No. 19 September 2006

International Newsletter

Research Institute for Sustainable Humanosphere Kyoto University,Japan

= Foreword =

Promotion of Domestic and International Collaborative Research Programs at RISH as an Inter-University Cooperative Research Institute

Prof. Toshitaka Tsuda
Head of the Department of
Collaborative Research Programs

RISH was established in April 2004 by combining two organizations at Kyoto University: the Wood Research Institute (WRI) and the Radio Science Center for Space and Atmosphere (RASC), which were founded in 1944 and 1981, respectively. Researchers at WRI studied the physics, chemistry and biology of wood, while RASC promoted research on the Earth's atmosphere, ionosphere and magnetosphere by means of observations with radio techniques and computer simulations.

RASC served as an inter-university cooperative research center, with the MU (middle and upper atmosphere) radar in the town of Shigaraki being the main facility for observational studies of the Earth's atmosphere and ionosphere since 1984. Later, in 1993, a computer system known as KDK (Kyoto-Daigaku Denpa-kagaku Keisanki-jikken) was added as a cooperative facility for the computer simulation of various radio phenomena in space plasma and in the atmosphere (The system is now called Advanced-KDK; A-KDK).

By building on this heritage, RISH has established the Department of Collaborative Research Programs in order to promote inter-university collaborative programs related to the Humanosphere by providing various facilities for observation and experiments, by utilizing databases and by promoting both domestic and international collaborative projects. In addition to the MU radar and the A-KDK, we now operate the following facilities:

- Microwave Energy Transmission Laboratory (METLAB) and Solar Power Station/Satellites Laboratory (SPSLAB),
- Equatorial Atmosphere Radar (EAR) in West Sumatra, Indonesia, for observations of atmospheric dynamics over Indonesia,
- Deterioration Organisms Laboratory (DOL), consisting of insectariums for termites and dry-wood beetles and an incubation room for decaying fungi,
- Living-Sphere Simulation Field (LSF) in Kagoshima Prefecture, for field assessments of the deterioration of wood materials and a simulation field for woody biomass recycling,
- Wood Composite Hall, in which is installed a system for evaluating wooden structural components and the development of new wood composites,
- Forest Biomass Analytical System (FBAS) for the chemical analysis of forest biomass, especially lignin analysis based on its chemical degra-

dation followed by mass spectrometric analysis.

RISH possesses intellectual properties on the collected wood material and an observational database, where the former consists of wood specimens including wood microscopic sections at the Xylarium, which are internationally registered as the International Wood Collections of the World (KYOw), and the latter have been archived through continuous observations of the atmosphere with the MU radar, EAR and other related facilities, and scientific satellite missions of space plasma such as AKEBONO and GEOTAIL.

A total of eight facilities and the database are utilized for cooperative programs, to which we invite researchers and graduate students from universities and research institutes, as well as from industry. The cooperative programs of RISH are not only restricted to researchers in Japan; we welcome collaboration with communities world wide so that we can enhance academic activities and education in this new scientific field of the humanosphere.

Cooperative facilities in RISH

= RISH International Symposium =

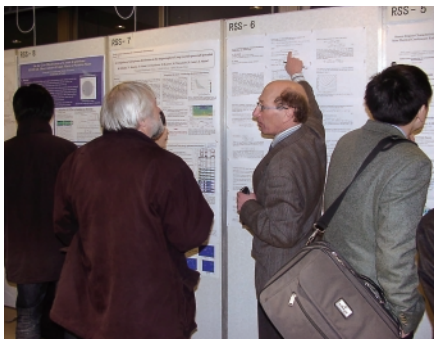
Radio Science Symposium for a Sustainable Humanosphere

Prof. Kozo Hashimoto and Prof. Yoshiharu Omura

In the 21st century, human beings face many serious problems, such as contamination of the environment, the shortage of energy and food, a continuing explosion in population, and global warming. Immediate action is needed to avert impending crises and to assure a sustainable development of human society. What can we do, and how can we contribute to society as radio scientists?

