

Cornell Researchers Explore Way To Turn Biomass Waste Into Gasoline Replacement

SAN FRANCISCO, Calif. — Worried by rising gas prices? Top off the tank with paper pulp. Fill 'er up with maple chips. Drive down the freeway using cheese whey.

As average U.S. gasoline prices soar beyond \$1.80 a gallon, proponents of using bio-based fuels and chemicals are gaining momentum.

Gasoline-replacement research in the past has focused on ethanol derived from corn, but now agricultural engineers are beginning to understand how biomass waste also can be used as a substitute for petroleum.

Larry Walker, Cornell professor of agricultural and biological engineering, and his students are using enzymes to break down solid biomass waste into a renewable energy form. In a talk at the American Chemical Society national meeting in March at the Moscone Convention Center, San Francisco, Walker said there is sufficient biomass waste available to supply all of the organic chemicals that are consumed annually in the U.S. and still have enough waste left over to convert to auto fuel.

"We need renewable resources, and energy flow. How do we develop alternatives to petroleum-based products? We do this through plant materials," said Walker. "Bio-based fuels are recyclable. Fossil-based fuels are not."

Although waste biomass is a cheaper raw material than oil, there is a catch. The cost of converting this raw material to energy is the major constraint to commercialization, according to Walker. The plant biomass is chemically diverse, and it must be separated then converted into desired products. The challenge, he explained, is to develop industries proficient in using this raw material and to develop more cost-effective enzymatic and microbial processes that convert these materials into industrial chemicals and energy.

Walker explained the principles behind biomass fuel:

Carbon dioxide is taken in by the plant through metabolism, and carbon enters plant cells where it is converted into cell walls. About 279 million metric tons of plant waste is generated in the U.S. annually from indus-

trial, commercial, and agricultural production. The key to using this resource lies in employing enzymes to break down the woody, fibrous part of the material into fermentable sugars.

Caroline Corner, Tina Jeoh, and Hyungil Jung, graduate students in agricultural engineering in Walker's Cornell laboratory, are studying the use of enzymes from thermophilic (heat-loving) bacteria to break down the cellulose in plant waste. The bacteria produce six enzymes called cellulase which attack the biomass through a process called hydrolysis. This allows the enzymes to process the cellulose into fermentable sugars, permitting scientists to produce fuel or industrial chemicals. Walker likens the action of the cellulase enzymes in breaking down the fibrous lignins (the binding in plants) to a "tag-team Pac Man moving along the cellulose fiber."

Dairy Farmers Of America To Hold Second Meeting

KANSAS CITY, MO—Dairy Farmers of America (DFA) will hold its second annual meeting at the Hyatt Regency Crown Center in Kansas City, Missouri, on April 10-11. Attendance at the two-day meeting is expected to top 1,500 dairy farmers and guests from across the nation. This year's meeting theme is "Beyond 2000" as the farmer-owned cooperative focuses on ways to help dairy farmers compete profitably in a competitive and rapidly changing industry.

In addition to the business meeting, this year's event features an expanded Dairy Bar and Trade Show with informational product and marketing displays by DFA's operational divisions and service units. Elsie the Borden cow will make a guest appearance on behalf of DFA's Borden Cheese division and in recognition of the famous icon's 60th year promoting quality Borden products. Joining Elsie will be Jim Cavanaugh who helped select the first Elsie at the 1939 World's Fair.

The meeting begins at 1:00 p.m. on Monday, with a general session featuring presentations outlining accomplishments of the dairy marketing cooperative by DFA Chairman Herman

Brubaker and President and Chief Executive Officer Gary Hanman. In addition, Charles Beckendorf, chairman of DFA's Finance Committee, will present the financial report of the organization's second year of operation.

A banquet Monday evening features Rep. Roy Blunt (R-MO) as the key note speaker outlining legislative challenges facing the dairy industry in the year ahead. In addition, DFA's Borden Cheese Division will announce the "Calling all Elsie's" contest winner. The winning DFA member farm couple receives an expense-paid trip to New York City where Elsie made her debut at the 1939 World's Fair.

Tuesday morning, the general session reconvenes with the DFA member delegate body discussing and voting on resolutions submitted by members in DFA's seven Area Councils. The resolution process gives members at the grass roots level an opportunity to have input in development of DFA positions on issues and policies that affect the dairy industry. The meeting concludes with a "question and answer" session with DFA executives. Adjournment is scheduled for 3 p.m., Tuesday, April 11.



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