Improving Biomass Conversion Efficiency by Modifying Lignin so Plant Cell Walls Are More Digestible and Fermentable

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method for modifying lignin that has the potential to deliver quantum improvements in biomass processing for bioenergy production and papermaking.

OVERVIEW

Lignocellulosic biomass is a very desirable feedstock for biofuel production. If the fermentation process for lignocellulose could be optimized, conversion of this biomass could yield 25 to 50 billion gallons of ethanol or other biofuels per year.

However, lignocellulose, which is composed of lignin, cellulose and hemicelluloses, is resistant to chemical or enzymatic hydrolysis. This resistance is a key limiting step in the conversion of biomass into fermentable sugars. Currently, pretreatment steps, which involve heating the biomass to high (170°C or greater) temperatures, using large amounts of water and/or using caustic acids or bases, are required before biorefining of lignocellulosic biomass.

Lignin also must be degraded or modified during paper manufacturing to make the desirable cellulose fibers available. But current pulping techniques require high amounts of energy, harsh chemicals or large quantities of wood and can result in poor quality paper.

THE INVENTION

Wisconsin researchers have demonstrated that lignin may be engineered to be more digestible and fermentable by structurally altering the lignin so its monomer complement incorporates coniferyl and/or sinapyl ferulate. This allows biomass polysaccharides to be utilized more efficiently and sustainably, which should reduce inputs for energy, pressure vessel construction and bleaching during papermaking, and lessen pretreatment and enzyme costs associated with biomass conversion.

THE WARF ADVANTAGE

Since its founding in 1925 as the patenting and licensing organization for the University of Wisconsin-Madison, WARF has been working with business and industry to transform university research into products that benefit society. WARF intellectual property managers and licensing staff members are leaders in the field of university-based technology transfer. They are familiar with the intricacies of patenting, have worked with researchers in relevant disciplines, understand industries and markets, and have negotiated innovative licensing strategies to meet the individual needs of business clients.

APPLICATIONS

- Conversion of lignocellulosic biomass to biofuels and industrially important chemicals
- Production of pulp for papermaking
- Production of animal feeds and forages

KEY BENEFITS

- By reducing the severity of the required pretreatment step, this discovery should lead to savings in both energy costs and water consumption.
- May enable sustainable local processing without massive facility costs
- Processing low-density plant materials locally may decrease transportation costs and reduce greenhouse emissions.
- May make animal feed more digestible
- Applicable to all types of plants

STAGE OF DEVELOPMENT

The modified lignin has been demonstrated in a model cell wall system, and the researchers now have a plant gene that may be used to produce the required monolignol ferulate conjugates. Plants that express the conjugate and contain the altered lignin have been engineered.

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

Related Portfolios
WARF Accelerator Program Technologies

Tech Fields
Clean Technology - Biofuels & renewable fuels
Clean Technology - Energy & resource efficiencies

CONTACT INFORMATION

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