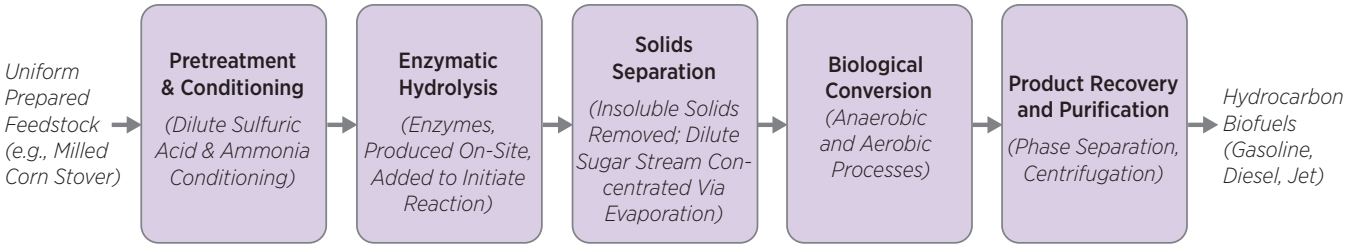
Biological Conversion of Sugars to Hydrocarbons

In the biological conversion of sugars to hydrocarbons pathway, biomass-derived sugars—separated from feedstocks through a series of chemical and biological processes—are further transformed, recovered, and purified to yield hydrocarbons for fuels and co-product commodities.

Process Block Diagram



Process Design Details

- Biomass is size reduced and preprocessed into a uniform-prepared feedstock (UPF) and delivered to the feed handling at a rate of 2,000 dry metric tons per day.
- UPF is treated with dilute sulfuric acid catalyst at mild conditions to liberate the hemicellulose sugars and break down the biomass cell walls.
- Caustics are added to the entire pretreated slurry to raise the pH level from approximately one to roughly five, and enzymatic hydrolysis is performed in parallel batch-type bioreactors.
- Solid materials are removed utilizing solid/liquid separation.
- Liquid biomass sugars may be concentrated by a triple-effect evaporation system to reduce excess water to a threshold of 50%.
- Concentrated sugars are processed biologically by anaerobic and aerobic conversion processes to produce hydrocarbon intermediates (short residence times of one to three days are preferred).
- Biological converted products are passed through phase separation or centrifugation steps to recover and purify the hydrocarbon intermediates or fuels.

Rationale for Selection

The biological conversion methods and technologies employed in the biological conversion pathway have successfully transitioned from laboratory research and development to cellulosic ethanol production facilities where their performance and economic viability can be assessed. This approach seeks to adapt and integrate these methods and technologies to accelerate the production of drop-in fuels from biomass. The hydrocarbon fuel intermediates resulting from this pathway can be used as a blend stock for conventional transportation fuels, targeting the Bioenergy Technologies Office goal of $3 per gallon of hydrocarbon fuel blends; or, they can be further upgraded to produce drop-in fuels.

Next Steps

Additional modeling is necessary to quantify baseline costs associated with the conversion process. Experimental data must be incorporated into the model to benchmark and verify progress and accomplishments. Techno-economic analysis models for the biological conversion pathway will be initiated in 2013.

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