Clean Technology

Unleashing Biomass Sugars Using Bromine Salt

View U.S. Patent No. 9,187,790 in PDF format.

WARF: P110209US02

Inventors: Xuejun Pan, Li Shuai

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method to hydrolyze lignocellulose into fermentable sugars without requiring pretreatment, harsh conditions or enzymes.

Overview

Methods to produce bioethanol from cornstarch or sugarcane are inadequate to meet the global demand for renewable fuels. To be sustainable, biofuel production should rely on abundant, cheap, inedible lignocellulose – like switchgrass, corn stover, wheat straw, wood chips and waste paper.

However, lignocellulose is a complex material made of cellulose wrapped by tough hemicellulose and lignin. For this reason, lignocellulose is more difficult than starch to break down and convert (hydrolyze) into fermentable sugars. Harsh acids, high temperatures or other chemical/mechanical pretreatments may be required before the raw biomass is suitable for hydrolysis with costly enzymes.

Researchers have speculated that conversion of lignocellulose material has the potential to yield 25 to 50 billion gallons of ethanol per year. There remains a clear need for a cost-effective, single-step hydrolysis process.

The Invention

UW–Madison researchers have developed a process for hydrolyzing lignocellulosic biomass in concentrated aqueous solutions of inorganic bromine salt with a small amount of acid. The process breaks down the lignocellulose material (corn stover, saw dust, hardwood, softwood, etc.) into fermentable sugars without pretreatment.

The reaction works on the raw lignocellulosic biomass for 5-200 minutes at moderate temperatures, hydrolyzing cellulose and hemicellulose and releasing monosaccharides for subsequent biofuel or chemical production. Lignin separates from the product sugars and can be filtered out for use in co-products. The bromine salt, like LiBr or $CaBr_2$, also can be recovered and reused.

Applications

- Breaking down lignocellulosic biomass to sugars
- Biofuel and chemical production

Key Benefits

- Single-step process
- Mild conditions
- Fast reaction
- No pretreatment or enzymes

- Easy implementation
- Overall sugar yield (hexoses and pentoses) may be greater than 90 percent.
- The process results in limited sugar degradation or fermentation inhibitors, like furans.
- Salts can be recycled.
- Lignin can be recovered with high purity to make co-products.

Stage of Development

The development of this technology was supported by WARF Accelerator. WARF Accelerator selects WARF's most commercially promising technologies and provides expert assistance and funding to enable achievement of commercially significant milestones. WARF believes that these technologies are especially attractive opportunities for licensing.

Additional Information

For More Information About the Inventors

- Xuejun Pan

Related Technologies

- WARF reference number P100184US02 describes a method of cellulose hydrolysis that uses metal compounds and enhances biofuel production.

Tech Fields

- Clean Technology : Biobased & renewable chemicals & fuels

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