Radio science developed rapidly in the last century, its contribution to communications symbolized by the trans-Atlantic transmission of radio signals by Marconi in 1901. Remote sensing of the ionosphere and the magnetosphere by radio waves has played an important role in the space age, motivating radio and space scientists to explore the geospace plasma environment, heliosphere, and beyond.

Along with the progress of space exploration and utilization, radio science and signal processing techniques have played increasingly important roles in human activities such as the use of the global positioning system (GPS) and Earth-observing systems in space. Microwave power transmission (MPT) has also been studied as a new application of radio science, and space solar power stations with MPT have



A snap shot in the poster session

The lecture venue

been proposed as a solution to the energy crisis. Prof. Hiroshi Matsumoto is one of greatest scientists working to advance radio and space science and humanospheric science.

To review the past achievements and to discuss the future challenges to be made in the field of radio and space science for the sustainable development of human society, we held the Radio Science Symposium for a Sustainable Humanosphere at Kyoto University on 20-21 March 2006. The symposium consisted of a series of 11 lectures by leading radio scientists and space physicists and poster sessions with 30 posters consisting of invited and contributed papers presented in the associated A-KDK workshop and METLAB workshop. There were 146 people in attendance, and the symposium was a great success.

= RISH International Symposium =

International Symposium on Sustainable Humanosphere 2006

-Toward the Harmonization of Economy and Ecology-

August 28-29, 2006

Prof. Hiroyuki Yano

The International Symposium on Sustainable Humanosphere 2006 -Toward the Harmonization of Economy and Ecology- was held at Biotechnology Center, Cibinong, Indonesia on 28-29 August, 2006 by the co-organization of Research Institute for Sustainable Humanosphere, Kyoto University (RISH), Indonesian Institute of Sciences, Indonesia (LIPI) and National Institute of Aeronautics and Space, Indonesia (LAPAN). It was a very successful meeting, sharing the multidisciplinary perspectives toward the sustainable human society in the 21st Century.

Here, we describe the program of the symposium.

Program

First day (August 28th)

14:00 Opening remarks

Shuichi Kawai, Director, RISH, Kyoto University

Umar Anggara Jenie, Chairman, LIPI, Chairman of LAPAN

14:30-15:20 Keynote

The Role of People's Organizations to Govern the Forests and Institutional Changes for Sustainable Development in Indonesia

Kosuke Mizuno, Director, Center for Southeast Asian Studies, Kyoto University

15:20-15:40 Coffee break

15:40-16:20 Review

A Review on JSPS program on Wood Science

Bambang Subiyanto, Research and Development Unit for Biomaterials, LIPI

16:20-17:00

A Review on Collaborative Studies between Japan and Indonesia in 1986-2006 on the Equatorial Atmosphere Dynamics

Toshitaka Tsuda, RISH, Kyoto University

19:00- Dinner at Salak Hotel, Bogor

Second Day

9:00 General Presentations

9:00-9:40

Biodiversity: Its Prospect for Regional Economic, Social and Environment Development Program

Endang Sukara, Life Sciences, LIPI

9:40-10:20

Genetic Improvement of Trees for Sustainable Forests

Takahisa Hayashi, RISH, Kyoto University

10:20-10:40 Coffee Break

10:40-11:20

Earthquake Resistant Residential Building for Indonesia, After Aceh, Nias and Yogyakarta Earthquake

Maryoko Hadi, RIHS

11:20-12:00

Ozone and Water Vapor Observations in the Tropics

Masato Shiotani, RISH, Kyoto University

12:00-13:30 Lunch

13:30-14:10

Diurnal Convection over West Java during the Pre-Monsoon Period: The Role of Sea-Breeze Convergence

Tri Whyu Hadi, ITB

14:10-14:50

State of the art developing Indonesia equatorial atmospheric model

Didi Satiadi, LAPAN

14:50-15:10 Coffee Break

15:10-16:30

Panel Discussion "Science for Sustainable Humanosphere"

Moderator: Hiroyuki Yano, RISH, Kyoto University

Panelist: Yuji Imamura, RISH, Toshitaka Tsuda, RISH, Bambang Subiyanto, R&D Unit for Biomaterials, LIPI, Bambang Prasetya, Biotechnology Center, LIPI, Didi Satiadi, LAPAN, Tri Whyu Hadi, ITB

