生存圏アジアリサーチノード活動報告

Humanosphere Asia Research Node Activity Report

ARN / HSS / ISSH 2017



生存圏アジアリサーチノード
Humanosphere Asia Research Node

Table of contents

1. Preface 2
2. Humanosphere Asia Reserarch Node 3
3. ARN/HSS 2017/7th ISSH Overview 13
   - 3-1. HSS 2017/7th ISSH
   - 3-2. ARN Biomaterials Workshop
   - 3-3. ARN/JASTIP Bioresources and Biodiversity Workshop
4. ARN/HSS/ISSH 2017 Reports from Young Researchers 27
5. Japanese Summary of the ARN/HSS/ISSH 2017 Reports 81

Acknowledgements 91

1. Preface



Director of RISH
Takashi Watanabe

The environment surrounding humans is changing rapidly with complicated interlinkages, threatening sustainable development and healthy living. There has been an increasing demand for reliable future projections based on an accurate understanding of current conditions of Humanosphere, and for the presentation of measures for solving the problems. To establish the Sustainable Humanosphere, international collaboration and expansion of Humamosphere Science on a global scale is essential.

In 2016, RISH launched a new program called the Humanosphere Asia Research Node (ARN) to strengthen its function as a hub for international collaborative research and foster innovation in the field of humanosphere science, with the ultimate goal of delivering solutions to global-scale problems. ARN's activities in the past include the following: 1) an ARN joint laboratory was founded in Indonesian Institute of Sciences (LIPI) jointly with Japan-ASEAN Science, Technology and Innovation Platform (JASTIP) project; 2) the 1st ARN Symposium on Humanosphere Science was held in Penang, Malaysia; 3) the 2nd ARN Symposium on Humanosphere Science was held in Uji, Japan, 4) a number of RISH Open Seminars were delivered and broadcasted live to selected foreign research organizations via web conferencing service; 5) a server mirroring system of "Humanosphere Science Database" was installed in Indonesia; 6) and a lecture and practical training course on atmospheric science were offered. ARN also served as a co-organizer for the International Workshop on Bioresources and Biodiversity at Uji, Kyoto (with the JASTIP), and "Humanosphere Science School 2016" in Indonesia.

From Oct.31st to Nov. 3rd in 2017, LIPI and RISH jointly held the Humanosphere Science School (HSS) together with the satellite meetings, the International Symposium for Sustainable Humanosphere (ISSH), ARN Biomaterials Workshop and ARN/JASTIP Bioresources and Biodiversity Workshop at Bogor and Cibinong, Indonesia. ARN supported 15 master course students, 8 Ph.D. course students and 4 post-doctoral researchers, total 27 young scientists, to join the series of meetings from RISH. Researchers from Thailand, Laos, Myanmar, China, Egypt, Malaysia and Taiwan were invited in addition to the participants from Japan and Indonesia. Through all these ARN's activities, RISH pursues the integration of different research disciplines, and seeks to promote the internationalization of humanosphere science.

This booklet is a report of HSS, ISSH and ARN meetings at Bogor/ Cibinong in 2017 with brief summary of ARN activities since 2016. Research abstracts of HSS/ ISSH and impression by the graduate students and young researchers are included. We will continue to actively expand on educational and research activities in collaboration with the Humanosphere Science community with an effort to scientifically demonstrate the landmarks in mankind's path toward the construction of a sustainable Humanosphere. We look forward to your valuable assistance, support and participation.

Director of RISH, Kyoto University
Takashi Watanabe

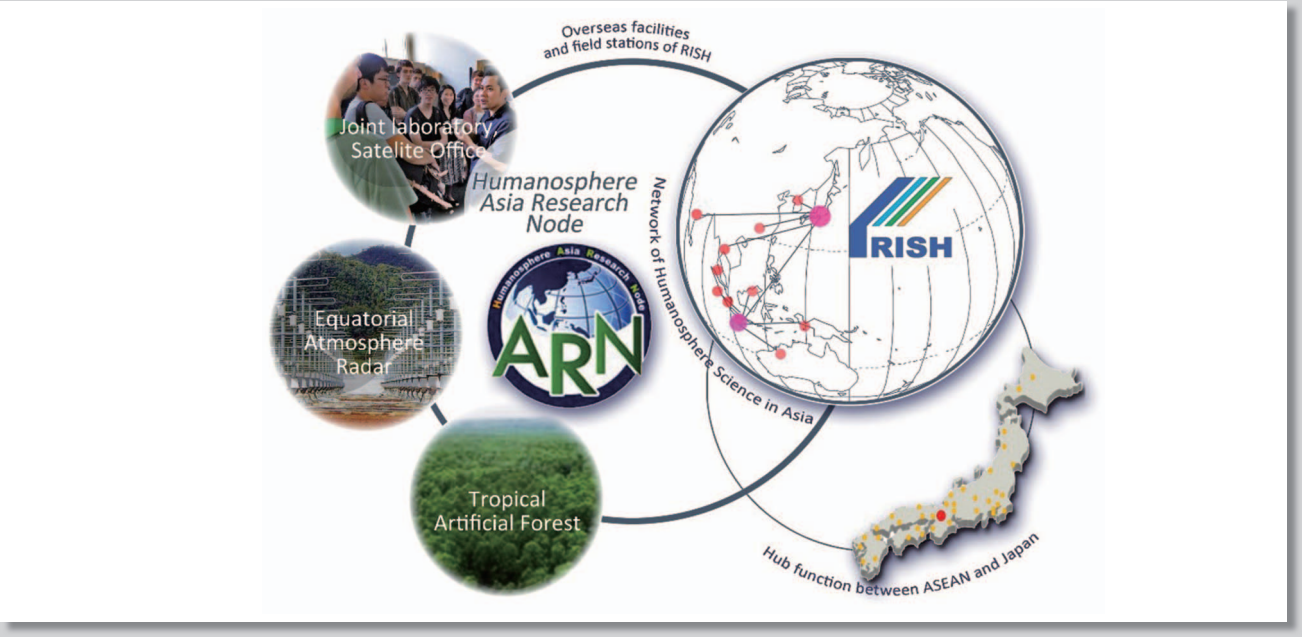
2. Humanosphere Asia Research Node



Outline of Humanosphere Asia Research Node

International Promotion of Humanosphere Science

In 2016, RISH initiated a new program named “Humanosphere Asia Research Node (ARN)”, thereby strengthening the hub functions of international collaborative research and fostering innovations on Humanosphere Science with an ultimate goal to deliver solutions on a global scale. In FY2016, ARN’s achievement includes the following: 1) an ARN joint laboratory was founded in Indonesian Institute of Sciences (LIPI) jointly with Japan-ASEAN Science, Technology and Innovation Platform (JASTIP) project; 2) the 1st ARN Symposium on Humanosphere Science was held in Penang, Malaysia; 3) a number of RISH Open Seminars were delivered and broadcasted live to selected foreign research organizations via web conferencing service; 4) a server mirroring system of “Humanosphere Science Database” was installed in Indonesia; 5) and a lecture and practical training course on atmospheric science were offered. ARN also served as a co-organizer for the International Workshop on Bioresources and Biodiversity at Uji, Kyoto (with the JASTIP), and “Humanosphere Science School 2016” in Indonesia. As July 2017, ARN held “the 2nd Asia Research Node Symposium on Humanosphere Science” at Uji, Kyoto, in which more than 30 speakers from not only Japan but also all over the world were invited. Most recently, ARN supported HSS 2017 together with two satellite symposiums in collaboration with JASTIP and the Science and Technology Research Partnership for Sustainable Development (SATREPS). With all these ARN activities, RISH is in a perfect position to pursue integration of different research disciplines and also to promote internationalization of Humanosphere Science.



Network of Humanosphere Science in Asia

We have initiated a collaborative network of Humanosphere Science in Asia with overseas research institutes to promote further utilization of RISH's large facilities and field stations in overseas.

Overseas facilities and field stations
Equatorial Atmosphere Radar (EAR), Kototabang, Indonesia
Tropical artificial forest, Indonesia
Kyoto University satellite office, Bogor Agricultural University (IPB), Indonesia
ARN & JASTIP Joint laboratory, LIPI, Indonesia

Major cooperative overseas research institutes
LIPI (Indonesian Institute of Sciences), Indonesia
LAPAN (National Institute of Aeronautics and Space), Indonesia
RIHS (Research Institute for Human Settlements), Indonesia
Faculty of Forestry, Mulawarman University, Indonesia
Forestry Faculty, Tanjungpura University, Indonesia
Faculty of Civil Engineering and Planning, Islamic University of Indonesia, Indonesia
NARL (National Atmospheric Research Laboratory), India
Indian Institute of Geomagnetism, India
Forestry and Wood Technology Discipline, Khulna University, Bangladesh
Faculty of Agro-Industry, Chiang Mai University, Thailand
Faculty of Science, Chulalongkorn University, Thailand
NSTDA (National Science and Technology Development Agency), Thailand
School of Bioresources and Technology, King Mangkut's University of Technology Thonburi, Thailand
King Mongkut's Institute of Technology Ladkrabang, Thailand
School of Biological Sciences, Universiti Sains Malaysia, Malaysia
Ho Chi Minh City Institute of Physics, Vietnam Academy of Science and Technology, Vietnum
Faculty of Engineering, National University of Laos, Laos
Institute of Plant Physiology and Ecology, Shanghai Institutes for Biological Sciences, CAS, China
Institute of Geology and Geophysics, Chinese Academy of Sciences, China
China Research Institute of Radio-wave propagation, China
College of Agriculture and Natural Resources, National Chung Hsing University, Taiwan
National Central University, Taiwan
National Cheng Kung University, Taiwan
Department of Information Technology, Hsing Wu University, Taiwan

Collaboration with Other Research Programs

ARN works in collaboration with other international research programs such as JASTIP, SATREPS and IUGONET, as well as domestic research network such as the Forum for Sustainable Humanosphere.

JASTIP

Japan-ASEAN Science, Technology and Innovation Platform

SATREPS

Production of Biomass Energy and Material through Revegetation of Deteriorated Grass Fields in Science and Technology Research Partnership for Sustainable Development (SATREPS) program

IUGONET

Inter-university Upper atmosphere Global Observation NETwork

The Forum for Sustainable Humanosphere

Consists of members from 47 ministries / public research organizations, 59 universities and more than 35 private enterprises

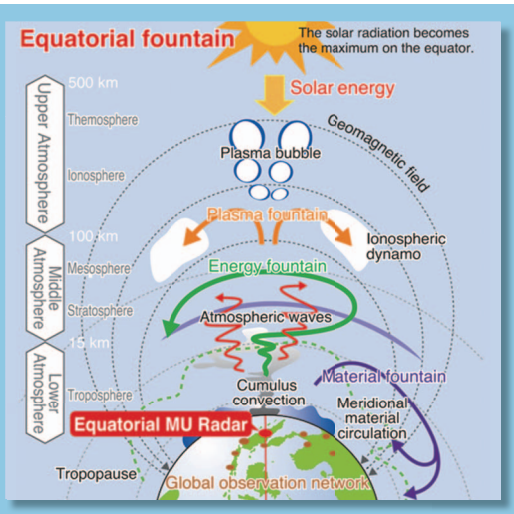


Hub Function between ASEAN and Japan

ARN serves a hub that connects research network between ASEAN and Japan through the joint laboratories in Indonesia, and also an opportunity for various research institutes of Japan to access ARN's overseas research facilities. In addition, we highly encourage overseas researchers to conduct collaborative research using the domestic facilities under the joint usage platform promoted by ARN.

International Collaborative Research

ARN promotes international collaborative research and field education on Humanosphere Science associated with “Equatorial Fountain”, “Utilization of Wooden Biomass”, and “Database for Humanosphere Science”.



Cooperative Study of the “Equatorial Fountain”

The energy and material flows that occur in all height regions of the equatorial atmosphere, which are referred to as the ”Equatorial Fountain”, will be studied.

Cooperative Research on the Sustainable Production and Utilization of Tropical Biomass in Relation to Environmental Conservation

Aiming to contribute to the production, recycling, and conservation issues of tropical biomass, this subject deals with topics as breeding of useful tropical plant, production of physiologically active substances, conversion of biomass to useful substances or materials, and development of high strength timber buildings.

This subject collaborates with projects such as JASTIP and SATREPS to promote the following international collaborative research on tropical biomass.

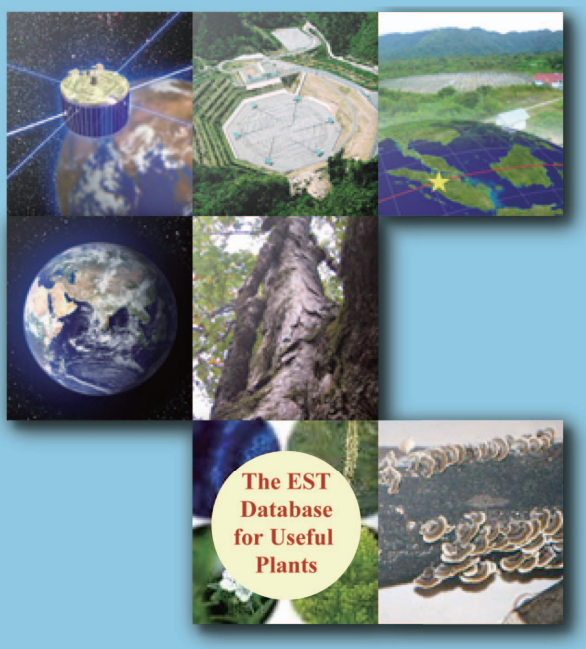
- Conversion of tropical biomass to functional materials, chemicals and fuels
- Search for useful tree species suitable for material production
- Invasive control of wood harmful insects
- Environmental purification using tropical microorganisms and enzymes
- Development of safe and environmentally friendly housing and its structural members
- Breeding of plants with useful traits and environmental restoration of degraded areas



International Cooperative Studies Using the Database for Humanosphere Science

This subject promotes collaborative research on database for Humanosphere Science by placing mirror server at overseas to improve accessibility that allows researchers in each country to utilize databases, accumulate individual research results and promote mutual reference.

The database for the humanosphere is the collection of digital data related to the humanosphere accumulated from research at our institute, including the terrestrial human habitat, the forest-sphere, the atmosphere, and outer space. These electronic data are open to the public via the Internet.



- Database of the space electromagnetic environment
- Atmospheric radar observation data
- Equatorial atmosphere observation data

- Global Atmospheric Observation Data
- Wood Diversity Database

- EST Database for Useful Plants
- Basidiomycetes Genetic Resource Data Base

- RISH was elected a regular member of the World Science Data System (WDS) of the ICSU (National Assembly Science Council) in March 2016 after being evaluated the importance of the long-term atmospheric observation database by the MU radar and the Equatorial Atmosphere Radar (EAR). Further promotion of international use of data is requested through maintaining and developing a Humanosphere database including the MU radar and EAR.
- The primary data independently obtained by the MU radar and EAR is copied as archive data and installed in the mirror server in Indonesia, so as to protect databases and to improve accessibility from Indonesia.
- We promote utilization of the Humanosphere database in Indonesia by utilizing the function of IUGONET which is a data exchange system. For this purpose, the data recording device (RAID, 140 TB) and PC for data management were relocated to LAPAN in Bandung.
- We are promoting collaborative research with Indonesia's wooden specimen storehouse through utilization of the wood diversity database of RISH.



Mirror server in Indonesia

Capacity Building

ARN supports the career development of young researchers and engineers by offering opportunities for engagement of collaborative research and involvement of international schools in Indonesia and other Asian countries. With ARN's support, their research capacity can be built as future leading scientists in various research fields of Humanosphere Science.

ARN & JASTIP Joint Laboratory

We established a joint laboratory (jointly with JASTIP) in Biological Functional Materials Research Center of LIPI, Cibinong, Indonesia to strengthen collaboration with international research partners and various domestic research institutes.





International School, Symposium

Capacity building of international researchers on Humanosphere Science is carried out through holding international school, workshop and symposium.





Most recently in November2017, we held Humanosphere Science School 2017 (HSS) and the 7th International Symposium for Sustainable Humanosphere (ISSH) in Bogor, Indonesia.

This year 2 satellite workshops were held:

- ARN Biomaterials Workshop
- ARN/JASTIP Bioresources and Biodiversity Workshop

Open Seminar

RISH Open Seminars are delivered and broadcasted live to partner research organizations LIPI and LAPAN in Indonesia via web conferencing service.



Intensive Course, Technical Training

We provide intensive lectures, various practical training and technical exercises on Humanosphere science.





Research guidance on wood material development, and Construction of network system for online meeting, provided by Dr. Umemura at LIPI, Bogor, Indonesia (April 2017)

Radar Observation Practice including practice of radar observation, basics of data processing and data analysis, provided by Dr. Hashiguchi at EAR Observatory, Kototabang, Indonesia (November 2016)

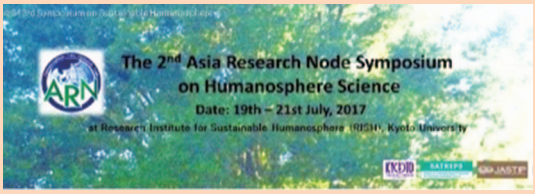
Intensive lecture on atmospheric dynamics process and atmospheric measurement method, provided by Dr. Tsuda at LAPAN, Bandung, Indonesia (April 2016)

Related Events

The 2nd Asia Research Node Symposium on Humanosphere Science

2017/07/19-21 Venue: Uji, Kyoto

The 2nd ARN Symposium on Humanosphere Science was proudly joined by a total of 228 participants from 41 research institutes in 13 countries including 36 invited speakers in which 18 were from Asia, 4 from Europe and United States and 14 from the domestic. We were also joined by 51 young researchers who shared their research by presenting their posters and taking part in the elevator speech session.











The 1st Asia Research Node Symposium on Humanosphere Science

2017/2/20-21 Venue: Penang, Malaysia

The ARN Symposium was held with the aim of internationalizing the Humanoshere sciences and the career development of young researchers. More than 60 participants from Malaysia, Japan, Thailand, Singapore, Taiwan, etc. attended the symposium, including 9 graduate students and 10 researchers from RISH.







The 2nd Workshop of Bioresources and Biodiversity Research in JASTIP & International Premeeting of Humanosphere Asia Research Node on Biomass Utilization

2017/1/23 Venue: Uji, Kyoto

A total of 27 presentations on the use of tropical biomass was given for 72 participants including 16 foreign researchers.





Humanosphere Science School 2016 (HSS) and The 6th International Symposium for Sustainable Humanosphere (ISSH)

2016/11/15-16 Venue: Bogor, Indonesia

Co-organized with JASTIP and SATREPS, HSS and ISSH 2016 was held in Bogor, Indonesia. Latest issues related to the Humanosphere science were discussed by a total of 260 participants.







International Symposium on 15th Anniversary of Equatorial Atmosphere Radar (EAR)

2016/8/4 Venue: Sari Pan Pacific Hotel, Jakarta, Indonesia

With a total of 221 participants, the Equatorial Atmosphere Radar 15th anniversary event was held in Jakarta, Indonesia. Major participants were listed below

- Minister Kozo Honma, Embassy of Japan in Indonesia
- Dr. Muhammad Dimyati, Rector of Indonesia Ministry of Research, Technology and Higher Education (RISTEKDIKTI)
- Dr. Thomas Djamaluddin, Director of National Institute of Aeronautics and Space (LAPAN)
- Dr. Kayo Inaba, Executive Vice President of Kyoto University
- Dr. Takashi Watanabe, Director of RISH, Kyoto University

Workshop of Bioresources and Biodiversity Research in JASTIP International Premeeting of Humanosphere Asia Research Node on Biomass Utilization

2016/02/17 Venue: Kyoto, Japan

Research introduction of Asia Research Node, JASTIP, and SATREPS was presented and research orientation was discussed.





3. ARN/HSS/ISSH 2017 Overview

3-1. ARN/HSS 2017/7th ISSH

3-2. ARN Biomaterials Workshop

3-3. ARN/JASTIP Bioresources and Biodiversity Workshop

- Humanosphere Science School 2017 -
- The 360th Symposium on Sustainable Humanosphere -
- The 7th International Symposium for Sustainable Humanosphere -

Greetings



RISH Chair
Hiroyuki Yano



LIPI Chair
Riksfardini Ermawar

The Research Institute for Sustainable Humanosphere (RISH) continues the activities to comprehensively understand the current situation in the “humanosphere”, which leads to the establishment of science and technology indispensable for sustainable development and contributing to the betterment of society. The 'humanosphere' includes all spheres supporting and interacting with human activities. In 2016, we launched a “Humanosphere Asia Research Node (ARN)” to strengthen its function as a hub for international collaborative research and foster innovation in the field of humanosphere science, with the ultimate goal of delivering solutions to global-scale problems.

The Indonesian Institute of Sciences (LIPI) and RISH jointly hold the Humanosphere Science School (HSS) together with the satellite symposium, the International Symposium for Sustainable Humanosphere (ISSH). HSS/ISSH have provided learning experience by sharing knowledge, science, and technology delivered by experts specializing in subjects related to Humanosphere Science to students and young scientists. This year, the international meetings, HSS2017/7th ISSH were held with two ARN workshops from 31st October to 3rd November 2017 in Bogor/Cibinong ARN supported 15 master course students, 8 Ph.D. course students and 4 post-doctoral researchers, total 27 young scientists, to join HSS/ISSH. The main theme for this year conference was “Advances in Science and Technology for the Future of Sustainable Humanosphere”. We hope that they will serve as a way for us to bridge Japan, the ASEAN region, and other countries in order to share our highest aspirations and provide each other with mutual encouragement and support. This is a report of ARN activities in HSS 2017/7th ISSH.

