



Biorenewable Insights: Conventional Carbohydrate Feedstocks

Conventional Carbohydrate Feedstocks is one in a series of reports published as part of NexantECA's 2022 Biorenewable Insights program.

Overview

Throughout most of human history, crops, other plants, and animals have provided for most human nutritive, chemical and material needs. Field crops, such as starch crops (grains and tubers), oilseeds, and sugarcane have been produced for many centuries, along with fruits, vegetables, and honey, as sources of quick and storable food energy. Fermentation alcohol has been made from starch and sugar resources for millennia. Wood, straw, dung, charcoal, and grasses have also been used as solid cooking and heating fuels historically and continue to be used in the developing world. Wood, raffia, cotton, and linen have provided the materials for clothing, furniture, and other durable goods. Soap has long been made from virgin and waste fats and oils.

With concerns over the implications of the high volumes and ubiquitous use of fossil fuels, society is now considering returning to the farm, forest, and ocean to source fuels and materials going forward.

Broad concerns about the future of the global economy and the natural environment have brought about a new goal for industries, consumers, and governments to strive towards in the twenty-first century: sustainability. The energy and chemicals industries are among those most heavily scrutinized for sustainability. Biofuels and bio-based chemicals have been widely touted as a potential solution for dependence on petroleum. They also have a favorable GHG (greenhouse gas) balance compared to fossil fuels and petrochemicals, because any carbon sourced from biomass can be directly traced to atmospheric carbon dioxide (CO₂) via photosynthesis.

Technologies

Current-generation conventional carbohydrate feedstocks include a wide variety of plant sources. These can include grains such as corn and wheat, grasses such as sugarcane, and roots and tubers such as cassava and sweet potatoes.

Primary carbohydrate crops globally are corn and sugarcane. These are used for food and sweetener production, as well as a feedstock for most fermentations (e.g., ethanol). Corn and sugarcane are and will continue to be, by far, the dominant feedstocks. Wheat, sugar beet, molasses (mostly from sugarcane), non-agricultural feedstocks (e.g., whey, beverage, and brewery wastes),

and other feedstocks (e.g., barley, sorghum, and cassava) are and continue to be minor/secondary feedstocks used for conventional ethanol production.

Process Economics

Cost of production models for the following are shown for the following, for crops this is both as produced and normalized to carbohydrate content. For sugar models 4 different wet corn milling models, 3 different sugar beet milling models, and 4 different sugarcane milling models are presented for each region where it is relevant:

- United States
 - Corn (no rotation)
 - Corn (rotation with soy)
 - Sugarcane (via mechanical harvesting)
- Brazil
 - Corn (no rotation)
 - Corn (rotation with soy)
 - Sugarcane (via hand harvesting)
 - Sugarcane (via mechanical harvesting)
- Western Europe
 - Wheat
 - Corn (no rotation)
 - Sugar Beet
- Asia
 - Corn (no rotation, China)
 - Corn (rotation with soy, China)
 - Sugarcane (via hand harvesting, India)

Supply

NexantECA has catalogued existing conventional carbohydrate crops supply by region.

Implications

NexantECA has developed expected price ranges for production costs and expected ranges for contract pricing of both finished sugars and utilizable sugar intermediates (e.g., sugarcane thick juice).

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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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