Closing remarks: Yuji Imamura, Head of Center for Exploratory Research on Humanosphere, RISH, Kyoto University

Prof. Kawai (right) and Dr. Sukara (left) at the symposium

= Visiting Professor =

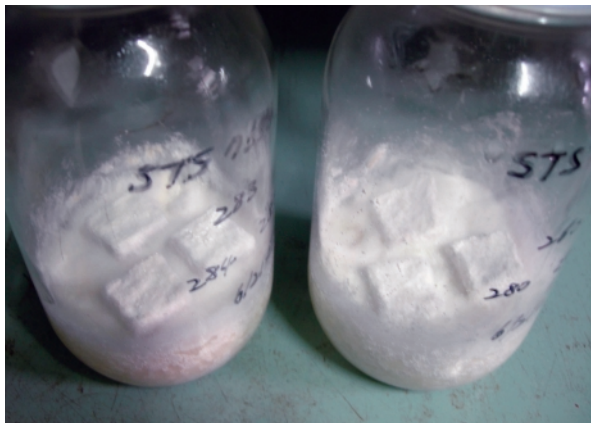
Research Activities in RISH

Kim Gyu-Hyeok
Visiting Professor from Korea

I am currently visiting the Laboratory of Innovative Humano-habitability at the Research Institute for Sustainable Humanosphere (RISH) as a Visiting Professor during my sabbatical leave from Korea University (Seoul, Korea). My research at RISH has focused on the development of an alternative disposal method for chromated copper arsenate (CCA)-treated wood wastes. The disposal of CCA-treated wood wastes is a growing problem worldwide due to scientific awareness and public concern about the release of toxic CCA components in current disposal methods. Most CCA-treated wood wastes are currently placed in approved landfills. Large volumes of CCA-treated wood waste are expected be added to the solid waste stream in the near future, causing various potential problems for landfills. Economic, regulatory and environmental pressures are stimulating the development of alternative disposal methods.

An alternative disposal method to be studied is bioprocessing of the CCA-treated wood wastes, which offers one approach to waste management under certain conditions. The concept of bioprocessing is to use CCA-tolerant wood decay fungi to reduce the volume of treated wood wastes by fungal degradation while simultaneously removing the CCA components, if possible. This bioprocessing method will be an economical and efficient alternative to depositing the wastes in landfills, especially if landfill restrictions on CCA-treated wood waste are imposed in the near future. Although a long-term goal of this research is to develop a fungal processing method with an easily managed system in a cost-effective manner, due to the limited length of my visit to RISH my research there has been confined to examining select decay fungi that can degrade CCA-treated wood while removing the metals from CCA-treated wood.

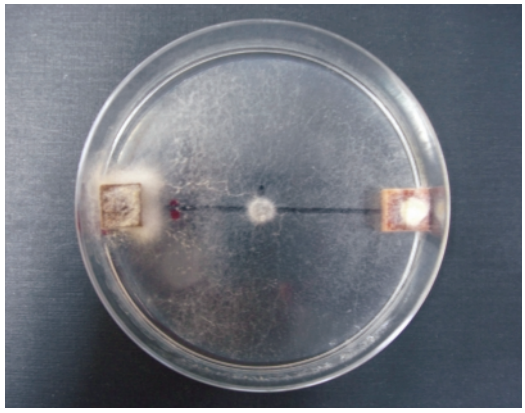
We conducted a series of experiments to screen fungal isolates exhibiting CCA tolerance, to determine the decay capacity of selected CCA-tolerant fungi to degrade CCA-treated wood and to determine the CCA-removing capacity of both CCA-tolerant and CCA-treated wood degrading fungi. A total of 108 decay fungi obtained from RISH were screened using an *in vitro* bioassay known as the 'choice test' for tolerance to CCA. A tolerant rating was based on fungal growth toward or on CCA-treated wood samples, with 31 fungal isolates found to be tolerant to CCA. The CCA-tolerant fungal isolates were tested for their ability to degrade CCA-treated radiate pine sapwood. To date, five isolates, which resulted in a weight loss larger than 10%, have been selected for further studies on bioprocessing.