HSS/ISSH2017 committee



3-1. HSS 2017/ 7th ISSH

1-2 November 2017, Bogor, Indonesia

Symposium

On 1-2 November 2017, we held HSS2017 and the 7th ISSH in Bogor, Indonesia. The conference theme focused on how advanced science and technology take roles in achieving sustainable development goals (SDGs). A total of 199 from 35 different institutions joined this year with varied and exciting interdisciplinary topics, reflecting the forefront of global research, networking to the improvements of the humanosphere.











Parallel session –oral presentation and group discussions-









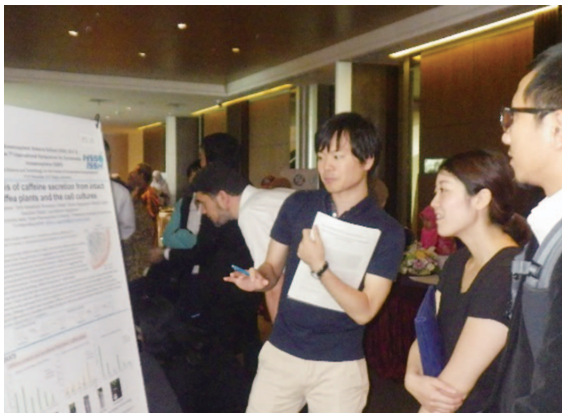




Parallel session -poster presentation-



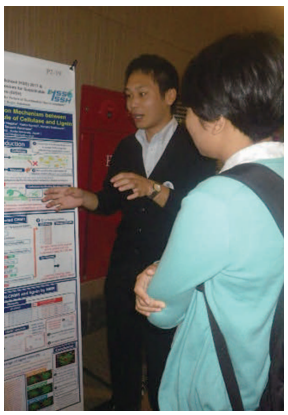










CALL FOR PAPERS

HSS ISSH 2017

1-2 November 2017
Salak Tower Hotel
Bogor, Indonesia

- Humanosphere Science School 2017 -
- The 360th Symposium on Sustainable Humanosphere -
- The 7thInternational Symposium for Sustainable Humanosphere -

"Advances in Science and Technology for the Future of Sustainable Humanosphere"

Forest science — Bioscience — Earth science — Applied science and technology

Community-based development and socioeconomic science

Keynote Speakers

Prof. Hiroyuki Yano[1]
Development of the continuous production process (Kyoto Process) of cellulose nanofibers reinforced plastics

Dr. Wahyu Dwianto[4]
Relaxing internal stress, a key factor to physical treatment in wood

Dr. Masaru Kobayashi [5]
Plant mineral nutrition: Fertilizer application and nutritional diagnosis

Dr. Kenji Umemura[1]
Adhesion and adhesives technology for lignocellulose

Prof. Yoshiharu Omura[1]
Exploration of radiation belts by space radio engineering

Dr. Yuki Tobimatsu[1]
Plant cell wall structure and chemistry

Dr. Amy Duchelle[2]
CIFOR's poverty and environment network: How global comparative data can challenge conventional wisdom

Prof. Mamoru Kanzaki[5]
Sustainable forest management: Challenges in Japan and Indonesia

Dr. Aya Yanagawa[1]
Insects and human activities on microwave usage

Dr. Takuji Miyamoto[1]
Molecular breeding technologies for crop improvement

Dr. Chartchai Khanongnuch [6]
Recent situation and prospect of biomass conversion to biofuel and biorefinery in Thailand

Prof. MA Yunita Triwardani W.[3]
The role of interdisciplinary approach in improving farmer's resilience to climate change

Dr. Akihisa Kitamori[1]
Research activities on traditional wooden buildings of Indonesia and Japan

Prof. Mamoru Yamamoto[1]
Study of ionospheric irregularities by using radar and sounding rocket

Dr. Chin-Cheng Yang[1]
Ecology and management of the invasive species: Yellow crazy ant as an example

Dr. Masahiro Sakamoto[5]
Engineering of carbon metabolism in plant biotechnology

[1]RISH-Kyoto University, [2]CIFOR, [3]University of Indonesia, [4]RC Biomaterials-LIPI, [5]GSA-Kyoto University, [6]FAI-Chiang Mai University

SUBMISSION DEADLINE

- Registration : 2nd November 2017
- Abstract : 15th September 2017
- Full Paper : 15th October 2017

REGISTRATION & SUBMISSION

Registration and abstract submission should be done online at:
http://situs.opi.lipi.go.id/hss2017/

REGISTRATION

Registration fee (program book, lunch, coffee break included)

Categories	Local Participant		International Participant	
	Presenter	Non Presenter	Presenter	Non Presenter
Professional	IDR 500.000 IDR 1.000.000*	IDR 400.000	USD 100	USD 50
Students	IDR 300.000 IDR 850.000*	IDR 250.000	USD 75	USD 50

* **Indexed publication**
Selected paper will be published in:
1. IOP conference series: Earth and Environmental Science
2. Journal of Lignocellulose Technology (ISSN: 2548-8503; e-ISSN: 2548-8929)
3. Proceeding of 7th International Symposium for Sustainable Humanosphere (e-ISSN: 2579-5554)

** Accommodations (hotel) and cultural night dinner are not included.

CONTACT

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Cibinong Science Center
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Phone/Fax : +62-21-87914511/+62-21-87914510

3-2. ARN Biomaterials Workshop 31 October 2017, Cibinong, Indonesia

ARN Biomaterials Workshop



Prof. Hiroyuki Yano from RISH and six young researchers including five students visited the LIPI Biomaterial Center in Cibinong, Bogor. After the facility tour, each participant introduced his/her recent research about material sciences and had discussions. Eight researchers from LIPI also shared their researches. Total 42 participants joined the workshop.













ARN Biomaterials Workshop

Venue : Auditorium of Research Center for Biomaterials
Date : Tuesday, 31 October 2017

Program

MC: **Lilik Astari**
13.00-13.05 Greeting by MC
13.05-13.15 Prof. Dr. Sulaeman Yusuf (RC for Biomaterials, LIPI)
Welcoming and opening speech

Moderator: **Dr. Lisman Suryanegara**
13.15-15.30 Scientific Presentations
Speakers: Prof. Dr. Hiroyuki Yano (Lab. of Active-biobased Materials, RISH), Dr. Khoirul Himmi S.(RC for Biomaterials, LIPI), Dr. Soichi Tanaka (Lab. of Sustainable Materials, RISH), Dr. Riksfardinie Annisa E (RC for Biomaterials, LIPI), Mr. Masaya Nagai (Laboratory of Sustainable Materials, RISH), Dr. Dede Heri YY (RC for Bomaterials LIPI), Ms. Kamii Nakamura (Lab. of Sustainable Materials, RISH)

15.15-15.30 Coffee break

15.30-16.45 Scientific Presentations
Speakers: Hiroki Yatsui (Lab.of Active-biobased Materials, RISH), Dr. Maya Ismayati (RC for Biomaterials, LIPI), Mr. Xianpeng Ynag (Lab. of Active-biobased Materials, RISH), Dr. Lisman Suryanegara .(RC for Biomaterials, LIPI), Ms. Jiahua Zhou (Lab. of Sustainable Materials, RISH)

16.45-17.00 Closing speech by Prof. Dr. Subyakto
17.00-18.00 Break

3-3. ARN/JASTIP
Bioresources and Biodiversity Workshop

3 November 2017, Bogor, Indonesia

The 3rd JASTIP Bioresources and Biodiversity Workshop "Synergy of ASEAN Countries and Japan for Sustainable Development" & The 2nd Humanosphere Asia Research Node Workshop toward Sustainable Utilization of Tropical Bioresources

This workshop was planned to further strengthen the international network in biomass-related “Humanosphere Science”, in conjunction with the activities of JASTIP. The topics of the researches covered biodiversity and conservation studies, bioprospection in the ASEAN region, development of innovative technology for bioresources and its dissemination. The workshop discussed the development of network of biodiversity and bioresource database and depository in ASEAN.
110 people participated.

Observation of Ex-situ Conservation of Bioresources at Bogor Botanic Garden











Workshop


The 3rd JASTIP Bioresources and Biodiversity Workshop
"Synergy of ASEAN Countries and Japan for Sustainable Development"








The 3rd JASTIP Bioresources and Biodiversity Workshop
Synergy of ASEAN Countries and Japan for Sustainable Development


The 3rd JASTIP Bioresources and Biodiversity Workshop
Synergy of ASEAN Countries and Japan for Sustainable Development




The 3rd JASTIP Bioresources and Biodiversity Workshop
Synergy of ASEAN Countries and Japan for Sustainable Development



The 3rd JASTIP Bioresources and Biodiversity Workshop "Synergy of ASEAN Countries and Japan for Sustainable Development"

&

The 2nd Humanosphere Asia Research Node Workshop toward Sustainable Utilization of Tropical Bioresources

Data: 3rd Nov, 2017, 8:30 – 17:00

Venue:

1) Salak Tower Hotel
   Jalan Salak No. 38-40 Babakan, Bogor Tengah, Kota Bogor, Jawa Barat 16129, Indonesia
2) Bogor Botanic Gardens (Centre for Plant Conservation)
   Jalan Ir. H. Juanda No. 13, PO Box 309, Bogor, Java 16003 Indonesia

Japan-ASEAN Science, Technology and Innovation Platform (JASTIP) organize this workshop to report the progress of research programs conducted by the member of Workpackage 3: Bioresources and Biodiversity Researches. The topics of the researches cover biodiversity and conservation studies, bioprospection in the ASEAN region, development of innovative technology for bioresources and its dissemination. The workshop will also discuss on the development of network of biodiversity and bioresource database and depository in ASEAN.

Since 2016, RISH started the new activities named “Humanosphere Asia Research Node (ARN)”. ARN integrates various facilities and human networks in ASEAN region and Japan for consolidating the international collaborative research on “Sustainable Humanosphere”. This workshop is planned to further strengthen the international network in biomass-related "Humanosphere Science", in conjunction with the activities of JASTIP.

Guest speakers (tentative) are from,

Chulalongkorn University; National University of Laos, Fukuyama University, Chiang Mai University, National Science Technology Development Agency;

Organized by

Japan-ASEAN Science, Technology and Innovation Platform (JASTIP)
The Indonesian Institute of Sciences (LIPI)
Bogor Botanic Garden
Kyoto University

Organizing committee: Takashi Watanabe, Mamoru Kanzaki,
S. Khoirul Himmi, Ruliyana Susanti, Yayan Wahyu Candra Kusuma

Itinerary for BBG tour (November 3, 2017)

Transportation: 2 buses, 2 cars
Facilitators: 2 guides + 1 assistant (my self)

Time	Location	Activity and Main attraction
08.30 am	Hotel	Depart from hotel (BBG buses and cars will pick up at the hotel)
08.45 am	BBG Gate 3	arrive at the BBG, the tour guides join the group with little introduction
09.00 am	Orchid house	Visiting native and hybrid orchid collections
09.15 am	Medicinal Plant Garden & Kandang Badak	Collection of medicinal plants & The world first *Rafflesia patma* in ex situ collection
09.35 am	Couple tree	Dipterocarpaceae (*Keruing*) collections
09.45 am	Mexican garden	Cacti collections (only pass through)
10.00 am	Treub Laboratory	SATREPS satellite office and laboratory
10.15 am	Bamboo collection	Collection of tropical bamboos
10.30 am	Reinwardt Monument and Garden shop	Reinwardt monument, main garden pond, Imperial Palace view, some photo sessions near the pond and the deck, end at Garden shop
11.00 am	BBG Gate 3	Depart from BBG with BBG buses and cars

Notes
* English speaking participants take the buses, while Indonesian speaking participants take the cars.
* For those who speak Indonesian, you can download BBG tour and navigation apps at the playstore (So far ANDROID only)
https://play.google.com/store/apps/details?id=com.krb.navigasi.petakebunrayabogor&hl=en
* The schedule is very tight, at each spot approximately 10 minutes for guiding talk and sightseeing.
* Please also be prepare of RAINING and MOSQUITOS during the tour.

*** Additional spots as an option or NEXT VISIT: Herbarium collections, Seed Bank, Zoological museum, Glass house for Nepentheaceae (pitcher plant) and Araceae, Dutch Cemetery.**

Program

8:30 – 11:30	**Observation of Ex-situ Conservation of Bioresources at Bogor Botanic Garden**
12:00 – 13:15	**Lunch**
13:15-14:55	**Bioresouces Session**
13:15-13:25	Takashi Watanabe[1] and Sulaeman Yusuf[2] ([1]Kyoto Univ., Japan, [2]LIPI, Indonesia) *"JASTIP/ARN Bioresouces study"*
13:25-13:40	Hunsa Punnapayak[1], Sehanat Prasongsuk[1], Pongtharin Lotrakul[1], Wichanee Bankeeree[1], Dede Heri Yuli Yanto[2] and Takashi Watanabe[3] ([1]Chulalongkorn Univ., Thailand, [2]LIPI, Indonesia, [3]Kyoto Univ., Japan) *"Bioremediation of Contaminated Water with Crude Oil and Toxic Dyes"*
13:40-13:55	Pattanop Kanokratana and Verawat Champreda (NSTDA, Thailand) *"Integrated utilization of sugarcane waste for biofuel and chemical production"*
13:55-14:10	Keonakhone Khounvilay (National Univ. of Laos, Laos) *"Alkaline Pretreatment Wild Sugarcane for Producing Bioethanol"*
14:10-14:25	Titik Kartika (LIPI, Indonesia) *"Bridging Science and Industry in Developing Bio-based Pest Management"*
14:25-14:40	Wahyu Dwianto[1],Didi Diarsa[2], Fauzan Azhiman[3], Teguh Darmawan[1], Jayadi[1] ([1]LIPI, Indonesia, [2]Core Margonda Creative Community Hub, [3]PT. Sinergi Nanotech Indonesia) *"Development of Integrated Technology between Wind Turbines and Electric Wood Bikes for Free-car Areas"*
14:40-14:55	Sadat Mohamed Rezk Khattab (Al-Azhar University, Egypt, Kyoto Univ., Japan) *"Production of Bioethanol from Agricultural Residues- Current Status and Prospects"*
14:55 -15:05	**Coffee Break**

15:05 – 16:15 **Biodiversity Session**

15:05 – 15:15 Mamoru Kanzaki[1] and Andria Agusta[2] ([1]Kyoto Univ., Japan, [2]LIPI, Indonesia)
"JASTIP Biodiversity and Bioprospecting Studies"

15:15 – 15:30 Shoji Maehara (Fukuyama Univ., Japan)
"Ability of Endophytic Microbe - the Production and Bioconversion –"

15:30 – 15:45 Khin Thant Sin (Panglong Univ., Myanmar)
"Bioprospecting and Genetic Resources in Myanmar: Case Study of Mandalay Region"

15:45 – 16:00 Enos Tangke Arung (Mulawarman Univ., Indonesia)
"Stingless Bee Products from East Kalimantan Forest for Food and Medicine"

16:00 – 16.15 Ni Luh Putu Rischa Phadmacanthy (LIPI, Indonesia)
Cervidae diversity in Southeast Asia: An analysis based on hair morphology"

16:15 – 16:30 **Coffee Break**

16:30 – 17:00 **General discussion on international collaboration**

Moderator: Mamoru Kanzaki & Takashi Watanabe

1. Biodiversity	Enos Tangke Arung (Mulawarman Univ., Indonesia)
2. Biodiversity	Shoji Maehara (Fukuyama Univ., Japan)
3. Biodiversity	Khin Thant Sin (Pang Long Univ., Myanmar)
4. Biodiversity	Agusta Andria (LIPI, Indonesia)
5. Bioresources	Hunsa Punnapayak (Chularongkorn Univ., Thailand)
6. Bioresources	Keonakhone Khounvilay (National Univ. of Laos)
7. Bioresources	Sulaeman Yusuf (LIPI, Indonesia)
8. Disaster	Kaoru Takara (Kyoto Univ., Japan)
9. Disaster	Takahiro Sayama (Kyoto Univ. Japan)
10. Disaster	Apip (LIPI, Indonesia)

4. ARN/HSS/ISSH 2017 Reports from Young Researchers

ARN/HSS/ISSH 2017 Report

Andri Fadillah Martin
(Laboratory of Metabolic Science of Forest Plants and Microorganisms)
Supervisor: Prof. Toshiaki Umezawa

1. Experiences in HSS and workshop as ARN activity

Humanosphere is defined as the spheres that support human activities including the human living environments, forest and grassland ecosystems, marine area, atmosphere, and also the space environment. Every human action will affect the surrounding environments in a wrong way or in a right way. It is becoming our duty to make our way of living more environmentally friendly and sustainable. Through the HSS/ISSH/JASTIP meetings held in Indonesia, I rediscovered a great deal of hope that the ever-growing science and technologies may solve many of the challenges for realizing sustainable societies. The meetings also reminded me that interdisciplinary and international assemblies such as ARN is indeed required to tackle with the global challenges we are facing and also to catalyze the creative processes in science, especially in our Humanosphere science field. HSS/ISSH symposium was not only a meeting of multidisciplinary science, but also intercultural interactions between international researchers from all over the world, where we could learn a lot and gain more mutual respect for each culture. On the JASTIP workshop held after the HSS/ISSH symposium, besides experiencing another international and interdisciplinary science meeting, we also experienced majestic aspect of mother nature directly in the field seminar at the Bogor Botanical Garden. We also visited the world famous Orchid house, Presidential Bogor Palace, the very rare corpse flower (*Amorphophallus titanium*), and the couple trees. The couple trees are actually two different tree species that grow adjacent to each other. These trees are a reminder to myself that mother nature is majestic and yet very fragile at the same time. It is our duty as human being to preserve the environment, living in harmony with nature in the same fashion we pursue sustainable development.

2. Presentation Summary

CHEMICAL AND SUPRAMOLECULAR STRUCTURE OF LIGNOCELLULOSE PRODUCED IN LIGNIN-MODIFIED RICE MUTANTS

Andri Fadillah Martin[1,2], Yuki Tobimatsu[2]*, Naoyuki Matsumoto[2], Miyamoto Takuji[2], Ryosuke Kusumi[3], Masaomi Yamamura[2], Taichi Koshiba[2], Masahiro Sakamoto[3], Toshiaki Umezawa[2,4]

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Abstract

Lignin, a phenylpropanoid polymer accounting for 15–30% of lignocellulosic biomass, has long been viewed as an impediment to chemical pulping and cellulosic ethanol production, but is increasingly viewed as a viable resource for sustainable production of aromatic fuels and chemicals. In this context, metabolic engineering of lignin aiming at improving biomass utilizations has been extensively studied. Thus far, numerous transgenic plants that produce lignocellulose variously altered in lignin content and structure have been generated via up- and/or down-regulations of genes functioning in the lignin biosynthetic pathway. However, little is yet known regarding how such lignin modifications affect supramolecular structures as well as utilization properties of lignocellulose. Here, we investigated chemical and supramolecular structures of altered lignocellulose produced in a rice mutant deficient in cinnamyl alcohol dehydrogenase (CAD), one of the key enzymes involved in the lignin biosynthetic pathway. Our previous study has shown that the CAD-deficient rice mutant displays remarkably enhanced lignocellulose saccharification efficiency. In the present study, lignin content and substructure distributions as well as intermolecular interactions of lignin and polysaccharide molecules in the mutant cell walls were closely examined by using a suite of solution- and solid-state NMRs, X-ray crystallography, and wet-chemical methods, and discussed in conjunction with the lignocellulose saccharification profile data.

Keywords: *enzymatic saccharification*, *cinnamyl alcohol dehydrogenase, lignin, metabolic engineering, nuclear magnetic resonance spectroscopy*

ARN/HSS/ISSH 2017 Report

Chihiro Kimura

(Laboratory of Biomass Conversion, RISH, Kyoto University)
Supervisor: Prof. Takashi Watanabe

1. Experiences in HSS and workshops as ARN activity

・How have you been affected by attending the HSS and ARN program?

HSS/ISSH gave me the first experience to present my research at a poster session of an international academic meeting. I really enjoyed the wonderful experience throughout the program. Thanks to HSS/ISSH and satellite workshops, I discussed my current research with many researchers specializing similar or different research fields, and obtained new insight and deeper understanding about my own research and other scientific area. In addition to the discussion at the poster session, lectures given by the experts of different research fields gave me new scientific knowledge. I think that it is very important to understand the idea and activities of researchers majoring various research fields and connect each research discipline, methodology and human network multilaterally. The international meetings allowed me to realize the importance of improving skills of English and presentation of research including poster design and explanation.

・How do you think importance of Humanosphere science?

I think that there are two important things in Humanosphere Science. The first is that Humanosphere Science have high potential and power to change our society. Establishment of sustainable society by replacing fossil resources to bioresources is the ultimate target of many researchers. However, pursuit of individual science is not enough. Humanosphere Science is integrated interdisciplinary science for harmonious coexistence of the global society and provides us solutions for establishing the sustainable society and environment surrounding human. The integration of many disciplines into one frame by Humanosphere Science enables the researchers of different fields to share the same goal through close collaboration. Moreover, the research activities and resultant outcomes will be accelerated by mutual understanding of the recent progress of each research field. The second important thing of Humanosphere Science is education. Students of RISH, including me, are encouraged to have deeper understanding about not only for their own research but also for situation, task, trend, problems and progress of other research and societies in the world. Thus, we can broaden our vision thorough the education program of Humanosphere Science. I conclude that Humanosphere Science is very important for students by helping us to consider the global and regional societies and their associated problems and future prospects.

・How does your research relate to Humanosphere science or the activity of ARN? Explanation of your research subject can be included.

