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Biomass Program

Sugars R&D

Chemical Processing Fundamentals

A key technical barrier to the commercialization of biobased fuels and chemicals is the high cost and relative inefficiency of producing sugars from lignocellulosic biomass (e.g., agricultural residues, perennial grasses, trees and forest thinnings, municipal solid waste). However, treatment with dilute acid shows promise for efficiently converting such biomass feedstocks into usable sugars.

In order to increase the rate and yields of sugar recovery from lignocellulosic biomass, a better understanding of the interaction of enzymes with biomass solids modified by dilute acid and other treatments is necessary. This project will employ modeling and experimental studies to increase understanding of the chemical and structural changes that occur in biomass during chemical depolymerization over a range of treatment chemistries and severities (pH, temperature, pressure).

At lower severities, the hemicellulose component can be hydrolyzed into 5- and 6-carbon sugars monomer and oligomers. At higher severities, cellulose is broken down into 6-carbon sugars via depolymerization.

Hemicellulose solubilization increases the accessibility of the remaining cellulose to enzymatic hydrolysis and conversion to sugars.

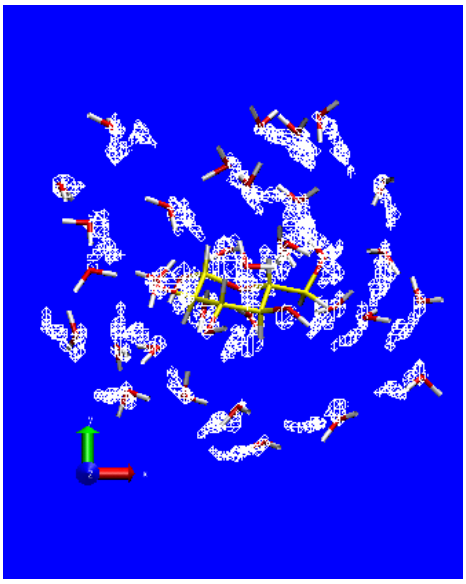

Illustration of a computer modeling approach to understanding degradation reactions of glucose which reduce the yield of fermentable sugars.

R&D Pathway

Ultrastructural and chemical characterization techniques will be used to determine factors with the greatest impact on the susceptibility of biomass to enzymatic hydrolysis, including the properties of dilute acid pretreated corn stover anatomical fractions. Researchers will then determine the chemical reaction pathways leading to sugar degradation and the effects of dilute acid pretreatment on lignin/enzyme interaction.

Benefits

- **Optimize pretreatment processes needed for cost-effective sugar production from lignocellulose**
- **Facilitate use of biofuels as an alternative energy source**

Applications

A better understanding of how the chemical and structural properties of cellulose and lignin affect the enzymatic digestibility of biomass will improve saccharification processes and decrease the cost of biomass sugars and subsequently, biofuels and biochemicals.

Project Participants

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Project Period

FY 2002 – FY 2006

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