Biomass Program

Thermochemical Conversion of Corn Stover

Current ethanol production processes utilize microorganisms, such as *Saccharomyces cerevisiae*, to convert biomass sugars to ethanol. Processing time from sugar to ethanol is on the order of days. This combined thermochemical/biochemical process is significantly faster with a processing time on the order of minutes and also generates electricity.

Biomass sugars are converted thermochemically to syngas, a mixture of carbon monoxide (CO) and hydrogen (H_2) gas. After the syngas is cooled, it is converted to ethanol using *Clostridium ljungdahlii*. The heat released by the syngas during cooling is recovered and can be used, along with the combustion of residual gas not consumed by the microorganism, to generate power. The goal of this research is to develop an economical gasification/fermentation process to produce ethanol from corn stover.

R&D Pathway

Researchers are modifying the stover gasification process in order to maximize the CO and H_2 concentrations in the syngas. This will improve the ethanol yield from the syngas fermentation step. Parameters to be investigated include the feedstock condition, gasification temperature, gasification efficiency, use of enriched air/carbon dioxide during gasification, and gasifier capacity.

The syngas fermentation process will be evaluated to define the optimal operating conditions for process scale-up, measure emissions for permitting, and determine the best options for utilizing the process by-products. Syngas clean-up will be addressed in this task.

A biomass gasification/fermentation process design will be developed and used to perform a detailed economic and energy balance analysis of the process.

Thermochemical R&D

Benefits

- **Provides an alternative pathway to ethanol and power**
- **Reduces sugar-to-ethanol processing time**

Applications

This technology offers the potential to economically and efficiently produce ethanol and power from a wide variety of renewable resources.

Project Participants

Bioengineering Resources, Inc.
Burns & McDonnell Engineering Company, Inc.
Chippewa Valley Ethanol Company
Katzen International, Inc.
University of Arkansas

Project Period

FY 2005 – FY 2008

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