Chair Chemistry of Wood Biomass Conversion

2.3.16 Laboratory : Laboratory of Biomass Conversion

Member :	Professor	Watanabe, Takashi, Dr. Agric. Sci.
	Associate Professor	Honda, Yoichi, Dr. Agric. Sci.
	Assistant Professor	Watanabe, Takahito, Dr. Agric. Sci.
	Master's Program	5
	Program-Specific Researcher	4
	Researcher	2

A. Research Activities (2010.4-2011.3)

A-1. Main Subjects

a) Conversion of wood biomass to energy and functional materials by microorganisms and enzymatic reactions

Wood biomass and its components are converted to energy and useful materials including ethanol, chemicals, feedstuff and others by using microorganisms and their enzymes. The research subjects include pretreatments of wood by selective white rot fungi, solvolysis and milling. The research includes enzymatic decomposition of inhibitors for ethanol fermentation, and analysis of physiological response of alcohol-producing microorganisms to the inhibitors of ethanol fermentation.

b) Molecular biological characterization of white rot fungi

Extracellular enzymes are isolated from the culture of white rot basidiomycetes and genes encoding these enzymes are cloned and characterized. Regulation of gene expression, overexpression with gene engineering techniques, a reaction mechanism of the enzymes, and their application in degradation of polymers are studied. New strategies for transformation and gene-targeting system are under development.

c) Development of efficient biocatalysts for wood biomass conversion

Isolation of biocatalysts for efficient conversion of wood biomass is aimed by modifying microorganisms including bacteria, yeasts, and lignin-degrading basidiomycetes with gene engineering techniques. These include construction of basidiomycetes with higher and more selective ligninolytic activities, and alcohol-producing microorganisms with higher tolerance to the fermentation inhibitors.

A-2.Publications and presentations

a) Publications

Books

- T. Watanabe: Pretreatment technology of woody biomass using selective lignin degradation of white rot fungi, Production technology of cellulosic bioethanol - For the sake of food crysis avoidance, pp. 133-145, NTS, 2010.

- T. Watanabe: Chemistry of hemicelluloses, Reactions of hemicelluloses, Scinece of Wood, pp. 136-153, Buneido Publishing, 2010.

Original Papers(including book-reviews)

- Liu, J., Takada, R., Karita, S., Watanabe, T., Honda, Y. and T. Watanabe: Microwave-assisted pretreatment of recalcitrant softwood in aqueous glycerol. Biores. Technol. 101(23); 9355-9360, 2010

- Baba, Y., Tanabe, T., Watanabe, T., Honda, Y. and T. Watanabe: Enzymatic saccharification of Japanese ceder wood by combined pretreatments using white rot fungus and organosolvolysis with lactic acid. Journal of the Japan Society of Material Cycles and Waste Management 21(6); 219-225, 2010

- Baba, Y., Tanabe, T., Shirai, N., Watanabe, T., Honda, Y. and T. Watanabe: Pretreatment of Japanese cedar wood by white rot fungi and ethanolysis for bioethanol production. Biomass Bioenergy 35(1); 320-324, 2011

- Verma, P., Watanabe, T., Honda, Y. and T. Watanabe: Microwave-assisted pretreatment of woody biomass with ammonium molybdate activated by H2O2. Biores. Technol. 102(4); 3941-3945, 2011

- Ohashi, Y., Uno, Y., Amirta, R., Watanabe, T., Honda, Y. and T. Watanabe: Alkoxyl- and carbon-cetered radicals as primary agents for degradaing non-phenolic lignin-substructure model compounds. Org. Biomol. Chem. 9; 2481-2491, 2011

- Sakamoto T., H. Kitaura, M. Minami, Y. Honda, T. Watanabe, A. Ueda, K. Suzuki, T. Irie: Transcriptional effect of a calmodulin inhibitor, W-7, on the ligninolytic enzyme genes in Phanerochaete chrysosporium. Current Genetics 56(5):401-410, 2010

Reviews

- Watanabe T.: Analysis and applications of selective lignin degrading ability of basidiomycetes for lignocellulosic biorefinery, Green Spirits, 5, 3-11, 2010.

Reports,others

- Watanabe, T., Honda, Y. and T. Watanabe: Reaserch on molecular relationship between fatty acid metabolism and selective lignin degradation in Ceriporiopsis subvermispora. Sustainable Humanosphere 6; pp2, 2010

b) Conference and seminar papers presented

- Annual meeting of Japan Society of Bioscience, Biochemistry and Agrochemistry 2011: 3 presentations

- The 61st Annual Meeting of Japan Wood Research Society: 6 presentations

- The 14th Annual meeting of Japanese Society of Mushroom Science and Biotechnology: 1 presentation

- The 14th Annual meeting of The Mycological Society of Japan: 1 presentation

- The 6th Meeting of East Asia for Mushroom Science 2010: 1 presentation

- The 9th International Mycological Congress: 1 presentation

A-3.Off-campus activities 1

Membership in academic societies

- Watanabe, Takashi : Japan Society for Bioscience, Biotechnology, and Agrochemistry (Council member of Kansai Branch), Japan Wood Research Society (Councilor, Committee of grobal environment, Committee of promotion of research), Japan Bioindustry Association (Counsillor), Kinki Agrihightech (Technical councilor, Head of Biomass div.), Japan Technical Association of the Pulp and Paper Industry (Committee of Wood Science)

- Honda, Yoichi : Japanese Society of Mushroom Science and Biotechnology (Council member and board)

- Watanabe, Takahito : Japan Society for Bioscience, Biotechnology, and Agrochemistry (delegate)

A-3.Off-campus activities 2

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Grant-in-Aid for Scientific Research (C) : Honda, Yoichi : What prevents hetorogous expression of ligninolytic enzymes?