The objective of our research is to produce antiviral compounds from sugarcane bagasse, one of the most abundant lignocellulosic agricultural residues. Bagasse has been receiving keen attention as a raw feedstock for bioethanol production. However, reduction of its production cost is still the major task in industrialization of bioethanol from bagasse. If we can produce antiviral compounds from bagasse lignin, feasibility of the practical applications of bagasse processing will increase due to the increase in total value of bagasse. The production of antiviral compounds is also beneficial to protect human and animal health. As a result, we can contribute to establishment of the sustainable society, a goal of Humanosphere Science. Furthermore, we expect to increase income of famers cultivating sugarcane by virtue of the adding higher value to sugarcane. I think the increase in famer's income contributes to strengthen relationship between Japan and ASEAN countries.

2. Presentation summary

Production of antiviral compounds from sugarcane bagasse by microwave reactions

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Abstract

There is an increasing concern to establish sustainable society by replacing fossil resources to renewable bioresources. Sugarcane bagasse is one of the largest lignocellulosic agricultural residue, and has been studied as a raw feedstock for production of materials, fuels and chemicals. In this study, we focused on production of antiviral agent from the agricultural residue. Viruses threaten human and animal health and cause huge economic losses. The production of antiviral compounds from the waste biomass will increase feasibility of the overall conversion process of bagasse and contribute to the life with high safety. We screened reactions producing antiviral agent against encephalomyocarditis virus (EMCV), a small nonenveloped single-strand RNA virus belonging to the family Picornaviridae. Microwave reactions using acidic, alkaline and oxidative catalysts in organic and aqueous solvents were applied to the decomposition of bagasse, and the degradation products were fractionated by extraction with DMSO, methanol and ethyl acetate. Quantification of the viral RNA replication by quantitative real-time polymerase chain reaction (PCR) indicated that significant differences in the total antiviral activity were found among the reactions applied and the monomeric and oligomeric antiviral agents were produced from the waste biomass. Identification of the antiviral compounds are in progress.

ARN/HSS/ISSH 2017 Report

Danang Sudarwoko Adi

(Laboratory of Biomass Morphogenesis and Information, RISH, Kyoto University)
Supervisor: Professor Junji Sugiyama

1. Experiences in HSS and workshops as ARN activity

Attending a series of Humanosphere Science School and ARN, which is held 1-2 November 2017 in Bogor-Indoneisa, is very important for me as a student and young researcher. In my understanding, the term of humanosphere is a science related to the humans and their environment, so this science is very big field research, and contain of 2 part: earth and atmosphere (space outer the earth). As a student of Kyoto University, this is my first experience to join in this huge school and symposium with the wider research interest. In this school, there are so many expert, especially from Japan and Asean countries, who gave a lecture related to the humanosphere science and the current situation on these areas. Each series has different topic and expert, from many institution, research field, and countries. They were shares their valuable experience based on their region, which makes this program is very comprehensive. As a student, we got information on the latest research and also inspiration about our research in the future and the trend of the commonly research in our interest research.

In this HSS and ARN Program, I can learn how to contribute to the sustainability of our sphere (life's environment) through my research. The center of all sciences is the humans itself. I got valuable experience about how to make a balance of our life to the environment and how to make our environment comfortable to human's life. Even there are some difficulties to understand all of the field science related to the humansophere, at least we can get some description and imagine about the human and their sphere (environment) relation-mechanism and the affection of each other. For example, atmospheric science is one of the lecture material in HSS and I didn't learn this deeply when I was student, both in the high school or undergraduate student. In this HSS-ARN program, I can imagine that there are some phenomena in the Ionosphere or called as irregularities and how to identify those problem, or there are also some radiation belt which is affected to the spacecraft and satellites, etc. The others lecture gave their experiences on the climate change and the effect to the farmer or their crops, wood science about physical properties and the characteristics of cell wall, wood utilization such as nano cellulose, bioethanol, traditional housing, adhesive, forest science, soil science, insect and invasive species, biology molecular, and many more.

For the other expert and young researcher, there were also opportunity to express their research interest through International Symposium on Sustainable Humanosphere (ISSH). This is big challenge to interact with the other researcher, to introduce their recent research, and also to make collaboration with the other. The ISSH consist of two part, oral and poster presentation. In this event, I joined on the poster presentation to introduce our study about image analysis. In this study, we would like to analyse of whole properties of the fiber cell, such as fiber length and cell wall thickness, more efficient and effective than the common method. This method was using wood vision tool and single cross section. We tried to reduce and avoid the chemical application, especially in the maceration process by Franklin's solution which is used hydrogen peroxide and acetic acid. Utilization of the strong acid can be dangerous to the environment, especially when disposing the residue, and also needed several treatment before released. Reducing these chemical utilization can keep the environment safe for human life. Not only for the human life, but also for the others organism, such as trees, microbes, animals, etc.

There were also a workshop called Japan-Asean Science, Technology and Innovation Platform (Jastip). This event began with the tour to Bogor Botanical Garden to see the Ex-situ conservation of bioresources. Then, many researchers present their result research regarding the bioreources and biodiversity research. I got so many valuable information in this workshop so that attending the all event in ARN was the most interesting experience for me.

2. Presentation summary (Please put your presentation abstract in HSS. Revision or extension is possible if necessary) (Description length of this part is within one page)

Reliability of Cell Wall Thickness and Fiber Length Measurement using Single Cross Section by Image Analysis

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Abstract

Cell wall thickness and fiber length were measured by different and separately methods, i.e. cross section and maceration, which needs time and also chemical reagent to macerate fibers. Many efforts had been done to make these analyses more efficient, such as using serial[1] or single[2] cross section methods. In this study, we provide novel and facile method to analyse the cell wall thickness and fiber length using single cross section by image analysis. Bottom part of 8-years old Platinum Teak from Indonesia were used in this study. 101 cross sectional micrographs from increasing radial positions of the trunk taken with 40x objective lens of the light microscope were used to analyse the cell wall, while 128 micrographs of the 4x objective lens for the fiber length measurements. Axial parenchyma cell length from the tangential sections also were used for fiber length analysis. All the image processing treatments were performed using wvtool R package[3]. Manual cell wall thickness and macerated fiber length measurement with Image J analysis were also conducted as a comparison. The result shows that cell wall thickness evaluated using wvtool gave the average thickness of the whole wood fibers without significant difference from the conventional manual measurement. The values of the fiber length was almost similar and also no significant different compare to maceration method.

Key words: image analysis, R wv tool, fiber length, cell wall thickness

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ARN/HSS/ISSH 2017 Report

Didi Tarmadi

(Laboratory of Innovative Humano–habitability, RISH, Kyoto University)
Supervisor: Prof. Tsuyoshi Yoshimura

1. Experiences in HSS and workshops as ARN activity

One of the goals of ARN (Asia Research Node) is strengthening international collaboration, particularly for students and young scientists. ARN has 3 main scopes of research, i.e., atmosphere, biomass and biodiversity, and data base. Since my research is related with entomology and biomass, and I come from Indonesia, my research topic is strongly with ARN activities. Therefore, I was very happy to have an opportunity to join in Humanosphere Science School (HSS), ARN and JASTIP workshops in Indonesia with fully funded from RISH, Kyoto University.

During HSS, ARN and JASTIP workshops, I interacted with many participants from Japan, Egypt, Malaysia, Thailand, Myanmar, Laos, China and Taiwan. Since they came with different research fields, I gained new experiences and knowledge. Moreover, I obtained valuable knowledge with variety of research fields from lectures during HSS. Interestingly, I met with some students and researchers from Myanmar and Laos, where we have similarity with biodiversity. We talked and deeply discussed regarding the researches, technologies, and possibilities for collaboration, and then we agreed to strengthen our collaboration in the future.

In addition, since HSS, ARN and JASTIP workshops were held in my country (Indonesia), I had a great opportunity to explain about Indonesia including biodiversity and cultures. When we visited to Bogor Botanical Garden, I accompanied some participants from Japan, China, and Egypt. Since some of them visited tropical country first time, I had an opportunity to introduce the biodiversity in my country as reflected by Bogor Botanical Garden.

2. Presentation

Role of lignin in nutritional physiology of a lower termite, *Coptotermes formosanus* Shiraki

Didi Tarmadi[1,2*], Yuki Tobimatsu[2], Masaomi Yamamura[2], Takuji Miyamoto[2], Yasuyuki Miyagawa[2], Toshiaki Umezawa[2], Tsuyoshi Yoshimura[2]

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Abstract

The mechanisms of the decomposition of polysaccharides by termites have been well-documented. However, there is little information regarding role of lignin in nutritional physiology of wood feeding insects. In this study, we investigated the effects of lignin on the physiological activities of a lower termite, Coptotermes formosanus. First, we investigated structural changes of lignin polymers during lignocellulose decompositions in the termite digestive system. Our chemical and NMR data suggested that C. fomosanus workers had an ability to partially modify lignin polymers in their hindguts. Second, we investigated the physiological activities of C. formosanus workers fed with artificial diets composed of isolated lignins and polysaccharides with varied formulations. Survival and body mass of the workers as well as presence of the three symbiotic protists in the hindguts were then periodically examined. The results suggested that although lignins are hardly utilized as a nutrient source when they are the sole food source, they have marked positive effects on the survival of C. formosanus workers as well as the maintenance of the major protists in their hindguts when fed with polysaccharide diets. We, thus, propose that the presence of lignin is crucial to maintaining the physiological activities of C. formosanus workers during their lignocellulose decomposition.

ARN/HSS/ISSH 2017 Report

Dyah Rahayu Martiningrum

(Laboratory of Radio Atmospheric Science, RISH, Kyoto University)

Supervisor : Prof. Mamoru Yamamoto

1. Experiences in HSS and workshops as ARN activity

Since 2016, Research Institute of Sustainable Humanosphere (RISH), started to conduct international collaboration research and capacity building between people who interest, sustain, and expand some effort in Humanosphere Science and Technology to find the global-scale solutions via Humanosphere Asia Research Node (ARN) program. This program sets up several activities such as joining laboratory, symposium, lecture and practical training course on humanosphere science and technology included on atmospheric sicence.

In the recent era, information of weather condition is important for modern human daily activity. Actually, in the upper atmosphere and the higher region we will find dynamic of weather, too, known as the space weather. Space weather is a branch of space physics and aeronomy concerned with the time varying conditions within the Solar System, including the solar wind, emphasizing the space surrounding the Earth, including conditions in the magnetosphere, ionosphere and thermosphere (Poppe, at.al., 2006).

Our study concern on ionosphere irregularities as a part of space weather fenomena. Even though most of space weather studies concern on sun, upper atmosphere and its environment, the recent studies show that weather in the lower atmosphere can effects on weather in the upper atmosphere (space weather) and otherwise, space weather impacts on weather variability in the lower atmosphere. Therefore, since I heard about this program and this forum I interest and challenge to join and discuss with lecturer, students, and researchers who came from atmospheric science and technology background. Fortunately, I met lecturer, students and researchers who came not only from atmospheric science and technology field, but also came from a wide field of study, such as space science, earth science, bio science, forest science, even from community based development. This symposium gave me opportunity to enrich my experiences and understandings about hunamosphere science and technology mainly related to my study.

Finally, I would like to thank all committe members for all their great effort to organizing the program. Also, I would like to express my sincere gratitude to lecturers for sharing and presenting lectures. Of course I would like to thank for all other participants. It is great and very nice to meet all of you. I hope we meet again in other program.

2. Presentation summary

EFFECT OF SOLAR AND GEOMAGNETIC ACTIVITY ON PLASMA BUBBLES OVER LOW LATITUDE REGIONS

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Abstract

3. Experiences in HSS and workshops as ARN activity

The ionosphere is a part of the upper atmosphere and formed by photoionization process from Sun, plays an important role in radio wave propagation. The occurrence of the ionospheric irregularities such as equatorial plasma bubbles can impact on communications and satellite systems. Observation and analysis of the ionospheric irregularities are important task for both scientific point of view and satellite system applications. In this study we observed ionospheric irregularities (plasma density depletion/plasma bubbles) by using Equatorial Atmosphere Radar (EAR), Ionosonde and GISTM receiver operated at Kototabang and Pontianak. Data during 2011-2012 analyzed to obtain seasonal variation of plasma irregularities and dependence of evening plasma bubble occurrence with solar and geomagnetic activity. Totally, 252 Equatorial Plasma Bubbles (EPB) occurred during 2011-2012; 193 detected as post sunset period and 59 detected as post midnight period. Most of post sunset EPB develop during equinox (March-April-September-October) and postmidnight EPB found during solstice (June-July). The dependence of solar activity and geomagnetic activity clearly confirmed by this study. The results not only confirmed the dependence of ionosphere plasma irregularities to solar activity and geomagnetic activity, but also related to scintillation events as well. For example, figure 1 shows the result for case March 1, 2011 (left panel) and March 11, 2011 when solar flare occur and geomagnetic storm occur as response of solar flare (right panel).

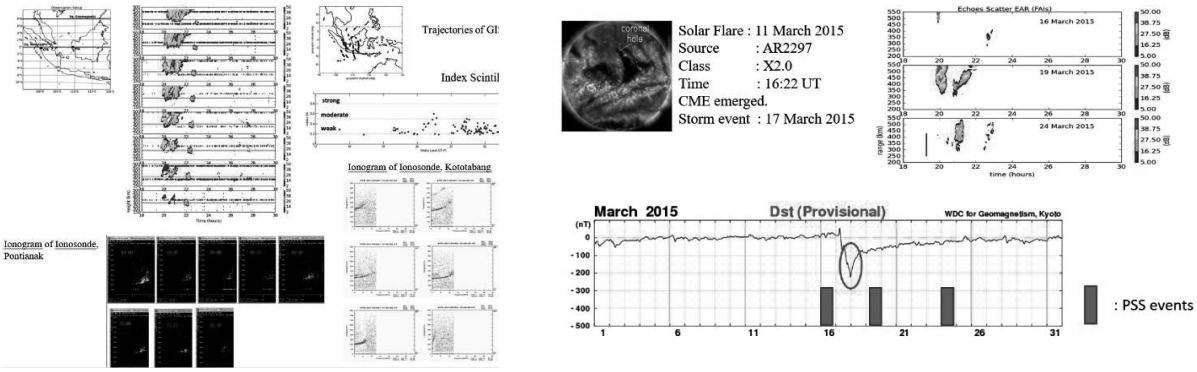


Figure 1. Relation of FAI, EPB, and scintillation (left panel); Relation of solar flare, FAI, and geomagnetic storm (right panel)

Keywords: *Equatorial Plasma Bubbles, Solar Activity, Geomagnetic Storm, Low Latitude*

ARN/HSS/ISSH 2017 Report

Hairi Cipta

(Laboratory of Biomass Morphogenesis and Information, RISH, Kyoto University)
Supervisor: Junji Sugiyama

1. Experiences in HSS and workshops as ARN activity

HSS (Humanosphere Science School) in Bogor is the second ARN activities that I joined to. First time I joined ARN activity in July 2017 at Kyoto University Uji Campus. As Indonesian, Bogor is not new for me. Some years ago, I visited Bogor when I was an undergraduate student. Now, as a master student, attending in such a scientific meeting is important. I could learn from other researchers about research activities management, research collaboration, and dissemination the research findings. HSS provides a platform for researchers with different background to share their recent works and to get positive feedback from others. It can trigger new idea to improve the research or develop the research to have more significant impact to the discovery of science and also society.

HSS also encouraged the collaboration between Japan and South-east Asian countries. I met with researchers who came from institutes in Laos, Thailand, Myanmar, and of course Indonesia. They also work hard to solve the humanosphere problem in their countries, and I can learn from it. Different background of culture may influence how people make decision and policy.

HSS which was located in Indonesia also gave me an excellent chance to build networking with Indonesian researchers and scholars. In this era, we need to work with people from other institution even from different background and field research to solve the problem that we may encounter in the near future. Therefore, I believe it will be useful. In HSS, I met a professor who is working in one of a state university in Indonesia who said the importance of build good network and connection with other researchers from the different institution, especially to conduct comprehensive research.

Also, HSS provided an opportunity to exchange the culture among participant who came from the different countries. Including participant of Kyoto University who are not only Japanese but also from other countries. From small discussion, I can find some similarities and differences other countries with my countries.

My research under supervising Prof. Junji Sugiyama is mainly about the observation of wood anatomical properties. The knowledge about wood anatomical properties combines with other research fields can help human to manage the forest. For example, when we want to decide which tree species that suitable for a specific purpose, the properties are important consideration. Each wood species has their unique anatomical properties. In my research, we tried some method to distinguish each wood species from that properties. For HSS, I presented an experiment to analyze pits arrangement of woody plant vessel element, which is the important trait for water conductivity. We tried to use two-dimensional Fast Fourier Transform (2D-FFT) which widely use to analyze periodical structure to help me analyze the pits arrangement. In the poster session, I got some feedback to improve our research, especially about the application of our research finding.

My other research topic in my master study is about wood preference for producing sheath of Indonesian traditional weapon, keris. For discussing this topic, collaboration with researchers who work in the cultural study about keris may improve the quality and accuracy of my research. Also, in the future, I would like to observe more about cultural wood object in Indonesia. For doing so, I need to collaborate with many people who may have different research fields.

2. Presentation

Quantitative analysis of pits on vessel element of woody plant using 2D-FFT

Hairi Cipta[1]*, Kayoko Kobayashi[1], Suyako Tazuru-Mizuno[1], Junji Sugiyama[1,2]

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Abstract

Pits are an essential part of the woody plant to distribute liquid pass laterally from one cell to the next[1]. Therefore, the existence of them is necessary for water conduction in trees, both in hardwood and softwood. Pits, including their arrangement and shape, are also important anatomical features for identification of a tree species. However, the standard for describing the pits is only in a qualitative way.

Two-dimensional Fast Fourier Transform (2D-FFT) has been used in many fields for various purposes[2,3,4]. 2D-FFT is useful image analysis algorithm to analyse periodicity, shape and direction on an image. This preliminary research aimed to find a new way to describe the pits features quantitatively by using 2D-FFT.

The materials consisted of three hardwood samples. Acquisition of images was used synchrotron X-ray microtomography. Using the images, we reconstructed three-dimensional (3D) images. Vessel element was unrolled to obtain its flatten surface. Then, the separation of different types of pits was conducted by cropping the image based on contact area that connecting vessel element to other wood cells (ray parenchyma, axial parenchyma, and another vessel element). Hanning Windows was used as a pre-treatment to reduce the edge effect. The pre-treated image was processed using 2D-FFT into FFT Power Spectrum Image.

The image pre-treatment was useful to reduce edge effect. The shape and size of the image power spectrum were strongly correlated to its real image. Different types of pits had distinctive features based on the power spectrum interpretation and measurement.

Acknowledgements
The synchrotron radiation experiment was performed at Spring-8 with the approval of the Japan Synchrotron Radiation Research Institute (Proposal No. 2016B1743). The authors thank to Dr. Fajar Waskito and Mr. Taufik Hermawan for providing wooden sheath samples. HC also thanks to The Indonesia Endowment Fund for Education (LPDP) for their support on his study.

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ARN/HSS/ISSH 2017 Report

Hirofumi Kakegawa

(Laboratory of Plant Gene Expression, RISH, Kyoto University)
Supervisor: Akifumi Sugiyama

1. Experiences in HSS and workshops as ARN activity

I participated in an international symposium for the first time. I again realized that many researchers study for lives of human beings. Indonesian researchers and students studied the disaster prevention and plants in Indonesia. I felt their researches was required in Indonesia.

After other participants' presentation, I felt fear of some sudden changes of our environment. Humans faces rapidly increasing serious problems, such as the explosive increase in population, global warming, the shortage of energy and materials due to expansion of economics, the spread of pathogenic viruses and frequent disasters due to increasing extreme weather. I realized we have to do something.

My topic is the caffeine secretion from *Coffea* plants. *Coffea* plants accumulate caffeine mostly in seeds, whereas the caffeine is also secreted into rhizosphere when they germinate. However, the mechanisms of the caffeine transport and the caffeine secretion have not been clarified. I am attracted to the unknown mechanisms because *Coffea* plants are famous for coffee beans. My research will be applied to the technique to produce alkaloids which can be used for medicine by plants.

Indonesia is included in Bean Belt and one of the most coffee bean producing country. Ninety percent of the coffee species which are produced in Indonesia are *Coffea canephora*. Because of the past epidemic of disease, most of *Coffea arabica* have suffered. Then, they were replaced with *Coffea canephora*. I hope my research will contribute the produce of coffee beans in Indonesia.

Because most of the topics in the symposium were not related to my research topic, I did not have many audience during my poster presentation. However, I had some opportunities to explain my research in English. It was my first experience to present my research in English, so I was glad to have a nice opportunity. It was difficult for me to explain my research to researchers in different fields.

I want to emphasize that I appreciate ARN/HSS/ISSH staffs. It was precious to participate in an international symposium and I learned a lot of things from this symposium. If I can take part in the next symposium, I want to improve my English presentation.

2. Presentation

Analysis of caffeine secretion from intact *Coffea* plants and the cell cultures

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Abstract

Plants synthesize more than 200,000 divergent metabolites, which can be divided into two groups, i.e., primary and secondary (specialized) metabolites. Primary metabolites such as amino acids and nucleotides are essential for life and thus are common to all organisms. Secondary (specialized) metabolites are organic compounds, which do not appear to be essential for cell growth, development, and reproduction, while they are often relevant for adaptation to environments. Among a variety of secondary metabolites, *Coffea* plants (*Coffea arabica* and *C. canephora*) produce caffeine (1,3,7-trimethylpurine-2,6-dione), a representative purine alkaloid. *Coffea* plants biosynthesize caffeine via three methylation steps and a deribosylation reaction. Whereas the biosynthesis rout of caffeine has been already clarified, endogenous genes/proteins mediating transport and accumulation of caffeine have not yet been identified in *Coffea* plants.

