Clean Technology

Biomass-Derived HMF Using Renewable Solvents

View U.S. Patent No. 8,772,515 in PDF format.

WARF: P120325US01

Inventors: James Dumesic, Jean Marcel Ribeiro Gallo, David Martin Alonso

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method to convert biomass into 5-hydroxymethylfurfural and other value-added chemicals using organic solvents.

Overview

The sugars found in biomass can be treated with solvent and converted into many important building block chemicals. One such chemical is 5-hydroxymethylfurfural (HMF), which is used to make plastic materials that traditionally have relied on petroleum sources.

A solvent like 2-sec-butylphenol can be used in the conversion process with great success. However, this solvent is highly toxic and during the reaction it produces a solid byproduct called humin that must be filtered. Also, upgrading the HMF into other chemicals requires separating it out first.

An alternative type of solvent could make the conversion process safer, cheaper and more efficient.

The Invention

UW–Madison researchers have developed a process to convert biomass-derived sugars into HMF, furfural and other downstream chemicals using an organic solvent. In this way, both the sugars and solvent are sourced from renewable feedstock.

Biomass sugars (mostly fructose and glucose) are reacted in a one- or two-phase reaction solution containing water and the organic solvent. This solvent can comprise lactones, furans and pyrans derived from plant matter like starch and cellulose. The reaction is conducted in the presence of acid and dehydration catalysts. Under suitable conditions, a portion of the sugar is converted to HMF.

Moreover, the HMF may be readily separated and upgraded into other chemicals like FDCA (furandicarboxylic acid), which is used to make fiber and packaging polyesters.

Applications

- Production of HMF, furfural and other value-added downstream chemicals

Key Benefits

- Solvents are renewable and effective.
- No solid humin is formed.
- No filtration step is required.
- Solid-acid catalysts can be used and easily recovered.
- Amenable to one- or two-phase reaction method

Stage of Development

The researchers have obtained HMF yields of 60 percent using glucose and 80 percent using fructose.

Additional Information

Related Technologies

- WARF reference number P120054US01 describes deriving HMF from glucose by utilizing Lewis acid and Brønsted-Lowry acid catalysts.
- WARF reference number P06305US describes a cost-effective procedure to synthesize furan derivatives, including HMF, from fructose.

Tech Fields

- Clean Technology : Energy storage, delivery & resource efficiencies
- Materials & Chemicals : Biochemicals & biomaterials

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854