Decay test of untreated wood (left) and CCA-treated wood (right)

For decay fungi capable of degrading CCA-treated wood, further research will be planned to increase weight loss as much as possible by maximizing initial fungal establishment and growth on the CCA-treated wood waste through elucidating 'what are the optimum conditions for fungal growth?' and 'which nutrient supplement is the best for fungal growth?' Eventually, CCA retention of decayed CCA-treated wood will also be analyzed to determine whether fungi can remove CCA chemicals simultaneously while degrading CCA-treated wood. The results from this research will provide the basis for developing a bioprocessing method to degrade CCA-treated wood waste while removing the metals as an alternative disposal method.

I would like to take this opportunity to add a few more words. First of all, I am deeply grateful to Professor Yuji Imamura and Dr. Tsuyoshi Yoshimura for providing a good opportunity to visit RISH. The hospitality of people here at RISH have made this year a most enjoyable and productive sabbatical leave. I hope this acquaintance of ours may develop into long-lasting intimacy.



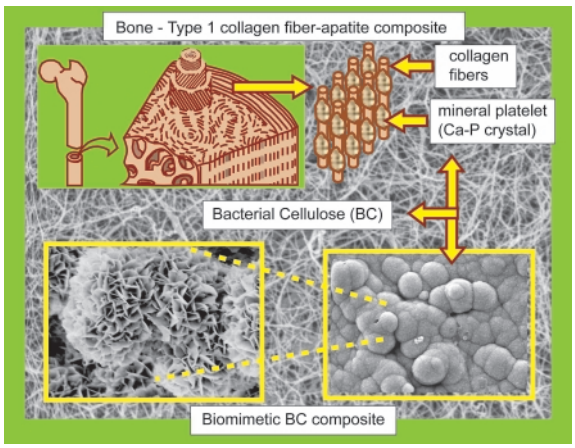
Choice test for screening CCA-tolerant fungi

= RISH-mission Scientists =

Research Activities in RISH

Thi Thi Nge
RISH-mission Scientist from Myanmar

It was a sunny day in April 2004 when I arrived at the Uji campus of Kyoto University to start work as a JSPS postdoctoral fellow at the laboratory of Biomass Morphogenesis and Information (BMI), one of the laboratories under the Core Research Divisions of the Research Institute for Sustainable Humanosphere, RISH. RISH is a newly established institute that was formed by combining two organizations, formerly known as the Wood Research Institute (WRI) and the Radio Science Center for Space and Atmosphere (RASC). RISH aims to expand its scientific missions to humanospheric science in depth, and took its first action toward that goal in April 2004. I would say that my research life here at Kyoto University was born together with RISH, bringing the good fortune of RICH, enRICHment of academic knowledge and intellectual information to me.

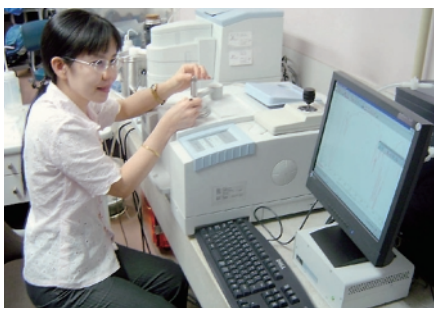


FE-SEM image of bacterial cellulose microfibrils network and apatite-deposited BC surface

Actually, I came to Kyoto for the first time in 2002 for a presentation at the First International Cellulose Conference while I was a Ph.D. candidate at The University of Tokyo. I came from Myanmar in October 1999 to pursue my doctoral degree as a Japanese Government Monbukagakusho scholarship student. At that time, I met with Prof. Junji Sugiyama, one of the organizers of this conference, in person, though we knew each other by mail, as I had asked him for suggestions related to one part of my Ph.D. thesis work. My research interest is the novel utilization of naturally occurring biopolymers for the development of socio-ecologically friendly composite materials across a broad spectrum of disciplines. Specifically, I have been doing research in the field of polysaccharides such as chitin/chitosan and cellulose, which are the expertise area of Prof. Sugiyama in terms of their structural and formation aspects from the cellular to the molecular level.

