Corn-Based Chemicals To Be Discussed At Conference

ST. LOUIS, Mo. — Fuel ethanol and liquid corn sweeteners are already facts of life. Large-scale production of corn-based plastics and de-icing compounds is just around the bend. And just over the horizon lies a whole new array of corn-based chemicals that may multiply the industrial uses of a renewable resource -- and add value to each bushel produced.

New ideas and developments in making industrial chemicals from corn will be discussed at the 2nd Corn Utilization Conference, November 17-18 at the Airport Radisson Hotel, Columbus, Ohio, sponsored by Funk Seeds International and the National Corn Growers Association (NCGA). Dr. George T. Tsao, professor and director of the Laboratory of Renewable Resources Engineering at Purdue University, will chair a special break-out session on the topic of corn-based chemicals. The possibilities to be explored include butanol-acetone fermentation; production of sucrose from corn; cyclodextrins and their applications; cornstarch as a herbicide encapsulation agent; and generation of soluble proteins from corn gluten.

*** Butanol-acetone fermentation.** With funding provided by the U.S. Department of Energy and the NCGA, Battelle Memorial Institute of Columbus is continuing research into a process which could drastically reduce the cost of producing butanol, a high cetane alcohol used as an industrial solvent and fuel additive, through fermentation.

The process by which butanol and acetone, another solvent, are derived from corn was discovered around World War I and was widely used until the 1930s, says Dr. Robert Busche of Bio En-Gene-Er Associates, Wilmington, DE. "With the introduction of petrochemicals, however, the cost of producing butanol through fermentation became prohibitive," says Busche, who will be appearing on the program with Dr. Bill Allen of the Battelle Institute. "Today the cost of just the fermentation alone is about $1.25 per pound of butanol while the entire cost, including product recovery, of producing butanol from petrochemicals is currently around 35 cents per pound."

The reason for the high cost is a phenomenon called 'product inhibition,' Busche explains. "Once butanol concentration reaches approximately one percent, the organisms which cause the fermentation stop producing it. Battelle's process eliminates this problem by immediately removing the product with an organic solvent."

Busche estimates the new process could bring the cost of butanol fermentation and recovery down to 56 cents per pound, still more than the conventional process, but petroleum price hikes similar to those experienced in the 1970s could easily eliminate that disadvantage.

Potentially the patented process could be applied not only to butanol, but also to other chemicals which could be produced through fermentation, says Allen. "With intensive effort, the process could be commerically available to two to five years," he says.

*** Production of sucrose from corn.** Conventional wet milling and refining of corn produces a simple sugar called glucose. Bio-Technical Resources, Inc., a private research laboratory in Manitowoc, WI, is perfecting a one-step fermentation process that takes the glucose and converts it into sucrose, the sugar commonly produced from sugar beets and cane.

"The fermentation results in a 20 percent sucrose solution which then is subjected to conventional refining techniques to produce crystalline sugar," says Dr. Mike Sfat of Bio-Technical Resources. "We have got the process down to a cost of around 40 cents per pound of sugar. Within two or three years, we hope to achieve our target cost of 20 cents a pound. At that point, sucrose produced from corn would be competitive with beet or cane sugar."

The potential market for corn-based sucrose would be 500 million bushels of corn each year, Sfat estimates. "High fructose corn syrup cannot replace sucrose in many food industry applications," he says. "The growth in liquid corn sweetener use is diminishing and probably is reaching a plateau."

*** Cyclodextrins.** Because of their ability to "capture" other molecules within themselves, thereby modifying their chemical and physical properties, cyclodextrins (donut-shaped carbohydrate molecules) offer a wide range of stabilizing and delivery applications across the chemical processing, pharmaceutical, personal care and food industries.

"First observed in the 1890s, cyclodextrins were known for years as high-priced laboratory curiousities," says George Reed of American Maize Product Company, Hammond, IN. "Now, after five years of research and development, American Maize has learned how to economically produce cyclodextrins from corn starch. Initial commercial sales are unfolding in photochemical and ag chemical markets, and we're currently working with the Food and Drug Administration (FDA) to gain clearance for cyclodextrins in pharmaceutical and food applications."

Cyclodextrins are molecular encapsulators which can modify the taste, texture, color and aroma of processed foods or shield highly reactive molecules from the degrating effects of heat, light and oxygen, for application in controlled, targeted or sustained-release delivery systems.

*** Corn starch encapsulation.** Using corn starch to encapsulate slow-release herbicides has proven effective, says Dr. R.E. Wing of the ARS-USDA Northern Regional Research Center in Peoria, IL. "Corn starch costs only 8 to 10 cents per pound, making it more economical than petrochemical-based carriers," Wing explains. "And it has the advantage of being FDA-approved for this purpose. We tried other starch-based agents, but found we had to add

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