Assistant Professor

E-mail : surawut.chu@kmutt.ac.th

Biography

Feb. 2017-present: Department of Tool and Materials Engineering, KMUTT. 2014-2017: Assistant Professor, The Joint Graduate School of Energy and Environment (JGSEE), KMUTT. 2012-2014: Researcher, JGSEE, KMUTT. 2009-2012: Postdoctoral Researcher, Kyoto University. 2006-2009: Ph.D. (Energy Science), Kyoto University. 2004-2006: M.Sc. (Polymer Science), Chulalongkorn University. 2000-2004: B.Eng. (Petrochemical and Polymeric Materials Engineering), Silpakorn University.

Area of Interest

Catalysts for bio refinery and green chemicals, Biomass utilizations, Nanomaterial fabrications, Polymer processing and composites, Energy conversion materials and devices

Research Activities and Achievements

1. Achievements
- 2017: Smart-Eco Products Award (Photocat Team), PTTGC Open Innovation Challenge: (PTTGC).
- 2017: Gold and Silver Medals; AICA, UUI, and KINEWS Special Awards; and AIA Achievement Award (The 3rd World Invention Innovation Contest).
- 2016: Outstanding Research Team Member (Leader: Prof.Dr. Navadol Laosiripojana) (TRF)
- 2016: Outstanding Researcher (KMUTT)
- 2014: Outstanding Ph.D. Thesis (2013 NRCT Award) (National Research Council, Thailand, NRCT)
- International publications (45 documents). *h*-Index 11. Citations 655 (Scopus, 2017).
- Reviewers for several international academic journals.

2. Selected Publications
- J. Payormhorm, S. Chuangchote, K. Kiatkittipong, S. Chiarakorn, N. Laosiripojana (2010) "Xylitol and Gluconic Acid Productions via Photocatalytic-Glucose Conversion using TiO_2 Fabricated by Surfactant-Assisted Techniques: Effects of Structural and Textural Properties," Materials Chemistry and Physics, 196(11), 29-36.
- S. Chuangchote, M. Fujita, T. Sagawa, H. Sakaguchi, and S. Yoshikawa (2010) "Control of Self Organization in Conjugated Polymer Fibers," ACS Applied Materials & Interfaces, 2(11), 2995-2997.
- S. Chuangchote, J. Jitputti, T. Sagawa, and S. Yoshikawa (2009) "Photocatalytic Activity for Hydrogen Evolution of Electrospun TiO_2 Nanofibers," ACS Applied Materials & Interfaces, 1(5), 1140-1143.

3. Ongoing Researches
Development of Electrospun Titanium Dioxide Nanofibers for Uses as Photocatalysts for Upgrading of Sugars to High-Value Chemicals (NRCT), Feasibility Study on Cleaning Technologies for PV Arrays (EGAT-TRF), Innovations for Conversion of Biomass to High Value Chemicals by Photocatalytic Process (NSTDA)

Message

Biomass based products are economic products of Thailand and many tropical countries, because agriculture is the main activity in those countries. However, there are some problems of agricultural products in Thailand, such as low seasonal productivity, price fluctuation, and some seasonal over demand. Therefore, upgrading biomass derivatives to high value chemicals can increase value of the biomass.

Innovative Conversion of Biomass Derivatives to High Value Chemicals by Photocatalysis

Surawut Chuangchote[1]
Verawat Champreda[2]
Navadol Laosiripojana[3]
Takashi Sagawa[4]

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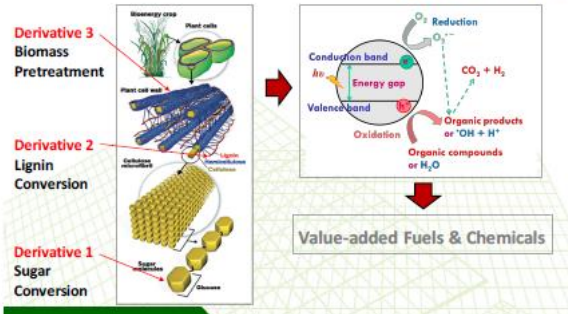
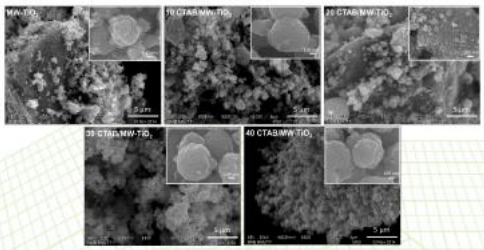
[1] Department of Tool and Materials Engineering, Faculty of Engineering, King Mongkut's University of Technology Thonburi (KMUTT).
[2] National Center for Genetic Engineering and Biotechnology (BIOTEC), National Science and Technology Development Agency (NSTDA).
[3] The Joint Graduate School of Energy and Environment (JGSEE), KMUTT.
[4] Graduate School of Energy Science, Kyoto University.

Development of Photocatalysts

Photocatalysis of Biomass Derivatives

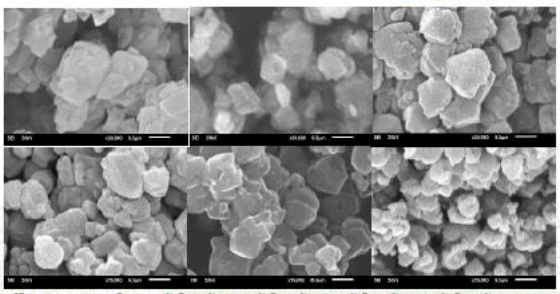


Development of TiO_2 Fabrication with CTAB Surfactant



SEM and FESEM images of TiO_2 photocatalysts synthesized by different concentrations of CTAB

Modification of TiO_2 with Supporters

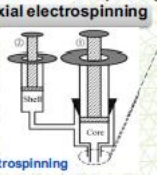


SEM images (30000x) of ZeY, TiO_2 (5%)/ZeY(95%), TiO_2 (15%)/ZeY(85%), TiO_2 (30%)/ZeY(70%), TiO_2 (45%)/ZeY(55%),and TiO_2.

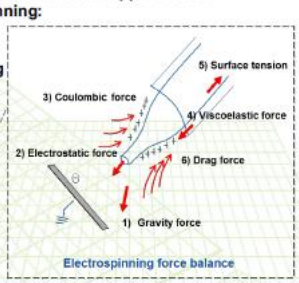
Electrospinning

Electrospinning is a technique to produce the polymer nanofibers from a wide variety of materials and versatile applications. Different methods of electrospinning:

1. Direct electrospinning
2. Emulsion electrospinning
3. Coaxial electrospinning

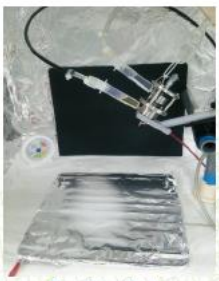


Coaxial electrospinning with two-capillary spinneret.



Electrospinning force balance

Electrospinning

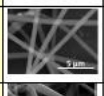
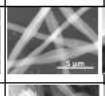
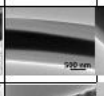
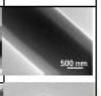
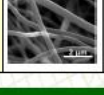
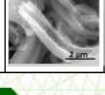
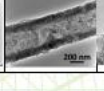


Experimental setup

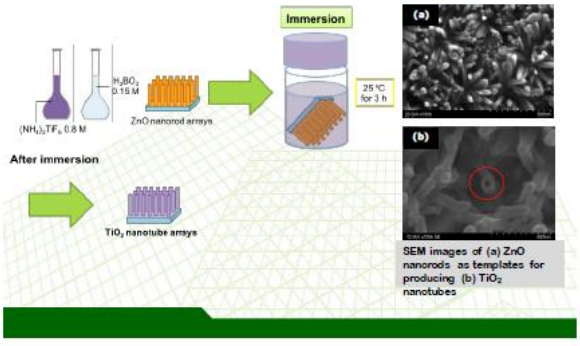
Internal factors:
- Type of polymer,
- Type of solvent,
- Solution concentration (viscosity),
- Solution conductivity, *etc.*

External factors:
- Collecting distance,
- Applied voltage,
- Solution flow rate,
- Ambient temperature, humidity, *etc*

Balance of Inner/Outer Nozzle End

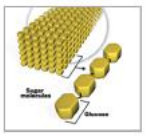
	SEM Images		TEM Images		
Nanofibers	PAN	PAN/PMMA	PAN/PMMA		
Nozzle	Single nozzle	Coaxial nozzle	Inward	Normal	Outward
Illustration					
As spun nanofiber *(Before calcination)*					
Carbon Nanofiber *(After calcination)*					

TiO_2 Nanorod Arrays



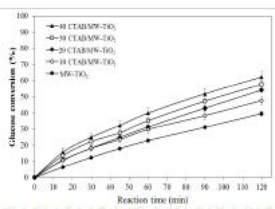
SEM images of (a) ZnO nanorods as templates for producing (b) TiO_2 nanotubes

Biomass Derivative 1: Sugar Conversion

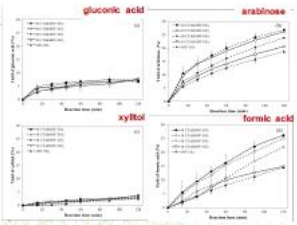


Photocatalytic Activity of TiO_2 Particles

The results of development of TiO_2 fabrication with CTAB surfactant



Photocatalytic conversion of glucose with TiO_2 synthesized with different concentrations of CTAB in MW.



Product yields of photocatalytic conversion of glucose with TiO_2 photocatalysts synthesized by different concentrations of CTAB

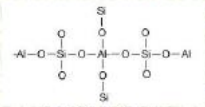
Modification of TiO_2 with Supporters

Zeolites

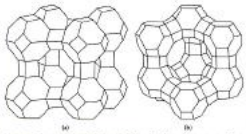
Zeolites are hydrated aluminosilicate minerals made from interlinked tetrahedral of alumina (AlO_4) and silica (SiO_4).

Advantages of Zeolites

- ✓ Improved selectivity
- ✓ High activity
- ✓ Excellent absorption ability



Basic Zeolite Structure



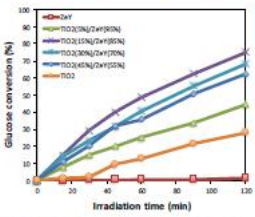
Structure of zeolite A (a) and faujasite-type zeolites X and Y (b) formed by sodalite cages

(Luis, 2016).

Modification of TiO_2 with Supporters

The results of modification of TiO_2 with zeolite supporter

Photocatalytic conversion of glucose

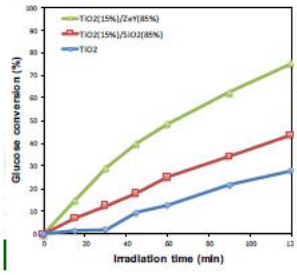


Photocatalyst	S_{BET} (m^2/g)
ZeY	590.76
TiO_2(5%) /ZeY(95%)	588.36
TiO_2(15%) /ZeY(85%)	524.41
TiO_2(30%) /ZeY(70%)	494.57
TiO_2(45%) /ZeY(55%)	419.44
TiO_2	34.38

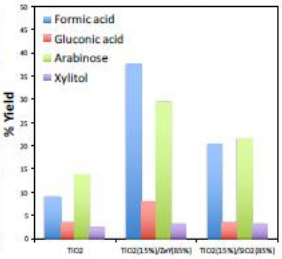
Modification of TiO_2 with Supporters

The results of modification of TiO_2 with zeolite supporter

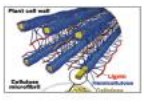
Photocatalytic conversion of glucose



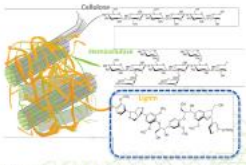
Product Yields



Biomass Derivative 2: Lignin Conversion



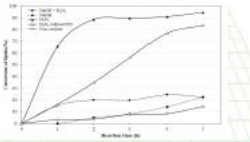
Photocatalytic Conversion of Lignin to High-value Products



Composition of the biomass

http://www.pab.ugent.be/bio-energy/313-lignin

Photocatalytic activity



Effect of kraft lignin concentration on photocatalytic conversion of kraft lignin (reaction conditions: 1g/L of P25, 100/0 v/v of water to ACN and 400 W of UV-lamp).

