PROCESSING BIOMASS

RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application Serial No. 61/347,692, filed May 24, 2010. The complete disclosure of this provisional application is hereby incorporated by reference herein.

BACKGROUND

Cellulosic and lignocellulosic materials are produced, processed, and used in large quantities in a number of applications. Often such materials are used once, and then discarded as waste, or are simply considered to be waste materials, e.g., sewage, bagasse, sawdust, and stover.

Various cellulosic and lignocellulosic materials, their uses, and applications have been described in U.S. Patent Nos. 7,074,918, 6,448,307, 6,258,876, 6,207,729, 5,973,035 and 5,952,105; and in various patent applications, including "FIBROUS MATERIALS AND COMPOSITES," PCT/US2006/010648, filed on March 23, 2006, AND "FIBROUS MATERIALS AND COMPOSITES," U.S. Patent Application Publication No. 2007/0045456.

SUMMARY

Generally, this ~~invention~~disclosure relates to carbohydrate-containing materials (e.g., biomass materials or biomass-derived materials), methods of processing such materials to change their structure, and intermediates and products made from the structurally changed materials. Many of the methods provide materials that can be more readily utilized by a variety of microorganisms to produce useful intermediates and products, e.g., energy, a fuel such as ethanol, a food or a material.

The methods described herein utilize saltwater, and/or water containing other contaminants, impurities or pollutants, either solely or in combination with freshwater, thereby reducing or eliminating the need for a supply of fresh, uncontaminated water.

According to one aspect, there is provided a method of making a product, comprising: providing a cellulosic or lignocellulosic feedstock; combining the feedstock with a water source that is saline, or brackish and that comprises 0.5 to 50 ppt (0.05 to 5 wt%) of NaCl;

saccharifying the feedstock; and producing a product from the saccharified biomass; thereby making the product.

In one aspectembodiment, the inventiondisclosure features a method comprising utilizing a water source that is saline and/or contaminated to convert a cellulosic or lignocellulosic feedstock to an intermediate or product.

Some implementations include one or more of the following features. The feedstock may be treated to reduce its recalcitrance. For example, in some cases, the feedstock has been treated with a physical treatment selected from the group consisting of mechanical treatment, radiation, sonication, pyrolysis, oxidation, steam explosion, chemical treatment, and combinations thereof. In some cases, the feedstock has been treated with a mechanical treatment selected from the group consisting of cutting, milling, grinding, pressing, shearing and chopping.

Converting the feedstock to an intermediate or product may include contacting the feedstock with a microorganism in aqueous solution. The microorganism may be adapted to function in saline or contaminated water. For example, the microorganism may be a marine microorganism, or an engineered microorganism.

The method may further include treating the water source to reduce its salinity or contamination and utilizing the treated water in the aqueous solution. The water source may include, for example, seawater or brackish water. Additionally, or alternatively, the water source may include wastewater, grey water, collected rainwater, a microbially contaminated freshwater supply, or mixtures of any of these or of any of these with freshwater.

The biomass feedstock may, for example, be selected from the group consisting of paper, paper products, wood, wood-related materials, grasses, rice hulls, bagasse, cotton, jute, hemp, flax, bamboo, sisal, abaca, straw, corn cobs, coconut hair, algae, seaweed, microbial materials, synthetic celluloses, and mixtures thereof.

"Structurally modifying" a biomass feedstock, as that phrase is used herein, means changing the molecular structure of the feedstock in any way, including the chemical bonding arrangement, crystalline structure, or conformation of the feedstock. The change may be, for example, a change in the integrity of the crystalline structure, e.g., by microfracturing within the structure, which may not be reflected by diffractive measurements of the crystallinity of the material. Such changes in the structural integrity

of the material can be measured indirectly by measuring the yield of a product at different levels of structure-modifying treatment. In addition, or alternatively, the change in the molecular structure can include changing the supramolecular structure of the material, oxidation of the material, changing an average molecular weight, changing an average crystallinity, changing a surface area, changing a degree of polymerization, changing a porosity, changing a degree of branching, grafting on other materials, changing a crystalline domain size, or changing an overall domain size.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this ~~invention~~disclosure belongs. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present ~~invention~~disclosure, suitable methods and materials are described below. All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety. In case of conflict, the present specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and not intended to be limiting.

Other features and advantages of the ~~invention~~disclosure will be apparent from the following detailed description, and from the claims.

DESCRIPTION OF DRAWINGS

FIG. 1 is a block diagram illustrating conversion of biomass into products and co-products.

FIG. 2 is a block diagram illustrating treatment of biomass and the use of the treated biomass in a fermentation process.

DETAILED DESCRIPTION

Using the methods described herein, biomass (e.g., plant biomass, animal biomass, and municipal waste biomass) can be processed to produce useful intermediates and products such as those described herein. Systems and processes are described herein that can use as feedstock materials cellulosic and/or lignocellulosic materials that are readily available, but can be difficult to process by processes such as fermentation. Many of the processes described herein can effectively lower the recalcitrance level of the