

Aug 20, 2008 IUPUI Press release.

Tuesday, November 18 2008 @ 06:04 PM MST

Aug 20, 2008 IUPUI Press release

Researcher Closes in On Ethanol Breakthrough that Reduces Need to Use Corn to Make Ethanol

Rich Schneider (rcschnei@iupui.edu)
317-278-4564

A yeast geneticist on the campus of Indiana University-Purdue University Indianapolis (IUPUI) is close to developing mutant yeast for ethanol production that would reduce or eliminate the need to use corn to make the alternative fuel.

The production of biofuels from basic plant material, rather than corn and other crops, would address concerns that making corn-based ethanol is pushing up food costs, said Mark Goebel, a professor of Biochemistry and Molecular Biology in the IU School of Medicine

Goebel's work is part of the Richard G. Lugar Center for Renewable Energy, which was established to address the societal needs for clean, affordable and renewable energy sources, improve the nation's energy security, and reduce global warming. Its primary mission is to promote research excellence in the area of renewable energy through collaborative efforts among faculty in the disciplines of engineering, chemistry, physics, biology, and environmental affairs. It will promote renewable energy applications through teaching, learning, civic engagement, and synergistic partnerships with industry, government labs and local communities.

Areas of current research include renewable energy through fuel cell technology, renewable hydrogen (solar, reformers), environmentally benign usage of renewable fuels, bio-fuel production and applications, and advanced battery technology.

Goebel said the crux of the problem of using basic plant material to make ethanol involves how yeast decide what they will eat.

When corn is used to make ethanol, yeast couldn't be happier. Corn kernels are ground to produce starch and the starch is broken down into glucose. Yeast is then used to ferment the glucose into ethanol.

"Although yeast can derive energy from a lot of different carbon sources, such as fatty acids and different kinds of sugars, yeast really, really like glucose, the sugar found in honey," Goebel said. "That's what they will use if it's there, even if it's there only in trace amounts."

And that's where the sticking point occurs. During the fermentation process, there is always a trickle of glucose coming into the system.

Unlike corn kernels, one-third of basic plant material consists of compounds that produce pine resins for which there are useful purposes. One-third is cellulose, which can be converted to glucose and used to make ethanol. But one-third is another kind of sugar, xylose, which yeast turn away from, like a child who is a picky eater pushes a vegetable to the side of his plate.

Goebel has developed strains of yeast that will utilize the xylose, even if glucose is around.

"How do you get yeast to give up their habit of using only glucose, no matter what else is around?" Goebel asked. The answer, he continued, is genetics.

"Yeast essentially care about glucose because they are genetically programmed that way, not because there is any physiological reason they have to care about glucose," he said. "We can genetically change that program. We are using genetics to modify yeast strains so that they will use other sugars just as well as glucose."

Producing mutant yeast strains that will eat xylose just as well as glucose means nearly doubling the amount of ethanol you get from the same volume of basic plant material. "You get a lot more ethanol for the same amount of work."

Another advantage of reducing or eliminating the need to use corn to make ethanol is that the rich farmland needed to grow corn isn't needed to grow basic plant material. "Essentially, you can go out and mow your lawn."