Coffea plants accumulate caffeine mostly in seeds, whereas the caffeine is also secreted into rhizosphere when they germinate. It is suggested that caffeine functions in rhizosphere as allelochemical to restrict growth and development of other plants, pest control, and is involved in the interactions between *Coffea* plants and soil-borne microorganisms. Because of the high caffeine content in seeds, it is suggested that caffeine is transported from cotyledons to roots and then secreted into the rhizosphere during germination process. The purpose of our research is to elucidate the mechanism of caffeine secretion by identifying caffeine transporters in *Coffea* plants.

It has been reported that both importers and exporters are responsible for the secretion of plant metabolites into rhizosphere. If this is valid for caffeine secretion, both importers and exporters are to be investigated. It has been reported that purine permease (PUP) family recognizes purine alkaloids such as adenine and nicotine as its transport substrates. Although rice plant does not produce caffeine, one of rice PUPs can uptake caffeine. Thus, we focused on PUP family of *Coffea* plants as a candidate of caffeine transporter. We have analyzed the gene expression of *CcPUPs* in leaves, roots and cultured cells of *C. canephora*.

ARN/HSS/ISSH 2017 Report

Hiroki Yatsui

(Laboratory of Active-biobased Materials, RISH, Kyoto University)
Supervisor: Hiroyuki Yano

1. Experiences in HSS and workshops as ARN activity

Through the conference of HSS and ISSH 2017, ARN Biomaterials Workshop and Asia Research Node (ARN)/JASTIP Workshop, I deepened my understanding of the importance of the Humanosphere science, the research which has been done so far, and the future development. Before joining this program, I only have knowledge and recognition to forest sphere field that I major in. But in these programs, I learned about research of space field, plant gene, humano-habitability, etc. I got extensive knowledge from these programs. In order to have a broad perspective, I felt it is important to acquire knowledge about various fields.

There are many problems that human beings have to solve in order to sustain their survival and prosperity. Among them, depletion of resources and energy, destruction of the environment due to global warming, population increase are the immediate problem. I recognized that to solve these problems above researches are important. It should be able to protect the Humanosphere by combining research in various fields.

There were many presentations related to forest conservation and utilization at this symposium. In addition to providing wood and food, forests have functions to prevent sediment-related disasters and flood mitigation and the function as CO_2 adsorption source. My research is to make functional materials by taking advantage of the materials obtained from the forest, and if it can become a substitute for petroleum products, it can reduce the amount of CO2 emissions and lead to the prevention of global warming. Therefore my research can be said to be a research to preserve the Humanosphere.

And it was my first visit to Bogor, Indonesia. Through these programs I learned about their research, culture and lifestyle. It was different from that of Japan and very interesting for me. All of the meals and plants in Indonesia were fresh for me and all the experience was attractive. But the most special experience in these programs was communication with people from many other countries. People from about 10 different countries attended these programs. Depending on the difference of their background, people have different perspectives and opinions. I touched various ideas and thinking and I was able to develop the breadth of knowledge. I think that people can get a broad perspective by learning various cultures and history and acquire more flexible and diverse thinking.

I would like to share the knowledge and experience gained by these programs with many people and to disseminate the significance and importance of the Humanosphere science.

2. Presentation summary

Fabrication of cellulose nanofibers/nanosized emulsions composites

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Abstract

New transparent nanocomposites composed of acrylic resin nanospheres (200 nm) and cellulose nanofibers (CNF) were fabricated. The nanospheres were easily collected by the CNF-network during filtration of the CNF/resin-nanoemulsion mixture. CNF drastically improved the mechanical performance of the resin. The Young's modulus of the resin increased 380-fold with only 5% addition of CNF. The tensile strength of the resin also increased with increasing CNF content and it was nearly 9-fold higher for the nanocomposite with 5% CNF content. The nanocomposites showed significantly high mechanical properties above T_g of the resin, which suggests the formation of CNF network where stress transfer is facilitated. Interestingly, the density of the nanocomposite (0.78) was lower than that of neat resin (1.18) owing to the existence of nanocavities between the nanospheres. Optically transparent nanocomposites having such a unique microstructure can find applications in transparent thin-film capacitor, battery and so on by filling the nanocavities with suitable materials.

ARN/HSS/ISSH 2017 Report

Ikhsan Guswenrivo

(Laboratory of Innovative Humano–habitability, RISH, Kyoto University)
Supervisor: Prof. Tsuyoshi Yoshimura

1. Experiences in HSS and workshops as ARN activity

The environment surrounding humans is changing rapidly, threatening sustainable development and healthy living. Therefore, understanding of the environment, its components, and how each of them interact each other offers a deep insight towards the better "humanosphere" sustainability. Most of the time, the occurrence of natural disasters such as heavy rain, typhoon and flood are unavoidable, but it could be predicted through the understanding of their characteristics and behaviors by the state-of-art science and technologies. The early preparation and prevention are really required for all the society members such as civilians, farmers, government agencies and other related industries in reducing the losses and damages due to the extreme weather.

RISH defines the "humanosphere", as the spheres supporting and interacting with human activities. Activities to comprehensively understand the current situation in the "humanosphere" are continuing to the establishment of science and technology indispensable for sustainable development and contributing to the betterment of society. This time in Humanosphere Science School (HSS) (1st and 2nd November 2017) and Asian Research Node International Symposium (ARN) (3rd November 2017) were organized in Bogor, Indonesia by collaboration of several institutions, agencies, and programs such as LIPI, RISH, ARN and JASTIP and researchers, academicians, professionals and public gathered in sharing knowledge, disseminating research finding, exchanging success stories, and expanding both national and international collaboration.

I had a very great experience, transferring knowledge, and getting a better understanding of the research topics from wide areas and fields during the meeting. Through this even, I am now have a new perspective and point of view of the world especially regarding the sustainability of humanosphere sciences. On the other hand, new research topics and areas, which are related with my study background, gave me a new ideas for future research. I feel grateful and thankful especially to RISH and ARN for giving me the opportunity to join this event. The participants of ARN/HSS/ISSH were not only from Indonesia and Japan, but also from Malaysia, Thailand, Myanmar, Laos, China and Taiwan. Besides transferring knowledge, lectures, and talks by researcher and students, I had a chance to make new a network with the participants from other countries. We were able to share a little bit about our country, our relation, our feelings and our cultures. Such sharing session provided a warm feeling among multiracial and multinational participants.

2. Presentation summary

Development of Multiplex Nested PCR for Simultaneous Detection of Ectoparasitic Fungi *Laboulbeniopsis termitarius* Thaxt and *Antennopsis gallica* Buchli and Heim on *Reticulitermes speratus* (Kolbe)

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Abstract

Laboulbeniopsis termitarius Thaxt and *Antennopsis gallica* Buchli and Heim are two of the most commonly found ectoparasitic fungi on termite body surface. While visual observation under dissecting microscope has been a common method to screen the presence of fungi on termites, a high number of termites is generally required and thus extremely time consuming. In this study, a fast, efficient assay was developed to detect infection of the fungi on the termite *Reticulitermes speratus* (Kolbe). Species-specific primers were designed based on sequence data amplified using a number of universal fungus primer pairs that amplify partial sequences of 18s rDNA gene of the two fungi. To detect the two fungi in a robust yet economic manner, a multiplex nested PCR assay, using species-specific primers, was then developed. The results suggested that both fungi were successfully detected even though in some cases where *L. termitarius* is at low titer (ex. a single thallus per termite). The newly developed assay in this study is recommended for future survey of the two fungi as this method is more sensitive, species-specific and time-saving compared to the visual observation, and likely may facilitate the understanding of the two fungi and their dynamics in the host populations.

Acknowledgements (if necessary)

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ARN/HSS/ISSH 2017 Report

Jiahua Zhou

(Laboratory of Sustainable Material, RISH, Kyoto University)
Supervisor: Kozo Kanayama

1. Experiences in HSS and workshops as ARN activity

RISH defines the "humanosphere" as spheres that support and interact with human activities. We continue to pursue a comprehensive understanding of the current situation in the "humanosphere" to establish science and technology that are indispensable for sustainable development and that contribute to the betterment of society.

The humanosphere envelopes all of humanity, requiring international cooperation to sustain the future. To that end, RISH founded the "Humanosphere Asia Research Node (ARN)" in 2016 to strengthen international collaboration and encourage humanosphere researchers to find global-scale solutions. ARN covered scientific and technological advances in the fields of material science, plant science, entomology, microbiology, ecology, forestry, wood science, chemistry, biochemistry, molecular biology, architecture, space science, atmospheric science, environmental science, electromagnetic engineering, agriculture and other related sciences contributing to creating "Sustainable Humanosphere".

I made a poster presentation about my research "effects of calcium carbonate content and pressing temperature on particleboard bonded with sucrose–ammonium dihydrogen phosphate adhesive". The consumption of wood-based composites continues to increase with the expansion of the world population. In wood industry, adhesives are important to obtain satisfactory physical properties of wood-based composites. Usually, synthetic adhesives derived from fossil resources are widely used. However, there is no doubt that the use of synthetic adhesives will be restricted in the future due to decreasing fossil resources. In addition, synthetic adhesives usually contain harmful chemical substances such as formaldehyde. Therefore, under the pressure of fossil resources and the requirement of human health. In our laboratory, a new natural adhesive composed of sucrose and ADP has been investigated. When particleboard was manufactured using the adhesive, some physical properties of the board satisfied the requirements of JIS A 5908 type 18 standard. However, pH of the board showed low value. Generally, pH value of board influence properties of metal materials such as nail. It is known that calcium carbonate ($CaCO_3$) is sometimes used as a filler and a pH adjusting agent. Therefore, improvement of pH and further excellent board performance can be expected by adding $CaCO_3$. I think substitution of natural wood adhesive for synthetic resin is necessary in the future. Therefore, my research can contribute to natural wood adhesive and "Sustainable Humanosphere".

2. Presentation summary

Effects of calcium carbonate content and pressing temperature on particleboard bonded with sucrose – ammonium dihydrogen phosphate adhesive

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Abstract

A new natural adhesive composed of sucrose and ammonium dihydrogen phosphate (ADP) has been investigated[1)]. When particleboard was manufactured using the adhesive, some physical properties of the board barely satisfied the requirements of JIS A 5908 type 18 standard. In addition, it was found that pH of the board showed low value of 2.9. Therefore, there is a room to improve the board properties to aim for practical application. It is known that calcium carbonate ($CaCO_3$) is sometimes used as a filler and a pH adjusting agent, and improvement of the board properties is expected. In this study, effects of $CaCO_3$ addition and pressing temperature on the properties of particleboard bonded with the adhesive were investigated. Powder of $CaCO_3$ was poured into wood particles, and the adhesive was sprayed onto the particles. The weight ratios of $CaCO_3$ to the solid-based content of adhesive were 0 to 30wt%. After drying the particles and mat-forming, particleboards were manufactured at 180 and 200℃ for 10 min.

The results showed that the pH values of the board increased with addition of $CaCO_3$ irrespective of pressing temperature, due to hydroxyapatite resulting from the reaction between ADP and $CaCO_3$. As a whole, mechanical properties of particleboard at pressing temperature of 200℃ were superior to those of the particleboard at pressing temperature of 180℃. Furthermore, the mechanical properties of the board hardly decreased even though a much amount of $CaCO_3$ was added. The reason seemed to be that hydroxyapatite interact with adhesive and wood. Consequently, it was clarified that combination of $CaCO_3$ addition and pressing temperature of 200℃ was effective for the properties of particleboard bonded with the adhesive.

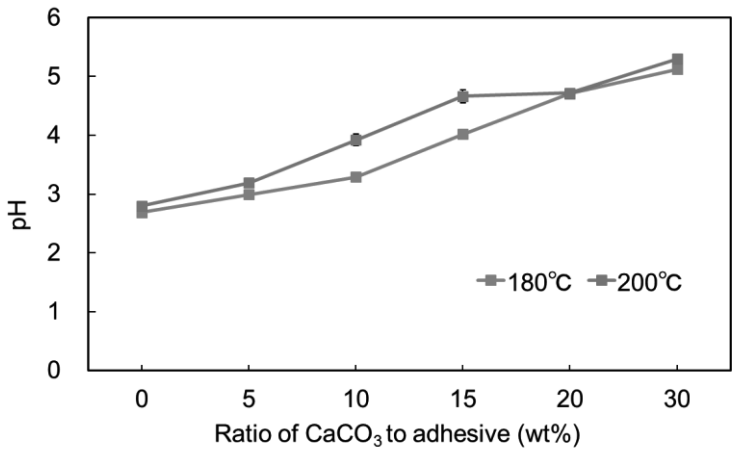


Fig. 1 Effects of $CaCO_3$ content and pressing temperature on on pH of solution after the TS measurement

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ARN/HSS/ISSH 2017 Report

Kamii Nakamura

(Laboratory of Sustainable Materials, RISH, Kyoto University)
Supervisor: Kozo Kanayama

1. Experiences in HSS and workshops as ARN activity

How was it affected by participation in HSS and ARN programs?

First of all, I thank you for participating in HSS and ARN program. The faculty who represent university and research institutes surely draw immense future. Through spending together, I had an opportunity to realize their thinking. This HSS and ARN programs gave many opportunities to students. Thanks to that, I was able to announce my research on an international stage and to know the wide range of research in Asian countries. And I got new things that I've never saw.

Kyoto University is open internationally. And our laboratory also continues to visit researchers from Asian countries, so that we can interact at close range. If you walk on campus, there are people of all nationalities. It is a very fulfilling and blessed environment for us. However, what I experienced this time was quite different from such daily life. It impacted on my mind. In Indonesia, everything such as people, weather, food, plants, smells were full of energy. I was overwhelmed. During meals and breaks, I interacted with many people about culture and research. They were all friendly and energetic. Even on the podium, they were natural. Their attitude was a great learning for me.

What do you think about the importance of Humanosphere science?

I think humanosphere science is very important because the change of the global environment such as population growth, global warming, shortages of resources, pollution of water and air cannot negligible and human activities are greatly influential. The amount of elements on the earth has not changed much since long time ago. So everything on the earth have mutual relations each other. And the earth faces the universe through the atmosphere. Therefore, the development of humanosphere science including all of layers is indispensable for creating a sustainable future. The urgency for the problems was often presented by Asian countries speakers at HSS and ARN programs. It might have been because they understood the crisis from their experiences. In fact in Indonesia, there were some problems such as heavy congestion at the road, polluted water in the drainage, rotting smell from it, and abnormal fine days in the rainy season. Even with my 1week stay, I experienced some problems that I only have known in books. In Japan, I did not feel these problems. So I was a little absent for it so far. However, my eyes opened at this time. It was noticed that the phenomenon occurred in a certain part of the earth could be the problem of the whole and there is only one Earth.

Are there any research area or labs outside your research field which you want to collaborate with currently or in the future?

I was interested in the presentation of Amy Duchelle (Center for International Forestry Research). She tries making poverty environment network (PEN). The data collection includes careful recording of all forest and environmental uses, and increase accuracy. The study includes not only forest science but also human living there information such as income and sex. And she tries to connect the whole world. I thought that this is exactly the mission of human science.

2. Presentation summary

Liquid permeation into wood applied by impact-elastic wave through surrounding liquid

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Impregnation of wood with chemical liquids has been used to overcome the disadvantages of wood. The aspirated pits exist in tracheid of coniferous wood disturbs the liquid flow, which causes the areas without being filled with the liquid after the impregnation. The purpose of our study is to penetrate the aspirated pits by applying impact-elastic waves through the surrounding liquid. To examine the effect of applying the waves, two closed vessels, called vessel 1 and 2, connected to each other by a valve were prepared. A wood block was placed in water at ordinary pressure (0.1 MPa) that filled the vessel 1, while water at a pressure of 1.0 MPa filled up the vessel 2. Water around the block was pressurized at low or high pressure-increasing rate controlled by the valve. For the low rate, just after the valve opened, the pressure around the block increased and subsequently decreased to be a constant, which was similar to the change in the pressure for the conventional method. While for the high rate, the pressure increased rapidly and subsequently decreased followed by the repetitive increase and decrease to be a constant, which indicates the impact-elastic waves might occur around the block. The permeation for the high rate pressurization was larger than that for the slow one. To confirm the generation of the impact-elastic waves, the water pressure in each direction just after the valve opened was measured in the vessel 1 with long cylindrical shape. For the high pressure-increasing rate, the maximum pressure along the longitudinal direction of the vessel was larger than that along the radial direction. While for the low rate, the maximum pressures were similar for the two different directions. These findings indicate that the impact-elastic waves occurred in the vessel 1 for in the high rate pressurization.

ARN/HSS/ISSH 2017 Report

Kazumi Kanazawa

(Laboratory of Structural Function, RISH, Kyoto University)
Supervisor: Hiroshi Isoda

1. Experiences in HSS and workshops as ARN activity

For the first, I greatly appreciate for giving me a chance to participate in the 7th International Symposium of Sustainable Humanosphere, Humanosphere Science School 2017 the 360th Symposium on Sustainable Humanosphere, the 3rd JASTIP Bioresources and Biodiversity Workshop, and the 2nd Humanosphere Asia Research Node Workshop.

I could experience both international cultural exchange and interaction between different fields by taking part in the symposium. There are many participants from some countries, and their presentations were about various theme relate to Humanosphere. Though my topic was in engineering field while most of the research presented in the symposium were in chemistry field, I was interested in some topics from different point of view.

It was the first time for me to visit Indonesia, but immediately I liked the atmosphere and townscape there. People in the country were energetic and cheerful. The best thing I was fascinated in was a series of orange-colored roof. High roadside tree and these orange-colored roofs seemed to fit the climate so much. As well as the atmosphere in the town, I felt the difference of that in the symposiums. There were a lot of women in participants and position of researcher, not students, seemed to be widely open for both male and female. The symposiums were held in friendly atmosphere from beginning to end. Indonesian wore colorful Batik which is the formal wear in Indonesia. In every coffee break, many participants actively communicated each other with a cup of coffee.

My study is about CLT wall infilled in steel frame. Cross Laminated Timber (CLT) made of some layers of lumber which is oriented at right angle each other. The reason why study of CLT relate to Humanosphere science is sustainability and low emission of construction energy. Because wood is the only sustainable building material, it is expected that more high-rise building use wood. Also, wood has an advantage of ease of processing, emission of construction energy is lower than that of concrete or steel. As CLT overcome the weakness of wood which is anisotropy of strength, more and more high-rise building utilize CLT as a structural member. I think it is the first step to replace concrete and steel with wood in high-rise buildings that we comprehend the property of composite structure of CLT and other material such as concrete and steel.

Last of all, this visit was a precious experience for me. I am very thankful to get the opportunity to participate in these symposiums and for kindness of the organizers. If I get the chance to take part in these symposiums, I would pleasantly participate in it.

2. Presentation summary

Case Study of Composite Structure with CLT Infilled in Steel Frame

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Abstract

Wood is considered sustainable building materials. It has been generally used as frame members. While Cross Laminated Timber (CLT) is a recently developed panel material, which consists of multi lamina layers cross bonded each other. Aiming to use wood in high-rise building, the possibility of composite structure system with CLT wall infilled in steel frame was investigated. Firstly to make the most of CLT shear force, drift-pin joint between CLT panel and steel frame was adopted and their strength and initial stiffness efficiency were studied. Then finite element analysis of the unit frame was executed. The unit frame of 12600mm in span consists of steel I-beam of W250x700mm, steel square pipe column of 400x400mm in the left, 500x500mm in the right, and two CLT panels which is 4700mm high, 3000mm wide and 150mm thick were installed as infill. As a result of in-plane shear pushover analysis, it was shown that steel frame and CLT wall have almost equivalent strength value. Finally analysis for real scale building model of 65m×43m in plan was carried out in which the CLT shear panels were installed as infill instead of the 18m steel brace. It was confirmed that composite structure with CLT wall infilled in steel frame have enough shear capacity against seismic loads.

Acknowledgements

The information presented in this study relates to the CLT Composite structural system project was supported by Ministry of Agriculture, Forestry and Fisheries. The authors would like to express their gratitude to members of project including Takenaka Corp. and DoT Corporation.

ARN/HSS/ISSH 2017 Report

Masaya Nagai

(Laboratory of Sustainable Material, RISH, Kyoto University)
Supervisor: Kozo Kanayama

1. Experiences in HSS and workshops as ARN activity

In my case, attending the HSS and workshops as ARN activity was not only the first time to give presentations with oral (ARN workshop) and poster (HSS) in English, but also the first time to go abroad. From this experience, I realized that I had never been interacted with other culture practically, even though I had some friends from other country and discussed them in English. During the conferences, I met many people, especially Muslims, and I felt the real life of them, such as using a rest room, listening the adhan, seeing the scene of downtown etc.. Furthermore, I got the chance to take another look at my research from these experiences because almost all people who asked any question were local and one of them contacted me by E-mail with long-sentences. In brief, I could understand what they thought about my study from their usual lifestyle. The reason is explained as follows.

Compared with Japanese lifestyle, their lifestyle was so simple, i.e., almost Indonesian people were living from hand-to-mouth, e.g., street venders, traffic wardens, and etc., I thought. However, people who attending the conferences were different from such people in the respect of the way of thinking about their life. So, all of them attended the conferences was considering sustainable development in their country. Although they tried to manage to continue the development, almost Indonesian people paid no attention to such a thing or they ignored it from industry developments such as plantation. From the both viewpoints, I realized that my research could connect sustainable development with industry in South-East Asia because materials of my study were obtained from bio-wastes, such as oil palm wastes, lime peels, and etc.. In particular, abundant oil palm trunk wastes were generated from extensive oil palm plantations in Indonesia and Malaysia every year.

