

New technique improves efficiency of biofuel production

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Researchers at North Carolina State University have developed a more efficient technique for producing biofuels from woody plants that significantly reduces the waste that results from conventional biofuel

production techniques. The technique is a significant step toward creating a commercially viable new source of biofuels.

"This technique makes the process more efficient and less expensive," says Dr. Ratna Sharma-Shivappa, associate professor of biological and agricultural engineering at NC State and co-author of the research. "The technique could open the door to making lignin-rich plant matter a commercially viable [feedstock](#) for biofuels, curtailing biofuel's reliance on staple food crops."

Traditionally, to make ethanol, butanol or other biofuels, producers have used corn, beets or other plant matter that is high in starches or simple sugars. However, since those crops are also significant staple foods, biofuels are competing with people for those crops.

However, other forms of biomass - such as switchgrass or inedible corn stalks - can also be used to make biofuels. But these other crops pose their own problem: their energy potential is locked away inside the plant's lignin - the woody, protective material that provides each plant's structural support. Breaking down that lignin to reach the plant's component carbohydrates is an essential first step toward making biofuels.

At present, researchers exploring how to create biofuels from this so-called "woody" material treat the plant matter with harsh chemicals that break it down into a carbohydrate-rich substance and a liquid waste stream. These carbohydrates are then exposed to enzymes that turn the carbohydrates into sugars that can be fermented to make [ethanol](#) or [butanol](#).

This technique often results in a significant portion of the plant's carbohydrates being siphoned off with the liquid waste stream. Researchers must either incorporate additional processes to retrieve

those carbohydrates, or lose them altogether.

But now researchers from NC State have developed a new way to free the carbohydrates from the lignin. By exposing the plant matter to gaseous ozone, with very little moisture, they are able to produce a carbohydrate-rich solid with no solid or liquid waste.

"This is more efficient because it degrades the lignin very effectively and there is little or no loss of the plant's carbohydrates," Sharma-Shivappa says. "The solid can then go directly to the enzymes to produce the sugars necessary for [biofuel](#) production."

Sharma notes that the process itself is more expensive than using a bath of harsh chemicals to free the carbohydrates, but is ultimately more cost-effective because it makes more efficient use of the plant matter.

The researchers have recently received a grant from the Center for Bioenergy Research and Development to fine-tune the process for use with switchgrass and miscanthus grass. "Our eventual goal is to use this technique for any type of feedstock, to produce any biofuel or biochemical that can use these sugars," Sharma-Shivappa says.

More information: The research, "Effect of ozonolysis on bioconversion of miscanthus to bioethanol," was presented June 23 at the 2010 Annual International Meeting of the American Society for Agricultural and Biological Engineers in Pittsburgh, PA

Provided by North Carolina State University

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