Price of High-value Chemicals

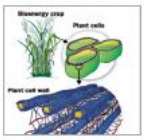
Chemicals from glucose conversion

Products	Price (THB)/kg	Applications
Gluconic acid	337	acidity regulator
Arabinose	1685-5055	sweetener
Xylitol	33.7-168.5	sweetener
Formic acid	16.513-18.53	preservative and antibacterial agent, use in cleaning products, dyeing and finishing textiles products, and use in direct formic acid fuel cell (DFAFC)

Chemicals from lignin conversion

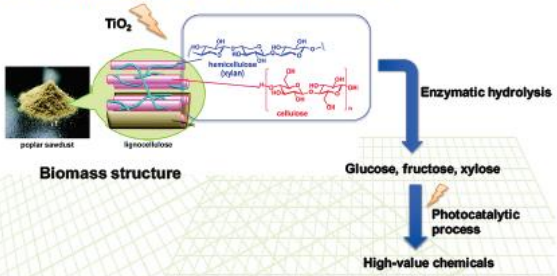
Products	Price (THB)/kg	Applications
2-methyl naphtalene	33.7-50.55	textile dyeing, printing and metal surface water treatment and chelating, used in organic synthesis,pesticide, pharmaceutical and dyne intermedite
4-hydroxy-benzaldehyde	33.7-3370	pharmaceutical intermediate, antiallergic agent blood system agent and anesthetic agents
Vanillin	33.7-505.5	synthetic flavor and fragrance
4'-hydroxy-acetophenone	3370	used in the manufacture of medicinal reagent

Biomass Derivative 3: Biomass Pretreatment

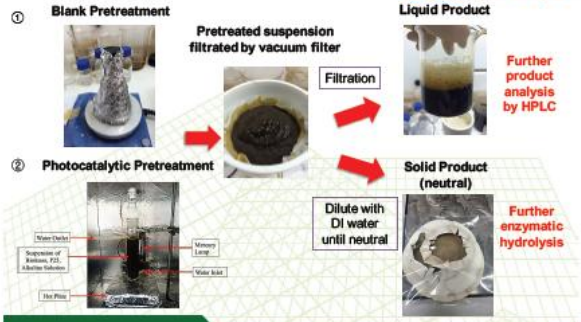


Photocatalytic Pretreatment of Biomass

Concept of Photocatalytic Pretreatment of Biomass



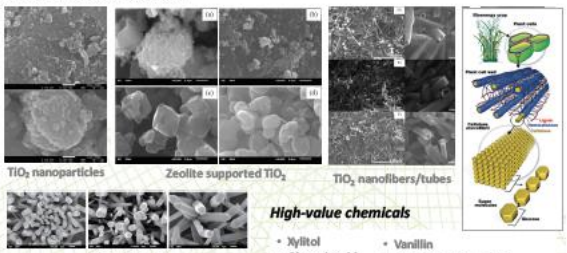
Photocatalytic Pretreatment of Biomass



Conclusion

Conclusion

Synthesized Photocatalysts



High-value chemicals

- Xylitol
- Gluconic acid
- Arabinose
- Formic acid
- Vanillin
- 2-methyl naphtalene
- 4-hydroxy-benzaldehyde
- *Etc.*

References

Papers

- J. Payormhorm, S. Chuangchote, K. Kiatkittipong, S. Chiarakorn, N. Laosiripojana, Xylitol and gluconic acid productions via photocatalytic-glucose conversion using TiO_2 fabricated by surfactant-assisted techniques: Effects of structural and textural properties, Materials Chemistry and Physics, 2017, 196, 29-36.
- N. Kaerkitcha, S. Chuangchote, and T. Sagawa (2016) "Control of physical properties of carbon nanofibers obtained from coaxial electrospinning of PMMA and PAN with adjustable inner/outer nozzle-ends," *Nanoscale Research Letters*, 11(1), 1-9.
- W. Arpavate, S. Chuangchote, N. Laosiripojana, J. Wootthikanokkhan, and T. Sagawa (2016) "ZnO Nanorod Arrays Fabricated by Hydrothermal Method Using Different Thicknesses of Seed Layers for Applications in Hybrid Photovoltaic Cells," *Sensors and Materials*, 28(5), 403-408.
- K. Roongraun, N. Laosiripojana, S. Chuangchote (2016) "Development of Photocatalytic Conversion of Glucose to Value-added Chemicals by Supported-TiO_2 Photocatalysts," *Applied Mechanics and Materials*, 839, 39-43.
- M. Wongaree, S. Chiarakorn, S. Chuangchote, and T. Sagawa (2016) "Photocatalytic Performance of Electrospun CNT/TiO_2 Nanofibers in a Simulated Air Purifier under Visible Light Irradiation," *Environmental Science and Pollution Research*, 23, 21395-21406.

Patent

- Xylitol Production from Glucose and Xylose Using Titanium Dioxide Photocatalyst," Patent Submission No. 1401007893.

4. Poster Presentation

	Poster title	Name (without honorifics)	Affiliation
1	Promotion of green economy with palm oil industry for biodiversity conservation in Malaysia	Yoshihito Sirai	Kyushu Institute of Technology
2	Feasibility Study on Social Implementation of Bioenergy in East Asia	Akio Nishijima	Waseda University
3	the potential of revegetation of marginal land for biomass production to support biorefinery project in Indonesia	I Made Sudiana	LIPI
4	Decolorization and detoxification of synthetic dyes and PAHs by tropical fungi from Indonesia and Thailand	Dede Heri Yuli Yanto	LIPI
5	Poly (lactic acid) modifications: enhanced properties and sustainable plastics	Athanasia A. Septevani	LIPI
6	Bioethanol from the hollocellulose of oil palm empty fruit bunch: microbial consortia	Dian Burhani	LIPI
7	Marine oil degrading microbes for application of green and environmental biotechnology	Elvi Yetti	LIPI
8	Cloning promoter regions and construction of plasmid expression for actinomycetes host	Fahrurrozi	LIPI
9	Dynamics and biodiversity of populations of yeasts, LAB and AAB involved in commercial cocoa bean fermentation station at PTPN XII, Jember, Indonesia	Fahrurrozi	LIPI
10	Development of robust Saccharomyces cerevisiae capable of fermentation of sugarcane bagasse hydrolysate to ethanol	Ahmad Thontowi	LIPI
11	Breeding and advanced fermentation of developed microbes from Indonesian biodiversity to produce bio-fuels (ethanol) and bio chemicals (lactic acid)	Ahmad Thontowi	LIPI
12	Development of integrated process for conversion of sugarcane trash to bioethanol and value-added chemicals	Euis Hermiati	LIPI
13	Dilute maleic acid pretreatment of sugarcane bagasse for enhancement of enzymatic digestibility	Lucky Risanto	LIPI
14	Endoxylanase GH family 10 and 11 with highly significant level of activities from Indonesia rare actinomycetes and its potential for biorefineries applications	Nanik Rahmani	LIPI
15	Study of Galactomannooligosaccharides (GMOS) from sugar palm fruit by mannan endo-1, 4-ß-mannosidase from Kitasatospora sp. for osteophoresis application	Nanik Rahmani	LIPI
16	Optimization of oil palm empty fruit bunch (OPEFB) microwave oxalic acid pretreatment using response surface methodology for production of fermentable sugars	Sita Heris Anita	LIPI
17	Screening and selection of inulin source from tubers and bananas for DFA III production	Sri Pudjiraharti	LIPI
18	Development of curved cross-sectional shape bamboo lamination I –The effect of compression and steam treatment on delamination ratio and shear strength	Teguh Darmawan	LIPI
19	Functionalization of lignin Isolated from Acacia mangium black liquor by polymer blending and grafting	Widya Fatriasari	LIPI

	Poster title	Name (without honorifics)	Affiliation
20	Characterization glutathione of Saccharomyces cerevisiae by-product from bioethanol fermentation oil palm empty fruit bunches	Yanni Sudiyani	LIPI
21	BAGUS Project contributes to geothermal exploration stage in assessing temperature reservoir of a high geothermal field	Shoedarto, R.M	Kyoto University
22	How can we realize the production and utilization of high quality but cheaper Biodiesel Fuel effective in the mitigation of climate change?	Yasuaki Maeda	Osaka Prefecture University
23	Up-regulation of grass lignin biosynthesis: a fundamental study toward the implementation of biomass-refinery	Takuji Miyamoto	Kyoto University
24	Genetic manipulation of lignin aromatic composition: a model study using rice for improved grass biorefinery	Yuri Takeda	Kyoto University
25	Comprehensive Conversion of Biomass and Waste to Super Clean Fuels by New Solid Catalysts	Noritatsu Tsubaki	University of Toyama
26	Extension of Solvent Treatment Method developed by SATREPS program to ASEAN region	Kouichi Miura	Kyoto University
27	Development of Aquaculture Technology for Food Security and Food Safety for the Next Generation	Nobuaki Okamoto	Tokyo University of Marine Science and Technology
28	Development of Aquaculture Technology for Food Security and Food Safety for the Next Generation: poster 2		Kasetsart University
29	Development of Aquaculture Technology for Food Security and Food Safety for the Next Generation: poster 3		Kasetsart University
30	Development of Aquaculture Technology for Food Security and Food Safety for the Next Generation: poster 4		Department of Fisheries, Thailand
31	The Project for Development and Dissemination of Sustainable Production System based on Invasive Pest Management of Cassava in Vietnam, Cambodia and Thailand	Keiji Takasu	Kyushu University
32	Development of Internationally Standardized Microbial Resource Center to Promote Life Science Research and Biotechnology	Ken-ichiro Suzuki	National Institute of Technology and Evaluation
33	Information-based optimization of Jatropha biomass energy production in the frost-and drought-prone regions of Botswana	Kinya Akashi	Tottori University
34	SATREPS: Science and Technology Research Partnership for Sustainable Development	JST	JST

	Poster title	Name (without honorifics)	Affiliation
35	Development of functional nanocarbon-based catalysts for biomass conversion processes	Tetsuya Kida	Kumamoto University
36	Development of new processes with thermotolerant microbes for bio-refinery including biofuels, towards utilization of ASEAN biomass	Mamoru Yamada	Yamaguchi university
37	Synthesis and Characterization of New Functional Nano-materials	Keiichi Ishihara	Kyoto University
38	Photocatalytic conversion of biomass to value-added fuels and chemicals		NSTDA
39	Development of Carbon Materials from Biomass for Energy Storage Applications		NSTDA
40	Innovations in Biomass Application for Catalytic Material Synthesis and Energy Devices		NSTDA
41	Development of New Functional Materials for Energy and Environment		KMITL
42	Optimal Design of Green Energy Systems Based on Photovoltaic Source for Rural Electrification in Malaysia	Mohd Amran Mohd Radzi	Universiti Putra Malaysia
43	Local Energy Governance and Community Renewable Energy (CRE) in Vietnam	Ryo Takeuchi	Kyoto University
44	Study on Energy Usage and Quality of Life for Rural Community Through Rural Electrification using Renewable Energy	Nasrudin Abd Rahim	University of Malaya
45	Community Renewable Energy Implementation in Thailand	Nilubon Luangchosiri	Kyoto University
46	RE implementation - PV installation program in University of Yangon	Pho Kaung	University of Yangon
47	Advancement of Asian Cassava Molecular Breeding by Cutting-edge Technologies	Motoaki Seki	RIKEN Center for Sustainable Resource Science
48	Bio-refinery Strategy for Fuel Production in Indonesia	Chiaki Ogino,	Kobe University
49	Our sustainable tree	Sumitomo Chemical Group	Sumitomo chemical group

4th JASTIP Symposium
"Biomass to Energy, Chemicals, and Functional Materials"
3rd and 4th July 2017 NSTDA, Thailand

PROMOTION OF GREEN ECONOMY WITH PALM OIL INDUSTRY FOR BIODIVERSITY CONSERVATION IN MALAYSIA

Yoshihito Shirai, Kyutech/UPM MSSC & Mohd Ali Hassan, UPM

Kyutech KYUSHU UNIVERSITY AIST UPM

Research Topic Using Our Pilot Plant in Keningau Sabah

Our Goals
- Modernization of Palm Oil Industry !
- Conservation of the Environment and Biodiversity !
- Promotion of Green Industry with Palm Biomass & Biodiversity !
- To Propose to Achieve the above Goals !