After this meeting and while I continued to work as a postdoctoral researcher at The University of Tokyo after my graduation, an idea came to me, which is that I want to study the morphological structure and formation process of chitin/cellulose-based biomimetic composites, novel biomaterials for potential osteological applications. Needless to say, the BMI immediately drew my attention. Fortunately, I had a chance to conduct my research at BMI as a JSPS postdoctoral fellow from April 2004 to March 2006. I am currently working as a RISH-mission Scientist at the Center for Exploratory Research on Humanosphere, one of the facets of the RISH research structure, run by the Center Head, Prof. Yuji Imamura.

So far my research has been focused on the development of bioactive apatite/bacterial cellulose (BC) biomimetic composites. Apatite is a kind of calcium-phosphate crystal that is one of the main constituents of bone and teeth. Since the unique properties of bone arise from the controlled integration of the organic (collagen fibrils) and inorganic (apatite crystals) components with a sophisticated architecture from the nano- to the mesolevels, the ultrafine bacterial cellulose microfibrils 3-D network structure with its native unique properties is used to search for possible synthesizing materials analogous to natural bone. Investigation of the role of different BC substrates to induce the bonelike apatite formation on its microfibril surface in a simulated body fluid with ion concentrations equal to those of human blood plasma, at physiological pH and temperature, was the primary goal of this study. Since bacterial cellulose is microbially-derived polysaccharide and hence an ecologically friendly biopolymer, the choice of bacterial cellulose to fabricate materials, not limited to biomedical applications, will help to conserve forest resources indirectly because bacterial cellulose is of commercial interest for many of the same reasons that cotton fields and forests attract the industrialist's attention.



Structural characterization by ATR-FTIR

As a mission scientist, I have attended a series of open seminars,

which are a place for sharing academic knowledge among colleagues as well as communicating with researchers from multidisciplinary fields. All mission scientists are encouraged to be involved by giving a presentation in this stimulating atmosphere beyond our host laboratories. Though my experience has been limited to a specific field, I am nevertheless impressed by the RISH scientific missions on humanospheric science issues, which addressed several facets of innovative research programs for the sustainability of the humanosphere, that is to say, for a sustainable high quality of life. In line with the RISH vision, I add my value and motivation to integrate intellectual vision toward enRICHment of the current RISH research missions' activities.

= Students from abroad =

Introduction to My Work as a Ph.D. in RISH

Rudianto Amirta
Pulp and Paper Laboratory, Forestry Faculty,
Mulawarman University, Samarinda,
East Kalimantan (Borneo), Indonesia

After 3.5 years of studying at Kyoto University I must return to my country, Indonesia. Although the duration of my stay in Japan was very short, it was enough to change many aspects of my life. My family and I enjoyed our life in Japan, especially after we shared our life with the Japanese people and became familiar with their culture.

A snap shot in IWoRS with Prof. Umezawa

Since returning to Samarinda at the end of March 2005, especially after the completion of my Ph.D. program at RISH Kyoto University, I have been continuing my work as a lecturer in the Faculty of Forestry, Mulawarman University. Not unlike what any foreigner would experience, at the beginning of my stay here in Samarinda I had difficulty adjusting to the Indonesian weather, but this only lasted a few days. Soon we adapted to the situation and continued our lives as we had before going to Japan.

Here on Samarinda I do not have adequate facilities to do the same activities as I was engaged in at Kyoto University. Reagent and equipment limitations caused me to change my research priorities. I cannot continue my study of lignin degradation by laccase-mediator system in the presence of ceriporic acid at this time.

In place of my earlier research, I have begun some new projects. One of the projects is a study of the production of wood pellets as an alternative energy source, and this project is being funded by an investor from Finland. In this project, we evaluated the feasibility of producing wood pellets from many species of tropical wood such as *Acacia mangium*, *Gmelina arborea*, and *Paraserianthes falcataria*. We analyzed raw material, density, heating level, emissions, and many aspects related to the quality of the product. I believe the limitations in resources and equipment have guided me to be more creative and patient, especially in the face of problems.

