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Converting Garbage into Biofuels

There is no doubt that the current high price of fossil fuels is driving the current quest to find new environmentally friendly alternatives. Because of government incentives and physical demand, we now convert 20 to 25 percent of our corn crops into ethanol biofuels.

There is a major negative side to this ethanol boom. Corn ethanol has driven the supermarket prices of milk, eggs, poultry, beef, and pork to new heights simply because diverting corn to ethanol production drives up the price of the remaining corn that feeds the animals that are the backbone of our food supply.

▲ Photo 1

◀ Photo 2

Photos courtesy Coskata

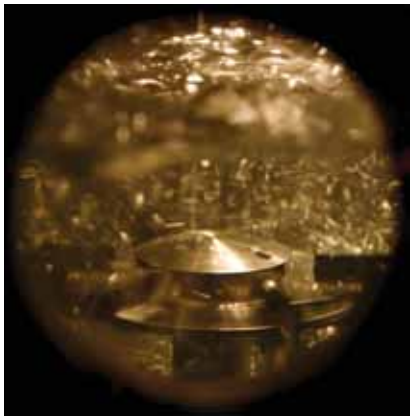

Photo 3 ▼

What we need is a modern-day alchemist who has the ability to turn garbage and other discarded petroleum-based products into biofuels. Such a technology could turn our landfills into gold mines, clean up our environment, and help us gain independence from foreign oil.

The scientists and engineers at Coskata Inc. are now ready to build a new factory that can actually perform this alchemist trick. Their bioreactors can convert garbage, old tires, plastic containers, paper, and agricultural waste into 99.7 percent pure fuel-grade ethanol.

Coskata's process first uses gasification, a high-temperature oxygen-empowered process to convert any carbon-based material into a synthesis gas called *syngas*. This gas is the food stock of the company's ethanol process, and it contains carbon monoxide, hydrogen, and carbon dioxide. The next step in the process uses designer microbes and bio-fermentation to convert the syngas created by gasification into ethanol.

The Coskata scientist in Photo 1 is performing his work with his hands and arms inside an anaerobic chamber. He is actually seeding new cultures, checking the growth of other cultures, and testing the viability of still other cultures that other scientists have already created to convert syngas into ethanol. The anaerobic chamber is an oxygen-free environment with an atmosphere that matches syngas, the environment in which the bacteria in the chamber that prove most viable will eventually feed and live.

The proprietary microorganisms that show the most efficiency for converting syngas into ethanol are then transferred from this chamber into a bioreactor fermenting tank (Photo 2). Here they will eat (bio-ferment) the syngas and excrete an extremely pure ethanol at a cost of about a dollar per gallon.

Photo 3 shows a camera's eye view through the window of the bioreactor fermenting tank. You are actually seeing the bacteria cultures growing on the special scaffolding found inside the tank. The fibers in the scaffolding deliver the syngas to the bacteria. Water and other nutrients are also supplied to create a comfortable living environment for the bacteria. As they eat and digest the syngas, the bacteria produce ethanol as their biological waste.

At this time, the scientists at Coskata breed their microbes to improve their ability to convert syngas into ethanol. They hope, in the near future, to start genetically engineering these microbes into even more efficient microbe strains. The company is now ready to ramp up production so it can manufacture ethanol in the quantities that our society desperately needs. GM, one of the main backers of Coskata, expects that this process will soon be turning all kinds of biomass into 40,000 gallons of ethanol a year.

Recalling the Facts

1. How has the current ethanol boom affected supermarket prices?
2. Describe the gasification process.
3. What takes place in the Coskata bioreactor?

Alan Pierce, Ed.D., CSIT, is a technology education consultant. Visit www.technologytoday.us for past columns and teacher resources.