Frontier Chemistry Center
フロンティア化学教育研究センター 講演会

演 題：**Innovative production of fuels & chemicals from renewable resources**

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日 時：2013 年 9 月 30 日 （月）15:00~16:00

場 所：工学部材料・化学棟大会議室（MC526）

要旨：

A 2-step process for biodiesel production has been developed. Triglycerides are first hydrolyzed to fatty acids, which are then reacted with methanol using either immobilized lipases or solid acids as catalysts to produce biodiesel. This 2-step process allows the use of crude vegetable oils containing fatty acids or water and produces salt-free glycerol directly.

A method for converting “hard” substrates such as xylose, arabinose and glycerol to biogas has been developed. Exogenous microbes that are able to convert these “hard” substrates into biogas intermediates are introduced into the conventional anaerobic digestion system for easier digestion by the methane-producing microbes.

A method for genome shuffling to improve microbes has been developed. The whole genome of the parental strain is amplified by error-prone PCR to create DNA fragments with random mutations followed by transforming the DNA fragments into the parental strain to create a library of mutants by homologous recombination. This technique has been successfully utilized to improve the ethanol tolerance of a yeast strain and acid tolerance of a lactic acid bacterium.

A method for introducing random point mutations to small size DNAs has been developed. The small size DNAs are first ligated to form long chain DNAs consisting of the repeated units of the small size DNAs, which are then subjected to the conventional error-prone PCR to introduce random mutations followed by cutting them into DNA fragments of the original size. This method has been utilized for directed evolution of the signal peptide of a glucoamylase.

Oil palm empty fruit bunch (EFB) was hydrolyzed to get hemicellulose sugars by the combined use of dilute H_2SO_4 and H_3PO_4, which has been shown to have a synergistic effect in improving xylose yield compared to using H_2SO_4 alone. Hemicellulose sugars reached >100 g/L in the hydrolysate without any additional concentration steps.

Furfural, 5-hydroxymethyl furfural and acetic acid in hydrolysate were efficiently degraded by simply adding the microorganisms that were isolated from the nature in Singapore.

Cellulose was hydrolyzed to glucose by using whole cell cultures without supplementing any exogenous enzymes, which was further enhanced by simultaneous saccharification and fermentation.

Thermophilic bacteria were isolated from the natural environment and used to convert all lignocellulose sugars to L-lactic acid at 50°C in a simple medium with high yield (>95%), titer (>200 g/|L) and productivity (>5 g/L/h). Genetic modifications of the isolates are under way to construct mutants to produce D-lactic acid.

本講演は、大学院総合化学院『化学研究先端講義／総合化学特別研究第二』の一部として認定されています。

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