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Milling Process Makes Ethanol More Economical

Innovative research at the University of Illinois is changing the way ethanol is produced — and making it more economical in the process.

Vijay Singh, U of I agricultural and biological engineer, has developed a new corn-milling process that increases the amount of ethanol produced per batch, as well as the value of the co-products resulting from the process. All that, said Singh, is the key to more profitable ethanol production.

With the price of oil going over $50 a barrel, ethanol has become more than just an environmentally friendly alternative fuel. Many experts see it as a sorely needed solution to America's dependence on imports.

But according to Singh, the conventional process used for ethanol production has its drawbacks, such as the massive amount of one particular co-product produced--distillers dried grain with solubles, or DDGS.

In the conventional dry grind process, raw corn is finely milled and cooked. The starch is fermented and converted into ethanol, and the three non-fermentables (germ, protein, and fiber) are carried through the process and recovered at the back end as DDGS.

One bushel of corn produces 2.65 gallons of ethanol and 15 to 17 pounds of DDGS. With ethanol production expected to increase to more than 6 billion gallons per year by the year 2006, that's a lot of DDGS, said Singh.

Utilizing all of it is a major problem. DDGS is used as livestock feed, but because of its high fiber content, it is mainly fed to ruminant animals, such as dairy and beef cattle.

Singh's process reduces the volume of DDGS produced and improves its nutritional characteristics. The process, called enzymatic dry grind, soaks the corn in water for a short period of time, then grinds it coarsely and incubates it with enzymes, which break down the corn kernel.

"That allows us to pull out the germ and fiber at the front end of the process, before fermentation," said Singh.

When the fiber is pulled out before fermentation, it reduces the total volume of DDGS by about 65 to 70 percent. It also reduces the amount of fiber in the DDGS and increases protein content. In fact, protein content even exceeds that of soybean meal.

"So now you've got a high-protein, low-fiber product that can be fed to non-ruminant animals such as poultry and swine, as well as cattle," he added. "The problem of utilization goes away.

When you pull this germ and fiber out, you've also created space in the fermentor that you can fill with more starch," Singh said. "Therefore, you can produce more ethanol per batch."

Another benefit of the enzymatic process is the recovery of germ and fiber, which are valuable co-products themselves, used in a variety of products, including corn germ oil and corn fiber oil.

Singh believes the enzymatic dry grind process will greatly increase the profitability of ethanol production.

"This process increases the amount of ethanol per batch, reduces the volume and improves the quality of DDGS," he said. "That's pretty significant."

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