New biomass technology dramatically increases ethanol yield from grasses and yard waste

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University of Georgia researchers have developed a new technology that promises to dramatically increase the yield of ethanol from readily available non-food crops, such as Bermudagrass, switchgrass, Napiergrass—and even yard waste.

"Producing ethanol from renewable biomass sources such as grasses is desirable because they are potentially available in large quantities," said Joy Peterson, professor of microbiology and chair of UGA's Bioenergy Task Force. "Optimizing the breakdown of the plant fibers is critical to production of liquid transportation fuel via fermentation." Peterson developed the new technology with former UGA microbiology student Sarah Kate Brandon, and Mark Eiteman, professor of biological and agricultural engineering.

The new technology features a fast, mild, acid-free pretreatment process that increases by at least 10 times the amount of simple sugars released from inexpensive biomass for conversion to ethanol. The technology effectively eliminates the use of expensive and environmentally unsafe chemicals currently used to pretreat biomass.

The technology is available for licensing from the University of Georgia Research Foundation, Inc., which has filed a patent application.

Inexpensive waste products—including corn stover or bagasse, the waste from corn and sugar cane harvests, fast-growing weeds—and non-food crops grown for biofuel, such as switchgrass, Napiergrass and Bermudagrass, are widely viewed as the best sustainable resources for ethanol made from biofuels.

"Using non-food crops that can be grown on marginal lands, like grasses, and fibrous waste streams like corn stover, is important because of the ongoing food-versus-fuel debate," said Peterson. "When agricultural crops, such as corn or potatoes, are grown for biofuels production, the cost of the starting material may fluctuate greatly because of competing demands for food and feed. The trade-off with using a biomass like grasses is that grasses are harder to break apart than corn or potatoes, and the cost of making the same fuel, like ethanol, rises."

Developing an efficient, cost-effective process to convert the fibrous stalks, leaves, and blades of plant wastes into simple sugars is the biggest challenge to bio-based ethanol production. Thick, complex plant cell walls are highly resistant to efforts to break them down.

Currently, woody biomass requires soaking under high pressure and temperatures in expensive, environmentally aggressive bases or acids before it is subjected to enzymes that digest it, producing simple sugars. The harsh pretreatment solutions subsequently must be removed and disposed of safely. They also cause formation of side products that can slow down the conversion of the sugars into ethanol.

In contrast, the environmentally friendly UGA technology eliminates the expense of harsh pretreatment chemicals and their disposal, and the formation of side products is minimal.

"The new technology has commercial application for the biomass industry, including producers of sugar cane, corn, switchgrass, Napiergrass and other woody biomass crops," said Gennaro Gama, UGARF technology manager responsible for licensing this technology. "It may also help renewable energy and biofermentation companies—and local governments.

"By allowing for the use of myriad raw materials, this technology allows more options for ethanol facilities trying to meet nearby demand by using locally available, inexpensive starting materials," he added. "This would greatly reduce the costs and carbon footprint associated with the delivery of raw materials to fermentation facilities and the subsequent delivery of ethanol to points of sale. Local production of ethanol may also protect specific areas against speculative fluctuations in fuel prices.

"It's easy to imagine that this easy-to-use, inexpensive technology could be used by local governments, alone or in partnership with entrepreneurs, to meet local demand for ethanol, possibly using yard waste as a substrate," he said.

Source: University of Georgia

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