ADVANTAGES of Palm Oil Industry as Green Industry!! Business as Usual (but wood, Ball)

Win-win situation between the Environment and palm oil industry

Our pilot plant has achieved successfully overcome the Sabah water regulation <BOD 20 ppm!!

Clear water has been obtained by evaporation

Large amount, high quality and less logistic issues: Palm Biomass!!

A Fundamental Feasibility Study of Green Economy: Green Power Generation on a large scale

Averagely one mill requests 10,000 ha (10km x 10km) of oil palm plantation!!

Self-Heat Recuperation Technology

Quite an energy saving method!!

Contact Address: shirai@life.kyutech.ac.jp

Quite an expected business!!

2

4th JASTIP Symposium
"Biomass to Energy, Chemicals, and Functional Materials"
3rd and 4th July 2017 NSTDA, Thailand

Feasibility Study on Social Implementation of Bioenergy in East Asia (April 2017- March 2020, e-ASIA Joint Research Program)

Akio NISHIJIMA WASEDA Univ.

<Participating countries and research representatives>

1. Japan,	Prof. Masafumi Katsuta,	WASEDA University
2. Thailand,	Prof. Paritud Bhandhubanyong,	Panyapiwat Institute of Management
3. Vietnam,	Prof. Tuan Le Anh,	Hanoi University of Science and Technology
4. Indonesia,	Dr. Anugerah Widiyanto,	Agency of the Assessment and Application of Technology (BPPT)
5. Myanmar,	Assoc. Prof. Ei Ei Htwe,	Ministry of Education
6. LAO P. D. R.,	Prof. Bounmy Keohavong	Souphanouvong University

<Goal>
1. Database and priority setting for social implementation of bioenergy in East Asia
2. Feasibility study (economic evaluation and LCA) on bioenergy
3. Region wide networking for the utilization of biomass in East Asia
4. Understanding of local needs and sustainable supply of feedstocks
5. Optimization of local production for local consumption and international market

<Approach>
1. Discuss and exchange information regarding research potential of each organization in the field of biomass utilization
2. Identify significant specific research areas to be jointly examined in light of future utilization in the ASEAN region
3. Form international research groups among six countries according to the research potential for meaningful results
4. Jointly confirm the progress chart of the consultation process of the groups in order to identify the critical paths and issues, thereby to make agreed modification in the activities
5. Arrange to foster young researchers' activities through the participation of this Program

<Entrance Strategy> (Procurement of feedstock)
1. Establish an agricultural and forest management system to supply biomass resources to manufacturers in a stable manner
2. Develop high-yield energy crops and plants (smart-agriculture)

<Exit Strategy> (Creation of demand & market)
1. Create biomass-related industries with high-value added goods such as chemicals and material
2. Price reduction by downcycling
3. Fully utilize of Feed-in Tariff and JCM scheme

<Technological Strategy> (Technological development)
1. Accelerate development of Next-generation technologies such as solid fuel (torrefaction) and liquid fuel (cellulosic ethanol , 2nd G BDF and Jet fuel)
2. Process optimization, Simultaneous production of fuels and chemicals

<Expected Outcome>
1. Creation of an efficient regional consultation mechanism for extensive biomass related issues (including agriculture and manufacturing) with the objective of making wider, optimal utilization of environmentally friendly resources in the ASEAN region.
2. Creation of a structure for multi-faceted information on biomass related research areas
3. Creation of a dynamic interdisciplinary process of innovation targeting smart utilization or resources.
4. Hands-on training of young researchers who will be leading research and innovation on biomass in their own country.

Biomass related SATREPS Projects in Asia

International policy dialogue, Biomass open Innovation forum (Dr. Norio Ohto, Takeda Foundation)

Development of high-yield energy crops and plants
Pongamia pinnata plantation in Indonesia (Dr. Hideo Samura, EAJ)

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4th JASTIP Symposium
"Biomass to Energy, Chemicals, and Functional Materials"
3rd and 4th July 2017 NSTDA, Thailand

The potential of Revegetation of Marginal Land for Biomass Production To Support Biorefinery Project in Indonesia

I Made Sudiana[1], Puspita Lisdiyanti[1], Atit Kanti[1] Reni Lestari, Arwan Sugiharto[1], Yopi [1], Masaru Kobayashi [2]and Toshiaki Umezawa [2]Research Center for Biology-LIPI, [1]Research Center for Biotechnology-LIPI, [2]Center for Plant Conservation-LIPI, [2]RISH, Kyoto University, Japan

Project out line

The area of marginal land is more than 20 millions ha distributed through out Indonesia. The soil and climate characters of marginal land are quite variable, hence the revegetation techniques should be in accordance to those condition. We developed soil conditioner, biofertilizer, optimal chemical fertilizer, biocontrol to suppress plant disease. To maximize biomass production as well as ecosystem recovery we introduced intercropping and plant selection which produce high biomass. More than hundred sorghum varieties are evaluated for their growth performance, biomass production rate, sugar content, juice production and their ability to grow under limited irrigation. The success of revegetation is then evaluated using life cycle assessment. To do this project we create research partnership through net working between Japanese and Indonesian researcher. From Japan side, RISH of Kyoto University, Kazuza DNA Research Institute, while from Indonesian team compose of Center for Plant Conservation-LIPI, Research Center for Biology-LIPI, Research Center for Biotechnology-LIPI, Research Center for Biomaterial-LIPI, Innovation Center LIPI. ICABIOGRAD and FORDA. Biomass production from this product can be used for many purposes such energy, food, and feed material for biorefinery project in Indonesia. The effect of project out put on enviroment is analysesd by LCA (life cycle assesment)

Marginal land survey to evaluate land suitability For biomass production

Marginal lands: a) calcareous soil in Sumba (NTT); b) entisol soil in Central Kalimantan; c) alang-alang field (East Kalimantan)

Plant selection and metabolic engineering of Sorghum with high lignin content

Plant microbes interaction studies: A) sorghum + mychorrhiza; b) soil conditioner studies; c) biofertilizer formula for sorghum

Revegetation technology development

Field trial to evaluate level of biomass production and determine factor that affect crop productivity

Field trial of sorghum variety: A) Local sorghum Kupang NTT ; b) Local sorghum Demak in Cibinong; c) sorghum kompul putih Cibinong; d) Super 1 in Cibinong

Biomass utilization To analyse product that will be produced and analyse the LCA

A) Sorghum bagasse to support biorefinery project in Indonesia ; b) Biopellet from sorghum bagasse; c) sorghum bagasse for microbial carrier; d) Sorghum bagasse for Particle board

Illicit Innovative Bio-Production in Indonesia (IPI)

JICA JST

LIPI

4th JASTIP Symposium
"Biomass to Energy, Chemicals, and Functional Materials"
3rd and 4th July 2017 NSTDA, Thailand

Decolorization and detoxification of synthetic dyes and PAHs by tropical fungi from Indonesia and Thailand

Dede Heri Yuli Yanto[1,*], Wichanee Bankeeree[2], Takashi Watanabe[3], Raden Permana Budi Laksana[1], Hunsa Punnapayak[2], Maulida Oktaviani[1], Fahriya Puspita Sari[1], Sita Heris Anita[1], Hiroshi Nishimura[3], Satoshi Oshiro[3], Ruibo Li[3], Chen Qu[3], and Sehanat Prasongsuk[2]

[1]Research Center for Biomaterials, Indonesian Institute of Sciences (LIPI), Indonesia
[2]Plant Biomass Utilization Research Unit, Department of Botany, Faculty of Science, Chulalongkorn University, Thailand
[3]RISH, Kyoto University, Japan

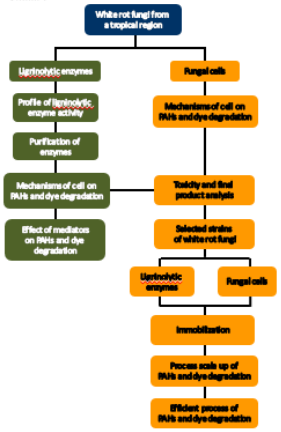
Purposes :

The objectives of this study are (i) to isolate the potent strains of ligninolytic enzyme producers from tropical regions, (ii) to evaluate the ability of their ligninolytic enzymes on dye and PAHs degradation, and (iii) to achieve the efficient of dye and PAHs degradation in process scale up for industrial scale involving fabric dye effluent and PAHs contaminated environment. The expected outcomes of this research with cooperation among Indonesia, Thailand, and Japan will be (1) diverse strains of white rot fungi from tropical areas with high efficiency for bioremediation including dye decolorization and PAHs degradation and (2) discovering the new technology for bioremediation being beneficial for environment of the society.

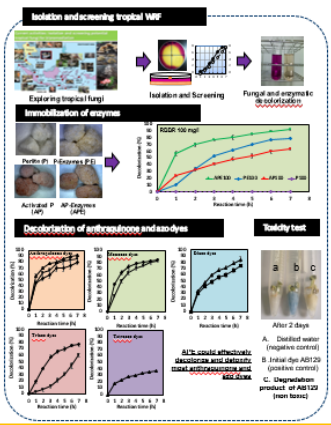
Outline :

Decolorization and detoxification of synthetics dyes and PAHs by tropical fungi from Indonesia and Thailand will be studied in collaboration of LIPI, Chulalongkorn Univ. and Kyoto Univ., aiming at establishing sustainable environment with high safety using tropical bioresources. The research consists of screening of useful microbes capable of degrading toxic dyes and polycyclic aromatic hydrocarbons (PAHs) and their appreciations to bioremediation. Fundamental studies on oxidative enzymes degrading the substrates are also involved. The fungi will be screened in Indonesia and Thailand, and application of the microbes or their enzymes to PAHs and dye decolorization will be carried out in each country by sharing the scientific and technological methodology, and the characterization of degradation compounds and enzymes will be carried out also in Kyoto Univ. in addition to LIPI and Chulalongkorn Univ. under the close communications and scientist exchange among the three organizations.

Scheme :



Achievement :



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Marine Oil Degrading Microbes for Application of Green and Environmental Biotechnology

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Research Center for Biotechnology, Indonesian Institutes of Sciences
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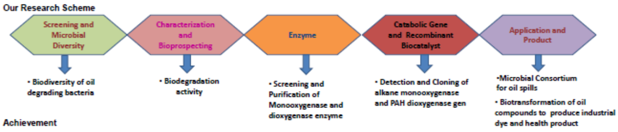
Outline of Research

Indonesia have abundant microbial biodiversity distributed in several environments. During 10 years, we have collected and characterized more than 140 marine oil degrading bacteria isolated from some Indonesian marine areas. Currently, our research group has conducted several research steps dealing with identification, screening of PAH & alkane, characteriation, screening & detection of enzyme alkane monoxygenase dan PAH dioxygenase to the microbes. We also initiated to establish the research to application field and products by consortium formulation of whole biocatalyst cell and recombinant enzyme for indigo dye production. Globally, we arrange road map of the research to develop these microbes on biotechnology approaches and bioprocess technology for various application fields such as environmental, industrial, and health.

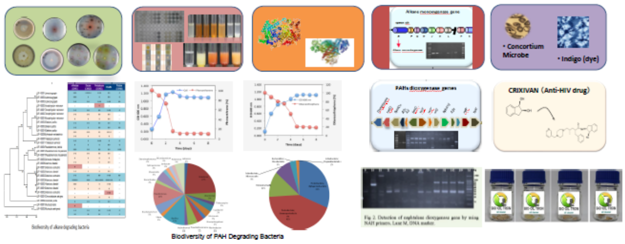
Purpose

Our research scheme globally aim to develop and harness our collection of marine oil degrading microbes to various application such as environmental,industrial, heatlh etc by biotechnology approach. In order to achieve the purpose, we undertook several sub researches to the microbes such as screening of potential biodegradation, enzyme, catabolic gene detection, recombinant enzyme production, and also consortium formulation for whole cell biocatalyst.