In Indonesia's tropical rain forest ecosystem, there are many interesting resources such as fungi, herbs, medicinal plants and wood. Many species of animals and insects also live here in harmony. Most of the resources are a mystery, as very little information has been published about them.

Because it is related to the degradation of lignin by white-rotting fungi, some of the white-rotting fungi that I collected from the tropical rain forest were used. I evaluated the selectivity of fungi with regard to the degradation of lignin. This research was done as part of a collaborative project involving the Faculty of Forestry and the Faculty of Mathematic and Natural Science of Mulawarman University.

In the case of medicinal plants, East Kalimantan can be described as a drug store. Thousands of years ago the local peoples used the traditional medicine of East Kalimantan to support their lives. Anti-fever, anti-malarial, anti-mosquito, anti-inflammatory, and also anti-cancer drugs were all found in the for-

A group photo in IWoRS

est of East Kalimantan. Unfortunately, the scientific information such as name, structure, and detailed function of the bio-compounds were not known at the time these plants were discovered. Therefore, our work has also focused on the investigation of several wood species such as *Caesalpinia sappan*, *Eugenia* sp., *Scorodocarpus bornensis*, and *Alstonia* sp., which are traditional medicinal plants. Based on our preliminary experiment, they showed indications of anti-androgenic activity (that is, a preventative effect against benign prostatic hyperplasia: BPH).

We hoped that many scientists would joint us and participate in this research. For this reason, we invited a group of researchers from Japan to participate in the 8th IWoRS seminar (Samarinda, Sept 3-5, 2005). They were Dr. Kuniyoshi Shimizu (Kyushu University), Dr. Tohru Mitsunaga (Gifu University), Prof. Minoru Terazawa (Hokkaido University) and Prof. Toshiaki Umezawa (Kyoto University). During the seminar, we showed these visitors our research activities on medicinal plants. We are glad to meet their respond, and we also hope that future collaboration will be possible.

Finally, I would like to give thanks to my *sensei*, Professor Takashi Watanabe, and also to all members of the Biomass Conversion Laboratory, Research Institute for Sustainable Humanosphere, Kyoto University, for their kindest guidance, encouragement, assistance, and cooperation during my Ph.D. course.

= Students from abroad =

My Ph.D. Research at the Research Institute for Sustainable Humanosphere RISH, Kyoto University

A. K. M. Baki.
Ph.D. student from Bangladesh

I would like first of all to express my sincere appreciation to Prof. Hiroshi Matsumoto, without whom it wouldn't have been possible to write in this International Newsletter. I communicated with Prof. Matsumoto and applied for the MEXT scholarship to do my research under his supervision while I was working on my masters degree in Germany in 2003 after getting a scholarship from the German Academic Exchange Service (DAAD). It was a turning point of my life when I learned that I had been awarded the MEXT scholarship. I came to Japan in October 2003 as a research student and was admitted into the Ph.D. course in the Faculty of Engineering in April 2004.

The field of my research is the Solar Power Station/Satellite (SPS). SPS research is based on Microwave Power Transmission (MPT). Our globe will require a sustainable electricity source equivalent to 3 to 5 times the commercial power we are presently using by the end of the fourth decade of this century. Power from SPS is considered "green" because of its negligible impact on greenhouse gas emissions. Research on MPT technology is being conducted worldwide with a view to fulfilling the enormous energy demand of this century. The Microwave Energy Transmission LAB (METLAB) and SPSLAB of Kyoto University are at the frontier in MPT research. As the main issue of MPT research is the high-precision beam control system to reduce the Side Lobe Level (SLL) and attain the highest possible efficiency, I have chosen this field as my research area and have some ideas that I believe can be applied in this field. I have submitted one paper to the Institute of Electronic, Information & Communication Engineers (IEICE) that has been accepted, and I will submit another paper soon for publication. The submitted paper is based on a new idea of an isosceles trapezoidal edge- tapered phased-array antenna that can reduce the SLL and improve the power efficiency. My other paper discusses ways of reducing the beam pointing errors for SPS.

