AGRICULTURE

Project Fact Sheet

The BEI Cellulose Hydrolysis Process and Reactor System (BEI CHP&RS)

Two-stage dilute acid hydrolysis process converts refuse-derived paper and green biomass waste cellulose into ethanol feedstock

Benefits

- May be constructed onsite or supplied by modular construction and transported to the user site to be assembled and operated as a compact processing unit in a new or existing waste to ethanol production facility
- Diverts waste paper and other types of urban cellulosic waste materials from traditional landfill disposal when co-located with waste generators or municipal waste recycling facilities
- Offers a significantly better energy balance than conventional ethanol production methods
- Contributes to environmental conservation by consuming formerly unusable waste products at costs less than the known state-of-the-art

Applications

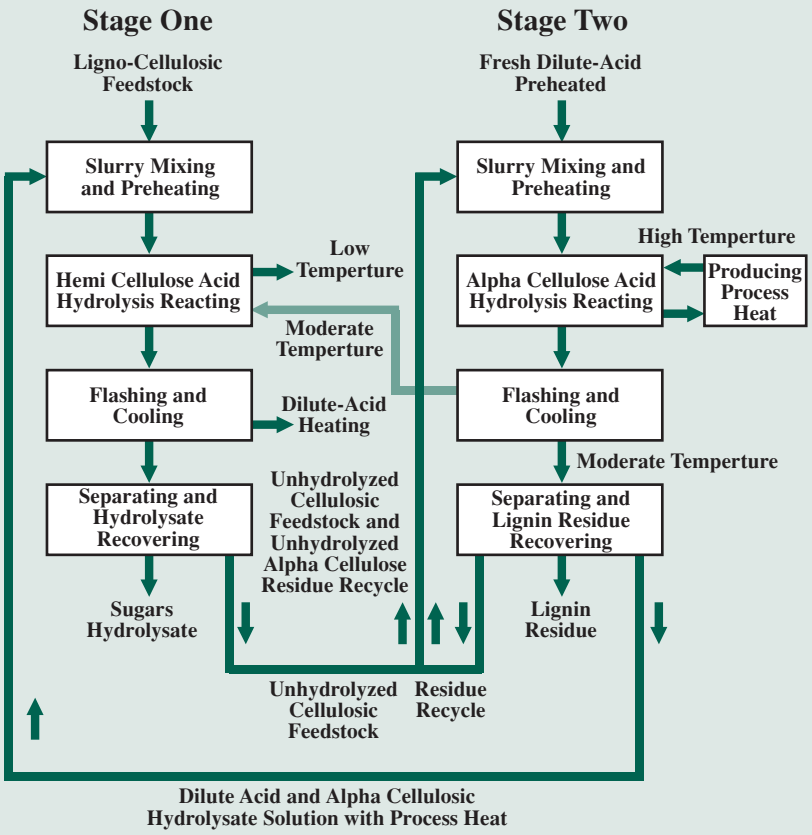
The BEI CHP&RS provides a simple, economical, and efficient method of producing ethanol from a wide range of feedstocks including crop residues, forest management logging residues, lumber mill sawdust and wood waste, pulp mill waste, municipal solid waste refuse-derived fuel, and agricultural crop residues such as wheat waste, barley straws, and corn-stover.

"Fuel-grade ethanol production is in its infancy now, and the BEI Cellulose Hydrolysis Process will participate in the strong growth we envision for MTBE substitutes."

– Donald Bogner

Fuel-grade ethanol is an economical substitute for methyl tertiary-butyl ether (MTBE), a hazardous chemical that is added to reformulated gasoline, oxygenated fuel, and premium grades of unleaded gasoline. Unmonitored MTBE discharges such as unburned fuel from water craft; gasoline spills and drips from accidents and refueling, and leaks from pipelines and storage tanks cause water pollution and human health hazards. Immediate substitutes are needed in California where MTBE will be phased out by January 1, 2003. Fortunately, the BEI CHP&RS is being commercialized by Genahol, Inc., and soon will be commercially valid and available for use in California, the Pacific Northwest, and other parts of the country.

Hydrolysis Process Schematic



The BEI CHP&RS economically produces highly fermentable hydrolysate sugars for subsequent processing into fuel-grade ethanol and other products.

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The BEI CHP&RS uses a double tube reactor, which is automatically and precisely controlled to convert cellulose to sugars that may be yeast-fermented to ethanol, other organic chemicals, or commercial products. The process uses low pressure, high temperature oil as a process heat source, which is superior to high-pressure steam that is commonly used in such processes. Process heat and dilute-acid chemicals are recovered in the second stage that are transferred and used in the first stage.

Continuous, precise, automated process control ensures polysaccharides present in the raw materials are hydrolyzed to maximum yield. Feedstock conversions are as high as 70% to 80% for hemi-cellulose (Stage One) and 60% to 70% for alpha-cellulose (Stage Two).

Project Description

Goal: The U.S. Department of Energy's Inventions and Innovation Program funded the project in 1998 to develop and demonstrate processing soft wood waste (pine and fir) into sugars for fermentation into fuel ethanol. This included activities to design, construct, and instrument a prototype pilot plant, which included process control equipment and a new double-tube heat-exchanger plug-flow-reactor, which is at the BEI Pilot-Plant Facility near Bozeman, MT.

Progress and Milestones

- The patented CHP&RS (US patent number 5,411,594 and CAN patent number 2,144.302) has recently been licensed to Genahol, Inc. of Wooster, Ohio.

- In 1998, the prototype facility was used to demonstrate dilute-acid cellulose-hydrolysis processing of distillers dried grains with solubles and processing corn gluten feed into fermentable sugars. Suitable equipment was selected for processing of corn-starch-to-fuel-ethanol.

- By 2001, the system was ready for commercial validation and preproduct demonstration.

Economics and Commercial Potential

Genahol currently has a contract with the Solid Waste Authority of Central Ohio to develop and construct a waste to ethanol facility in Columbus, Ohio. The facility will convert approximately 750 tons of MSW and green waste into 10 million gallons of ethanol a year. Genahol is also working with a major city in the Southwest to develop a waste to ethanol plant capable of converting 750 tons of MSW/green waste per day.

The process leads to the production of alternative fuel as well as food products Ethanol production costs are about $.65 per gallon, which is 50% less than ethanol from conventional hydrolysis processing of corn. Because dilute acid chemicals and process heat are recovered in the second stage and reused in the first stage, the process offers a 35% savings in the amount of acid required and a 30% savings in the amount of energy required compared to a typical dilute acid cellulose hydrolysis process. When dilute sulphurous acid is used and recycled, the process eliminates the need for an acid disposal system.

Brelsford Engineering and Genahol, Inc. are currently seeking investors who want to participate in the demonstration, commercial validation, and initial commercialization of this biomass renewable energy conversion process. Potential users include municipal solid waste recyclers, food industry, forest industry, and agriculture industry. The market penetration strategy is to offer site selection and techno-economic feasibility consulting services related to constructing the BEI CHP&RS as modular units that can be scaled up for industrial or municipal use or scaled down for small-scale application and/or on farm fuel ethanol production.

The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and to conduct early development. Ideas that have significant energy-savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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