Our Research Scheme



Achievement



Biodiversity of PAH Degrading Bacteria

Our Publication

- Nuzul Farini, Ahmad Thontowi, Elvi Yetti, Suryani, dan Yopi. 2017. Pertumbuhan Bakteri Laut *Shewanella indica LBF-1-0076* dalam Naftalena dan Deteksi Gen Naftalena Dioksigenase. BIOPROPAL INDUSTRI Vol.8 No.1, Juni 2017 : 19-31
- Safitriani, Ahamad Thontowi, Elvi Yetti, Suryani, dan Yopi. 2017. Pertumbuhan Optimal Bakteri Laut *Pseudomonas aeruginosa* LBF-1-0132 dalam Senyawa Piren. *Jurnal Biologi Indonesia* 13(1): 107 - 116 (2017) *(2017)*, ISSN 0854-4425 akreditasi: 657/AU3/P2MI-LIPI/07/2015
- Elvi Yetti, Ahmad Thontowi, and Yopi. 2016. Polyaromatic Hydrocarbon Degrading Bacteria from the Indonesian Marine Environment. *Biodiversitas*. Volume 17, Number 2, October 2016, Pages: 857-864 ISSN: 1412-033X E-ISSN: 2085-4722 DOI: 10.13057/biodiv/d170263
- Elvi Yetti, Ahmad Thontowi, dan Yopi. 2016. Penapisan dan Optimasi Pertumbuhan Bakteri Laut yang Berpotensi sebagai Hidrokarbonoklastik PAH Fenotiazin. *Jurnal Pascapanen dan Bioteknologi Kelautan dan Perikanan*. Volume 11 Nomor 2 (2016), ISSN : 1907-9133(*print*), ISSN : 2406-9264(*online*)
- Puspasari Noerwan Tanjung, Elvi Yetti, Ahmad Thontowi, Agung Suprihadi, Susiana Purwantisari & Yopi. 2016. Karakterisasi Biodegradasi Senyawa Poliaromatik Dibenzothiophene Oleh Bakteri Laut *Novosphingobium mathurense* LBF-1-0061, *Jurnal Biologi Indonesia 12 (2): 257-264 (2016)*, ISSN 0854-4425 akreditasi: 657/AU3/P2MI-LIPI/07/2015
- Elvi Yetti, Ahmad Thontowi, Yopi, and Puspita Lisdiyanti. 2015. Screening of Marine Bacteria Capable of degrading Various Polyaromatic Hydrocarbon. *Squalen Bulletin of Marine & Fisheries Postharvest & Biotechnology, 10 (3) 2015, 121-127* ISSN: 2089-5690 e-ISSN: 2406-9272 Accreditation Number: 631/ AU2/ P2MILIPI/ 03/ 2015 DOI: http: // dx.doi.org/ 10.15578/ squalen.v10i3.123
- Thontowi et al. 2013. Polyaromatic hydrocarbon degradation and dioxygenase gene detection from *Alteromonas alvinellae Bt05. Annales Bogoriensis. 17(1): 35-45.*
- Thontowi & Yopi. 2011. Alkane degradation and detection of m o n o x y g e n a s e g e n e f r o m *Alcanivorax sp. from Jakarta Bay. Annales Bogoriensis 15(2): 25-3*

4th JASTIP Symposium
"Biomass to Energy, Chemicals, and Functional Materials"
3rd and 4th July 2017 NSTDA, Thailand

Breeding and advanced fermentation of developed microbes from Indonesian biodiversity to produce bio-fuels (ethanol) and bio-chemicals (lactic acid)

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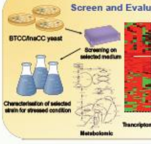
[2] National Standardization Agency, Indonesia
[3] Graduate School of Engineering, Kobe University, Japan
[4] Graduate School of Science, Technology and Innovation (STIN), Kobe University, Japan

Outline

Consolidated bioprocessing (CBP), which combines enzyme production, saccharification and fermentation in a single step, has gained increased recognition as a potential bioethanol and lactic acid production system.The key to CBP is the engineering of a microorganism that can efficiently hydrolyze lignocellulosic polysaccharides to fermentable sugars and efficiently ferment this mixed-sugar hydrolysate to produce ethanol and lactic.The promising strategy for effective breeding and advanced fermentation by applied developed microbes with exploration the potential indigenous yeast from Indonesia. The local yeasts were chosen for arming yeast candidate which has several tremendous characters such as tolerance to ethanol, inhibitors, low pH, high temperature, low nutrition capacity and fluctuating process.

Screen and Evaluate of Yeast Strains

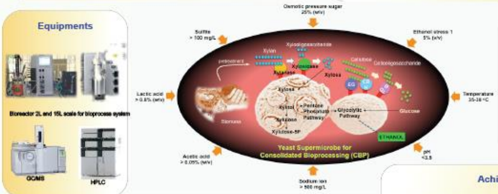


- to isolate, screen and evaluate *yeast* strains with capable for xylose metabolism from InaCC and BTCC
- to sequence genome of potential isolated microbes from InaCC and BTCC

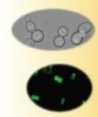
Construction of Arming Yeast

- to construct recombinant microbes with arming technology for fermentation process and chemicals production from InaCC and BTCC strain

Equipments



Yeast Strain



Fermentation of Indonesian Biomass

- to develop the separation technology of bioethanol from fermented culture medium
- to develop lactic acid separation from cultured medium by liquid-liquid extraction
- to establish the downstream processing of lignocellulose degradation and fermentation process

Achievment

- we obtained 2 strains candidate for bioethanol and lactic acid production respectively
- we performing BTCC yeast strain for arming yeast
- we fermented 100 g/L of sugarcane bagasse by using BTCC yeast strain

Contact

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4th JASTIP Symposium
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3rd and 4th July 2017 NSTDA, Thailand

Study of Galactomannooligosaccharides (GMOS) from Sugar Palm Fruit by Mannan Endo-1,4-β-mannosidase from *Kitasatospora* sp. for Osteophoresis Application

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Outline of Research

Galactomannan carbohydrates can be hydrolyzed by enzyme into mono-saccharides and galactomanno-oligosaccharides (GMOS). The indigenous of Actinomycetes which can produce endo-type mannanase have been chosen to improve the utilization of galactomannan carbohydrates especially to produce galatomanno-oligosaccharides. Palm sugar fruit which is so far only be used for the mixture of fresh drinks can be increased its economic value into functional food products that are very beneficial to health. Focus of this research are study the potencial of palm sugar fruit to produce galactomanno-oligosaccharides and characterize the product for functional food application, especially for osteophoresis treatment. In the first step, one isolate candidate has been selected for the production of mananase enzyme, namely *Kitasatospora* sp, which is optimum in buffer sodium phosphate pH 6.0 and 60°C temperature with activity 57.7 U/mL as candidate to produce mananase enzyme for GMOS production. The next step we will conduct the optimization of hydrolysis palm sugar fruit by this mannanase to produce GMOS, characterization the hydrolysis product and osteophoresis treatment.

Scheme of Research

Achievement of the Research

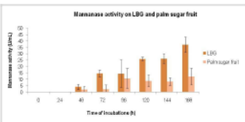

Fig 1. Selection of carbon source for mannanase production by the *Kitasatospora* sp

Fig 2. Processing of palm sugar fruits production

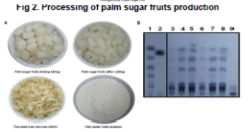

Fig 3. (A) Preparation of palm sugar fruit powder and (B) TLC analysis of hydrolysis product of palm sugar fruit by mannanase from *Kitasatospora* sp

Purpose of the Research

Study development of galactomannan from palm sugar fruit to produce galactomannooligosaccahrides and potential for osteophoresis application by Indigenous Actinomycees from Botechnology Culture Collection (BTCC)

Next Plan Research

Optimization of hydrolysis palm sugar fruit using RSM,characterization of GMOS and prebiotic fermentation of GMOS

Acknowledgements

This work was supported by the Unggulan LIPI research grant on 2017 by Dr Yopi and also was supported by RONPAKU (Dissertation PhD) Program (R11512 to NR) by RONPAKU Fellowship from the Japan Society for the Promotion of Science (JSPS)

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4th JASTIP Symposium
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Screening and Selection of Inulin Source from Tubers and Bananas for DFA III Production

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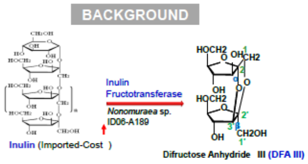
ABSTRACT

DFA III has been known can stimulate intestinal calcium absorption and bone density of rats. Screening to seek potential inulin source from local plants, tubers and bananas, for the production of DFA III has been carried out. The result showed that DFA III can be produced only from the extract of *Dahlia* tubers. From thirteen types / varieties of *Dahlia* tubers tested, tubers of Dahlia variety of formal decorative flower (FD) with light yellow color was a potential raw material for DFA III production.

BACKGROUND



PHYSIOLOGICAL FUNCTION OF DFA III
- ↑ Calsium absorption in intestine
- ↑ Calsium concentration of bone
- ↑ Density of bone
- A Non-Calorie Sweetener

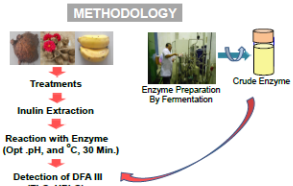
→ *Prevention of Osteoporosis*; *Good for Diabetic Patients*

Tubers and Bananas → - Abundat in Indonesia - May Contain Inulin → Raw Material for DFA III Production ..?

OBJECTIVES

1. To Seekt A Local Plant as Raw Material for DFA III Production
2. To Substitute Commercial Inulin

METHODOLOGY



ACKNOWLEDGEMENT

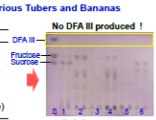
This work was financially supported by The Government of Republic Indonesia through Competitive Project of LIPI Year 2016.

RESULTS

Test DFA III Formation From Various Tubers and Bananas

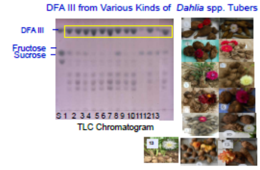
No.	Tubers
1.	*Dioscorea hispida*
2.	*Ipomoea batatas* (L.) (Violet)
3.	*Amorphophallus paeoniifolius*
4.	*Dioscorea esculenta* L
5.	*Ipomoea batatas* (L.) (White)
6.	*Ipomoea batatas* (L.) (Orange)

No DFA III produced !



TLC Chromatogram

DFA III from Various Kinds of *Dahlia* spp. Tubers



TLC Chromatogram

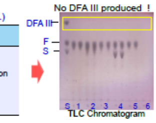
No.	*Dahlia* spp. Tubers	DFA III (g/L extract)
1.	Flower FD-Bright Red	17,7
2.	,, Pastel Pink	18,1
3.	,, Magenta	13,6
4.	,, Red Orange	**29,3**
5.	,, Deep Magenta	20,4
6.	,, Light Yellow	**38,3**
7.	,, Red Maroon	18,2
8.	,, Medium Violet Red	14,7
9.	,, Red	21,4
10.	,, White	-
11.	,, Oranye	14,3
12.	,, Peach	2,6
13.	,, SC- White	**24,2**

FD:Formal Decorative SC:Semi Cactus

Kinds of Bananas (*Musa* spp.)

No.	Tubers
1.	*Musa* Subg. *AAB* Kapas
2.	*Musa* Subg. *AAB* Raja
3.	Musa Subg. AAA Green Ambon
4.	*Musa* Subg. *AA* Muli
5.	*Musa* Subg. *ABB* Kepok
6.	*Musa* Subg. *AAB* Tanduk

No DFA III produced !



TLC Chromatogram

CONCLUSION

Tubers of Dahlia plant of Formal Decorative flower with light yellow color was a promising raw material for DFA III production.

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Development of Curved Cross-sectional Shape Bamboo Lamination I – The Effect of Compression and Steam Treatment on Delamination Ratio and Shear Strength

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Figure 1. Cross-section of bamboo slat.

Outline: Bamboo lamination is generally made of flat shape cross-section on each side. To get a flat shapes cross-section, generally is done by removing the curved portion on the outer and inner parts of the bamboo wall thickness (**Figure 1**). Slicing on the outer parts of bamboo can remove the bamboo parts that have a higher density, because the bamboo density is affected by the amount of vascular bundles, where the density distribution increases in position from the inner to the outer parts near to the bark (Yu *et al.*, 2008). The rectangular size of flat shape cross-section bamboo lamination is very dependent on the wall thickness of the bamboo used, therefore flat shape cross-section slicing will be effectively performed on bamboo species that have thick walls. Bamboo lamination can be developed by utilizing the elasticity of the curved bamboo slats.

