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U of I Investigators Evaluate Ways for Ethanol Plants to Recycle More Water

Ethanol plants use about four gallons of water for every gallon of ethanol they make, using the dry-grind process. But investigators at the University of Illinois are trying to determine if the amount of water that is recycled during ethanol production can be increased significantly.

"If you have a plant that's going to produce 100 million gallons of ethanol, like the proposed Anderson plant, that's about 400 million gallons of water per year; and that's not a trivial amount," said Kent Rausch, a U of I agricultural and biological engineer involved in the project. "If we can increase the amount of recycled water from 50 to 85 percent, that will make a big difference from economic and environmental standpoints."

In the conventional dry-grind process, raw corn is finely ground and cooked; then the starch is fermented and converted into ethanol. After the ethanol has been recovered, the remaining material is called whole stillage. It contains water, protein, fat, fiber, and ash from the corn kernel and yeast. The stillage is run through a centrifuge, and about 50 percent of the water is recycled. The soluble material that remains after centrifuging is called thin stillage.

Rausch and his colleagues are planning to add membrane filtration -- filtration through very small holes -- to the process at this point. "We're looking at filtering the thin stillage to improve our ability to recycle it," said Rausch. "Impurities that inhibit yeast growth build up in the water and reduce ethanol yield; that makes the process less efficient." Although a total recycle may not be possible, he said, "Our goal is to get rid of those impurities so more water can be recycled."

Rausch and his colleagues are also experimenting with a modified dry grind process that removes much of the protein, fiber, and fat before the fermentation process.

"As a result, the thin stillage obtained from the modified dry grind process will be different," said Rausch. "This will affect the filtration rate through the membrane, so we will test which membrane construction and pore size will work most effectively with each process."

Vijay Singh, an agricultural and biological engineer at the U of I, and Ron Belyea, an animal scientist at the University of Missouri, are coinvestigators for this study, funded by the Council on Food and Agricultural Research (C-FAR).

"Water use is important to the economic well-being of the plant even where water is plentiful," Rausch concluded. "Reducing the demand for water in the process should reduce the environmental footprint. We want these facilities to do all they can to be good stewards in the community."

Source: Kent Rausch; (217) 265-0697; krausch@uiuc.edu