EPA honors a greening of U.S. industry

Picture a process that would enable farmers to raise livestock on treated grasses and field stubble as efficiently as they now raise them on corn, a costly grain. Or imagine converting a primary ingredient of Nutrasweet into the first biodegradable soil dispersant for laundry detergents.

These novel technologies are among the five recipients of the first annual Presidential Green Chemistry Challenge Awards. Selected from a field of more than 100 candidates, the winners received no money this week, just a pat on the back from Environmental Protection Agency Administrator Carol Browner for helping launch the nation's industrial ecology movement. This new approach to industrial design minimizes resource use and waste generation throughout a product's life cycle.

The Monsanto Co. of St. Louis was recognized for retailoring its synthesis of Roundup, the firm's popular herbicide. The company had been using hydrogen cyanide, ammonia, formaldehyde, and hydrochloric acid to create a needed amino acid. Making it with a novel copper catalyst instead reduced the toxicity of the process and decreased wastes from 1 pound for every 7 pounds of the amino acid to virtually zero, notes Monsanto chemist Thaddeus Franczyk.

Dow Chemical Co. of Midland, Mich., won for its 10-year development of a process to make sheets of polystyrene foam that employs carbon dioxide instead of hydrocarbons or ozone-depleting chlorofluorocarbons (CFCs). Though hardly a novel idea, developing a means of reliably extruding polystyrene while blowing density-reducing carbon dioxide bubbles into it proved quite difficult, says Gary Welsh, a chemical engineer on the project.

In making foam for egg cartons, retail meat and produce trays, and fast-food packaging, Dow's process has eliminated the equivalent of 3.5 million pounds of CFCs and related ozone-damaging chemicals since 1991.

Identification of a safer barnacle-killing agent for use in paints applied to the hulls of large ships brought Rohm and Haas Corp. of Spring House, Pa., its green chemistry award. Once the new isothiozolone migrates out of paint, it degrades quickly—within about 1 day in water or 1 hour in sediment. This breakdown is far shorter than the 9 days in water and up to 9 months in sediment typical of the tributyl tin oxide it replaces. Also unlike the tin, the new compound shows no long-term reproductive toxicity to marine life.

A small firm won another of the awards for creating a biodegradable substitute for the polyacrylates that make up about 5 percent of each box of laundry detergent. By imparting a negative electrostatic charge to loosened dirt, they prevent it from redepositing back onto other items in the wash. "About 4 billion pounds of this polyacrylate is produced around the world annually, and none of it is biodegradable," notes Larry Koskan of Donlar Corp. in Bedford Park, Ill.

By heating L-aspartic acid into long-chain molecules, then adding water and sodium hydroxide, Donlar now cooks up biodegradable polyaspartate. The polyaspartate also finds use on farms, where it enhances plant roots' uptake of fertilizer, and in industry, where it prevents the buildup of scaly calcium deposits inside water lines.

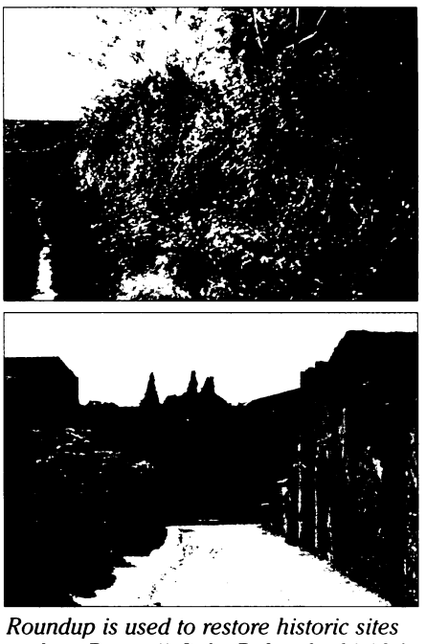
Cooking strawlike plant wastes with lime (calcium oxide or hydroxide) appears to remove acetate, more than doubling the plant material's digestibility for ruminants. Adding oxygen eliminates the similarly indigestible lignin in woodier wastes.

Mark T. Holtzapple and his group at Texas A&M University in College Station won their award for these findings and their application to as-yet-unpatented industrial processes that mimic a cow's fermenting rumen. With them, Holtzapple says, bioreactors should be able to economically create solvents, high-grade alcohol fuels, and feedstocks for plastics.

EPA needs to encourage environmentally beneficial change in a nonregulatory way, says Bruce Piasecki of Rensselaer Polytechnic Institute in Troy, N.Y. That, he suspects, is "a hidden message behind the new green chemistry awards."

— J. Raloff

Monsanto Co.



Roundup is used to restore historic sites such as Pompeii, Italy: Before herbicide's use (top) and after (lower).

Gene tells fruit flies how to wing it

This hapless fruit fly has wings growing out of its large, tomato-red eyes. The stubby gray wings don't help the insect fly—they can't even move—but biologists are abuzz over the laboratory feat.

"We've turned one kind of tissue into another," says study leader Sean B. Carroll of the Howard Hughes Medical Institute at the University of Wisconsin-Madison.

Carroll says he was surprised that a single gene—not several—was enough to spark the formation of a major structure like wings. He and his colleagues activated the gene, called vestigial, *in regions of embryonic flies that don't normally form wings. In the resulting adult flies, wing tissue developed in eyes, heads, antennae, or legs.*

The researchers had to limit where they activated vestigial, *Carroll notes, to prevent wing tissue from sprouting all over the fly.*

The team's goal wasn't to design winged freaks, however. The discovery, reported in the July 11 NATURE, *is intended to help unravel the genetic tangle behind the development of such complex animal structures as claws, arms, legs, and tails, all of which form out of the seemingly uniform tissue of embryos. The report also shows that although* vestigial *alone can prompt wing tissue growth, a number of other genes must respond to its initial signal.*

— E. Skindrud

Carroll et al./NATURE