Making Xylitol Sweetener From Corn

A low-calorie sweetener called xylitol may someday be made from corn.

Makers of some specialty brand sugarless chewing gums now pay about $3 per pound for xylitol, which gives their product a minty-cool taste.

"New technologies may drive production costs down and the volume up," says Timothy D. Leathers, an Agricultural Research Service geneticist at the National Center for Agricultural Utilization Research (NCAUR), Peoria, Illinois. He's researching a way to derive the sweetener from corn fiber leftovers of U.S. ethanol production. Currently, industry sells corn fiber and fermentation coproducts together as cattle feed for a few pennies per pound.

Xylitol, a white crystalline powder termed a sugar alcohol or polyol, is made in Finland from acid-treated fibers of birch wood by a chemical process. The process requires high pressure and temperature, an expensive catalyst, and extensive steps to remove byproducts. A biotechnological approach involving corn fiber should require less energy, says Leathers.

Expecting that beet and cane sugar will remain much cheaper than xylitol made from the xylose in corn fiber, Leathers envisions that the future of the alternative sweetener lies in niche markets. Already xylitol commands a $28 million market in foods for special dietary uses, mouthwashes and toothpastes, as well as chewing gums.

Xylitol has one-third fewer calories than conventional sugar but about the same sweetening power. Diabetics process it through the gut without involving insulin.

Researchers in the United States and abroad showed children's dental health improved if their chewing gum included xylitol. The sweetener allows harmless bacteria to crowd out common mouth microbes that digest normal sugars—the ones associated with tooth decay.

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Technician Melinda Nunnally examines an assay plate to determine which enzymes break down corn fiber.

Leathers began to brighten the prospects for making xylitol in the United States from corn nearly 10 years ago. He found that one strain of *Aureobasidium* yeast, in a process called hydrolysis, released up to 20 percent of the xylose from corn fiber that was treated with alkaline hydrogen peroxide. Since then, he's found a mixture of *Aureobasidium* enzymes that releases up to 70 percent.

He and his colleagues also developed a process using a strain of another yeast, *Pichia guilliermondii*, to convert the xylose into xylitol. To overcome a distracting problem called glucose repression (in which glucose slows or shuts down some microbial metabolism), the scientists used two teams of *P. guilliermondii*. The first team gobbled up all the glucose—its first choice in food—in the fermentation vat. Then the next team focused on consuming xylose to produce xylitol.

NCAUR chemist Badal Saha identified another promising strain of xylitol-producing yeast, *Candida peltata*. In spite of glucose repression, he achieved a 56-percent yield of xylitol from xylose in the mixture.

Saha and Leathers found that a xylose-related sugar, arabinose, induced no repression of xylitol production. The scientists envision genetic engineering that might enable the yeasts to produce xylitol from arabinose as well as from xylose.—By **Ben Hardin,** ARS.

The research is part of New Uses, Quality, and Marketability of Plant and Animal Products, an ARS National Program (#306) described on the World Wide Web at http://www.nps.ars.usda.gov/programs/cppvs.htm.

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