OVERCOMING THE CHALLENGE OF CHEAP SUGARS

Unmarketable Hawaiian Papaya Used to Produce Green Fuels

1. What are green fuels?

Green fuels are a category of fuels within the larger family of biofuels. Like other biofuels, green fuels are produced using different types of renewable feedstock. However, their processing technology and chemical formula make them closer to fossil fuels.

Green fuels are sourced from a variety of oils such as canola, jatropha and algae. When these oils are refined using the Ecofining process commercialized by UOP, they become an excellent chemical substitute to the whole barrel of crude oil and allow for the production of a wide range of products including asphalt, green diesel, green gas, green jet-fuel and solvents.

The chemical similarity of green fuels and fossil fuels has several advantages. Unlike ethanol or biodiesel which must be blended with fossil fuel in various proportions, green fuels can be used as they are in existing engines without any modification. Further, green fuels can be transported, stored and distributed using existing channels, which is not the case of ethanol or biodiesel because of their corrosiveness.

Green fuels have another advantage over fossil fuels. Since they are produced from an organic source, they have lower sulfur content and thus do not require the costly step of desulfurization that all fossil fuels must go through.

2. What is the technology licensed by Evolugate?

The technology licensed by Evolugate is an automated apparatus for the continuous culture of microorganisms under controlled conditions. The Evolugate technology offers tremendous possibilities for all the industries relying on living microorganisms in their production processes. With this technology, BioTork can improve the economics of many biofuels production processes. Those Improvements can be achieved in different ways depending on the type of limitations the processes suffer from. It could be increasing the tolerance of microorganisms to certain inhibitors such as heat, ethanol concentration or others. It can also be adapting the microorganisms to process more sugars from the feedstock notably xylose and arabinose, or finding a way to use wasted byproducts including bagasse, seedcake and raw glycerol.

The Evolugate technology is patented by the USPTO (Patent No: 7,939,315) and BioTork has acquired the exclusive worldwide license for biofuels applications from Evolugate.

3. How big is papaya production in Hawaii? How can this project help the farmers?

Papaya is the second largest food crop in Hawaii (1). By mid 90's the papaya ringspot virus almost killed the industry but public sector scientists from Cornell University, University of Hawaii and USDA took extreme measures to save what could be saved (2). Today there are close to 200 papaya farms in Hawaii with an average size of 10 acres and a production of 32 million pounds (3). Although papaya consumption is increasing in mainland U.S. and worldwide, Hawaiian papaya did not recover its pre 90's production levels because of a fierce competition from Mexico, Brazil and the Philippines (4). On top of that, for every pound of papaya produced in Hawaii, it is safe to say that close to another pound is either left on the tree or culled at packing houses (5). Every year, around 16 million pounds of papaya is wasted for purely cosmetic reasons. This loss is entirely borne by the farmers. The BioTork/PBARC project has the ability to turn a liability (wasted papaya) into a source of income for the farmers. Today, the farm price for a pound of papaya ranges between 20 and 50 cents per pound. An economic model has yet to be built, but the papaya farmers' income can be increased by revenues from the sale of culls that are now wasted.

4. What is the strategic importance of green fuel development projects for the State of Hawaii?

Hawaii is located approximately 2,506 miles from continental United States. At any given time the islands have a petroleum supply of 14 to 21 days (6). Knowing that 88% of its energy needs are met by imported petroleum, Hawaii seems particularly vulnerable to events that can disrupt shipping. Further usage of petroleum in the state of Hawaii is much more different than any other state, which makes its situation even more complex. Imported petroleum in Hawaii is used as follow: 34% for air transportation (9% in mainland US), 32% for electricity (1% in mainland US) and 27% for ground and marine transportation (7). These figures make Hawaii the most petroleum dependent state in the US and the recent fluctuations in petroleum production levels and prices will affect the tourism industry (air transportation) and the quality of living in Hawaii (electricity and food supply). Actually, the cost of 80% of goods sold in Hawaii is linked to the price of fuel (6). Local alternatives must be found to reduce this weakness and green fuels from Hawaiian biomass represent one alternative to a serious situation.

5. Can this project be conducted with other types of fruit and vegetable culls?

Yes, definitely. According to Biofuels Digest, DOE Secretary Steven Chu is fond of saying that "Sugar is the new oil." What it means is that if an abundant source of sugars can be secured at a cheap cost, these sugars can be converted into lipids that will replace the petroleum barrel. Biomass is the most abundant source of sugars on the planet and has the potential to provide enough energy for the whole planet as long as the sugars it contains can be converted to lipids. BioTork has the capacity to adapt different types of microorganisms to process the sugars of any type of biomass such as perennial crops, woody

biomass, fruits and vegetable culls, industrial by-products and municipal wastes. Developmental research projects like the one conducted with PBARC is a great step towards energy security for Hawaii and the United States, and a major contribution to the economical viability of many industries.

References:

(1) Food and Safety Network, 2003: "The Culture of Papaya in Hawaii" retrieved November 30, 2011 from http://foodsafety.kstate.edu/articles/533/ge_papaya_factsheet.pdf

(2) Komahana Research and Extension Center, University of Hawaii at Manao, 2008: " Pest Management Strategic Plan for Papaya Production in Hawaii", retrieved November 30, 2011 from www.ipmcenters.org/pmsp/pdf/HIPapayaPMSP.pdf

(3) USDA-Natioal Agriculural Statistcs Service, 2010: "Hawaian Farm Fact, July 2010", retrieved November 30, 2011 from www.nass.usda.gov/Statistics_by_State/Hawaii/Publications/Fruits_and_Nuts/annpapFF.pdf

(4) Amy Peasant, 2003: "Market Outlook Report: Fresh Papaya", retrieved November 30, 2011 from http://hawaii.gov/hdoa/add/research-and-outlook-reports/papaya%20outlook%20report.pdf

(5) Department of Tropical Plant & Soil Sciences-University of Hawaii at Manoa: "Farmer's Bookshelf" retrieved November 30, 2011 from http://www.ctahr.hawaii.edu/fb/papaya/papaya.htm

(6) Theodore Peck, Hawaii State Energy Office, 2009: "Hawaii Clean Energy Initiative" retrieved on November 30, 2011 from www.pbcp**hawaii**.com/_library/documents/TheodorePeck.ppt

(7) Rochester History Resources, University of Rochester, retrieved on November 30, 2011 from http://www.history.rochester.edu/class/hawaii/home.htm