The curved bamboo slats can be attached to each other when the bamboo slats are arranged and pressed on their elastic limit, so that each side forms a curvature line. Thus, the development of bamboo lamination by maintaining the curved cross-sectional shape of bamboo slats has a potential to increase the effectiveness of the use of materials and time in its manufacture.

Purpose: The objective of this research was to study the potential of bamboo slats by maintaining the curved cross-sectional shape of bamboo slats through observation of loading on bamboo slats curve, and to investigate the characteristics of curved cross-sectional shape bamboo lamination after glued and pressed in air-dry condition, and the effect of the compression and steam treatment on its delamination ratio and shear strength.

Scheme: The material used in this study was Andong bamboo (*Gigantochloa psedoarundinacea*) with an average density of 0.60 (range 0.58-0.62). Bamboo stem with a minimum length of 6 m, was cut along 5 cm for each segment and split into 4 parts and grouped to measure their diameter and wall thickness to observe the radius of bamboo curvature. To know the elastic limit of the bamboo curve cross-section, a universal testing machine (UTM) is applied to the bamboo slat pieces under air-dry condition.

Bamboo laminations were made from and divided into unpeeled bark (UBC), peeled bark (PBC), peeled bark and inner part (PBIC) of curved cross-sectional shape, and flat cross-sectional shape (F) of bamboo slats. The samples were made from 4 layers of bamboo slats by arranged sequentially according to their radius group of curvature. Furthermore, the samples were glued by using an adhesive-based natural rubber latex with a weight of 250 g/m². The lamination process was conducted by a molding tool (**Figure 2**) at room temperature. Steam treatment was conducted only for UBC samples. The samples were arranged on the mold, and then compressed into 20% of their initial thickness (prior to bamboo curve surfaces were coincided each other). Furthermore, steam treatment at 120°C was given at 1 kg/cm² pressure for 60 min in autoclave, and oven-dried at 105°C for 24 hr.

Figure 2. Before (a) and after pressing (b) by a molding tool.

Achievement:

- Remarkable difference was shown in the delamination ratio values. No delamination was occurred for PBIC and F samples, even after hot water immersion tested. Therefore, peeled bark and inner part (PBIC) of curved cross-sectional shape and flat (F) cross-sectional shape samples have a better bonding property.
- Bamboo has a high density on the outer part near the bark and a low density on the inner part. Unpeeled of low density and soft inner part (UBC and PBC) of curved cross-sectional shape samples have a weakening in the shear strength test. On the other hand, peeled bark and inner part (PBIC) of curved cross-sectional shape, and flat (F) cross-sectional shape samples has a better shear strength values. The rectangular or flat (F) cross-sectional shape sample has the best shear strength value of 4.92 MPa.
- Compression and steam treatment processes improved the density, delamination ratio and shear strength values of UBC samples as shown in **Table 2**. By a 20% compression target, the density of UBC samples increased from 0.60 to 0.81, delamination ratio decreased from 38.26% (in **Table 1**) to 14.49%, and shear strength increased from 3.88 MPa (in **Table 1**) to 4.81 MPa. Compression process on the curved cross-sectional shape of bamboo lamination obtaining a tightly bonding-line, and led to compaction.
- In compressed wood, compression on the wood surface pushed the walls of the cells and the pores of the wood more tightly (Amin and Dwianto, 2006). Likewise, the structure of bamboo parenchyma tissues was pressed so that the density increased. More densified the curved cross-sectional shape of bamboo lamination could reduce the weaknesses that occurred in the bonding-line if a shear load was applied. The shear strength value of UBC samples (4.81 MPa) increased close to the value of the F samples (4.92 MPa).

Table 1. Characteristics of curve and flat shape cross-section bamboo lamination.

Samples Code	Cross-section Shape	Moisture Content (%)	Density	Delamination Ratio (%)	Shear Strength (MPa)
UBC	Curve	13.67	0.60	38.26	3.88
PBC		11.26	0.62	26.40	4.26
PBIC		13.53	0.61	0	4.79
F	Flat	11.50	0.62	0	4.92

Remark: unpeeled bark (UBC), peeled bark (PBC), peeled bark and inner part (PBIC) of curved cross-sectional shape, flat (F) cross-sectional shape.

Table 2. The effect of compression and steam treatment processes on density, delamination ratio and shear strength of curved cross-sectional shape of bamboo lamination.

Samples Code	Cross-section Shape	Compression Target %	Density Before	Density After	Delamination Ratio %	Shear Strength (MPa)
UBC-0	Curve	0	0.59	0.69	16.80	3.94
UBC-20		20	0.60	0.81	14.49	4.81

Conclusions: Bamboo lamination can be made while maintaining the curved cross-sectional shape of the slats. The bamboo lamination from the bamboo slats without peeling on the bark and inner part still has a high enough delamination ratio (38.26%) and the lowest shear stress (3.88 MPa). The compression and steam treatment processes in the bamboo curve could improve the delamination ratio (14.49%), and increased the shear strength value (4.81 MPa).

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4th JASTIP Symposium
"Biomass to Energy, Chemicals, and Functional Materials"
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BAGUS Project contributes to geothermal exploration stage in assessing temperature reservoir of a high geothermal field

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BAGUS Project

As Japan has been the leader in reducing GHG emissions and has done real implementation of the emission reduction targets to achieve its 2050 goal, Japan has proactively brought out eco-friendly and energy-conserving technologies through **joint projects** with emerging economies and developing countries.

Beneficial and Advanced Geothermal Use System (BAGUS) project is one of international joint research programs promoted by Science and Technology Research Partnership for Sustainable Development (SATREPS) under supervision of JST and JICA to develop geothermal exploration, and sustain its resource for generating geothermal power in a large scale in Wayang Windu Geothermal Field (WWGF), Indonesia.

Wayang Windu Field

Wayang Windu Geothermal Field (WWGF) has been the largest geothermal power plant in Indonesia and the biggest single unit geothermal steam turbine in the world for 15 operation years

This field has high reservoir that is characterized by fumaroles, hot springs, and mud pools on the surface. They are located along the slopes of Quaternary volcanoes of Mt. Malabar, Mt. Puncak Besar, Mt. Gambung, Mt. Bedil, Mt. Wayang and Mt. Windu that stretch from north to south. But how high is the temperature beneath?

Geothermal Exploration Stages

Reconnaissance Study (1)
- Desktop studies
- Site visits
- Analysis

Geothermal Exploration (2)
- Geological prospecting
- Geochemical prospecting
- Geophysical prospecting

Exploration Drilling Preparation (3)
- Environmental Impact Assessment
- Permits prepared
- Funding applications

Exploration Drilling Campaign and Production Development (4)

As part of geochemical prospecting techniques, geothermometers are generally used for estimating the reservoir temperature. It also becomes invaluable tool in monitoring an established geothermal production reservoir.

Methods and Results

Solute Geothermometers

These geothermometers are based on temperature-dependent mineral-fluid equilibria, and their applications rely on basic assumptions of mineral reaction equilibrium in the reservoir (Nicholson, 1993). In order to check on the accuracy and completeness of the data, before we apply the solute geothermometers, ion balance is employed first.

In this study, we use quartz geothermometers instead of cation geothermometer because based on Figure 1, all fluids did not equilibrate with host rocks:

Conductive (Fournier (1977)
$T = 1309 / (5.19 - \log C) - 273.15$
$C = SiO_2$ in ppm

Adiabatic Fournier (1977)
$T = 1522 / (5.75 - \log C) - 273.15$

Figure 3. Results of gas and solute geothermometers in the north, center and south part of WWGF based on surface manifestations data

Gas Geothermometers

Gas geothermometers are based on steam/water ratios which correspond to the discharge process at the surface. This condition limit the application of gas geothemometer for fumaroles since steam and water phases are rarely discharge at the surface altogether (Nicholson, 1993). CO_2-H_2S-H_2-CH_4 empirical geothermometer from D'Amore and Panichi (1980) op. cit. Nicholson (1993) can be used for both natural and well steam discharges as it is used in this study.

$$T°C = \frac{24775}{\left[2\log\left(\frac{CH4}{CO2}\right) - 6\log\left(\frac{H2}{CO2}\right) - 3\log\left(\frac{H2S}{CO2}\right) + 7\log PCO2 + 36.5\right]} - 273$$

Figure 1. Triangular Na-K-Mg as preliminary technique to assess fluids which may have undergone subsurface process, or never been in full equilibrium with host rocks, like all of those samples.

Figure 2. Type of hot spring from Cl-HCO3-SO4 diagram. Fluid from MBA hot spring can not be used for geothermometer analysis.

Among solutes geothermometers, quartz conductive and adiabatic equations were used for the calculation because all hot springs are assumed did not get the interaction with the wall rocks. The calculations range from 150-170°C.

Meanwhile, CO_2-H_2S-H_2-CH_4 gas geothermometers showed results of 166 – 238°C. It seems, the southern part of WWGF has hotter subsurface temperature than that the northern part, and the center has the lowest one.

Future Study

As new field survey had been deployed on 2016, the comparison of geothermometer results will be performed on the next analysis. These geothermometer results also will be confirmed with the temperature from well-logging activities and other geoindicator analysis.

References

Bogie, I., Kusumah, Y.I., Wisnandary, M.C., Overview of the Wayang Windu Geothermal Field, West Java, Indonesia. Geothermics 37 (3), 347-365 (2008).
Icelandic International Development Agency. The Geothermal Exploration Project Geothermal Development in the East African Rift Valley Countries Sub-project of the Compact on Geothermal Development in East Africa (2004).
Malik, D., and Rosbadi A. A., Surface Thermal Manifestation Evolution Under Exploration Stage in Wayang Windu Field, Proceedings of The 12th Annual Indonesian geothermal Association Meeting & Conference (2012).
Nicholson, K., Geothermal Fluids, Chemistry and Exploration Techniques, Springer-Verlag, Berlin Heidelberg (1993).

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How can we realize the production and utilization of high quality but cheaper Biodiesel Fuel effective in the mitigation of climate change? Results from SATREPS(2012-2017)

Yasuaki Maeda(OPU), L.T.N.Hanh(OPU), K.Imamura, L.V.Boi (VNU Hanoi)

Back Ground: Biomass energy faced to the barriers due to (1) low price of petroleum, and (2) BDF produced from Canola (EU), Soy bean(US) and Palm(Asia) are not effective in the mitigation of climate change due to the Indirect Land Use Change(ILUC).Here I will show how to overcome these barriers from the point of view of A:Raw materials: (1)waste or in edible oil. (2)Cultivated at desolated land, B: Green Production method, C: Utilization of by-products metal soap and glycerin.

A)Raw Materials: Oil trees are cultivated at the coal mining desolated land in Quang Ninh provice(Photo1). Rubber seeds and animal fat which are now solid wastes(photo2-4).

Photo1. Cultivation of oil trees at coal mining. Photo 2. Rubber plantation photo 3. Rubber fruits, seeds, oil and BDF (10Mt/y in Asia) Photo 4. Animal fat. (30,000/y in Hanoi)

B) Green Prodution of BDF: Co-solvent method which can produce BDF very rapidly (time is less than 1/10) without heating and small amounts of waste (also 1/10 compared with conventional mechanical stirring. Further more, pure glycerin, which can be utilized for glycerin fuel cell or hydrogen evolution by photo-catalyst with sun light, can be produced as by-product because soap can not be formed in the transesterification process.

