Development of high-throughput characterization of lignocelluloses and the analysis of lignocelluloses from Jatropha curcas

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RECENT RESEARCH ACTIVITIES

Development of high-throughput characterization of lignocelluloses and the analysis of lignocelluloses from *Jatropha curcas* (Laboratory of Metabolic Science of Forest Plants and Microorganisms, RISH, Kyoto University)

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It is becoming more important to establish a sustainable society, which depends on renewable resources. Wood biomass is the most abundant renewable resource on the earth, and therefore, the better utilization and efficient production of wood biomass are the key factors to establish a sustainable society. In this context, our laboratory is involved in analyzing metabolic functions of forest plants from a wide variety of aspects, including organic chemistry, biochemistry, molecular biology, and metabolomics, aiming at the elucidation of mechanisms of wood formation of biomass plants and their biotechnological application. Here we describe some of the recent research topics of our laboratory.

1. High-throughput lignin characterization and determination and saccharification efficiency

In molecular breeding of wood biomass plants, straight-forward, high-throughput, and microscale characterization of wood biomass components is important to select the best recombinant lines at the stage of juvenile plantlets. Because lignin is one of the major components in wood biomass, its biosynthesis is one of the major targets in molecular breeding of wood biomass plants. However, the conventional methods for lignin analysis are low-throughput and employ complicate experimental procedures. We have already modified the thioglycolic acid lignin determination and nitrobenzene oxidation method suitable for large number and small quantity of samples. We recently modified the thioacidolysis for rapid and microscaled analysis [1]. In addition, using near-infrared spectroscopy analysis, we established the rapid quantification system of lignin and starch contents and saccharification efficiency [2]. Using the analytical methods, we are selecting the rice plants to enable the efficient conversion of wood biomass to energy.

2. Analysis of lignocelluloses from *Jatropha curcas*

Jatropha curcas is one of promising oil producing plants because the plant produces large amounts of oil and shows an excellent adaptation capacity to a large variety of soil and climate conditions. *J. curcas* trees are trimmed to ca. 2 m in height to facilitate the harvesting of the fruits. As a result, *J. curcas* oil production is accompanied by the concomitant production of 10 ton ha^{-1} $year^{-1}$ of branches, which are discarded without utilization. The yield of the woody branches is almost similar to that of fast growing trees in temperate zone. Thus, the utilization of the trimmed braches is critically important for increasing the economical efficiency of *J. curcas* plantations. To exploit the branches as lignocellulosic raw materials for the production of pulp, paper, wooden board, and biofuels, it is necessary to characterize lignins in the branches. In this context, lignins of *J. curcas* organs were qualitatively and quantitatively characterized by thioglycolic acid, thioacidolysis, and nitrobenzene oxidation methods [3].

References

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