The purpose of my study was to evaluate the dimensional stability of wood impregnated with solutions of sucrose, citric acid, and the mixture of them. In this study, I concluded that citric acid certainly showed the highest value of improvement of wood dimensional stability in this condition, but sucrose and citric acid were chemical reacted in wood cell walls in fact. This indicated that the mixture of sucrose and citric acid had a possibility to improve the dimensional stability of wood in other conditions. This study, as described previously, would be able to connect sustainable development with industry, and it means that my research could contribute to sustainable development of human society. In this respect, I was activated my motivation in studying by attending these conferences, and now I want to make relationships with more wider research area for obtaining more information.

Summarizing, attending these conferences was the precious time for me because I could break typical values of my understanding of other nations. From this experience, I recognized the worth entering into the global community and also mutually understanding of each other. If I had been keeping in Japan, I would not have known anything about international community, the relationship Japan with Indonesia, and objective opinions about my study.

Finally, with this in mind, I appreciate that I got the opportunity to participate the HSS and workshops as ARN activity, and I would like to participate again if I have such a chance.

2. Presentation summary

Dimensional stability of wood improved by using the impregnation with sucrose and citric acid

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Abstract

In wood industries, the substitutes for petroleum-based impregnation solutions are required for continuing the sustainable development. In the previous studies, it has been clarified that the dimensional stability (DS) of wood was improved by the bulking of cell walls with the use of sucrose (Su), and also by the cross-linking caused by citric acid (CA) in cell walls, respectively. Furthermore, it has been reported that the mixture of them could be used for wood adhesive because the cross-linking generated between Su, CA, and hydroxyl group of wood. However, it has not yet been clarified that, whether the mixture of them could improve the DS of wood. The purpose of our study is to confirm the effect of the mixture of Su and CA on improvement in the DS of wood impregnated with that mixture. At the first step, the impregnated wood was analyzed by using differential scanning calorimeter (DSC) to clarify the temperature at which cross-linking occurred in the wood cell walls impregnated with Su and CA. Cross-cut samples of hinoki (Chamaecyparis obtusa) with dimensions of 5 × 25 × 25 mm (longitudinal × radial × tangential) were impregnated with a 20 mass% aqueous solution of the mixture of Su and CA. The impregnated samples were subsequently conditioned in an atmosphere at 30%RH and 40 °C. The conditioned samples were subjected to the freeze drying. The heat-flows of the freeze-dried samples were measured with a heating rate of 1 °C/min in a nitorogen atmosphere. From this experiment, the mixture-impregnated wood in dried state is required to be treated at around 150 °C for the generation of the cross-linking. The mechanism of the cross-linking and the effect of the bulking will be reported in the presentation.

Keywords: *Wood; Natural products; Dimensional Stability; Cross-linking; Bulking effect*

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ARN/HSS/ISSH 2017 Report

Munadian

(Laboratory of Innovative Humano Habitability, RISH, Kyoto University)
Supervisor: Prof. Tsuyoshi Yoshimura

1. Experiences in HSS and workshops as ARN activity

Join HSS program has been a great experience for me, as we know that this event is a forum for interdisciplinary researchers, practitioners, and professionals to share their knowledge or results of scientific research, is not only specific academic seminar but rather than its whole package seminar that we can learn many things from interdisciplinary science. The conference theme focuses on how advanced science and technology take roles in achieving sustainable development goals (SDGs). Something that I learn from this seminar is to solve the humanity problem and to achieve our goals we cannot defend to certain skill or sciences, every aspect has their own role. And we have to work together make a collaboration covering natural sciences till social sciences.

As said by one of keynote speaker Prof. Yunita T. Winarto based on her research that inter subjectivity between the scientists from a different discipline and between the scientists and farmers has been a significant means in making the collaborations works effectively and as the results, it can improving farmer's resilience to climate change. Listen to Prof. Yunita lecture remind me about my current research and final goal from my research, currently I am working with plant cell, tissue culture and fungal as elicitor to agarwood, but actually my final goal is how to make agarwood become main non timber forest product which is can generate household income for people who dependence their livelihoods to the forest with sustainable and healthy manners and as the final results it can preserve our forest from any illegal logging which is being one of the main factors for forest degradation. As a person who grew up in the country that is suffering from deforestation, I optimist that someday I can give contribution with my research finding in order to bring back my country as a densely forested country.

I do realize to achieve my goal it cannot be done with only find the suitable fungal elicitors for to generate agarwood inside the timber and success to produce agarwood, further than that there must be a role of an interdisciplinary approach to achieve this goal.

Join HSS and ARN activity give me a hope that there is a forum and platform that gather many scientist from many inter discipline knowledge. I feel like make one step forward to achieve my goal with being able to make presentation and introduce my research to other scientist.

2. Presentation summary

Crude extract of Fungal elicitors in agarwood plant cell suspension culture from *Aquilaria Malacensis* lamk.

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Abstract

Agarwood cannot generate in the normal wood tissues, but may form in the cut or burned tissues in Aquilaria spp. Several fungi which are responsible for the formation of agarwood have been isolated and identified using DGGE method. Plant cell culture systems are viable alternatives for the production of secondary metabolites. Secondary metabolite synthesis and accumulation in cell culture can be triggered by the application of elicitors to the culture medium. Dual cultures of fungal and plant tissue were set to characterize the presence of agarwood compounds in the fungal elicited cell suspension culture. Seven fungal isolates were selected for elicitors. The autoclaved crude mycelial extract was used as the elicitor. A total of 39 compounds was identified from the 7 different elicitors. The major constituents being derivatives of 2-(2-phenylethyl) chromone, aromatic compounds, sesquiterpenes, monoterpenes, sterol compounds and fatty acid methyl ester. Compounds detected included major aromatic compounds (the group of aldehyde, phenol, ether, ketone). Besides Sesquiterpenoid, 2-(2-Phenylethyl) chromone derivatives, of which about one hundred different structures have been reported, are considered to be one of the characteristic and most abundant constituents responsible for the quality of agarwood.

Keywords: *agarwood, cell culture, elicitors, fungal*

ARN/HSS/ISSH 2017 Report

Nor Azlan bin Mohd Aris

(Laboratory of Yamamoto, RISH, Kyoto University)
Supervisor: Hiroyuki HASHIGUCHI

1. Experiences in HSS

The environment surrounding humans is changing rapidly, threatening sustainable development and healthy living. Therefore, understanding of the environment, its components, and how each of them interact to each other offers depth insight towards the better "humanosphere" sustainability. Most of the time, the occurrence of natural disasters such as heavy rain, typhoon and flood are unavoidable, but it could be predicted through the understanding of their characteristics and behaviors so that thorough preparation could be carried out. These early preparation and prevention are really required especially for the affected societies such as civilians, farmers, government agencies and other related industries in reducing the losses and damages due to the extreme weather.

RISH defined the "humanosphere", which includes the spheres supporting and interacting with human activities. Activities to comprehensively understand the current situation in the "humanosphere" are continued, which leads to the establishment of science and technology indispensable for sustainable development and contributing to the betterment of society. This time in early November 2017, Humanosphere Science School (HSS) is organized in Bogor, Indonesia by collaboration of several institutions and agencies such as LIPI, RISH, ARN and JASTIP to name a few, which purposely to gather researchers, academicians, professionals and public in sharing knowledge, disseminating research finding, exchanging success stories, and expanding both national and international collaboration.

I am thankful especially to RISH and ARN for the given opportunity to join this event. This is a good experience for me to explore and get a better understanding of the research topics consist of very wide areas and fields. These also change my view of the world and its components in a whole new perspective. Beside the lectures and talks given by researchers and students, the banquet session also became more interesting whereby a representative from each participant country such as Indonesia, Japan, Egypt, Thailand, Taiwan, China, Laos, and myself from Malaysia had the opportunity to share our experience in the event. This is where we all share a little bit about our country, our relation, our feelings and our cultures. Such sharing session provides a warm feeling among multiracial and multinational participants which is a very positive moment.

Finally, our visit to Bogor Botanical Garden (BBG) is a sweet moment that allow us to see the biodiversity in tropical country such as Indonesia. Even though I am from Malaysia where the climate is very much alike and maybe most of the biodiversity are as similar as in Indonesia if not all, but it is rare for me to visit such place even in my country. My research is mainly about atmospheric sciences which is part of the "humanopshere" researches. That is why, such opportunity given to join this kind of visit is just invaluable at least for me. I got plenty of pictures taken as a token where it could be a starting point for my long journey in understanding the earth's biodiversity which could contribute towards a bigger goal for the sustainable humanosphere.

2. Presentation summary

Development of Software-Defined Multi-Channel Receiver System for the Equatorial Atmosphere Radar (EAR)

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Abstract

Equatorial atmosphere is typically associated with the generation of most active convective motions which caused by absorption of strong solar radiations thus significantly affecting global atmospheric changes. However, the coupling processes in the equatorial atmosphere which incorporate hierarchical structure horizontally and vertically are still under debate specifically due to the sparseness of the observational data in the region. Furthermore, all the processes involved in the different layers of atmospheric were typically studied independently without a unified viewpoint which leads to a difficulty to identify the proper mechanism involved in the atmospheric changes and fluctuations.

Equatorial Atmosphere Radar (EAR) was established in June 2001 by the collaboration between Research Institute for Sustainable Humanosphere (RISH), Kyoto University and Indonesian National Institute of Aeronautics and Space (LAPAN) to improve the understanding of the equatorial atmospheric and its dynamical and electrodynamical coupling processes. EAR is a VHF Doppler radar operated at 47 MHz with an active phased-array antenna system and located at the equator at Kototabang, West Sumatra, Indonesia (0.20°S, 100.32°E, 865 m above sea level). It uses a quasi-circular antenna array with a diameter of approximately 110 m which consists of 560 three-element Yagi antennas. The maximum output power of the EAR is 100 kW.

Currently, the EAR has only a single receiving channel, and it still manages to produce interesting observations output regarding the atmosphere turbulence. Furthermore, with the availability of Radio Acoustic Sounding System (RASS) at the EAR site, it enables the observations of vertical profile of temperature thus make it possible to observe turbulence occurrence through continuous observations. The rapid development of multi-channel receiver system in most radar system allows for the implementation of more sophisticated observation technique such as spaced-antenna (SA) and spatial imaging observations. Here, we present the initial development of multi-channel receiver system for the EAR using general-purpose software-defined radio receivers.

The multi-channel digital receiver system will be developed using the combination of Universal Software Radio Peripheral 2/N210 (USRP2/N210) series and GNU Radio which allow the implementation of sophisticated software-defined radar receiver, yet at lower development cost compared to conventional radar hardware. The receivers are synchronized using 10 MHz reference clock and 1 pulse per second (PPS) signal. Signals processing such as filtering, range gating, and coherent integration will be performed in real time utilizing a personal computer and GNU Radio software and the data produced will be stored in an external hard disk for post processing.

ARN/HSS/ISSH 2017 Report

Sadat Mohamed Rezk Khattab

(Laboratory of biomass conversion, RISH, Kyoto University)
Supervisor: Takashi Watanabe

1. Experiences in HSS and workshops as ARN activity

・ How have you been affected by attending the HSS and ARN program?

Junior researchers are mainly focus on novelties of their specific topics and researches points, thence, the chances for innovation from connecting different topics or studies usually need extraordinary efforts that can't be occur unless there is institutional support. Research Institute for Sustainable Humanosphere (RISH), Kyoto University initiated many programs such Humanosphere Science School (HSS), and Humanosphere Asia Research Node (ARN) to strengthen the hub functions of international collaborative research and fostering innovations on Humanosphere Science with an ultimate goal to deliver solutions on a global scale between Asian and Japan. As a consequent of my participation of Humanosphere Science School 2017-The 360th Symposium on Sustainable Humanosphere- - The 7th International Symposium for Sustainable Humanosphere - http://situs.opi.lipi.go.id/hss2017/, I am very enthusiastic to spread the ideas, recommendations and participating in the future programs where I realized the importance of the main goals of HSS and ARN after attended the wide range of connected topics and their relation to Humanosphere sustainability. In addition, I am trying to find a way of collaboration to expand such these programs to reach my country "Egypt".

・ How do you think importance of Humanosphere science?

After participated in Humanosphere science, I can't deny the role of it for
1- Saving the sustainability of bioresources plants, animal, earth, water, atmosphere etc.
2- Participation in solving our current problems such as global warming.
3- Open the window for exploits all our natural resources.
4- Helping in welfare the society.

・ How does your research relate to Humanosphere science or the activity of ARN? Explanation of your

Egypt still has some problems with exploit agricultural residues "rice straw, rice husks, sugarcane bagasse, and stalks of corn and sorghum" where the surplus of it usually burns as illegal solution from farmers. During attendance in this symposium, I observed such these problems in the Asian countries too, which emphasize that the exchange experience and ideas for utilizing the agricultural residues is very important for solving such these problems. Moreover, without such HSS and ARN symposia I will not discover such this huge diversity of biomass species and its quantities. HSS and ARN programs reveal some of the blind spots between the connections of the topics of sustainable Humanosphere. For example, microbiologist designs and guide machinery yeast cells and redirect it to produce our needed products synchronously with elimination of wastes. The surplus of glycerol from biodiesel industries prompted us to utilize glycerol via a molecular breeding of glycerol-utilizing yeasts to produce versatile chemicals and fuels, in order to maintain sustainability of these biomass resources, biodiesel/ fatty acid industry.

2. Presentation

Catalyzed-Glycerolysis for Biorefinery of Bagasse

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Abstract

Hitherto, the higher costs of converting bagasse to bioethanol hinder its production at industrial scale. Nonetheless, the development of promising strategies for integrating the producing of bioethanol with other bio-based chemicals has been initiated to make the process cost competitive and economically viable. In addition, the development of efficient methods based on the organosolv pretreatment assisted by microwave and biocatalysts hydrolyze has achieved to release sufficient quantity of fermentable sugars and value-added chemicals during depolymerization of lingocellulosic matrices. Glycerolysis was carried out using 70 % glycerol (5% w/v) catalyzed by 360 µM Lewis acid per gram and electromagnetic waves of microwave controlled by temperature at 180°C for 30min. This catalyzed-glycerolysis pulped 55% of bagasse. The depolymerized lignin components were separated by acetone washing followed by water. Cellic CTec2 cellulase enzyme saccharified 77 % of the pulped bagasse mainly to glucose, which represented in 56% of pulp. Recombinant xylose fermenting yeast Saccharomyces cerevisiae SK-NY fermented all the released sugars from enzymatic saccharification with efficiency reached 100 % of theoretical value within 3 hours. Furthermore, GCMS detect some lignin monomers such as p-coumaric acid, vanillin, eugenol and syringaldehyde from depolymerized lignin during catalyzed-glycerolysis.

Keywords: Bioethanol, Bagasse, Glycerolysis, Microwave, Bio-based chemicals

ARN/HSS/ISSH 2017 Report

Satoshi Oshiro

(Laboratory of Biomass Conversion, RISH, Kyoto University)
Supervisor: Takashi Watanabe

1. Experiences in HSS and workshops as ARN activity

How have you been affected by attending the HSS and ARN program?

When I attended the HSS and ARN program, I was impressed with the style of the research activity in Southeast Asian countries. The researches are based on environmental problems and unique resources in Southeast Asia, and the researches in this region take practical approaches to solve the problems and utilization of the resources. Specifically, I was interested in the research activities including degradation of pollutants in wastewater, influences in ecology of tropical rain forest by human activity, biomass resources which can be utilized in Southeast Asian countries, and identification of bacteria metabolizing organic pollutants difficult to decompose. Especially among them, I remember that the discussion about possibility of utilization of biomass resources (ex. sugarcane bagasse, rice husk and rice straw) is very active and the researchers consider whole process from selection of usable biomass resources to final products practically.

In Japan, there are a lot of research activities aiming at achieving the most advanced and cutting-edge outputs, such as precise and quantitative analysis of biomass samples, novel chemical treatments linking to high efficient biomass utilization using advanced devices and technologies. I felt that the collaboration of Japanese research with unique resources in Southeast Asian countries has the potentials to solve the problems in Southeast Asian countries and provide the novel research topics.

As mentioned above, I realized that discussion with researchers by face to face at the symposia are important to obtain a real knowledge about hot topics and style of research activities in Southeast Asia. We cannot obtain such experiences only by reading research articles. I think that the HSS and ARN program provided young researchers with such a great opportunity to realize what research topics are focused in Southeast Asia. Moreover, these programs were meaningful for me because I could get a chance to review the importance and meaning of my research and to broaden my mind in the research activity.

How do you think importance of Humanosphere science?

Focusing on the utilization of biomass resources, we have to consider many factors including the selection of biomass which is useful to produce biofuels and chemicals, optimization of reaction process, evaluation of environmental burden and energy balance. To resolve the complex issues such as biomass utilization, researches from various fields should share the factors that are important to solve the problems. I think Humanosphere Science will exhibit the important function as the framework to share the global scale problems difficult to solve only by researchers of one specific scientific field.

How does your research relate to Humanosphere science or the activity of ARN? Explanation of your research subject can be included.

My research theme is improvement of the function of enzyme that degrades lignin, one of the components of woody biomass. This research aims at high efficient utilization of woody biomass and contribution to the establishment of a society with reduced dependence on fossil resources, one of the missions of Humanosphere Science. The enzyme in my research field is also useful for degradation of contaminants in wastewater. Our research makes collaboration with LIPI and Chulalongkorn University in Thailand, to develop the degradation of pollutants in wastewater by enzymatic reactions. Through the collaboration research, I learned about the enzymatic degradation of chemicals causing pollution, and I also provided the techniques about purification of enzyme and evaluation of enzymatic reactions. Such experiences facilitate our research activity each other. I hope young researchers in Japan and Southeast Asia perform excellent research and improve their activity each other through the activity of ARN.

2. Presentation summary

Binding analysis of tandem dimer of lignin-binding peptide and design of artificial enzyme carrying the peptide for enhanced lignin degradation

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Abstract

Lignin, accounting for 10-35 % weight of lignocellulosic biomass, is abundant natural aromatic polymer on the earth. Hence, lignin is promising resource of aromatic chemicals replacing them from fossil fuels. The selective lignin degrading reaction is important for the production of biofuels and chemicals from whole lignocellulosic biomass. However, highly selective and efficient lignin degradation is still challenging, due to chemical and physical recalcitrance of lignin. As a novel tool for selective lignin degradation, we recently discovered 12-mer peptides that bind to lignin by the phage display technique. We expect the attachment of the lignin-binding peptide to (bio)catalysis enhances the lignin degradation. In this study, we designed tandem dimer of lignin binding peptide, to improve the affinity of the peptide to lignin. We also investigated conformational change of the tandem dimer peptide upon recognition of lignin. As a result, the tandem dimer peptide indicated 10-fold affinity compared with original 12-mer lignin-binding peptide. We also found that tandem dimer peptide changed its conformation to recognize the difference between softwood and hardwood. Additionally, we designed the artificial enzyme bearing the tandem dimer peptide and comparatively evaluated the enhancement of lignin degradation.

Keywords: *Lignin binding peptide, Lignin degrading enzyme, FTIR, NMR*

ARN/HSS/ISSH 2017 Report

Shizuka Sakon

(Laboratory of Biomass Conversion, RISH, Kyoto University)
Supervisor: Hiroshi Nishimura

1. Experiences in HSS and workshops as ARN activity

・How do you think the importance of Humanosphere science?

RISH defines the “Humanosphere” as spheres that support and interact with human activities. Specifically, it consists of four spheres, the human living environment, the forest-sphere, the atmosphere, and the space environment. Field of studies to understand each sphere are wide range and interact complicatedly. In order to understand the humanosphere to realize a sustainable society, it is necessary to deepen the understanding of each field and to have an interdisciplinary knowledge beyond the boundaries of each field. I regard RISH as an organization to cooperate understanding of the humanosphere beyond the framework of each field. Moreover, understanding of the humanosphere needs cooperation beyond country. ARN is the partnership for cooperation to facilitate understanding of the humanosphere and realization of a sustainable society in Asia.

・How have you been affected by attending the HSS and ARN program?

To listen to the presentation of overseas people by attending this HSS-ISSH and ARN program held in Indonesia was a good experience for me. When I listened the presentation of overseas researcher in Japan, I could only hear with an ambiguous image like a story of a distant country. However, in this time, I could listen to the presentations with more interest. Because of I listened in a country closer to the place where the research is being conducted. Especially, I could listen to a presentation about research on a specific location such socio-economics and ecology with the more transparent image. I think this reason is that the position of the research site could be captured apparently in my mind by going abroad. Besides, I learned the current status and problems of the study on biomass energy which close to my research field. For example, these are various types of biomass that become surplus in each country, or the background that they occur, or research to use them. And I have got various questions and suggestions from foreign researchers and scientists of different fields. I felt it is wonderful to be able to make the same story with overseas people who have little in common by interested in each other and introduce what each is working on.

I have got a clearer image of overseas research, and I also have reached a new vision of seeing the world from Southeast Asian countries including Indonesia. I think that what a person use as criteria for their judgment are often something that person saw and heard him or herself, and these are almost occupied what happens in the community which the person belongs. Therefore, if a person stays the same circumstance or belongs to the community with limited diversity for a long time, his or her point of view and sense of value are biased gradually. In HSS, I learned many problems about humanosphere sciences in Southeast Asian countries, and various studies to overcome them. So, I think that it is important to go to various places and belong to a diverse community for acquiring and maintaining a broader view.

"Humanosphere" science is a complicated subject. Gathering the interests from a different field of researchers and communicating each other are important. This will make new perspectives. I think these points of view are also important outside the research of humanosphere.

