technology TODAY

August 2001

Alan Pierce
Technology.Today@worldnet.att.net

Bioprocessing Corn into Plastics

IN the mid-1970s, a British chemical company started producing plastic from a natural bacterium. Their goal was to find a way to make plastic without using the limited resource petroleum.

Using a special diet of organic acids, they turned their bacteria into miniature plastic manufacturing machines. Their bacteria produced a very poor grade of plastic but proved that an environmentally friendly (biodegradable) plastic could be produced from a natural, renewable resource.

Researchers soon turned to genetic engineering to improve plastic quality and production from a number of different biological renewable resources. The plastics produced to date, by genetic engineering, have been very expensive and of limited use.

Dr. Patrick Gruber, a chemist at Cargill Dow, took another path, and his corn-to-plastic process will now provide the raw plastic pellets that many manufacturers already plan to use to produce biodegradable surgical implants, plastic bottles, plastic packaging, fibers for clothing, carpeting, and even water-based paint emulsions.

This plastic, made from corn, goes by the name NatureWorks PLA. The PLA is short for *polylactide polymer*. Dr. Gruber is currently Vice President and Chief Technology Officer of Cargill Dow LLC, located in Minnetonka, MN.

At a news conference, I asked Dr. Gruber and Mr. O'Brien (a Cargill Dow Communications Officer) if they felt the boycott of genetically engineered crops would negatively affect the acceptance of their process. I learned that their award-winning process is not based on genetic engineering.

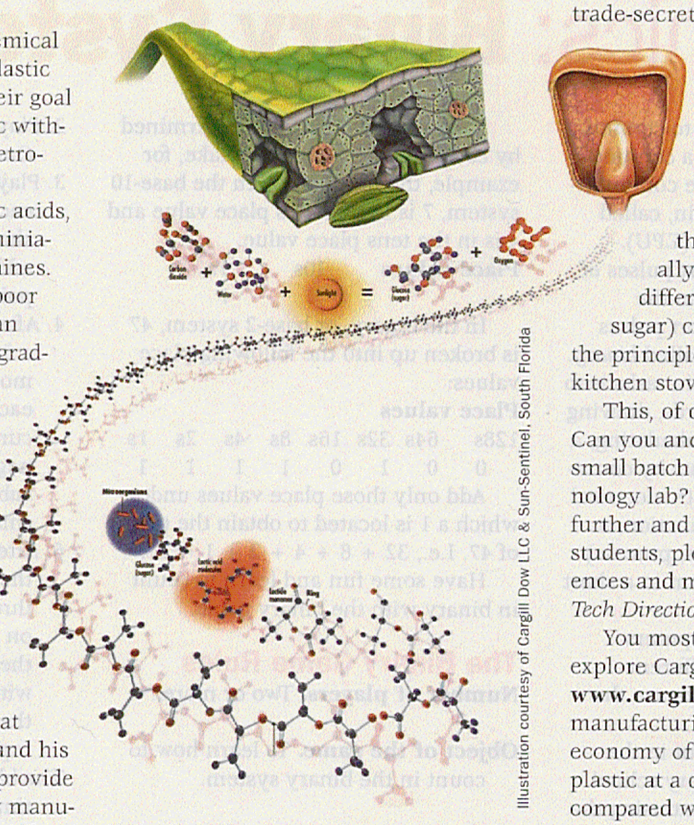

Illustration courtesy of Cargill Dow LLC & Sun-Sentinel, South Florida

Making plastic: From cornstarch to lactide monomer rings to polylactide polymers.

Their process first converts ordinary cornstarch (no need for genetic engineering) into sugar, which is then fermented to convert the sugar into lactic acid. The next step of their process heats the lactic acid, changing it into lactide monomer rings. A trade-secret polymerization process converts the rings into long chains of polylactide polymer.

Dr. Gruber envisioned this process 10 years ago while looking for other uses for corn. He indicates that the process will eventually harvest plastic from many different high-dextrose (natural sugar) crops. He actually proved the principle behind the process on his kitchen stove.

This, of course, raises the question, Can you and your students whip up a small batch of this plastic in your technology lab? If you research the process further and try to duplicate it with your students, please document your experiences and mail them to the editor of *Tech Directions*.

You most certainly will want to explore Cargill Dow's site at **www.cargilldow.com**. Tour their new manufacturing plant that, through economy of scale, will produce this plastic at a competitive market price compared with petroleum-based polymers. Cargill Dow has already received numerous awards for this breakthrough achievement in bioprocessing.

Recalling the Facts

1. What is the most significant difference between petroleum-based plastic and NatureWorks PLA?
2. Describe how PLA is made from corn.
3. Why is NatureWorks PLA considered to be an environmentally friendly plastic?