Photo 5. Co-solvent method for Green BDF production Fig.1. Rapid separation Photo 6. Pilot Plant in VNU Hanoi Photo.7 High quality BDF by co-solvent

C) Fuel as B100: BDF produced was used for Ha Long Cruising Boat and Hanoi Bus as B100

Photo 8. B100 fueled engine test with Ha Long boat Photo 9. Common Rail engine for B100 Fig 2. Exhaust gasTest from BDF 10. BDF fueled Ho Chi Minh Bus

D) By-products, Glycerin and metal soap utilization

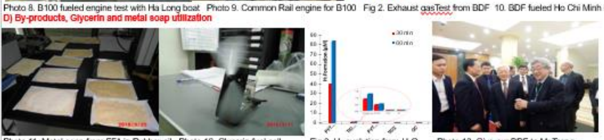

Photo 11. Metal soap from FFA in Rubber oil Photo 12. Glycerin fuel cell Fig.3 H_2 evolution from H_2O Photo 13. Give our BDF to Mr.Trong

E) How to produce BDF cheaper than Petro-diesel: BDF cheaper than petro-diesel can be produced by cascade and integrated utilization of by-products such as metal soap, vitamin E, cosmetic oil and glycerin.

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Extension of Solvent Treatment Method developed by SATREPS program to ASEAN region

Kouichi Miura, Hideaki Ohgaki, Ryuichi Ashida (Kyoto Univ.), Katsuyasu Sugawara (Akita Univ.)
Bundit Fungtammasan, Nakorn Worasunarak, Suneerat Fukuda (JGSEE/KMUTT),

We have been developing the so called "Degradative Solvent Extraction" technology under a SATREPS project between Japan and Thailand. The technology dewaters and upgrades low carbonaceous resources such as low rank coals, biomass, wastes, etc. under rather mild conditions. The upgraded products are expected to be utilized as high quality fuels, precursors for advanced materials, etc. as shown in Fig. 1. The purposes of our collaborative research are to extend the outcome of the SATREPS project to ASEAN countries through several schemes, including joint researches and human exchanges.

The figure below shows what we can realize using the degradative solvent extraction. Low grade carbonaceous resources such as low rank coals, biomass wastes, etc. are converted to three solid products called Soluble, Deposit, and Residue, depending on their solubility. The three fractions are all free from water. Soluble which is free from ash and high carbon content is the smallest molecular weight fraction and its properties are almost independent of raw materials. The SATREPS project intends to establish the Degradative Solvent Extraction technology using a relatively large extraction apparatus and to propose the methods to utilize Soluble and Residue. Now we are designing the large extraction apparatus and have already succeeded in proposed in prepare unique carbon fiber from Soluble and to use Residue as high quality solid fuel.

What the "Degradative Solvent Extraction" can realize.

Properties of Soluble

C base yield from coal : ~30%
from biomass : ~70%

Raw material independent property
high HHV : C≒82 %, H ≒9 %, O ≒9%
low MW: 100-500, peak at ca. 300
80 % are volatile components
melts below 100 °C
free from water and ash

Introduction of affiliate Laboratory:

Institute of Advanced Energy, Kyoto University

Main research contents: Utilization of low grade carbonaceous resources by novel technologies.
Facilities and Equipment: Thermoanalysis facilities (TG,TMA, and DSC), Gaschromatograph, FTIR, SEM-EDS, Elemental Analyzer, Pore surface analyzer

JGSEE/KMUTT

Main research contents: Utilization of coal and biomass wastes by novel technologies.
Facilities and Equipment: Thermoanalysis facilities (TG,TMA, and DSC), Gaschromatograph, GC-MS, FTIR, SEM-EDS, Elemental Analyzer, Sulfur analyzer, Pore surface analyzer, Drop tube furnace, Low temperature plasma asher

Experimental facilities at Kyoto Univ. and JGSEE/KMUTT

Expected outcomes and Prospects for the social implementation.

We are expecting the following outcomes from the SATREPS project:

1. Implementation of a new technology for utilizing low rank coals and biomass wastes in Thailand
2. Human building in both Japan and Thailand for effective utilization of biomass waste/low rank coal
3. JGSESS/KMUTT and PTT-RTI help dissimilation of the technologies developed to ASEAN countries
4. JGSESS/KMUTT works as a center of biomass conversion technology development and human resource building in ASAEN countries

We have held a Workshop that publicize the SATREPS activity with the attendance of ASEAN delegates on March 1, 2016. Through this kind of activity we will extend the results of the SATREPS project. This JASTIP project will surely guarantee such activities.

Attendee from ASEAN countries (March1, 2016, Bangkok, SATREPS Workshop)

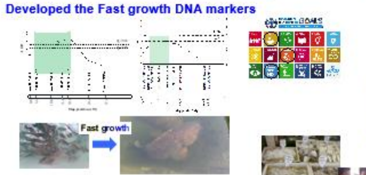
Development of Aquaculture Technology for Food Security and Food Safety for the Next Generation

Nobuaki OKAMOTO[1] and Varin TANASOMWANG[2]
[1]Tokyo University of Marine Science and Technology, [2]Department of Fisheries, Thailand

Next-generation of aquaculture system promises solutions to current issues
Aquaculture has boomed in recent years worldwide, and now accounts for almost 50% of all fishery produce. However, fish farms face great many problems, including frequent disease outbreaks, securing stable supplies of feed, and maintenance of safety, and there is an urgent need for next-generation technologies that address these problems. As the leaders of Asia's aquaculture industry, Thailand and Japan have teamed up to leverage biotechnology to develop new systems for boosting production of groupers, sea bass, prawn and other commercially important varieties of seafood. In particular, molecular breeding, surrogate broodstock technology, immunization/ vaccines, development of feed alternatives, establishment of stricter seafood safety protocols were the focus.

Focus also on creation of improved strains as a new departure in aquaculture
This project aimed to leverage molecular genetic findings to develop strains that grow rapidly and are resistant to disease and stress. We also attempted to use certain species of fish as surrogates to produce the gametes of species that have so far proven difficult to culture, as well as developing technologies for other aspects of aquaculture, including the production of alternatives to fish meal as feed, prevention of infectious diseases, and assurance of food safety.

Developed the Fast growth DNA markers



Surrogate broodstock technology

Developed EMS/AHPND diagnosis method

You can see more in detail about our project at http://www.jst.go.jp/global/english/kadai/h2307_thailand.html

JST-JICA SATREPS "The Project for Development and Dissemination of Sustainable Production System based on Invasive Pest Management of Cassava in Vietnam, Cambodia and Thailand"

Keiji TAKASU, Faculty of Agriculture, Kyushu University

Cassava in Asia: Cassava (Fig. 1) is a tropical tuber crop and the sixth most important crop in the world. Over the last couple of decades, cassava production has been increasing steadily in South East Asia because cassava has high carbohydrate production potential and generates billions of dollars of foreign currency revenue as cash crop and as bio-energy crop (Fig. 2).


Fig.1 Cassava plants (left), tubers (center) and stem cuttings (right). After harvest, stem cuttings are kept in the field until they are planted.


Fig. 2 Multipurpose uses of cassava and its starch

Invasive diseases and insect pests of cassava in Southeast Asia: the rapid acceleration of trade among SE Asia have led to increasing crop damage from invasive diseases and insect pests, including cassava mealybug, cassava witches' bloom and Sri Lankan cassava mosaic virus (SLCMV) (Fig.3). These diseases and insects are suspected to spread quickly and widely by movement of cuttings (Fig. 1).

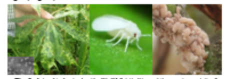


Fig 3. A leaf infected with SLCMV (left) and its vector, white fly (center), and cassava mealybug (right).

Project goal: Development of model systems for sustainable cassava production in Vietnam and Cambodia

Collaborative research Institutes: Kyushu University, Tokyo University of Agriculture, University of Tokyo, Riken, and Nagoya University, Japan; Agricultural Genetics Institute, Plant Protection Research Institute, Hung Loc Agricultural Research Center, Nong Lam University, Vietnam; University of Battambang, Cambodia; and Rayong Field Crops Research Center, DOA, Thailand.

Research components: There are the four research components, ST1, ST2, ST3 and ST4 to conduct international collaborative research project (2015-2020).

ST1: Plant Disease Management
- Cassava phytoplasma/virus detection technology (Fig.4)
- Effective pest monitoring system using ICT(Fig.5)

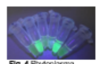


Fig. 4 Phytoplasma Universal Detection Kit


Fig. 5 smart phones could be useful tools for monitoring pest occurrence, extension management, and technology transfer

ST2: Insect Pest Management
- Guide book for cassava insect pests and their natural enemies (Fig.6)
- Effective biological control of mealybugs (Fig. 7)


Fig. 6 cassava pests and their natural enemies


Fig. 7 A parasitoid of cassava mealybug (left), which can be easily mass-reared with pumpkin (right)

ST3: Seed Management and Molecular Genetics
- Healthy cassava seedlings (Fig. 8)
- Introduction of Thai's technology to Vietnam and Cambodia
- New breeding technology for shortening breeding cycle


Fig. 8 *In vitro* tissue culture (left), hydroponic culture (center), and screen houses for healthy seedling productions at AGI, Hani, Vietnam.

ST4: Sustainable Technology Dissemination
- Sustainable dissemination system of healthy seedlings and pest management tools
- Baseline survey (Fig. 9)
- Capacity development (Fig. 10)


Fig. 9 household interview for baseline survey


Fig. 10 Technical training for young scientists at collaborative institutes at Vietnam

Expected outcomes:
1. Management tools for cassava diseases and insect pests
2. Pest monitoring system using ICT
3. Sustainable healthy cassava seedling production and dissemination system in Cambodia and Vietnam (Fig. 11)
4. Transfer of technology and knowledge of cassava production in Thailand to Vietnam and Cambodia
5. Capacity development for plant pathology, entomology, crop science and breeding and rural development
6. Benefit partner countries by raising the income of small-scale farmers, boosting employment at processing plants in the region, serving as a source of foreign currency, providing biomass for use, and offering policy hints

Fig 11. A market-based "triple-win" dissemination model that benefits the private sector, farmers, and government.

SATREPS Project: Development of Internationally Standardized Microbial Resource Center to Promote Life Science Research and Biotechnology

Ken-ichiro Suzuki*, Hiroko Kawasaki *Biological Resource Center, National Institute of Technology and Evaluation (NBRC) and*
Witiaksono, Siti N. Projono and Bambang Sunarko *Indonesian Institute of Sciences (LIPI)* *Present address: Tokyo Univ. Agriculture

Purpose of Project
- **Development of Indonesian microbial resources** for human health and environmental restoration
- **An ex-situ conservation** of Indonesian microbial resources through impovement of Indonesian Microbial Collection at RCB-LIPI
- **Sustainable utilization** of Indonesian microbial resources for improving food and health
- **Creating global partnership** between culture collection center and stimulating development of bioindustry in Indonesia and Japan

Output of Project
1. **InaCC**, Indonesian national microbial resource centers, was established in LIPI to collect and preserve microorganisms to promote further study and application.
2. **InaCC** will contribute to access and use of Indonesian microorganisms in compliance with CBD related laws and regulations.
3. Diversity and potential of Indonesian microorganisms were recognized.
4. More than 2000 strains of various microorganisms, including filamentous fungi, yeasts, microalgae, bacteria, archaea and bacteriophages were registered and preserved in **InaCC** with their taxonomic information.

Outlines of Project

Summary of Research for New Microbes
- Yeasts accumulating lipid in the cells were isolated.
- Yeasts utilizing xylose were isolated.
- New actinomycete species were isolated and characterized.
- Endophytic fungi in chinchonae were isolated.
- Ectomycorrhizal fungi for Dipterocarps and Sumatra pine were isolated.

InaCC Inaugurated on Sept 11, 2014


Inauguration ceremony of InaCC Building was held at the attendance of Vice-President of Indonesia, Minister of Ristek, Governor of Bogor Province as well as Chairman of LIPI


InaCC Building LIPI (3,500 m²)

Establishment of **InaCC**
↓
Technology was transferred for preservation, quality maintenance and management of microbial resource center.
↓
Cooperative studies were achieved and microorganisms isolated from Indonesian environment were added in InaCC collection.
↓
InaCC is supplying microbial strains to researchers and Industries in compliance with Indonesian laws and regulations.
↓
InaCC will support international cooperation including biological material transfer.


InaCC was certified by ISO9001:2008 for Quality management.