2. Presentation summary

Analysis of Lignin-Carbohydrate Complexes in Woody Biomass by Using NMR

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Abstract

Woody biomass consists of lignin, cellulose, and hemicellulose. Lignin is a recalcitrant aromatic polymer which has a three-dimensional network structure in wood cell walls. Lignin is promising as a chemical raw material because aromatic rings can utilize as raw materials for various chemical products. Here, we focus on Lignin-Carbohydrate Complexes (LCCs), which have covalent bonds between polysaccharide and lignin. The abundance of LCCs is small in wood cell walls, but significantly important in physical and chemical properties. Thus, a better understanding about LCCs is necessary to develop an efficient conversion system of woody biomass. In this study, we try to fractionate and analyze LCCs from hardwood. We separated an LCC fraction in combination with enzymatic digestion, solvent extraction, and column chromatography, and analyzed by 2D-HSQC NMR.

ARN/HSS/ISSH 2017 Report

Shu-Ping Tseng

(Laboratory of Innovative Humano-habitability, RISH, Kyoto University)
Supervisor: Tsuyoshi Yoshimura

1. Experiences in HSS and workshops as ARN activity

・How do you think importance of Humanosphere science?

Humans impact the environment in several ways, and some human actions are harmful to the environment. The challenges that we are facing today include global warming, air and water pollutions, shortage of energy, deforestation and loss of biodiversity. These problems affect us all, thus requiring our actions if the world is to remain sustainable for human beings and other species. The study of Humanosphere science is fundamental to the sustainability of the planet and its life supporting systems. Identifying the current issues in humansphere and finding possible solutions are the most important things in this era.

・How does your research relate to Humanosphere science or the activity of ARN? Explanation of your research subject can be included.

My research interests are in the invasive biology of longhorn crazy ant (*Paratrechina longicornis*), including the ecology and invasion pathways of longhorn crazy ant and management of this ant. Humanospheric science is defined as an interdisciplinary science that conducts research concerning the humanosphere. Invasive biology is part of Humanospheric science by this definition. The human-mediated dispersal events have resulted in a global problem of species invasions of great international concern. Invasive species exert huge detrimental effects on the ecosystem, agriculture and economy. Government budgets worth billions have been spent on preventing, controlling and/or eradicating invasive species worldwide. Invasive species are a global issue, and the study of invasive species often relies on international cooperation. The program“Humanosphere Asia Research Node (ARN)” aims to strength the hub functions of international collaborative research and fostering innovations on Humanosphere Science, which also provides me an opportunity for my research cooperation. The collaborative network of ARN includes several research institutes in Indonesia, Malaysia, Thailand, and India. Next year, I will conduct my research in ARN’s cooperative overseas research institutes in Malaysia and Indonesia. Results from parallel researches in different countries are very valuable for studies on invasion biology.

2. Presentation summary

Global invasion of the longhorn crazy ant, *Paratrechina longcornis*

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Abstract

The longhorn crazy ant, *Paratrechina longicornis*, is a ubiquitous agricultural and household pest throughout most of tropical and subtropical regions. Despite worldwide distribution of this pest ant, the native range of it remains controversial. In an attempt to resolve such issue, preliminary genetic analyses using sequences of *mitochondrial DNA* (mtDNA) were carried out for the populations of *P. longicornis* we collected worldwide, and our results indicate the presence of two highly divergent mtDNA clades (*clades* I and *II*), with both coexisting in most of geographical regions. The high level of genetic homogeneity within mtDNA clade I suggest no substructure for *P. longicornis* samples across continents. The lack of genetic variation of clade I may attribute to mtDNA sweeps resulting from *Wolbachia* infection. On the contrary, mtDNA clade II, possesses higher genetic diversity with three subclades that are roughly associated with their geographic origins. Since mtDNA only provides limited information, data based on markers that are highly polymorphic are currently being generated to reconstruct invasion history of *P. longicornis*, and how human activities have shaped this pest ant species could be resolved.

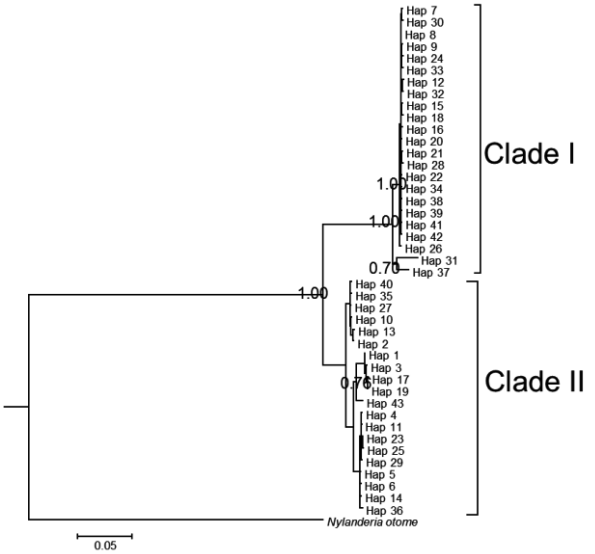


Figure 1. Bayesian 50% majority rule consensus tree of *P. longicornis* by using Mrbayes.

ARN/HSS/ISSH 2017 Report

Soichi Tanaka

(Laboratory of Sustainable Materials, RISH, Kyoto University)

1. Experiences in HSS and workshops as ARN activity

1-1. Relation between my research and Humanosphere science/Activity of ARN and HSS/ISSH

For the sustainable development in the Humanosphere, the fossil resource-based materials are required to be substituted for the natural resource-based ones. Wood is the most important biomass resource for the material usage. It is required for the wider usage of wood to fulfill the strict standard required as an industrial material by enhancing the performance and reliability of wood and wood-based materials. Chemical treatment, or introduction of chemicals into wood, is one of the major methods for the enhancement. In the conventional treatment, however, distribution of chemicals in wood was irregular, leading to the inadequate performance and reliability. This irregularity can be categorized to macroscopic irregularity, indicating that the chemically treated wood includes the untreated cells in its structure; and microscopic irregularity, indicating that each cell includes the untreated regions in its amorphous structure.

I had presentations related to this topic in ARN workshop on October 31th and HSS/ISSH symposium on November 2nd. The participants from Asian countries showed much interest on my research, and I exchanged some information with some audience about the chemical treatment. I recognized the difference in the properties required for the material between in Japan and in other Asian countries. In Japan, the reliability is especially important for the produced material. While in other Asian countries, the reliability is less important than the other factors such as the cost and usefulness and etc, which make it easier and faster to develop new materials and to find out new way of using it. This suggests that the requirements for the sustainable development in global scale is completely different from that in a country scale.

In the ARN program, the laboratory tour of Research Center for Biomaterials in LIPI was also held on October 31th. There were many young researchers and student from University in Indonesia engaged in the improvement of wood properties, and had the opportunity to exchange the information about my research.

It was indicated from these experience that the ARN and HSS/ISSH program was a good opportunity of both making my study known to them and reconsidering my study, and I thought that the program functioned as a hub for collaborative opportunity.

1-2. About thinking importance of Humanosphere science

For maintaining human activities sustainably, it should be important to analyze the activities on the personal scale to the global scale. Japanese student and young researchers in general are good at studying at a laboratory (personal) scale, but not so good at global scale. This may be due to the lack of opportunity to see foreign countries with their own eyes and to exchange their opinion with foreign people. Therefore, the role of Humanosphere science, I think, is a kind of the enforcement for making them think their study globally, and the ARN activity is one of the efficient way to give them the opportunity to reconsidering their study. Furthermore, the Humanosphere science itself should be changed on the basis of the activity.

2. Presentation summary

Techniques for controlling amount of chemicals in cell walls in pre-treatment for wood flow forming

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Abstract

Wood flow forming is a new wood processing technique that can produce a compact with a various form from wood blocks using a metal mold. To obtain the compact with high dimensional stability, the blocks are required to be treated with some chemicals before the forming. For the effective treatment, the chemicals should be existed in cell walls rather than in cell cavities. In the treatment, we focused on the diffusion of chemicals from cell cavities into cell walls in conditioning process (process of evaporating solvent) of chemical solution-impregnated wood. The purpose of this study is to clarify the atmospheric state (relative humidity (RH) and temperature) in the conditioning that promote the diffusion of chemicals into cell cavities. Wood blocks were impregnated with a 20 mass%-aqueous solution of polyethylene glycol (PEG1540) selected as the chemical. The impregnated blocks were subsequently conditioned under an atmosphere whose relative humidity and temperature were controlled in several schedules. The amount of PEG in cell walls, which was estimated from the dimension of the sample, was confirmed to depend on the RH and temperature. It was clarified that the swelling of the cell walls was required to be controlled during the conditioning for promoting the diffusion of the chemicals into cell walls. In my presentation, the methods to control the swelling during the conditioning will be introduced.

Keywords: *Wood; Chemical treatment; Impregnation; Conditioning; Cell wall*

ARN/HSS/ISSH 2017 Report

Takahiro Kegasa

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Supervisor: Junji Sugiyama

1. Experiences in HSS and workshops as ARN activity

This is my second time to visit Indonesia following 9th Pacific Regional Wood Anatomy Conference held at Bali. It is known that Indonesia has wide variety of species such as woods, fungi, animals and so on. General speaking, we have to keep these biodiversity thorough all eternity and leave it for our descendant. Thus, Indonesia is good location to study Humanosphere science; development of this study moves our society close to realization of sustainable human activity. Especially, Bogor is famous city for green color originated from plant and angkot. Therefore, we could see around one of the world's largest botanical garden located on centre of city. It is much valuable experience for us, because we saw some rare plant species like *Amorphophallus titunum* and study the Indonesian history about breeding and exportation of Asian plant products i.e. luxury goods such as tobacco and coffee beans. Moreover, many researchers had developed botany in Netherland, and Indonesia was reigned by just the nation. As a result, the botanical garden had been managed by Netherland. In the trip to this garden, I noticed the importance to maintain the biodiversity. In my research, I try to capture the anatomical information of wood and this study will be applied for automated wood identification. Using this technique people who works at customs can easily identify wood species to prevent from illegal wood trades and, this lead to sustainable biodiversity conservation and sustainable human activities.

On the other hand, the lecture and presentation in HSS provide me new perspectives excepted for wood anatomy; for example wood-based materials science, wood chemistry, and furthermore space science. Especially, I was interested in wood-based materials science because I intend to work Furniture Company from next spring. In the lecture presented by Dr. Wahyu Dwianto, I learned about physical treatment to relax inner stress inside of wood. I will able to make use of this knowledge, because I intend to work at a furniture company from next spring. In poster section, I saw many posters about not only forest science but bioscience, applied science and so on. This symposium was good chance to deepen the knowledge about Humanosphere science.

In the future, I might visit Indonesia again as business person because the company where I will work has a branch and a factory there and many furniture products are made of wooden materials from the country. When someday I go there again, I hope to meet some friends who I met in this time. Finally, I conclude that this experience and meeting in Indonesia is very valuable for my life in the future.

2. Presentation summary

Analysis of Anatomical Feature in Fagaceae Wood Species with Computer Vision

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Abstract

Woody plants in Fagaceae grow within Japan naturally and these species are often excavated from some ruins. Namely, it is conceivable that they had been used in dairy life since ancient time. Moreover, they have various anatomical features such as porosity, broad-rays, axial parenchyma and scalariform perforation[1]. Recently, computer vision (CV) system has been used in many areas as an automated recognition technique. Also in a field of wood science, it is gradually beginning to be explored in wood identification for cultural properties[2-3] and for safe timber trade[4]. In this study, we aim to capture anatomical features in Fagaceae species using future extraction algorithm based on its system. Features were extracted by several algorithms such as Scale-invariant feature transform (SIFT), Local Binary Pattern (LBP) and Higher order local autocorrelation (HLAC). Moreover, these features and combination of these features were dimensionally reduced by linear discriminant analysis (LDA), and recognition accuracies were calculated by k-Nearest Neighbor (k-NN) and Support Vector Machine (SVM).When high recognition rate is achieved, CV is expected to detect unknown anatomical features so far hidden in the image dataset. By cluster analysis and multiple regression analysis, we also intend to elucidate what computer vision looks.

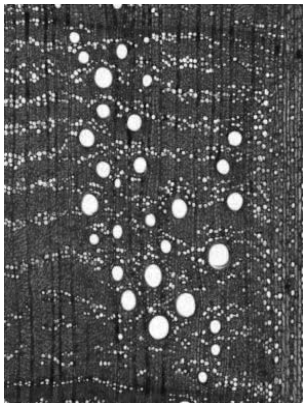


Fig.1, Microscopic image of *Quercus Phillyraeoides* used in my study.

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ARN/HSS/ISSH 2017 Report

Tatsumasa Hagiwara

(Laboratory of Space Systems and Astronautics, Yamakawa Laboratory, RISH, Kyoto University)

Supervisor: Hiroshi Yamakawa

1. Experiences in HSS and workshops as ARN activity in English

Firstly, this is the first time to visit Indonesia, my first impression toward the Indonesian is very kind and warmhearted. Through the presentation in poster session as HSS work and the attendance in workshop as ARN work, I found that I need not only the English ability but also the communication skills to attempt the mutual understanding. Furthermore, when I present my research to the researcher and students who are not familiar with my research field, I found that it is difficult to understand my presentation with a lot of technical terms for the listeners. Therefore, when I use the technical terms in not only Japanese but also English in my presentation, I realized that I have to explain the technical terms briefly. Moreover, it is hard for me to listen and understand the accented English because I'm not familiar with that. Through the discussion on their current research and the problems they faced and focused on with many students and researchers close to my age who come from Asian countries, I found a lot of different things we can't experience in the discussion with only Japanese such as thinking of the certain region, difference of the important viewpoint and different thinking. The discussion in HSS and ARN was a great experience for me. Through the discussion, I also realized the difficulty to widespread the idea due to the difference of the culture and personality between Japan and foreign countries.

In this time, by attending the HSS and the workshop as ARN, thinking the biodiversity which is one of the main topic of this symposium not only make our life better but also is effective measure for current serious problems like global warming and expansion of the tropical diseases. However, when the only developed countries which have the cutting-edge technology take the measure, there are no effect to the global issues. So, we need to not only collaborate with the developing countries but also provide the technics and the know-how when we consider as the global scale. Also, when we research at the place where we are not familiar with, it is difficult to survey efficiently. Therefore, we need to corporate with the person who are familiar with that area. To achieve these collaboration, I think we need to the conference or symposium where we can report the current research and discuss each other like this symposium. These symposia connect to the further development. Nowadays, RISH is mainly collaborate with Asian countries, especially ASEAN countries, on the biodiversity. For the further development, I think they need to collaborate with not only the Asian countries but also America and Europe.

Lastly, my research topic is on the propulsion system for the next generation spacecraft. The spacecraft has utilized for the exploration of the asteroids and the planets of the solar system such as Mars, Jupiter and Saturn. The problem of the current propulsion system is the low use efficiency of onboard fuel, basically low propulsion efficiency. Therefore, in this research, we proposed the new high efficiency system and aim to the short mission term. We are able to decrease the failure rate and explore in the short mission time. Space exploration could not only examine the origin of the Earth but also have a potential of the procurement of the resource from the planets. The resources on the Earth is finite, so resource depletion is the serious problem now. The immigration to the other planets and space exploration is important for thinking the humanosphere activity.

2. Presentation summary

Thrsut Evaluation of Magneto Plasma Sail with Magnetic Nozzle

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Abstract

One of the main propulsion system that generates the thrust for the space mission is electric propulsion system. Magnetic sail is the candidate for the electric propulsion system, which generates the thrust by capturing the solar wind with the magnetic field. According to the past study, the thrust of the magnetic sail equipped with realistic size of the coil is not enough to execute the deep space mission. Therefore, we proposed the new system called magneto plasma sail with magnetic nozzle. This new system combines two systems, magneto plasma sail and magnetic nozzle. Magneto plasma sail is the system which generates the thrust by the interaction between the solar wind and inflated magnetic field via plasma injection. Magnetic nozzle is the system which generates the thrust by converting thermal plasma or non-directional kinetic energy to directed kinetic energy. The thrust measurement of the magneto plasma sail with magnetic nozzle by using a pendulum type thrust stand experimentally has been conducted for verifying the concept of the thrust increase in the magneto plasma sail with magnetic nozzle. As the experimental results, the thrust of the magneto plasma sail with magnetic nozzle is approximately 2 times larger than the sum of the thrust of magnetic sail and magnetic nozzle.

Acknowledgements (if necessary)

The present experiment has been conducted by utilizing the advanced plasma chamber which is corporative utilization facility at Institute of Space and Astronautical Science(ISAS), Japan Aerospace Exploration Agency(JAXA) in Sagamihara, Kanagawa Prefecture. We appreciate all the support. We wish to acknowledge valuable discussions with engineers who belong to practice technology support center at National Institute of technology Akashi College for manufacture and improvement of the experimental parts.

ARN/HSS/ISSH 2017 Report

Xianpeng Yang

(Laboratory of Active Bio-based Materials, RISH, Kyoto University)
Supervisor: Hiroyuki Yano

1. Experiences in HSS and workshops as ARN activity

After attending HSS and ARN workshops, my main feeling is: when humanosphere science meets international collaboration, it becomes interesting.

Actually, I was not familiar with humanosphere science until I attended "The 2nd Asia Research Node Symposium on Humanosphere Science" which was held in July 2017 at Uji, Kyoto. I was attracted by the multidisciplinarity of humanosphere science, immediately. I never thought that the communication between forest science and space science could take place. But it is reasonable as human activities have reached to deep sea and outer space. We may think more deeply about our researches and inspire new ideas when communicating with researchers from different areas. I hoped that someday I could attend humanosphere science symposium to give a presentation.

Many thanks to ARN. I had the chance to share my recent researches in HSS and ARN workshops. My research is to develop novel cellulose nanofibers based hydrogels. Cellulose nanofibers, from wood cell, are renewable materials with excellent mechanical properties. To utilize forest resource rationally and effectively is one of main objectives of humanosphere science. Hydrogels are highly hydrated polymer network. Due to the wet and soft properties, hydrogels have various applications (such as jelly, soil conditioners, tissue engineering and so on), covering daily life, academic research and agricultural and industrial production. For the replacement of human tissues with hydrogels, such as skin and cartilage, one of the main challenges is the mechanical properties. Traditional hydrogels are very weak and fragile. The goal of my research is to improve the mechanical properties of hydrogels by utilization of cellulose nanofiber. I introduced two strategies in HSS and ARN workshops: (1) combination of stiffness and strength of cellulose nanofibers and the toughness of poly(vinyl alcohol); (2) design of the interfaces between cellulose nanofibers and polymers.

Though I could not find much related researches in HSS and ARN workshops, I was quite inspired by other researches. For example, some researches focused on lignin-carbohydrate complexes which are important structures in wood cell. I am thinking about the possibility of mimicking these perfect natural complexes to design hydrogels with better mechanical properties. When communicating with young researchers, I felt their vigor, creativity and confidence. When communicating with senior researchers, I appreciate their insight, kindness and responsibility. When communicating with local people, I was excited by unique Indonesian cultures. In addition, during some lectures about climate change and species diversity which are essential to sustainability, I was thinking about the meaning of my research again and again. What is the real research? How to make research more interesting? How can I change something? As a PhD student, I can not answer these questions well now. But I will continue to think. I was encouraged by many other researchers. On the other hand, as a foreign student in Kyoto University, I'd like to take the cases in china into account. I was surprised at good collaboration between Japan and AREAN, though more and more international collaboration is initiated in China. Nowadays, international collaboration plays the key role in solving big problems, like environmental problem and depletion of fossil energy, many of which are related to humanosphere science.

Last but not least, after visiting Bogor Botanical Gardens, I felt again that nature is the best teacher. I think that the best way to do research on humanosphere science is to learn from nature and obey the laws of nature.

2. Presentation summary

Stiff and strong cellulose nanofiber/poly(vinyl alcohol) nanocomposite hydrogels

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Abstract

It remains a challenge to prepare hydrogels with high stiffness, strength and toughness which are extremely required for replacement of human tissues, such as skin and cartilage[1-3]. In current work, we combine the stiffness and strength of cellulose nanofibers (CNF) with the toughness of poly(vinyl alcohol) (PVA) to prepare nanocomposite hydrogels, without any utilization of chemicals during preparation.

First wet CNF cake is obtained by filtrating CNF suspension with concentration of 0.1 wt%. Then the wet CNF cake, with water content around 90% and layered structure, is carefully peeled off from PTFE filter membrane and immersed in PVA solution. PVA chains diffuse into layered CNF cake, resulting in CNF/PVA nanocomposite. To induce crystallization of PVA chains and reinforce the interactions between PVA and CNF, drying-annealing method is utilized: 80 °C for 3 hours and 120 °C for 1 hour. Dried CNF/PVA nanocomposites are rehydrated in water for 3 days to form CNF/PVA hydrogels. The semi-transparent hydrogels, with water content of 65-85%, are extremely strong, as shown in Figure 1. The optimized sample shows elastic modulus of 47.92 ± 0.99 MPa, fracture strength of 15.91 ± 0.48 MPa and fracture energy of 2302.9 ± 42.0 J/m^2, which are almost equal to human tissues.

