Biomass Program

Sugars R&D

Development of Improved Ethanol Fermentation Microorganisms

A viable biobased economy requires the ability to economically process lignocellulosic biomass to chemicals, materials, fuels, and power. Lignocellulosic biomass is composed of cellulose (glucose polymer), hemicelluose (mixture of glucose, xylose, and other 5- and 6-carbon sugars), and lignin (complex mixture of sugars and hydrocarbon ring structures). For biochemical conversion, lignocellulosics such as wood and crop residues require pretreatment, such as acid hydrolysis, to breakdown the cellulose-hemicellulose-lignin matrix and free the sugars for utilization.

Conventional pretreatment methods do not free all of the biomass sugars and this project is aimed at maximizing the release of fermentable sugars from the hemicellulose fraction. Researchers at the University of Florida are identifying enzymes in bacteria that cleave specific sugar complexes to release xylose. The identified enzymes will then be inserted, or expressed, in ethanol-producing *E. coli* strains and tested to see if the new fermentation organisms simultaneously release additional sugars from the pretreated biomass and convert them to ethanol.

With improved fermentation enzymes, lignocellulosic biomass such as agricultural residues will be more efficiently converted to ethanol and other bioproducts.

R&D Pathway

Researchers will perform the following tasks: (1) purify and characterize bacterial enzymes, and designate those that perform the targeted reaction; (2) clone and sequence the genes that encode the desired enzymes in bacteria; (3) express the genes in ethanol-producing strains of *E. coli*; (4) evaluate the potential for the modified *E. coli* strains to increase the yields of ethanol formed during the simultaneous hydrolysis of the targeted sugar complexes and fermentation of those sugars and the sugars released during acid hydrolysis.

Benefits

- **Increase the portion of available sugars in lignocellulosic resources**

Applications

This research will advance biomass pretreatment, lower the costs of biochemical conversion processes, and ultimately boost the viability of sugar biorefineries.

Project Partners

University of Florida

Project Period

FY 2000 – FY 2004

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