At the working desk

I live here in Japan with my wife and son, who always make my life enjoyable and who help me to relieve the stress of my research obligations. The cooperation and help from every one in my lab is really praiseworthy. I feel myself very fortunate to have had the chance to do my Ph.D. research at a world famous university like Kyoto University. For me, the most essential action was learning the Japanese language so that my family and I could integrate with the Japanese society and life style.

= Students from abroad =

Wood Preservation as an Effective Action against Global Warming

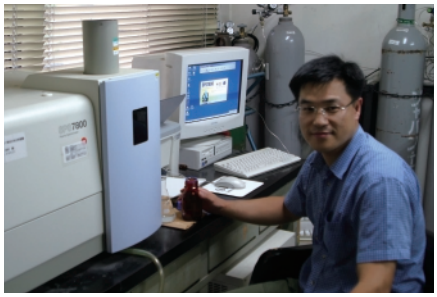
Won-Joung, Hwang
Ph.D. Student from Korea

My Ph.D. program at Kyoto University started when I entered the research course of the Wood Research Institute in December 2002 followed by study at the Graduate School of Agriculture beginning in April 2003. Prior to beginning the program at the Wood Research Institute, I had been trained as a basic wood scientist covering wood anatomy, evaluation of wood quality, determination of charcoal properties under the supervision of Prof. Nam-Hun Kim in Korea. Through these research activities, I had come to the personal conclusion that wood preservation focusing on the protection of wood from biodeteriortation and/or biodegradation must be one of the effective actions to decrease the CO_2 emission and the resultant global warming. Therefore, I had decided to come to the Laboratory of Innovative Humano-habitabilty at the Research Institute for Sustainable Humanosphere (RISH), Kyoto University, to conduct my Ph.D. research in the field of wood preservation (before April 2004, this institution was known as the Laboratory of Deterioration Control, Wood Research Institute, Kyoto University).

A snap shot in the Kagoshima field experiment

"Wood preservation" is a multidisciplinary science consisting of synthetic chemistry, biological chemistry, microbiology, entomology and allied sciences. Fortunately, the laboratory is well set up to promote research projects with the help of multidisciplinary scientists. Prof. Yuji Imamura, my supervisor, is a well-known scientist not only in wood preservation but also in wood anatomy. In addition, Dr. Kunio Tsunoda and Dr. Tsuyoshi Yoshimura have made excellent academic achievement in the fields of wood preservatives/wood microbiology and wood-attacking insects, respectively. I have been studying the natural durability of several wood species, the performance of novel wood preservatives (biological performance against decay fungi and termites, and leachability) and the method of wood preservative treatment, all with these professors' complete support. Regarding other laboratory staff members, particularly Ms. Ai Tashiro, I will never forget their kindness in making my and my family's stay comfortable here in Japan. My great thanks also goes to the many foreign scientists who visited the laboratory. Their comments and suggestions about my project are still promoting my research activities.

A fungal testing



ICP analysis of wood preservatives

Lastly, I would like to note two unforgettable events that have occurred during my time in Japan. The first one was the search for nests of the subterranean termite, *Coptotermes formosanus*, in Kagoshima Prefecture. We (Dr. Michael Lenz of CSIRO, Australia, Dr. Yoshimura, Mr. Junichi Kodama, Mr. Erwin and I) dug out almost 10 nests of the termite for the orphaning experiment from max. 2-m depth soil using only human power!! The second one was a private event. I was very much excited to see the beautiful sunrise from the top of Mt. Fuji with my wife.

The Committee of International Academic Exchange
Toshiaki Umezawa (Chair),
Shuichi Kawai,
Toshitaka Tsuda,
Kazufumi Yazaki,
Mamoru Yamamoto,
Tsuyoshi Yoshimura,
Naoki Shinohara and
Ayako Honda (adm. office)

Published by S. Kawai
(Director of RISH)

Research Institute for Sustainable Humanosphere (RISH)
Kyoto University
Gokasho, Uji, Kyoto 611-0011, Japan
Tel: +81-774-38-3601
Fax: +81-774-38-3600/31-8463
http://www.rish.kyoto-u.ac.jp/

Title Back:
Illustrated by Chikako Noshi