Biomass Program

Sugars R&D

Fundamentals of Biomass Hydrolysis at Low pH

The ability to recover and use all the major components of lignocellulosic biomass (cellulose, hemicellulose, lignin) is critical to developing economically viable bioproducts and biorefineries. This project focuses on the biomass pretreatment step of hemicellulose acid hydrolysis to recover the hemicellulose sugars and prepare the biomass for subsequent enzymatic or acid cellulose conversion. The ultimate goal is to identify promising routes to reduce the sugar production cost by 30% compared with established methods.

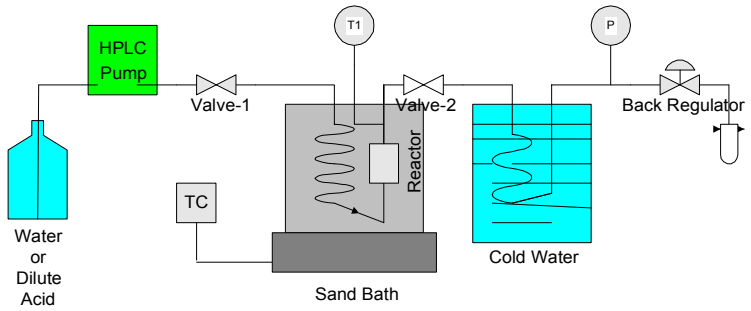
Corn stover will be the primary feedstock for this work, enabling leverage of related work funded by the U.S. Department of Agriculture. It is expected that the results for stover could be extended to other biomass feedstocks such as agricultural residues and grasses.

R&D Pathway

Researchers are investigating three hydrolysis systems: water-rich hydrolysis, water-restricted, and near neutral pH. Using different reactor configurations (e.g., batch tube, Parr, flowthrough) with varying solids and pH levels, researchers have developed comprehensive data on the destructuring, disaggregation, and depolymerization of hemicellulose to sugars.

Flow rate has been found to enhance hemicellulose removal, which is inconsistent with models typically applied to describe hemicellulose hydrolysis. New models have been defined that reveal mass transfer could be important in explaining this anomaly.

The flowthrough reactor experiments showed that lignin is modified as hemicellulose reacts, and the resulting disruption of lignin may play a significant role in enhancing cellulose digestion. In addition, researchers have shown that non-productive adsorption on lignin can be reduced by prior treatment with low-cost proteins, thereby substantially cutting enzyme costs.



A flowthrough reactor is used to improve the understanding of biomass pretreatment.

Benefits

- **Lower-cost production of sugars from lignocellulosic biomass**

Applications

Research results will support the development of the next generation of pretreatment/fractionation/hydrolysis technologies and ultimately help lower the production cost of sugars and bioproducts.

Project Participants

Dartmouth College
Purdue University
University of Sherbrooke, Canada

Project Period

FY 2002 – FY 2004

For more information contact:

Andy Trenka
DOE Golden Field Office
Andy.Trenka@go.doe.gov

EERE Information Center
1-877-EERE-INF (1-877-337-3463)

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