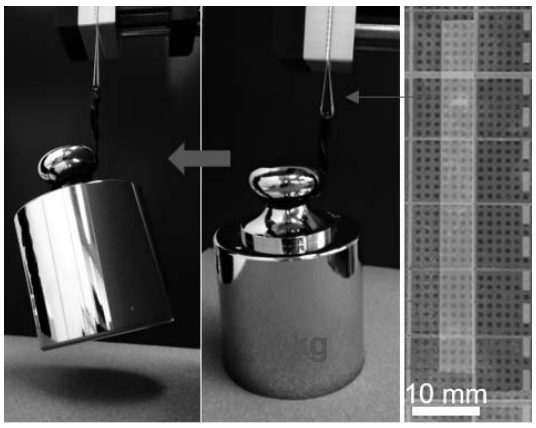


Figure 1. Stiff, strong and tough CNF/PVA nanocomposite hydrogels

It is proposed that in the drying and annealing process, strong interactions (hydrogen bonds) between CNF and PVA form instead of interfibrillar hydrogen bonds. Meanwhile, PVA network is formed due to physical cross-linking of crystalline region, which maintains well in hydrated state. As PVA network is strong, tough and highly stretchable, it probably acts as cross-linker and contributes to the reinforcement in stiffness of composite hydrogels. When the composite hydrogels are stretched, the fracture of PVA chains and disintegration of hydrogen bonds may dissipate much energy, maintaining the stretchability. Therefore, the excellent mechanical properties of CNF/PVA hydrogels result from the enhanced stiffness in hydrated state and maintained stretchability.

The present work demonstrates a facile method to prepare stiff, strong and tough hydrogels, which may suggest applications in regenerative medicine and separation membrane.

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ARN/HSS/ISSH 2017 Report

Ueda Youta

(Laboratory of Structural Function, RISH, Kyoto University)
Supervisor: Isoda Hiroshi

1. Experiences in HSS and workshops as ARN activity

・How have you been affected by attending the HSS and ARN program?

I participated in both ARN and HSS and made a poster presentation about my research “Analysis of failure mechanism of CLT load-bearing-wall against horizontal force”. It was my first international symposium. It was a valuable experience for me who only participated in domestic academic societies. I was able to learn a lot of things such as diverse research, how to show presentations, cultural differences and so on. I want to actively participate in many international academic societies so that I can have good experiences from now on.

・How do you think importance of Humanosphere science?

I think that Humanosphere science is a very important field. I am from the Faculty of Engineering Department of Architecture and I did not have the opportunity to learn about the research of other faculties. However, since I belonged to RISH from Graduate School, I was able to know various research types and expand my horizons. Furthermore, I could objectively look at the field of architecture. I began to think about not only as a structure but also how people are engaged in life with people. I think Humanosphere science is important in terms of expanding my horizons like this

.・How does your research relate to Humanosphere science or the activity of ARN? Explanation of your research subject can be included.

I am studying research on the CLT method to realize middle-rise building with wood. It is closely related to the Humanosphere science in that it effectively uses wooden which has low environmental burden. Japan's forest area is very high and we must make effective use of it. If buildings and offices of the CLT construction method increase, the number of workers in the forestry industry will also increase, and the industry will also be revitalized. From this, I think that it is very meaningful to think about the problem not only from the viewpoint of architecture but also from the viewpoint of Humanosphere science in diverse fields.

・Are there any research area or labs outside your research field which you want to collaborate with currently or in the future?

As a laboratory, we have a relationship with various fields such as joint research with Chinese universities, shaking table test of CLT in the United States, WCT held in Vienna, Austria. Many master's students in the laboratory are also involved. Since I was the first international exchange this time, if I have the opportunity I would like to go to Europe where CLT is popular

2. Presentation summary

Analysis of failure mechanism of CLT load-bearing-wall against horizontal force

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Abstract

As a way to open up new possibilities for wooden buildings with low environmental impact, cross-laminated timber (CLT) that can effectively utilize low-quality materials and enable a reasonable wall structure has attracted attention, and mid-rise building technology is under development.

In the shaking table experiment of 5 story CLT building, a compression failure was caused at around the fastener hole at the bottom of the wall panel of first floor, and it became criteria in seismic performance. In order to verify this phenomenon, a static horizontal loading test was conducted for the CLT wall specimen with applying the vertical load assuming the upper floor load as a reproduction. At the same time, the camera was placed facing the panel, and the position of the paper marker placed on the panel was measured on the image.

From observation and image measurement, it was confirmed that firstly compression yield occurred at around bottom surface of the wall, then it was followed by yield around the hole, and finally it lead a destruction in shear failure in the vicinity of the hole. By investigating stress distribution around the hole by image measurement, it was observed that axial stress concentration became more intense as it approached the edge.

Furthermore, to investigate in detail, nonlinear finite element analysis was conducted. The specimen was modeled with a truss frame in 25 mm × 25 mm grid. Material constants in longitudinal, transversal and shear direction were input according to the experimental values. Restraint conditions according to the hold-down fastener and tie-rod at bottom and top of the wall panel and the vertical force were given respectively.

The analytical model was able to reproduce the load - story drift angle relationship. It was confirmed that the stress distribution around the hole coincides with the image analysis.

Keywords: *CLT, finite element analysis , a static horizontal loading test, image measurement*

ARN/HSS/ISSH 2017 Report

Yu Iseki

(Laboratory of Biomass Conversion, RISH, Kyoto University)
Supervisor: Takashi Watanabe

1. Experiences in HSS and workshops as ARN activity

・How have you been affected by attending the HSS and ARN program?

Humanity are facing problems threatening sustainable development and healthy living. However, each country focuses on individual demand and problems important for their countries such as increasing yield of crops in Indonesia and import of products from bioresourses to Japan. I think that we can study worldwide problems in each country but deep understanding of the problems is difficult without communication across the countries. In the HSS and ARN workshops, I learned a wide range of topics including Tsunami disaster presented by Indonesian scientists. No Japanese people presented about Tsunami in the HSS and ARN workshops. I think that participation of researchers studying the same research areas is important from the point of mutual communications.

・How do you think importance of Humanosphere Science?

Humanity have been developing science and technologies and selecting the best ways for contribution to the development. Freon was regarded as a superior freezing agent when it was developed. However, Freon was found to give serious damage to the ozone layer after few years. Before one and a half decade ago, we leached the idea that Humanosphere Science should be developed. At that time, we had to consider how Humanosphere Science secures sustainability from the point of both desirable and undesirable effects. Utilization of wood will contribute sustainable development. On the other hand, it may cause environmental destruction if wood is logged at a rate exceeding growth and reforestation, especially in tropical regions. I think that we have to evaluate the effects of our action on our earth prior to execution.

・How does your research relate to Humanosphere Science or the activity of ARN? Explanation of your research subject can be included.

I'm studying lytic polysaccharide oxygenase (LPMO) which are receiving increasing interest in recent years due to acceleration of cellulose breakdown. Cellulose is the main component of plant cell walls together with lignin and hemicelluloses. Cellulose can be converted to biofuels and biochemicals. When the advanced conversion system of cellulosic biomass is implemented, we can acquire a huge amount of sustainable resources replacing to fossil resources.

There were several researchers studying LPMO and cellulase in the ARN activities. We shared the related information such as methods and results each other.

2. Presentation summary

Studies on lytic polysaccharide monooxygenase (LPMO) from the selective white rot fungus, *Ceriporiposis subvermispora*

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Abstract

Widely available in large quantity and non-competing with food supply, woody biomass is expected to serve as a platform for green chemicals and effectively mitigate greenhouse gas emission effects. Woody biomass is mainly composed of cellulose, hemicelluloses and lignin. A selective white rot fungus, *Ceriporiposis subvermispora* is known as a basidiomycete decomposing preferentially lignin without significant damage to cellulose. The selectivity for lignin degradation depends on culture conditions, and both simultaneous and selective degradation has been observed during the wood decay by this fungus. *C. subvermispora* secretes cellulolytic enzymes, cellobiohydrolase, endoglucanse and β-glucosidase. In addition to the hydrolases, this fungus possesses the genes encoding lytic polysaccharide monooxygenase (LPMO) which is known to boost enzymatic degradation of cellulose by the hydrolases [1]. Typical LPMOs require an electron donor such as ascorbic acid, cellobiose dehydrogenase and phenols. Recent studies suggested that lignin can serve as an electron donor for LPMOs but the molecular mechanism is not well understood [2]. In this study, we expressed LPMO of *C. subvermispora* in *Pichia pastoris*, purified and characterized the enzymatic properties by focusing its cellulolytic activities and interaction with lignin.

[1] Leila Lo Leggio, Thomas J. Simmons *et al, Nature Communications* 7:11134 (2015)
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ARN/HSS/ISSH 2017 Report

Yuki Tokunaga

(Laboratory of Biomass Conversion, RISH, Kyoto University)
Supervisor: Takashi Watanabe

1. Experiences in HSS and workshops as ARN activity

・How do you think importance of Humanosphere science ?

The most important thing for ensuring prosperity of human is to establish sustainable society. To achieve this goal, I think that we have to solve the following two subjects. The first is to convert central resources from fossil fuels to renewable resources. Recently, huge amounts of materials and energy are consumed due to population explosion and rapid industrial development. However, because the amount of accessible fossil resources such as petroleum, coal and natural gas are limited, and their excessive use causes global warming due to greenhouse gas (GHG). It is difficult to continue human activity if we cannot reduce our dependence on the fossil resources. To overcome the serious problem, we have to convert central resources to renewable resources such as biomass (Subject 1). The revolutional change is the most required for ensuring sustainable society.

The second subject is to evaluate and understand our environment. The change of central resources, above mentioned, is not enough for ensuring sustainable society. We have to well understand the properties of biomass resources. (1) Quantity of biomass resources is quite huge as estimated by the fact that around 30 % of the ground is covered by forest. (2) Biomass, especially forest biomass secures biodiversity because it offers habitant for various kinds of animals, insects and microorganisms. (3) Biomass affects atmosphere as well as our living because biomass plays important roles in circulation of water, carbon and nitrogen. From these reasons, biomass resources constitute a part of environments surrounding our life and society, and the utilization of biomass instead of fossil resources influences our environments. Conversion of central resources to renewable resources (Subject 1) are required to conduct under appropriate evaluation and understanding of the environment. This is the second subject. In my opinion, an important point of Humanosphere Science is to learn these subjects and make efforts toward the sustainable future.

・How have you been affected by attending the HSS and ARN program ?

One of the most impressive experiences of HSS and ARN is active interaction between researchers. In particular, interactions between “different countries” and “different fields of study” are attractive for me. I think that these two interactions help us to solve the above subjects 1 and 2.

First, “Interaction between different countries” is important in conversion of central resource to renewable resources (Subject 1). Biomass resources exist all over the world, but the properties of biomass differ among the species and environments. For example, efficiency of enzymatic saccharification is completely different between Japanese cedar and sugarcane bagasse. Researchers should understand these differences and select effective methods for their study. In addition, optimum system for production and usage of biomass differ among the countries and regions due to the differences in whether, soil, culture, economy and other factors. Thus, researchers are required to find appropriate species and usage of biomass for the society and environments through the discussion with other scientists in foreign countries. For this reason, “Interaction between different countries” is important.

Second, “Interaction between different fields of study” is important for evaluation and understanding of environments (Subject 2). As mentioned, Humanosphere includes human habitant, forest, ocean, atmosphere, space and other spheres surrounding humans. These spheres interact each other in a complicated manner. In case of forest, it is well known that outflow of soil gives nutrition to life in sea, and photosynthesis affects circulation of water and carbon. Therefore, we cannot evaluate each sphere independently. For comprehensive discussion, researchers should understand various fields outside of their study. For this reason, “Interaction between different fields of study” is important.

Deeper understanding of other countries and study for establishment of sustainable society helps our research. ARN and HSS gave us a valuable opportunity through the two interactions above described.

2. Presentation summary

Analysis of Adsorption Mechanism between Carbohydrate Binding Module of Cellulase and Lignin by NMR

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Abstract

Enzymatic hydrolysis of lignocellulose is essential for establishing sustainable society. However, efficient enzymatic saccharification of lignocelluloses is still a challenging task due to recalcitrance of the biomass structures and non-productive binding of cellulase to lignin. Understanding of the interaction between cellulase and lignin is pivotal to accomplish the efficient enzymatic saccharification. Fungal cellulases often have catalytic domain and carbohydrate binding modules (CBMs). CBMs play a role to bring the catalytic domain in close proximity to the substrate to improve efficiency of saccharification. However, CBMs have often high affinity to lignin, and the non-productive binding of cellulase to lignin through CBMs strongly inhibits the activity of the enzyme. Until now the interaction mechanism has not been clearly understood at the molecular level. In this study, we have analyzed the molecular interaction between ^{15}N-labelled CBM1 of cellobiohydrolase (Cel7A) from *Trichoderma reesei* and lignin by NMR titrations. The ^{15}N-labelled CBM1 was expressed, purified, and characterized by SDS-PAGE, MALDI-TOF-MS and NMR. The interaction between CBM1 and milled wood lignin (MWL) from Japanese cedar and *Eucalyptus globulus* was analyzed by ^{1}H-^{15}N HSQC. The binding behaviour of CBM1 was discussed from chemical shift perturbation of signals assigned as an amino acid residue in CBM1.

Keywords: *Carbohydrate binding module, Cellulase, Cellulose, Lignin, NMR*

Acknowledgements

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5. Japanese Summary of the ARN/HSS/ISSH 2017 Reports

生存圏研究所より参加した日本人大学院生と若手研究者レポートの和文要約

木村智洋 [Chihiro Kimura]

生存圏科学には 2 つの重要な点があると考えている。1 つ目は社会を変える力を有することである。現在の石油資源に依存した社会を持続可能な社会へと変換するための研究が多くなされているが，一分野での研究では社会に変革をもたらすことには限界があり，その中で生存圏科学という大きな枠組みがとても重要な役割を果たすと感じている。一つの枠組みにすることで，多分野の研究者が同じ目標を持ち，連携を取りながら研究を進められるだけでなく，他分野の現状を理解することでより早い速度で社会に良い影響を与えられる研究が進むように思う。2 つ目は教育である。生存圏研究所に属することで学生は，自分の研究ばかりではなく異分野の研究や他国の状況などを知る機会が与えられ，広い視野を持つことができる．この経験は将来，国際化社会や，地球規模の問題を考えるうえで大変役立つだろうと思っている。

私の研究は農業残渣であるサトウキビバガスを分解し，抗ウイルス活性物質を生産することを目的としている．バガス中のセルロールはバイオエタノールの原料として注目されているがコスト面で問題をかかえている．そこで，私の研究で未利用であるバガス中のリグニンから抗ウイルス活性物質を生産することが可能となればバガス全体の価値を高めることができ，バイオエタノールのコスト問題の解決に寄与することができると考えている。この結果，持続可能な社会の構築の一助となり，生存圏科学の目標とする社会へと前進することができる。また，バガスに付加価値をつけることでサトウキビ全体の価値を高め，生産農家の収入増加が期待できる。これが現実となれば，日本とASEANとの関係をますます発展させることができるではないかと考えている。

掛川博文 [Hirofumi Kakegawa]

私は今回初めて国際学会に参加しました。その中で感じたことは、当たり前のことですが、世界中で研究者がいて、ヒトの生活に役立つ研究を行っているということです。現地のインドネシア人の研究を聞き、地域の防災に関わる研究やインドネシアに生息する植物の研究を行い、求められて研究を行っていることを感じました。

また、私は今回様々な人の発表を聞き、私たちを取り囲む環境の変化に恐ろしさを感じました。現在、人間は爆発的な人口増加、地球温暖化、経済成長に付随するエネルギーや物質の不足、病気の蔓延や豪雨による災害などの深刻な問題に直面しています。改めて私たちが何かしなければならないと感じました。

私は現在、コーヒーノキによるカフェイン分泌について研究しています。コーヒーノキはカフェインを種子に蓄積し、発芽後根から分泌します。しかし、その植物組織間での輸送と分泌機構は解明されていません。そのメカニズムを解明するために私は現在研究を進めています。コーヒーノキはコーヒー豆で有名であるにもかかわらず、コーヒーノキにおけるカフェインの輸送機構が分かっていないことに面白さを感じています。もし、私の研究がうまく進めば、医薬品に利用できるようなアルカロイド物質を植物を用いて生産させる技術に応用できるかもしれません。

インドネシアはコーヒーベルトに属し、世界でも有数のコーヒー豆の生産国です。インドネシアで生産されるコーヒーの品種の90%はカネフォーラ種です。過去に病気が流行し、アラビカ種に大きな被害が出たことで、病気に強いロブスタ種に植え替えられました。私は実験材料にアラビカ種を利用しているので、私の研究がインドネシアのコーヒー生産にいくらか貢献できれば幸いです。

今回のシンポジウムから私の研究が少し外れていたためか、私の発表を聞きにくる人は多くはありませんでした。しかし、説明する機会は何度かありました。私は今まで英語で研究について話したことがなく、初めての体験だったためとてもうれしかったです。また、他の研究分野の人にこちらの研究を伝えることの難しさを感じました。

今回、シンポジウムの運営に関わる方々に本当に感謝していることを伝えたいと思います。国際シンポジウムに参加することは貴重な体験であり、今回のシンポジウムで多くのことを学びました。もし次回のシンポジウムに参加できるなら、もっと良い英語の発表ができるよう成長してお

きたいと思います。

八ツ井弘樹［Hiroki Yatsui]

私は今回のHSS,ARN シンポジウムを通じて生存圏の定義から、生存圏科学の重要性、これまで行われてきた研究及び今後の展開についても理解を深めた。本プログラムへの参加前は、私は生存圏科学の中でも自らの研究分野である森林圏分野に関する知識及び認識しか持っていなかったが、本プログラムの中で人間生活圏や宇宙圏の分野に関する研究に触れ、認識を深めることができた。また、多様なバックグラウンドを持つ人々の考えに触れることで、より自分の知識を深め、思考の幅を広げることができた。

人類が繁栄するためには解決しなければならない問題が多く、その中でも資源・エネルギーの枯渇、地球温暖化による環境破壊、人口増加は大きな問題である。幅広い研究分野が協力することでこれらの問題を解決に導けると私は考える。

また、今回のプログラムで私は初めてインドネシアのボゴールを訪れた。私は本プログラムを通じてインドネシアで行われている研究、インドネシアの文化や生活様式を学んだ。それらは私にとって新鮮であり、全ての経験が魅力的であった。その中でも最も印象的であった経験は多くの国の人と交流できたことである。本プログラムには10 カ国近い国からの参加者がいた。様々な文化、歴史を学ぶことで広い視野を獲得し、より柔軟で多様な思考を獲得できるではないかと考える。今回のプログラムで得た知見及び経験を多くの人と共有し、生存圏科学の意義、重要性を広めたい。

中村神衣 [Kamii Nakamura]

まず今回HSS and ARN programに参加させていただいたことに感謝申し上げます。大学の根幹を担う先生方は、きっと大きな未来を描いており、今回プログラムを通じてその片鱗を感じた。特筆すべきは、今回のプログラムは多くのチャンスが学生にも分配されている点である。そのおかげで私は、国際的な舞台で自分の研究を発表し、アジア諸国で行われている多岐に渡る研究を知ることが出来た。また、多くの新しいものを感じ取れた。この経験は私の人生の糧になった。

京都大学は国際的に開かれており、当研究室でもアジア諸国から研究者の来訪が絶えず、近い距離で交流ができる。また、キャンパスを歩けばあらゆる国籍の人がいる。とても充実した環境である。しかし今回、体験したものは、そのような日常生活とは大きく違い、私の心にかなりのインパクトを残した。インドネシアは人、天気、食物、植物、匂い、あらゆるものに勢いがあった。エネルギーに満ちていて、私は圧倒された。食事や休憩時に、文化や研究についてたくさんの人と交流した。彼らはみなフレンドリーでエネルギッシュだった。また、彼らの発表の姿勢は、謙遜もしなければ虚勢もはらず自然体で、私は自分に取り入れたいと思った。

生存圏科学は非常に重要な分野だと思う。人口爆発、地球温暖化、資源の枯渇、水や大気の汚染など地球環境の変化が著しく到底無視できる状況ではなく、それには人間の活動が大きく関わっている。そして、地球上の元素の量は数千万年前からほとんど変わっていないことから、地球上ではすべてが相互関係の上に成り立っている。また地球は大気を介し宇宙に面している。だから、地球を大気、宇宙まで含め三次元的に捉えた生存圏科学の発展は、未来を創造する上で必要不可欠である。今回ARN HSSにおける東南アジア諸国の発表には、環境問題に対する緊急性がしばしば感じられた。これら問題がまさに目の前で生じていれば緊迫感がでるのは当然であろう。実際、会場のインドネシアでは、道路は大渋滞、排水溝には汚染水、そこから腐敗臭、雨期なのに３日間晴れ続きの異常気象、一週間の滞在でも環境問題の一端を体感した。日本では、これら問題を目にすることは頻繁にはなくぼんやりとしていたが、今回一気に差し迫る現実だと目が開けた。地球上のある部分で生じた現象は、地球全体の問題になり得るのだと、自分のいる所が大丈夫ならいいのではなく、地球はひとつしかないという事実を思い知らされた。

私はAmy Duchelle（国際林業研究センター）の発表に興味を持った。彼女は貧困環境ネットワーク（PEN）を作ろうとしている。森林および環境利用の記録のデータベースが構築されている。この研究は、各地点の森林科学情報だけでなく、収入や性別などのそこで暮らす人々の情報も含

まれており、森林と人間の繋がりを重視した、社会的意義のある研究だと思った。

金澤和寿美 [Kazumi Kanazawa]

はじめに、今回第７回ISSH及びHSS2017、第３回JASTIP、第２回ARNに参加させていただく機会をいただき、貴重な経験をさせていただいたことに感謝申し上げます。
今回のシンポジウムでは、多くの国からの参加者が様々な研究について発表され、国際交流が図れたとともに研究分野間での交流も図れたと感じました。私の研究は工学的な分野である一方、参加者の研究は化学的なものが多く、深く理解することが難しかったですが、興味深いテーマがいくつもありました。

