Biomass Program

Biochemical R&D

Integration of Leading Biomass Pretreatment Technologies with Enzymatic Digestion and Hydrolyzate Fermentation

A substantial amount of data exist on the performance of individual pretreatment, enzymatic hydrolysis, and fermentation technologies. However, the lack of data on integrated systems needs to be addressed as interactions between the process steps can impact the overall performance of a lignocellulosic biomass-to-ethanol process.

The goal of this project is to develop comprehensive performance information on a common basis on integrated biomass pretreatment, enzymatic hydrolysis, and fermentation systems. This work will include developing a model to predict the performance of each unit operation, relating performance to features of biomass and catalysts, and estimating process economics on a common basis. Results will be made publicly available.

R&D Pathway

Researchers are pretreating cellulosic biomass (corn stover and hybrid poplar) using dilute acid, sulfur dioxide, ammonia, lime, and controlled pH technologies. Cellulase and hemicellulase enzymes are applied to the solids to convert the pretreated cellulose and hemicellulose to sugar monomers. For each pretreatment, researchers are defining conditions to maximize the recovery of sugars from cellulose and hemicellulose. The effects of cellulase and hemicellulase loadings on sugars yields are also being studied.

Methods to condition and ferment the various hydrolyzates to ethanol using a recombinant microorganism are being applied. Models are being developed for each unit operation to better understand the processes and their interactions. A comparative economic analysis of the different pretreatment options will be performed.

Benefits

- **Define routes to improve yields and reduce costs**

Applications

The research results will facilitate the development and commercialization of biochemical conversion technologies for use in integrated sugar biorefineries.

Project Participants

Auburn University
Dartmouth College
Genencor International
Michigan State University
National Renewable Energy Laboratory
Purdue University
Texas A&M University
University of British Columbia
University of California Riverside

Project Period

FY 2004 – FY 2007

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)
www.eere.energy.gov

Visit the Web site for the Office of the Biomass Program (OBP) at
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