Number of Strains Isolated and Registered in InaCC and NBRC

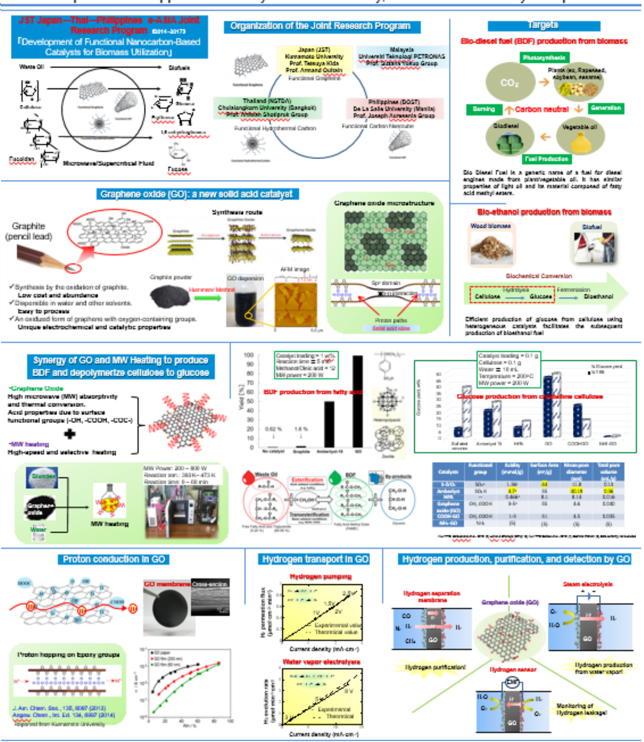
Research Subject	Microbes	Deposited in InaCC	Deposited in NBRC
RS2-A	Fungi	378	42
RS2-B	Yeasts	824	151
	Fungi	12	
	Microalgae	16	2
RS2-C	Actinomycetes	337	44
	Bacteria	53	
RS2-D	Bacteria	268	57
	Archaea	78	78
	Bacteriophages	9	9
RS2-E	Microalgae	89	39
RS3-A	Bacteria	240	61
RS3-B	Fungi	10	10
RS4-A	Bacteria	60	9
RS4-B	Bacteria	84	-
	Actinomycetes	5	5
Total		2472	707

Acknowledgment
SATREPS Colleagues of NBRC / NITE and other Japanese members
SATREPS Colleagues of RCB-LIPI and other Indonesian members

This work was partly supported by the Science and Technology Research Partnership for Sustainable Development (SATREPS), which is a research program structured as a collaboration of the Japan Science and Technology Agency (JST) and the Japan International Cooperation Agency (JICA).

Development of Functional Nanocarbon-Based Catalysts for Biomass Conversion Processes

Tetsuya Kida, Professor,
Department of Applied Chemistry and Biochemistry, Kumamoto University in Japan



Development of New Processes with Thermotolerant Microbes for Bio-refinery Including Biofuels, towards Utilization of ASEAN Biomass

Mamoru Yamada[1], Savitree Limtong[2], Anton Muhibuddin[3] and Somchanh Bounphanmy[4]
[1] Graduate School of Sciences and Technology for Innovation, Yamaguchi University, Japan. [2] Faculty of Science, Kasetsart University, Thailand.
[3] Faculty of Agriculture, University of Brawijaya, Indonesia. [4] Faculty of Natural Science, National University of Laos. Laos PDR.

Outline

In this project, we develop new and low-cost bioconversion processes of agricultural residues to useful materials including bio-fuels, using thermotolerant microbes from tropical environment. Japanese side develops new fermentation production technologies including the robustness improvement of thermotolerant microbes. Thai side develops technologies including isolation of thermotolerant microbes for the use of agricultural cellulosic residues and Indonesia and Laos sides develop technologies including isolation of thermotolerant microbes for the use of agricultural starch residues.

By mutually complementary studies on the isolation and breeding of microbes, fermentation, and technology development, it is expected to develop low-cost fermentation production technologies towards efficient utilization of agricultural residues in each of the countries concerned.

Purpose

Efficient utilization of biomass for biofuels or other useful materials is needed to overcome the problem of the global warming. For use of agricultural residues in ASEAN countries, in which there is abundant biomass, we will develop next-generation technologies with thermotolerant microbes that will enable bioconversion with greatly reduced running costs.

Achievements

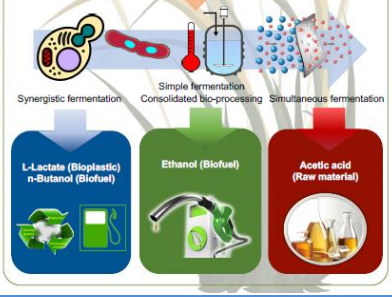
1. Acquisition of thermotolerant and tough microbes for high-temperature fermentation or temperature-uncontrolled fermentation.
2. Establishment of effective high-temperature fermentation with agricultural residues, especially in Thai and Indonesia.
3. Establishment of temperature-uncontrolled fermentation with agricultural residues, especially in Indonesia and Laos.
4. Establishment of an effective membrane separation procedure to concentrate fermented materials.
5. Development of the total process as a new technology from the upstream to downstream in production of useful materials with ASEAN biomass, especially in Thai.
6. Tight network formation for utilization of ASEAN biomass.
7. Fostering of young scientists involved in utilization of ASEAN biomass.

Developments

Enzyme and acid treatments → **Saccharification of biomass**

Thermotolerant and tough microbes → **High-temperature or uncontrolled fermentation**

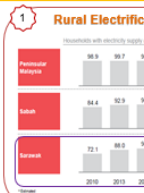
Membrane separation → **Concentration or dehydration of materials**



Optimal Design of Green Energy Systems Based on Photovoltaic Source for Rural Electrification in Malaysia

Mohd Amran Mohd Radzi[1], Nasrudin Abd. Rahim[2], Dr. Che Hang Seng[2], Prof. Dr. Hideaki Ohgaki[3], Mohd Izhwan Muhamad[1]
[1]Universiti Putra Malaysia, [2]Universiti of Malaya, [3]Kyoto University

1 Rural Electrification in Malaysia



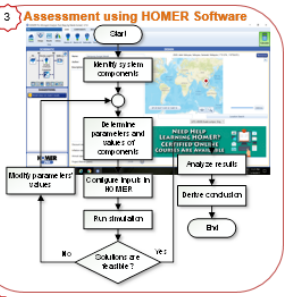
In Sarawak, which is located in Borneo Island, the estimated coverage in 2015 is only 94%, and to be targeted to achieve 99.9% in 2020. Although there are various existing works on installing renewable systems, potential of evaluating them for further improvement can be carried out, especially with appropriate design.

Renewable energy systems!

2 Objective

To develop optimal design of fully **green energy systems based on photovoltaic (PV) source** with reasonable cost and appropriate dispatch energy strategy for rural electrification in **two selected areas in Sarawak**

3 Assessment using HOMER Software



4 Outcomes of Optimal Design

Component/Parameter	Value	
	Kampung Opar	Kampung Sungai Merah
Architecture/PV (kW)	13.3	2.39
Architecture/1kWh LA	36	7
Architecture/Converter (kW)	3.22	0.67
Architecture/Dispatch	Cycle charging	Cycle charging
Cost/Cost of energy (COE) (USD)	0.652	0.624
Cost/Net present cost (NPC) (USD)	38,052	6,789
Cost/Operating cost (USD)	1,660	268.22
Cost/Initial capital (USD)	25,029	4,686
System/Renewable fraction (%)	100	100
PV/Capital Cost (USD)	13,264	2,385
PV/Production (kWh)	17,858	3,210
1kWh LA/Autonomy (hour)	24	25
1kWh LA/Annual Throughput (kWh)	4,526	851
Converter/Rectifier Mean Output (kW)	0.6	0.1
Converter/Inverter Mean Output (kW)	0.4	0.08

5 Conclusion

The work has successfully been carried out to design and simulate the renewable energy systems. The proposed systems have been configured in HOMER with all components involved such as PV source, load, battery and converter. The results conclude the optimized results with the lowest NPC.

6 Future Prospect

Appropriate design with comprehensive analysis through powerful software tool like HOMER should provide better future prospect in ensuring sustainable renewable systems. Through the optimal outcomes, the cost will be reasonable and should enhance possibility of applying the systems to fully cover all unelectrified areas. Finally, the supplied electricity later will provide better life for rural people.

Study on Energy Usage and Quality of Life for Rural Community Through Rural Electrification using Renewable Energy

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Abstract

To study the energy usage pattern and lifestyle before and after electrification of rural communities, we have started an international collaborative research which focuses on the interior Sarawak, Malaysia. Several rural villages in Sarawak have been identified, where some of the villages received electrifications via renewable energy sources, particularly by solar home systems (SHSs), while some others remained non-electrified due to their more remote geographical location. Four Iban communities with different rural electrification plans (grid, SHSs), have been studying on the changes in the energy usage pattern and the living lifestyle of these villages. Based on the findings on the differences and/or similarities between the energy usage pattern and life style of the villages under different rural electrification schemes, the more effective approach of implementing rural electrification can be deduced.

Introduction

Energy is indispensable for the development of human society. In this line, "Energy for all" is issued in Sustainable Development Goal 7 and the development of sustainable rural electrification schemes are required. Currently, to provide basic household electricity with standalone renewable energy (RE) systems, such as solar home systems (SHSs), is considered one of the solutions in remote villages where the grid power is not economically feasible. However, a fair number of the rural electrification projects have been observed to be unsustainable, due to various reasons. The evaluation of World Bank rural electrification projects found little evidence of direct impact on income generation or economic growth. Therefore, it is important to study the impacts of different rural electrification in rural communities to improve the sustainability of such schemes. For this purpose, we have started an international collaborative research which focuses on the interior Sarawak, Malaysia, where several rural villages remains in the off-grid condition due to their geographical location. Four Iban communities, Menangkin, Tabong, Jenggin and Kampung Sungai Merah, with different rural electrification plans (grid, SHSs), have been studying on the changes in the energy usage pattern and the living lifestyle of these villages. Figure 1 shows the different electrification schemes in these villages.

Fig. 1. Study sites in Sarawak and their electrification schemes.

Methodology

To measure the change of lifestyle of the villagers, a face-to-face interview based investigation has been carried out before and after the electrification. We use the concept of the quality of life (QOL) to quantify the villagers' living lifestyle with additional questions related to the energy consumption and the external conditions.

Wisconsin QOL indicators (M.A. Becker, 2014)
-General Satisfaction Level,
-Activities and Occupations,
-Psychological Well-Being,
-Symptoms/Outlook,
-Physical Health,
-Social Relations/Support,
-Money,
-Activities of Daily Living,
-Goal Attainment.

+ Energy consumption
-Electricity appliances
-Daily activity pattern
-Cooking method

+ External conditions
-Transportations
-Schools
-Hospitals

System Design

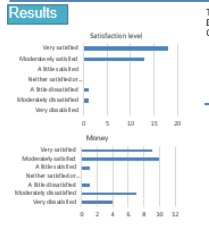
Kampung Sungai Merah

5 SHSs have been installed in this February and interview session will be held soon. . .

Monitoring

Analysis and Report

Results



The face-to-face interview has been conducted to 33 villagers, ranging from 20 to 71 years old. Based on the survey conducted so far, the following findings have been made with respect to the villagers' QOL:

- Most of the villagers (75%) have received education only up to primary school level
-Their incomes are lower than average (RM 3,831/month)
- 90% villagers are satisfied with their lives
- Thinking importance to connect with neighbors, and are in good health/mental conditions.
- Personal activities, i.e. watching movies or going for shopping, are at very low level because their access to transportation is very poor.

Summary

The aims of the project are:

- to study the **energy usage pattern** and **lifestyle** before and after the electrification of rural community in interior Sarawak, Malaysia
- to find the **effective schemes of implementing rural electrification** by survey on the differences and/or similarities between the energy usage pattern and lifestyle of the villages under different rural electrification schemes

We conducted interviews in 4 rural Iban villages in Sarawak, Malaysia. The QOL analysis shows a mono-culture style under non-electrification condition. SHS are about to be installed in one village. We will continue the interview session for these villages after the electrification or any big changes in the external conditions.
Myanmar, Cambodia, and Philippines researchers also want to attend this collaboration research.

