Biofuels for Sustainable Energy Future

Research is continuing on the hog-waste-to-bio-oil studies, with the aim of eventually commercializing the technology. This could mean that the 15 million tons of swine waste annually produced in North Carolina could be converted to about 67.7 billion gallons of crude bio-oil, which could be processed into transportation fuels, bio-binders for use in road paving, fertilizers, or other bio-based products. Once they are commercialized, bio-based products from animal waste will have a significant impact on the hog industry, the environment and the economic opportunities for North Carolina farmers.

Who cares and why?

North Carolina imports approximately 5.6 billion gallons of liquid fuels each year. Agricultural researchers at North Carolina Agricultural and Technical State University (N.C. A&T) are helping the state move closer to its strategic goal of replacing 10 percent of these imports with biofuels, developed from biomass produced entirely within the state, by 2017. Biomass is any non-food biological material from plant or animal origin. In the process, N.C. A&T scientists in the School of Agriculture and Environmental Sciences are helping to introduce new non-food biofuels crops for use as feedstocks, while also aiming to find a profitable use for the 15 million tons of hog waste produced per year, an environmental issue that has troubled the state for two decades.

What has the project done so far?

Several years of USDA/Evans-Allen Program funded studies have demonstrated the potential of converting swine waste and other forms of biomass, including cattails, into liquid biofuels and other bio-based products, including a bio-asphalt for use as road-paving or construction adhesives. A spin-off company, Bio-Adhesive Alliance, has been established at N.C. A&T with the goal to commercialize a process that replaces petroleum-based binders in asphalt with converted waste from the hog farms in North Carolina. The hog waste-based binder could cost about one-quarter the amount of the petroleum binder, and generate fertilizer ingredients as a by-product. Another new direction in biofuels research at N.C. A&T sees scientists studying ways to convert miscanthus grass, wood waste or municipal solid waste, into liquid hydrogen for use in fuel cells, as well as other transportation fuels. This new direction is funded by the National Science Foundation, and being carried out by an interdisciplinary team of scientists in the NSF-CREST Bioenergy Center.

Published studies to date indicate that co-hydrothermal liquefaction of swine manure with organic additives could be a cost-effective method for obtaining bio-oil that has a heating value of five times the value of the raw biomass. The resulting heavy oils could be used for boiler fuel or refined further into other liquid fuels.

At N.C. A&T, research on cattails demonstrates that diluted sulfuric acid pre-treatment and subsequent fermentation with the yeast *Saccharomyces cerevisiae* (ATCC 24858) could be a cost-effective method for producing cellulosic ethanol. The yield was approximately 88.7 percent of the available sugars and an economic model indicated the final product could have minimum ethanol selling price

(MESP) of $2.28. Researchers also have reported that cattails harvested in the fall have the highest cellulose and xylan content, and therefore the highest ethanol production. These findings suggest that cattails, if they could be harvested sustainably, possibly from constructed wetlands, could be a viable source of cellulosic ethanol. N.C. A&T research is showing how to convert miscanthus grass fertilized with swine waste, wood waste and municipal solid waste into syngas vapors, which, in turn are being converted to hydrogen fuels and liquid transportation fuels.

Impact Statement

Research on cattails, studies demonstrate that diluted sulfuric acid pretreatment and subsequent fermentation with the yeast *Saccharomyces cerevisiae* (ATCC 24858) could be a cost-effective method for producing cellulosic ethanol.

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What research is needed?

More research is being conducted involving the conversion of miscanthus grass fertilized with swine waste, wood waste and municipal solid waste into syngas vapors, which, in turn are being converted to hydrogen fuels and liquid transportation fuels.

Want to know more?

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Additional Links:

http://www.ncat.edu/research/bioenergy/index.html; http://www.ncat.edu/academics/schools-colleges1/saes/index.html
http://www.ncat.edu/academics/schools-colleges1/saes/agresearch/researchmag/index.html

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