- Grant-in-Aid for Young Scientists (Start-up) : Nishimura, Hiroshi : Analysis of extracellular peroxidized metabolites from the glucan matrix involved in lignin biodegradation by white rot fungi

2.Other Research Grants

- NEDO Grant for Frontier Research and Technology of biomass energy : Watanabe, Takashi : Highly efficient conversion system of wood biomass into bioethanol

- NEDO Grant for Frontier Research and Technology of biomass energy : Watanabe, Takashi : Basic studies for efficient enzymatic saccharification and fermentation (Sub-project) Analyisis of microstructure of biomass by CBM

- Special Coordination Funds for Promoting Science and Technology
: Watanabe, Takashi : Creation of the paradigm of sustainable use of tropical rainforest by the intensive forest management and advanced utilization of forest resources (Sub-project) Screening of tropical fast growing wood for bioethanol production

- The research grant for Mission Research on Sustainable Humanosphere from Research Institute for Sustainable Humanosphere (RISH) , Kyoto University : Watanabe, Takahito : Characterization and heterologous expression of fermentation inhibitors-degrading laccase genes from the basidiomycete Trametes versicolor RC3

A-4.International cooperation and overseas activities 1

International meetings(country,roles)

- Takashi Watanabe : Lignobiotech Two Symposium (Japan, International Program committee), 2010 5th WCU Symposium, Chemo-Enzymaic Catalysis of Lignocellulose for Biorefinery (Korea, Plenary Lecture), BIT' 3rd World Congress of Industrial Biotechnology 2010 (China, Invited Lecture), Pacifichem 2010 Lignin Biorefinery Workshop (USA, Invited Lecture)

- onda, Yoichi : Lignobiotech Two Symposium (Japan, Member of Program committee)

International joint research, overseas research surveys

- Fostering Program of Leading Young Scientists toward the Establishment of Humanosphere Science in East Asia, The JSPS Exchange Program for East Asian Young Researchers , Watanabe, T., Thailand, Indonesia, Vetnum, India, Malysia

- Creation of the paradigm of sustainable use of tropical rainforest by the intensive forest management and advanced utilization of forest resources, Kanzaki, M., Indonesia

- Proposal of evaluation and sustainable management of large scale tropical plantation forest, Yoshimura, T., Thailand

A-4.International cooperation and overseas activities 2

Visiting Research Scholars

- Guesst Research Associate 1（Indonesia）

- Guesst Research Associate 2（Thailand）

B.Educational Activities(2010.4-2011.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level: Science of Humanosphere –Conversion of Solar Energy- (Takashi Watanabe, Honda), Mushroom Biology Seminar (Honda),Seminar on Lifesciences and Society (Honda), Mushroom Science (Honda)

- Graduate level: Chemistry of Wood Biomass Conversion (Takashi Watanabe, Honda, Takahito Watanabe), Sminar on Chemistry of Wood Biomass Conversion (Takashi Watanabe, Honda, Takahito Watanabe), Experimental Course in Chemistry of Wood Biomass Conversion (Takashi Watanabe, Honda, Takahito Watanabe), Science for diagnostics and control of the Humonosphere (Honda)

B-2.Off-campus teaching etc.

Part-time lecturer

- Watanabe, Takashi: Shizuoka University, Special lecture on biomass conversion

- Honda, Yoichi: Kitami Institute of Technology, Special lecture on chemical system technology I & III, Biomass Conversion and Genetic Engineering in Basidiomycetes

B-3.Overseas teaching 2

Lectures and seminars

- Watanabe, Takashi

Disintegration of plant cell walls and characterization of surface carbohydrates for 2nd generation biofuels & biorefineries
(Lecturer) : Chiang Mai University, Faculty of Agro-Industry(Thailand)

Disintegration of plant cell walls and characterization of surface carbohydrates for 2nd generation biofuels & biorefineries
(Lecturer) : LIPI, R & D Unit for Biomaterials(Indonesia)

- Honda, Yoichi

Genetic transformation and promoter assay system in white rot fungi(Lecturer) : Faculty of Forest Sciences and Forest Ecology, University of Göttingen(Germany)

Transformation and promoter assay system in white rot fungi, Pleurotus ostreatus and Ceriporiopsis subvermispora(Lecturer) : Biological Chemistry, Science Faculty, University of Naples Federico II(Italy)