Community Renewable Energy Implementation in Thailand

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[1]Graduate School of Energy Science, Kyoto University
[2]Faculty of Engineering, Chiang Mai University

Introduction

Renewable Energy (RE) is one of the key elements for sustainable development in Thailand and in other countries. Using RE, instead of fossil fuel, helps reduction of greenhouse gases, which cause global warming. In household scale, RE can be used in many ways. For example, firewood of charcoal is used to substitute Liquid Petroleum Gas or LPG for cooking. Solar PV is used to generate electricity for household consumption. Or solar energy is commonly used for drying clothes instead of using gas or electric heater.

Community RE project implementation is significant for de-centralized energy production and utilization. The community renewable energy projects typically use local resources for energy production. The energy produced is then used locally. In this way, the community becomes less dependent on imported energy. The community can be self-sufficient in terms of energy. In addition, the local economy could be improved in cases that some RE projects might provide income to community members. This is very significant to achieve Sustainable Development Goals (SDGs).

Anyway, RE implementation in slightly larger scale i.e. in community scale is very challenging. Community RE project requires contribution (e.g. capital, labor, commitment) from community members in order to drive the RE project running. Most of the cases, using locally available RE resources requires collective actions among community members.

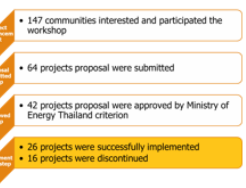


Figure 1. The process of communities renewable energy implementation in Thailand by Ministry of Energy Thailand from 2015-2016

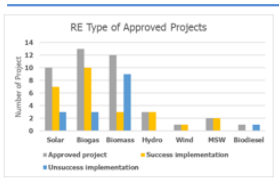


Figure 2. Energy generation activities (Number of the approved project from Ministry of Energy Thailand)

Methodology

Four key research questions were used to guide the research methodology, which are:

1. What is the current status of the CRE sector in Thailand?
2. What are the strengths of the CRE sector?
3. What are the challenges the CRE sector facing?
4. What are the opportunities that the CRE sector could pursue to help it grow?

To answer these questions, four research methods were used – surveys, interviews, group discussion and desk-top research.

Based on the 4 key research questions, the questionnaire was designed and used as a basic material for surveys and group discussion. The survey and interviews of the focus group were undertaken during February and March 2017 in 18 provinces of Thailand.

Results

Figure 3. Dominate factors of 28 successful implementation projects

Figure 4. Dominate factors of 16 discontinued projects

The following key factors are identified for both successful and discontinued projects;

- Owning RE resources
- Mature technology
- Good relation with education institution
- Co-investment

In addition, successful CRE projects are superior in;

- Leader Intention and vision
- Management skill and Human resource
- Community, Government and local authority participation

Summary

At the very final stage, it is important that the project have the leader who has the leadership having strong intension and management skill and the good relationship with community members and local authority. In other words, it is very difficult to check these factors at the planning stage.

Advancement of Asian Cassava Molecular Breeding by Cutting-edge Technologies

FY2012-2015

Advancement of cassava molecular breeding by cutting-edge technologies

Dr. Motoaki Seki

RIKEN Center for Sustainable Resource Science (JAPAN)

Molecular breeding of cassava by heavy-ion beam mutagenesis and transformation

Dr. Ham Huy Le

Institute of Agricultural Genetics (VIETNAM)

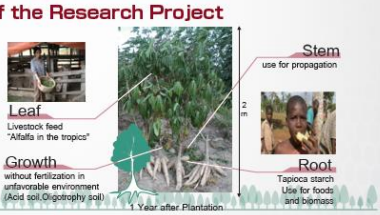
Marker breeding and transcriptome analysis for improving disease resistance in cassava

Dr. Jarunya Narangajavana

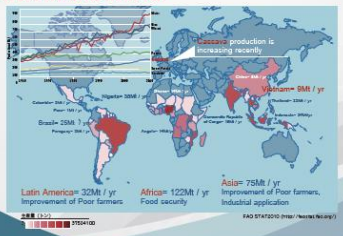
Mahidol University (THAILAND)

General Description of the Research Project

This collaborative research project aims to identify useful cassava genes and to advance molecular breeding of useful cassava plants,such as those with high-yield and high added value in Southeast Asia, by applying leading-edge science and technology to useful genetic resources of cassava, an important tropical crop.



Crop Production in the world



Now continuously Supported as part of a SATREPS Project (2016-)

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4th JASTIP Symposium

"Biomass to Energy, Chemicals, and Functional Materials"

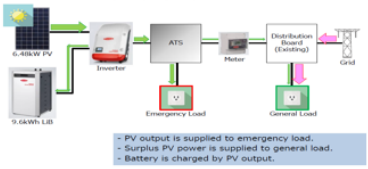
3rd and 4th July 2017 NSTDA, Thailand

RE implementation - PV installation program in University of Yangon

Dr. Pho Kaung / Rector of University of Yangon, Dr. Hla Toe / Pyay University and University of Yangon
Dr. Aye Aye Thant / University of Yangon, Hideaki OHGAKI / Kyoto University
Kyocera, and Earth RE Co. Ltd.

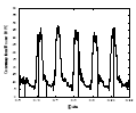
Objectives

University of Yangon wants to supply stable electricity by using renewable energy. Electricity requirement of the university is about 2 MW. A pilot project has been launched for installation of a PV system for a basic research and education in University of Yangon. A 20 kW grid-tied PV system has been designed and installed in the newly built research compound which has the maximum available capacity of up to 48 kW PV modules in the roof. Therefore a design work for the additional 30 kW grid-tied PV system has been started. We also continuously collect the electricity consumption pattern in the building and the grid stability, as well as the electricity generation from the installed PV system to optimization of the future PV system.



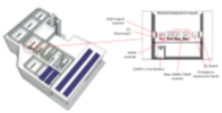
Operation of 20 kW PV with 10 kWh Li-ion battery storage system in Yangon University

Electricity consumption in the Science Building of University of Yangon



We started a basic data collection of the electricity consumption of the science building from March, 2016 by using power logger PW 3365A, Hioki. Fig.2 shows a typical electricity consumption pattern from June 5 to 11, 2016. It is clear that there were black-outs almost once in a day. However, the duration of the black-out was less than 10 minutes. The longest duration of the black-out was 40 minutes at June 6 to June 7. The diesel back-up generator (750 kW) has been installed in the power distribution station and it has been operated by manual. Therefore, the black-out of the grid power line could be longer than the observed one. Currently the peak electricity consumption does not exceed 50 kW, but it should be larger in the new research building. Therefore 100 kW PV system should be prepared. However, the limitation of the budget, the designed system is targeting only partial equipment, emergency lights which requires about 3 kW.

Next phase of 30.24 kW for pilot plan 100 kW



Expected outcomes

The aims of the project are:
-to design the pilot PV system in the research building to supply a stable electricity
-to monitor the electricity consumption pattern and stability of the grid electricity
-to teaching and research of student and young researchers
-to design additional 30.24 kW grid-tied PV system in the research building
-to design the final goal of 2 MW PV system

New University Research Centre of UY, some science advanced research equipment will west up in this centre, University of Yangon, 11041, Kamayut Yangon.

We have abundant of RE resources and situations, we want to do collaboration research with other organizations

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Our Sustainable Tree

Our Sustainable Tree

Work Together towards the SDGs!

SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

SUSTAINABLE DEVELOPMENT GOALS

SUMITOMO CHEMICAL GROUP
GLOBAL PROJECT

5. Exhibition Booth

	Company	
1	AZ Science Thailand Co. Ltd	
2	Dai-Ichi Kikaku Co. Ltd	
3	Eight-Japan Engineering Consultants Inc.	
4	Hitachi Zosen Corporation Bangkok Office	
5	Mitsui Chemicals Singapore R&D Centre, PTE LTD	
6	JFE Steel (Thailand) Ltd.	
7	JFE Engineering (Thailand) Ltd.	
8	I2P Ventures	
9	Shimadzu (Asia Pacific) Pte Ltd.	
10	Kikkoman Biochemifa Company	

	Company	
11	Toyo Business Group	
12	Benja-Wins Co.,LTD	
13	Thailand Environment Institute	
14	Mitr Phol Innovation Center	
15	Green Innovative Biotechnology Co., Ltd.	
F1	JICA Project AUN/SEED-Net	
F2	JSPS Bangkok Office	
F3	JST	

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6	Akira Takagi	Kyoto University
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8	Amnart Insavang	Petroleum and Energy Business Development IRPC Public Company Limited
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10	Anucha Euapermkiati	PTT Global Chemical Public Company
11	Anurak Winitsorn	PTT Public Company Limited(PTT)
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17	Atthapon Srifa	Mitr Phol Group, Mitrphol Innovation and Research Center
18	Auttapol Golaka	Siam Cement Public Company Limited
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21	Banjong Buhiran	IRPC Public Company Limited
22	Benjaphon Suraraksa	National Center for Genetic Engineering and Biotechnology
23	Benjarat Bunterngsook	National Center for Genetic Engineering and Biotechnology
24	Benyapa Suwan	NSTDA
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34	Chewarat Panrachapin	Toyo Business Group
35	Chiaki Ogino	Kobe University
36	Chinnatad Sinprasertchok	Feed Addition co.,
37	Chomtana Yubaniyane	CO
38	Chonpoopideb Teamuidebalcou	Chulalongkorn University
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40	Chularat Sakdarannaroy	Mahidol University
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54	Hiroyuki Hasebe	JFE Engineering
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62	Jirawadee Matoon	Co organized
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73	Karsioete Teerantayanarn	GIE
74	Kazuhiko Aoki	JST
75	Keerati Saongpitai	BSC
76	Kei Ayukawa	Kyoto University
77	Keiichi Ishihara	Kyoto University
78	Keiji Takasu	Faculty of Agricultue, Kyushu University
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87	Konrat Kerdnawee	Chulalongkorn University
88	Korakod Nusit	Naresuan University
89	Korrakit Pongpiriyapap	Toyo Business Group
90	Kridsanapon Seakphukheaw	National Science and Technology Development Agency
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110	Natchanapong Vajiravongburi	Inspector General,
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117	Nobuko Sugawara	AZ Science Thailand Co. Ltd
118	Nobutaka Ito	Faculty of Engineering, Chiang Mai University
119	Noriaki Matsuo	Hitachi Zosen Corporation Bangkok Office
120	Noriko Furuya	JSPS Bangkok Office
121	Nuengnam Navaboonniyom	AA World Eco Co., Ltd.
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125	Paidawan Soannongoa	YANMAR S.P. CO., LTD.
126	Pakorn Petchprayoon	Geo-informatics and Space Technology Development Agency(GISTDA)
127	Paphanarin Raeoklorn	BSC
128	Papitchaya Utanun	NSTDA
129	Paripok Phitsuwan	King Mongkut's University of Technology Thonburi
130	Parnchewa Udomsap	King Mongkut's Institute of Technology Ladkrabang
131	Patraporn Wattanakulchart	National Metal and Materials Technology Center (MTEC)
132	Pattaraporn Nim-O	Thailand Environment Institute
133	Paweena	King Mongkut's Institute of Technology Ladkrabang
134	Pawnprapa Pitakjakpipop	National Metal and Materials Technology Center (MTEC)
135	Peerada Prommeenate	King Mongkut's University of Technology Thonburi, Bangkuntien
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138	Phonnapa Yapan	Thailand Environment Institute
139	Piangpit Pattanamonglchon	
140	Pichai Uamturapojn	Thailand Environment Institute (TEI)
141	Pichet Rojanapitayakorn	SCG Chemicals Co., Ltd.

142	Pinit Jirukkakul	Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives
143	Pipat Suttiwisedsak	Ekarat Pattana Company Limited
144	Pipat Chitnumsab	Electricity Generating Authority of Thailand (EGAT)
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153	Preedawan Chaisnchonlathon	Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives
154	Purichaya Kupteyit	
155	Puspita Lisdiyanti	LIPI
156	Puttinun Jaruwat	Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives
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158	Rit Iemthanon	OEA
159	Rubwad Mathuranyanon	mitrphol
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168	Shiro Sadoshima	Ambassador of Japan in Thailand
169	Shoko Tsurubo	Kyoto University
170	Shota Komoto	Dai-Ichi Kikaku Co. Ltd
171	Siripit Songtawee	Chulalongkorn University
172	Siriporn Theammaka	TAIST Student
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178	Suchat Pongchaiphol	National Center for Genetic Engineering and Biotechnology(BIOTEC)
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