ONEXANT SPECIAL REPORTS



REPORT OVERVIEW Subjects addressed:

- Conventional Feedstocks for Fermentations:
 Corn
 - Sugarcane
- Cellulosic Feedstocks for Fermentations
 - SHF
 - SSF
- Fermentations are Modeled to Ethanol as a Representative Product
- Technical and Economic Analysis
- Technology Developer Status and Timelines

Cellulosic Sugars: Unlocking Biomass' Potential

Fossil fuels and petrochemicals form the building-blocks of modern society. They are the raw materials for food, energy, cooking, heating, and durable goods such as clothing and furniture. However, concerns are mounting about the economic costs and environmental sustainability of the world's reliance on non-renewable fossil fuels. Consequently, some of the world's biggest players in the energy and petrochemical industries are seeking to develop alternative feedstocks, prominently including fermentable sugars. Fermentable sugars are fungible and easily converted to a variety of fuels and chemicals. Nexant's proposed study will assess the technical, commercial and economic status of producing sugars from cellulosic sources.

This study comes at a timely juncture, as sustained high oil prices support research efforts into bio-based chemical and polymer products. Crude oil prices have consistently been above \$100 a barrel. Since high energy prices affect oil-dependent petrochemical/industrial players and end-users alike, the economic incentive is great to develop economically competitive, renewable-based feedstocks and consumer products.

In addition, important recent developments have been focused on the development of bio-based feedstocks for the chemical and fuel sectors. New players in industry are working to develop merchant sources of cellulosic sugars. Established firms are also betting on the potential development of breakthrough bio-based technologies. At the same time, the rapidly growing movement to label products as "green" is becoming an important driver for durable goods manufacturers, who are keen to discover ways to utilize growing volumes of renewable materials. At the same time cellulosic sugars and products appear to be on the brink of commercialization.

Reflecting these trends, many traditional chemical producers have been diversifying into bio-based technologies through investments, partnerships and acquisitions. To explore the opportunities for cellulosics to replace conventional carbohydrate crops as feedstocks for chemicals and fuels from renewable sources, Nexant has undertaken a new multi-client report which analyzes conventional carbohydrate crops against cellulosic biomass from a number of sources. The report also compares conventional feedstock fermentations to SSF (simultaneous saccharification and fermentation, a one step process) and SHF (subsequent hydrolysis and fermentation, a two-step process).

This report, *"Cellulosic Sugars: Unlocking Biomass" Potential",* is a comprehensive study investigating and evaluating developers and approaches such as:

- Mascoma Consolidated bio-processing (CBP); direct conversion of biomass into fermentation products
- Proterro Cyanobacterial production of sucrose via photosynthesis
- Virdia Concentrated acid hydrolysis with HCI
- Renmatix Supercritical hydrolysis
- Chemtex PROESA Enzymatic hydrolysis

Nexant's multi-client report will be useful to those firms considering shifting toward renewables or to anyone who needs a comprehensive overview of progress toward the use of next generation sugar feedstocks and their economics.

The *"Cellulosic Sugars: Unlocking Biomass' Potential"* report is currently available for price of US\$22,000. Please contact ChemSystems@nexant.com for a subscription form.

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