Abstract of Presentation

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Microbial and microwave-assisted degradation of lignin for lignocellulosic biorefinery

Abstract: Biorefinery is a production system for fuels, chemicals, materials and energy from biomass in integrated chemical and energy industries, and it provides a new concept to change the petrochemical industry developed in 20th century. There is a growing demand to establish biorefinery to solve the problems of global warming and deficiency of fossil fuels. Because biomass is our only "carbon-based" renewable resources, biorefinery plays a key role to replace oil-based chemical industry. Among the potential industrial biorefineries, lignocellulosic biorefinery has immense potentials to replace oil refinery, due to large quantities of lignocellulosics, non-competitiveness in food supply and availability as plant wastes.

In enzymatic conversion of lignocellulosics it is necessary to decompose the network of lignin prior to the enzymatic hydrolysis because lignin makes the access of cellulolytic enzymes to cellulose difficult. Production of value added products from lignin is also important issue due to its abundance and demand for the supply of aromatic chemicals from renewable resources. Thus, effective lignin-degrading pretreatments are needed for the lignocellulosic biorefinery. Our group has been focusing on ligninolytic systems of selective white rot fungi and microwave-assisted degradation of lignin, aiming at producing biofuels and biochemicals from a wide range of biomass including recalcitrant softwood. We have applied the fungal pretreatments to the production of bioethanol, biomethane, feed for ruminant animals and molded products from wood. New microwave reactors have been developed using a simulation technique for an irradiation cavity, and used for the pretreatment of various woody biomass. Pretreatments with white rot fungi and microwave irradiation increased efficiency of enzymatic saccharification and ethanol fermentation. A bench scale plant for bioethanol production using the pretreatment system and gene-engineered bacteria is planned to build in 2009. The enzymatic hydrolyzates obtained by the process can be potentially used for the production of biochemicals, in addition to bioethanol. With regard to biopolymers, production of an antimicrobial agent, poly (ε-L-lysine) by *Streptomyces albulus* has been studied. A joint research covering the lignin-degradation, polymer and material science accelerates establishment of the lignocellulosic biorefinery.