# Ethanol Prospects Rise with New Yeast

The Canadian discovery of a yeast with a healthy appetite for five-carbon sugars —such as xylose—may spell an eventual breakthrough in ethanol economics. Used in gasohol, ethanol has become a popular, albeit controversial, gasoline extender (SN: 4/12/80, p. 234).

Ethanol is produced by fermentation of cereal grains and other carbohydrate-rich materials. Standard fermentation yeasts thrive on six-carbon sugars such as glucose. However, such sugars make up only 40 percent to 50 percent of the material in many wood wastes and agricultural residues. As much as 25 to 35 percent of the remainder may be five-carbon sugars—totally ignored by discriminating yeasts.

This in part explains the reason many engineers scoff at claims that ethanol is an attractive fuel. For example, although corn is a popular ethanol feedstock, the American Society of Mechanical Engineers notes that "even the most modern corn-to-ethanol plants being planned or under construction using energy-conserving technology are expected to result in the production of ethanol with about a one-to-one overall energy balance. That is, the energy required to grow and harvest corn plus the energy required to produce ethanol at the processing plant is about equal to the heating value of the ethanol." But a yeast able to metabolize both five- and six-carbon sugars could tip the energy balance. According to the Solar Energy Research Institute (SERI), such yeasts could yield 50 percent to 80 percent more alcohol from the same raw materials.

And after a three-year search, last December Henry Schneider of the National Research Council in Ottawa discovered *Pachysolen tannophilus* to be just such an omnivorous diner. Boasting of his fungal find, the biochemist says, "It can ferment xylose into ethyl alcohol better than any other yeast."

Since December, Schneider has been cataloging some of *P. tannophilus*'s unusual dietary quirks. For instance, yeasts normally dine in an oxygen-poor or even oxygen-free atmosphere. But Schneider says *P. tannophilus* won't begin to eat unless it has "continuous access to air." Once the yeast grows and establishes a "heavy culture," however, the air supply can be shut off. And it ought to be, if alcohol production is one's goal, because this yeast has a natural predilection for the sauce. It will not only begin making alcohol, but also consuming it so long as the dining ambience remains aerobic. Luckily, once fermentation begins, turning off the oxygen does not turn off the production of alcohol.

Though it eats more, *P. tannophilus* is not yet as efficient as brewer's yeast—its main competition. The latter is able to obtain 95 percent of the theoretical yield offered by its six-carbon-sugar diet, Schneider says, while *P. tannophilus* has so far been able to harvest only 80 percent of its theoretical yield.

Already Schneider has received inquiries from companies "all over the world." He expects "within a year, for certain," that NRC will engage one of those firms in a joint venture to run comparison tests of *P. tannophilus* and brewer's yeast under conditions found in the commercial industry.

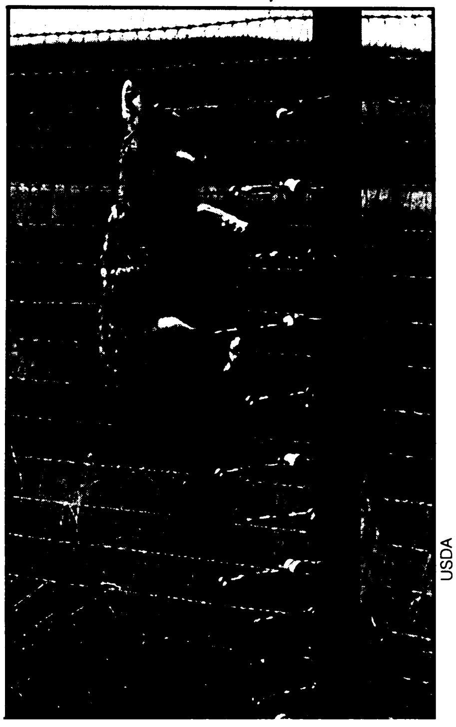
Initially the new yeast may not work as well or as fast as brewer's yeast, or it might find conditions that inhibit its efficiency. But Schneider says, "I'm hopeful that in about six months we'll get results about as good or better than brewer's yeast." And "the reason I can say these things without blushing," he told SCIENCE NEWS, is that there is ample precedent for expecting that more productive mutants can be selected "in pretty short time." Penicillin, he says, is a good historical example.

Some researchers have taken a different route — genetic engineering — in their search for a yeast that eats five-carbon sugars. At SERI, researchers are attempting to implant a gene for metabolizing them into brewer's yeast. When the program began a year ago, "We didn't have a source for the gene within yeast," Karel Grohmann told SCIENCE NEWS, "so what we did was take it from a bacterium." He won't divulge which strain for proprietary reasons. Grohmann says genes have already been successfully cloned. "The next step would be to move the genes into a yeast and see if you get expression." That feat is scheduled for September. □

# Compound 1080 ban: To be or not to be

A controversy rages where seldom is heard a discouraging word. At home on the range are cattle and sheep. So, too, are wild canine predators such as the coyote. The National Woolgrowers and National Cattlemen's Associations recently declared that predation of livestock by these wild canines has reached crisis proportions and that the U. S. Environmental Protection Agency should permit emergency use of predacide products containing the banned toxin Compound 1080. At least a dozen environmental groups disagree. The opposing parties clashed at recent hearings held by EPA to consider reinstating the use of the controversial 1080.

*Compound 1080 proponents say they have tried to no avail fencing out, trapping and shooting coyotes. But U. S. Department of Agriculture tests have shown that* electrified *enclosures keep canines out.*



USDA

Compound 1080—or sodium monofluoroacetate ($FCH_2COONa$)—is a white, crystalline, powerfully toxic powder. Its recorded LD50 (a statistical estimate of the dosage that would be lethal to 50 percent of a large sample of the test species) for coyotes is 0.1 milligrams of toxicant per kilogram of body weight, and its estimated human LD50 is from 0.7 to 2.1 mg/kg. Lethality is achieved mainly via 1080's ability to block the citric acid (Krebs) cycle—an essential process for converting food into energy. Previously, this lethal toxin was widely distributed throughout the West in meat baits: aqueous solutions of the compound injected into whole carcasses or pieces of horses, mules or sheep. In 1972, however, EPA banned such use of 1080 because of findings that it posed "unreasonable risk to humans and nontarget [and sometimes endangered] wildlife." The cancellation of registrations for 1080-containing products passed uncontested.

Now, however, spokespersons for the livestock industry claim herders need the compound as a predator control tool. Since the 1972 disallowance of the toxin, "there have been alarming increases in livestock losses to predators," says 1080 proponent Raymond M. Momboisse of the Pacific Legal Foundation. For example, "In 1971, Colorado sheep growers lost 7.7 percent of their lambs to predators; in 1974, they lost 16.5 percent," he says.

But these statistics are meaningless—often obtained by questionnares that depend on the memory of ranchers who