New yeast can ferment more sugar, make more cellulosic ethan

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(PhysOrg.com) -- Purdue University scientists have improved a strain of yeast that can produce more biofuel from cellulosic plant material by fermenting all five types of the plant's sugars.

Nathan Mosier, an associate professor of agricultural and biological engineering; Miroslav Sedlak, a research assistant professor of agricultural and biological engineering; and Nancy Ho, a research professor of chemical engineering, used genes from a fungus to re-engineer a yeast strain Ho developed at Purdue. The new yeast can ferment the sugar arabinose in addition to the other sugars found in plant material such as corn stalks, straw, switchgrass and other crop residues.

"Natural yeast can ferment three sugars: galactose, manose and glucose," Ho said. "The original Ho yeast added xylose to that, and now the fifth, arabinose, has been added."

The addition of new genes to the Ho yeast strain should increase the amount of ethanol that can be produced from cellulosic material. Arabinose makes up about 10 percent of the sugars contained in those plants.

In addition to creating this new arabinose-fermenting yeast, Mosier, Sedlak and Ho also were able to develop strains that are more resistant to acetic acid. Acetic acid, the main ingredient in vinegar, is natural to plants and released with sugars before the fermentation process during ethanol production. Acetic acid gets into yeast cells and slows the

fermentation process, adding to the cost of ethanol production.

"It inhibits the microorganism. It doesn't produce as much biofuel, and it produces it more slowly," Mosier said. "If it slows down too much, it's not a good industrial process."

Mosier, Sedlak and Ho compared the genes in the more resistant strains to others to determine which genes made the yeast more resistant to acetic acid. By improving the expression of those genes, they increased the yeast's resistance.

Mosier said arabinose is broken down in the same way as the other four sugars except for the first two steps. Adding the fungus genes allowed the yeast to create necessary enzymes to get through those steps.

"This gave the yeast a new tool set," Sedlak said. "This gives the yeast the tools it needs to get arabinose into the chain."

The team's findings on acetic acid were published in the June issue of the journal *FEMS Yeast Research*. The findings on arabinose were published in the early online version of the journal *Applied Microbiology and Biotechnology*.

Mosier, Sedlak and Ho will continue to improve the yeast to make it more efficient during industrial ethanol production and more resistant to inhibitors. The. U.S. Department of Energy funded their research.

Provided by Purdue University