Renewable energy, Biofuels, Agriculture

The University of Georgia Research Foundation, Inc.

Technology Commercialization Opportunity

Highly-Efficient Enzymatic Hydrolysis of Grasses for Ethanol Production

UGARF Case: 1392
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School: Department of Microbiology
Intellectual Property Status: Patent Pending

Introduction

The U.S. Department of Energy estimates that biofuels made from crops of native grasses could reduce the nation's dependence on foreign oil, curb emissions of the "greenhouse gas" carbon dioxide, and strengthen America's farm economy. Cellulosic ethanol contains more net energy and its production produces significantly fewer greenhouse gases than ethanol made from grains. Grasses do not present the same economic (e.g., supply, speculative prices) uncertainties as those presented by grains. Recent, periodic floods of the Mississippi basin, and continued drought in the US Southeast led to great disruptions of the harvest of several grain crops. Additionally, the use of grasses as biofuel sources provides access to the billions of pounds of inexpensive yard waste produced in the US each year, which could be used to stimulate local economies through the production of low-overhead bio-ethanol.

Yet, there are some technical challenges that need to be solved before grass pulp becomes economically viable for making ethanol. The biggest bottleneck is developing a cost-effective process to convert pulp into simple sugars. Efficient conversion of plant material to ethanol requires a pretreatment prior to enzymatic hydrolysis, making the substrate more available for enzymatic action.

Technology Summary

The technology is comprised of mild, acid-free pretreatment method, an enzymatic digestion process, and a suitable novel pretreatment reactor for the highly-efficient production of simple sugars and – later – of ethanol from readily available biomass. This is an effective, gentle (low pressures and temperatures) and fast (2 – 10 minutes) treatment resulting in greater enzymatic digestibility of grasses. Post-digestion yield of simple sugars available for fermentation increased by as much as 10-fold compared with samples that did not undergo pretreatment. The increased digestibility directly resulted in an increased ethanol yield (> 50% increase) from fermentations.

Advantages

- Reliable, fast, inexpensive, scalable, environmentally-friendly and effective
- Obviates the use strong bases or acids as required by currently available pretreatments. Not only does this remove the additional cost of these reagents, but it eliminates the expense for their subsequent safe removal and disposal
- Pretreatment conditions prevent the formation of inhibitors often produced by biomass degradation
- Uses readily-available, inexpensive substrates
- Suitable for use on other biomasses

Potential Applications

- A promising option for pretreatment of various types of biomass for bio-ethanol production
- Production of ethanol from Bermuda grass, switch grass and Napier grass, forestry- and yard waste, recovered (e.g., municipal solid waste) cellulosic matter, among others

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