インドネシアに訪れたのは初めてでしたが、すぐにインドネシアの街並みや雰囲気を好きになりました。オレンジ色の瓦が続く低層の街並みは特に素晴らしく、背の高い街路樹や気候と相まって、日本とは違った異国情緒を感じました。食事や街の雰囲気だけでなく、研究を取り巻く環境も日本とは違っているようでした。発表者には女性も多く、学生としてではなく研究者という道が広く男性にも女性にも開かれているように感じました。また、学会自体もインドネシアの正装であるバティックを着用して参加されている方が多く、coffee breakでは多くの方がコミュニケーションを盛んにとっており、始終和やかな雰囲気でした。

私の研究は鉄骨フレームに挿入されたCLT壁についての研究です。Cross Luminated Timber(CLT)とはひき板を繊維方向が直行になるよう積層接着した木質材料で、従来の木材の強度異方性という弱点を克服し、中高層建築の使用に期待がもたれています。木材は唯一持続可能な建築材料であるだけでなく、建設や生産時のエネルギー消費量が少ないことから、将来的に中高層建築に使われているコンクリートや鉄を木質材料に置きかえるためにCLTとコンクリート・鉄との混構造建築の研究を進めることは必要不可欠だと考えられます。

最後になりましたが、この経験は私にとって大変貴重なものとなりました。シンポジウムのオーガナイザーの方々、生存圏研究所の先生方、様々な手続きをしていただいた事務の方々に感謝申し上げます。またこのような機会をいただければ是非参加させていただきたいです。ありがとうございました。

永井雅也 [Masaya Nagai]

私にとって今回のHSSやARNのワークショップへの参加は、初めて英語で種々の発表をする機会を得たというだけでなく、海外への渡航という点でも初めての経験となった。この経験から、実質的な他国への理解を得るためには実際に現地に行かなければならないということを理解した。HSSやARNの活動を通じて、特にムスリムの方々と出会い、様々な経験を通じて、彼らの生活感を認識し、自身の研究を振り返ることができた。

日本とインドネシアの生活様式を比較する中で、インドネシアにおける一般的な持続的開発に対する意識と現地の研究者の方々との意識の乖離に気づき、よってそのことから、自身の研究がその溝を埋めることができるのではないかという考えに至った。

私の研究の目的は、スクロースやクエン酸を含浸した木材の寸法安定性の評価をすることであった。結果としては、クエン酸による寸法安定性の効果が今回の実験条件では最大であったが、スクロースとクエン酸の混合溶液を木材に含浸後、処理材を加熱することによって、スクロースやクエン酸が木材の細胞壁内において化学的に反応することが分かった。このことから、他の条件において、スクロースとクエン酸の混合溶液が木材の寸法安定性にさらに寄与する可能性があるということが分かった。また、今回の実験で用いたスクロースやクエン酸はオイルパームやレモンの皮などの廃棄物系バイオマスからも得られるため、よって私の研究は、産業と持続的開発を結びつけることができるのではないかという思いを抱き、自身の研究に対する意欲が掻き立てられ、現在、より広い研究分野との交流をし、更なる情報を得たいと考えている。

まとめると、HSSやARNのワークショップに参加することは私にとっての転機となり、国際社会に対する自身の固定観念を変えることができた。また同時に、国際社会に進出することと相互に理解することの重要性も理解した。もし日本に閉じこもっていたならば、国際社会についても、

日本とインドネシアとの関係ついても、更には自身の研究に対する客観的な意見でさえ何1つ理解できなかっただろう。

最後に、以上を踏まえ、HSSやARNのワークショップに参加する機会を得られたことに感謝をし、またこのような機会が得られるならば、ぜひ参加したいと考えている。

大城 理志 [Satoshi Oshiro]

HSSおよびARNのプログラムの研究発表に参加し、印象に残ったことは、東南アジアにおける研究活動は自国の環境問題や東南アジア地域独自のリソースに根ざしたものが多く、これらの問題の解決やリソースの活用について実践的なアプローチをしているということである。

具体的には、廃水の汚染除去や、森林の生態系への影響、自国で利用可能なバイオマス試料に関する研究、環境残留物質を代謝するバクテリアの同定に関する研究発表が印象に残っているが、特に、このなかでもバイオマス試料（サトウキビバガス、籾殻、稲わらなど）の自国での利用可能性に関する議論が多く行われ、バイオ燃料や化学原料の供給源となるバイオマス試料の選定から最終産物へのプロセスまで具体的に考えられているという印象が強く残った。

日本では、最先端の機器や技術を駆使したバイオマス試料の精密な分析、高効率のバイオマス試料利用プロセスに関する研究など、科学的、技術的に最先端であることを志向した研究が数多くなされている。日本の最先端の研究と東南アジアの独自のリソースを組み合わせることで、東南アジアにおける課題の解決を促進するだけでなく、新たな研究が生まれる可能性も感じた。

このように、東南アジアにおける研究活動で重視されている課題、研究のスタイルというものは、論文を読むだけではなく、実際に研究者の発表を聞き、対話をすることで初めて把握できるものであると改めて実感した。このHSSおよびARNのプログラムは日本の若い研究者にとって、東南アジアにおける研究課題を実感する機会を与えてくれるとともに、自身の研究の立ち位置を考え視野を広げるうえで非常に有意義なものになったと考えている。

バイオマスの利用という課題について考えただけでも、バイオ燃料や化成品としての利用に適したバイオマスの選定、反応プロセスの最適化、プロセスの環境負荷、エネルギー収支の評価など、様々な要素を考える必要がある。これらの要素を考慮しながら課題の解決を目指すには、一つの分野の専門家のみの力ではなく、様々な分野の専門家が課題解決における要素を共有する必要がある。生存圏科学は一分野の専門家だけでは解決できない地球規模の課題を共有する枠組みとして重要な機能を果たすものであると考えている。

私は木質バイオマス成分のリグニンの分解酵素を改変する研究を行っている。本研究は、木質バイオマス利用の効率化を目指しており、脱化石資源社会の実現という生存圏科学における課題の解決に寄与するものであると考えている。また、研究対象の酵素は、木質バイオマス利用の他に、水質汚染物質の除去にも利用されており、ARNの活動の一つとして、インドネシア科学院(LIPI)、タイ王国のチュラロンコン大学と共同で酵素による汚染物質除去の研究が行われている。この共同研究をきっかけに、私個人としても汚染物質の酵素分解について知見が広がっただけでなく、東南アジアの研究者にも、生物試料からの酵素の精製、酵素反応の評価について手法を伝えるなど、お互いにとって、研究の進行上プラスとなることが多いと感じている。このARNの活動を通して、日本と東南アジアの若い研究者が共同で優れた研究活動を行い、お互いに成長していくことができれば幸いである。

左近静香 [Shizuka Sakon]

RISHは生存圏を「人類の生存を支え、人類と協調的に相互作用する場」であると定義している。具体的には「人間生活圏」「森林圏」「大気圏」「宇宙圏」に分けられるが、これらそれぞれを理解するための研究分野は多岐にわたり、さらに複雑に相互作用しあっている。持続可能な社会を実現するための生存圏の理解には、各分野の理解を深めるとともに、分野ごとの境目を超えた学際的な理解が必要である。RISHは、この分野ごとの枠組みを超えた生存圏科学への理解を協働して行っていくためのつながりであると私は考える。さらに、生存圏の理解は、国を超えた枠組み

も必要とする。ARNは、アジア地域での生存圏理解と持続可能な社会の実現を促進する協働のためのパートナーシップである。

今回のインドネシアで開催されたHSS及びARNプログラムで、海外の研究者の発表を聞くことは私にとって良い経験になった。日本に海外の方に来てもらって発表を聞いても、遠い国の話としてあまりイメージして聞けなかったが、研究が行われているところにより近い場所で聞くことで、より興味を持って聞くことができたからである。特に、社会経済学や生態学などの、特定のフィールドで行われている研究について、よりはっきりとしたイメージをもって聞くことができた。海外に行くことで、調査地の位置が自分の中ではっきりと捉えられたからではないかと思う。私の研究分野に近いバイオマスのエネルギー利用に関する研究についても、東南アジアでの課題や現状を把握することができた。例えば、それぞれの国で余剰となっているバイオマスの種類やそれらが生じる背景、また、それらを利用するための研究である。私の研究のポスター発表では、海外の研究者から、様々な質問やアドバイスを受けることができた。HSS、ARNにおいて、お互いに興味を持ち、取り組んでいることを紹介しあうことで、異なるバックグラウンドの海外の研究者と同じ問題について話ができるということは素晴らしいことだと感じた。

海外で行われている研究のイメージが、より明確になったことと同時に、インドネシアを始めとした東南アジア諸国から世界を見るという新しい視野を得ることができた。私は、人が自分の判断の基準とするものは、その人自身が実際に見聞きしたことや行ったことをベースにすることが多いと考えている。そして、その見聞きしたことというのは、その人自身が所属しているコミュニティで起きることがほとんどを占めている。ずっと同じ環境にとどまっていたり、多様性の乏しいコミュニティに属したりしていると、人の考え方や価値観などは次第に偏ってくる。このため、実際に様々な場所に赴いたり、多様性のあるコミュニティに属したりすることが、より広い視野を獲得し、維持することに重要だと私は考えている。新しい視点を得るために、物理的に場所を変えてみるというのはとてもよい方法だと感じた。

生存圏科学は理解が複雑な対象である。互いに興味を持ってコミュニケーションをとったり、新しい視点を取り入れたりすることで、生存圏科学の発展につながる新しい視点が得られるかもしれない。このことは、生存圏科学の研究以外においても重要ことではないかと思う。

田中　聡一 [Soichi Tanaka]

生存圏において人類が持続的な発展を遂げるには、材料を石油資源由来から天然資源由来のものに転換することが不可欠である。特に木材は、地上最大のバイオマスであるため、その材料としての利用が重要である。木材の幅広い利用のためには、特に基準の厳しい工業材料における利用を促進することが重要であり、そのためには木材や木質材料の性能や信頼性をより高めていくことが必要である。その手段の一つとして主に化学処理(化学物質の木材への導入)がある。しかし、従来の化学処理手法では、木材中の処理物質にはムラがあり、性能や信頼性を十分に高めることができていない。このムラは、処理された細胞とされていない細胞の存在(巨視的ムラ)、および処理された細胞壁中非結晶領域と処理されていない同領域の存在(微視的処理ムラ)に分類され、報告者はそのムラを解消する手法に関する研究を行っている。

ARNワークショップ(10月31日)およびHSS/ISSH シンポジウム(11月2日)では、上記のトピックに関連する研究発表を行った。アジア諸国(主にインドネシア)からの参加者は、報告者の発表に関心を持ったようで、発表後に化学処理方法について情報交換も行った。その中で、日本と他のアジア諸国において材料に求められる性質の違いを認識した。日本では材料の信頼性が特に重要であり、これこそが国内でのバイオマス利用促進のための鍵である。一方、他のアジア諸国では、信頼性は新規性やコストなどの他のファクターと比べるとそれほど重要視されておらず、材料の開発や利用法開拓が容易かつ迅速であるため、その点では先端的な研究を進めやすい環境にあるという印象を受けた。10月31日のARNプログラムでは、LIPIの生物材料研究センターの研究室訪問も行った。研究センターには、インドネシア国内の大学の学生も含めて、若手の研究者が多く活躍しており、特に私の専門と関係する木材の改質に関する研究についての情報交換を通じて刺激を受けた。以上から、ARN、HSS/ISSHプログラムは、自身の研究に関する情報提供と再考し、モチ

ベーションを得る良い機会だったと考えている。

人類の活動を継続するには、その活動を個人からグローバルなスケールまで幅広く分析する必要がある。日本人の学生や若手研究者の多くは、一研究室レベルでの研究は得意だが、グローバルな視点に立った研究は苦手とする傾向にあると思う。これは、海外の研究を自身の目で見て、現地の人々と情報交換する機会を自ら得ようをする者が少ないことが一因と思われる。従って、若手人材のそうした海外アレルギー克服を後押してグローバルな視点を身に着けさせるため、という視点からも生存圏科学は重要であると考えている。ARNの活動は、上述の経験より、若手人材にとって広い視野に立って自身の研究を見つめ直す方法の一つとして有効であると感じた。さらに、生存圏科学そのものも活動から得た知見をフィードバックして変化する必要性を感じた。

毛笠貴博 [Takahiro Kegasa]

私にとってインドネシア訪問は9 月にバリ島で開催された第9 回PRWAC に引き続き2 度目のことでした。インドネシアには、森林、真菌類、動物など多種多様な種が存在することが知られています。一般的に、我々はこれらの生物多様性を守り、私たちの子孫のために残す必要があります。したがって、インドネシアは生存圏科学を学ぶために適した場所であると言えます。この分野の発展は、持続可能な人間活動の実現に近づくことを意味しています。特に、ボゴールは緑の有名な都市であり、私たちは、市内中心部に位置する世界最大の植物園の周りを見ることができました。我々は*Amorphophallus titunum* のようないくつかの希少植物を見て、タバコやコーヒー豆などの嗜好品である植物の育種と輸出に関するインドネシアの歴史学ぶという貴重な経験をしました。さらに、オランダの多くの研究者は植物学を発展させ、まさにそのオランダはインドネシアの旧宗主国でした。そのため、植物園はオランダによって管理されていました。この植物園へのエクスカーションで、私は生物多様性を維持することの重要性に気づきました。私の研究では、私は木材の解剖学的情報を捕捉することを目的としており、この研究は自動の樹種識別システムに応用されます。この技術が実用化されると、税関で働く人々は、違法な木材取引を防ぐために樹種を容易に特定することができ、持続可能な生物多様性の保全と持続可能な人間活動に貢献することができます。

一方、HSS の講演とプレゼンテーションは、私に材料科学、木材化学、さらには宇宙科学などの新しい視点をもたらしました。私は次の春から家具の会社に勤務することが決まっているので、特に材料科学に興味がありました。 Wahyu Dwianto 博士の講演では、木材の内部応力を緩和するための物理的処理について学びました。私は来春以降、家具の製造においてこの知識を生かすことができるでしょう。ポスターセクションでは、森林科学だけでなく、バイオサイエンス、応用科学などのポスターもたくさん見ました。このシンポジウムは、生存圏科学に関する知識を深める良い機会でした。

私は勤務する会社はインドネシアに支店と工場を持っており、また多くの家具製品は木材で作られているので、将来的にビジネスマンとして再度インドネシアに訪れるチャンスがあるかもしれません。その機会があれば、今回出会った方々にお会いし、さらに知識を習得したいと考えています。最後に、私はこの経験とインドネシアでの出会いが、将来の私にとって非常に価値があるものであったと感じています。

萩原 達将 [Tatsumasa Hagiwara]

第一に，HSSとARNのワークショップにてインドネシアを始めて訪れたが，インドネシア人はみな優しく，温かい人ばかりであると感じた．HSSでのポスター発表とARNでのワークショップに参加し感じたことは，まず外国人とコミュニケーション，意思疎通を図るためには，英語力だけでなく，コミュニケーション能力も必要であると感じた．さらに，自分の研究分野を他分野の方々に伝えるときは，専門用語を多く用いると理解してもらえない．そのため，日本語のみならず英語においても専門用語を使用するときは，その用語について簡単に説明する必要があることを実

感した．また，日本ではあまり経験のない少し訛りのある英語を聞き取るのにも苦労した．しかし，アジア諸国の年齢の近い学生や研究者たちと現在の研究状況や直面している問題について議論することにより，その地域の考え方や重要な観点の違い等を見出すことができ，非常によい経験となった．また，議論を通して，日本では日常的なことであっても，外国では文化や性格の違いなどから非日常的なことも多くあり，広く浸透させることが難しい点などが分かった．

今回，HSSとARNのワークショップに参加し，議論の中心話題の1つであった生物多様性について考えることは，今後の私たちの生活を豊かにするだけでなく，現在問題となっている地球温暖化，熱帯雨林の砂漠化などに対する有効な手段である．しかし，技術のある先進国だけがこのような対策を施したとしても地球全体でみると，ほとんど効果がない．地球規模で行うためには，発展途上国と協力し，技術を提供するだけでなく，ノウハウを教える必要があると感じた．また，調査する場所になじみのない人が現地で調査などを行うためには，現地の環境をよく把握している人たちに協力してもらうことで調査の効率が上がると考える．そのためには，今回のようなワークショップを行い，現在の状況等を報告しあい，意見交換する場が必要であると感じた．ワークショップを通じて，共同研究や連携がさらに深まることで，さらなる発展へと繋がる．さらに，現在は，アジア圏，特にASEAN諸国と生存圏研究所との連携が多くなっている．しかし，今後さらに発展させるためには，アジア諸国のみならず，ヨーロッパやアメリカといった国々とも，連携していく必要があると考える．

最後に，私の研究は次世代の宇宙探査機の推進システムに関する研究である．宇宙探査機は，小惑星の探査や，土星や木星といった太陽系惑星の探査に利用されている．現在の推進システムの問題点としては，燃料の使用効率の低さ，つまり，低い推進効率である．そこで，本研究では，より高効率な推進システムを提案し，ミッション期間の短縮を目標としている．ミッション期間の短縮により，機器の故障率を下げることができるだけでなく，短期間での探査が可能となる．宇宙探査を行うことは，地球の起源を調べるだけでなく，惑星からの資源調達の可能性を秘めている．地球上の資源は，有限であり将来的な枯渇が問題となっている．そこで，宇宙への移住を実現することで生存圏の拡大と，資源調達の可能性を探ることが可能である．つまり，宇宙探査は，生存圏を考える上で非常に重要なことである．

上田陽太 [Youta Ueda]

私は、ARNとHSSに参加し、私の研究内容である”水平力をうけるCLT壁の破壊性状に関する解析”のポスターを作成、発表した。今回のシンポジウムは、私にとって初めての国際シンポジウムであり、国内の学会しか参加してこなかったので、非常に貴重な経験となった。多様な研究分野、英語のプレゼンの体裁、文化の違いなどの多くのことを学ぶことが出来た。今回のような良い経験を得るように、今後は、国際祭学会等に積極的に参加していたと感じた。

生存圏は、非常に重要な分野であると私は思う。私は、工学部建築学科出身であり、他の学部の研究を知る機会がなかった。しかし、大学院から生存圏研究所に所属してから、多様な種類の研究を知ることができ、視野を広げることができた。更に、建築という分野を客観視することができた。構造物としてだけでなく、人との生活とどのような携わり方をしているかを考えるようになった。このように視野を広げると言う意味で、私は、生存圏は重要だと思う

私は、木造で中高層階建築を実現するCLT工法に関する研究をしている。環境への負荷が低い木造を有効活用しているという点で、生存圏と密接な関係にある。日本の森林面積は非常に高く、有効活用していかなければならない。CLT工法のビルやオフィスが増えれば、森林業の労働者も増え、産業も活性化するだろう。このことから、建築という視点だけでなく、多様な分野を包括的している生存圏という視点で問題を考えることは、非常に有意義だと考える。

研究室としては、中国の大学との共同研究、アメリカにおけるCLTの振動台実験、オーストリア・ウイーンで開催されたWCT等、多様なフィールドとの関わりをもっている。研究室の修士学生も多く携わっている。私は、今回が初めての国際交流だったため、機会があれば、CLTが普及している欧州にも是、いってみたいと考えている。

今回のHSS/ISSHが私にとって初めてのポスター発表であり，貴重な体験をさせていただけたこ

とに感謝している。ポスター発表では，専門の先生方や異分野の先生方と私の研究について議論することができ，私にとってとても有益な時間を過ごすことができた。様々な分野の先生方から講演では，他分野の研究活動を知り，それらと自分自身の研究を組み合わせていく重要さを実感した。また，今回のシンポジウムを通して，英語だけでなく，自分の研究をわかりやすく説明する技術を磨く必要性を感じた。

井関優侑 [Yu Iseki]

持続可能な地球環境を築くためには、エネルギーや資源の獲得といった世界共通の問題を解決する必要がある。しかし、個々の国の事情はそれぞれ異なり、解決すべき問題の順序も異なる。そういった事情を理解するためには、実際の会話を通じて情報を共有することが大切だと感じた。

今回のシンポジウムでは、一部のインドネシア人は津波について研究していた。津波は日本人にとっても身近な存在だが、津波に関する日本人研究者は出席していなかった。お互いの国の事情を理解するためにも、似たテーマをもつ研究者が各国から参加することは重要だと思った。

我々人類は生存圏科学を発展させようとしている。しかし、どんな科学にも良い面と悪い面がある。持続可能な地球環境の構築のためとはいえ、生存圏科学が発達することで引き起こされる問題を想像することは必要だと考える。

私はセルロースを分解するLPMOという酵素のセルロース分解反応に着目して研究している。セルロースはリグニン及びヘミセルロースと同様に、木材を構成する主な物質である。セルロースの分解を効率的に行うことができれば、エネルギーや資源の獲得問題の解決に繋がると予想される。

徳永有希 [Yuki Tokunaga]

人類にとって最も重要なことは持続的社会を構築することである。これを達成するためには、生活の基盤を化石資源からバイオマス資源のような再生可能資源に転換することが必要である。また、バイオマス資源は環境の一部を形成することから、環境を正しく評価・理解することも重要である。生存圏科学の重要性は、持続的社会の実現に向けて以上のようなことを学び、更なる活動のために行動する点にあると考える。

ARNおよびHSSへの参加に当たって印象的であったことは研究者同士の交流が盛んな点である。具体的には「多国間での交流」および「異分野での交流」が魅力的であり、それらは生存圏科学における課題の解決に役立つと考えた。国が異なればバイオマス資源の性質、種類や量、利用方法が異なるため研究者は適切な選択をする必要がある。その点で「多国間での交流」は重要である。また、生存圏は様々な圏を包含しており、それらは密接に影響しあっているため、それぞれの圏を独立したものとして評価することはできない。生存圏の包括的な議論を行うために「異分野での交流」を行い、異なる研究分野への理解を深めることが重要である。

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