Biomass Program

Bioproducts R&D

Value-Added Products from Hemicellulose Utilization in Dry Mill Ethanol Plants

The objective of this project is to investigate enzymatic and microbiological processes for generating value-added products from distiller's dried grains (DDG), the low-value fiber co-product of dry mill ethanol. DDG is currently sold as animal feed, but it is rich in cellulose, hemicellulose (xylose, arabinose), and protein. Researchers are developing a process to hydrolyze the hemicellulose and ferment the pentose sugars (xylose and arabinose) to itaconic acid using a fungal system. In addition, the oxidative catalysis of sugars to other products will be explored.

R&D Pathway

The project is composed of six R&D tasks covering analysis of feedstock (DDG) composition through the development of processes and microorganisms to convert the DDG sugars to itaconic acid and other products.

In the first task, analysis of DDG from two dry mills revealed that hemicellulose content was similar between the mill samples and that residual glucose was present in the DDG. The residual glucose may help accelerate growth initiation of the fungus for fermentation.

In task 2, researchers are developing hemicellulase mixtures that are optimal for hydrolyzing the arabinoxylan component of DDG into simple sugars for conversion to products. They are examining enzyme mixtures that are commercial or in the development phase, as well as enzymes isolated from thermophilic fungi.

In task 3, *Aspergillus terreus* is being used to ferment glucose, xylose, and arabinose to itaconic acid. Although yields have been higher for glucose, conversion of the pentose sugars has still been significant.

Task 4 involves exploratory research in the catalytic oxidation of sugar monomers with oxygen or hydrogen peroxide to identify potential future product pathways.

Development of a novel organism and process for succinic acid production will be carried out in task 5. The economic parameters and commercial feasibility of the products and processes proposed will be defined and evaluated in task 6.

Benefits

- Enable the production of value-added products from low-value DDG
- Boost the profitability of ethanol dry mills

Applications

Additional high-value product streams from DDG will help lower the production cost of ethanol and grow the market for biobased fuels and chemicals.

Project Participants

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Iowa Corn Promotion Board
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Project Period

FY 2003 – FY 2006

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