Bio-oil and other *valuable* products *from* poultry manure and litter

By Treena Hein

Project in Nova Scotia prepares for start-up.

In order to better dispose of manure and slaughter waste, ACA Co-operative Ltd., a large egg and broiler producer/processor in Kentville Nova Scotia, has purchased a pyrolysis-gasification unit from Advanced BioRefinery Inc. of Ottawa. ACA markets 45 poultry products and 13 egg products, many under the Eden Valley Farms brand.

After the pyrolysis process, the bio-oil is gasified into mostly carbon monoxide (CO) and hydrogen (H) and burned in a diesel generator engine. About 50 percent of litter-manure put into the pyrolysis system can be turned into bio-oil at 80 percent efficiency.

Gerry Kennie, ACA's vice-president of agriculture, says the technology, which will be delivered at the end of the year, will address some long-standing environmental issues.

"We initially started looking at better ways to dispose of waste products such as poultry manure and plant offal," he says. "It is getting more difficult to put manure on some of the soils in this area as they are becoming saturated from many years of animal manure being applied to them. Environmental Farm Plans are being completed for farming operations and these identify the need for sustainable methods of disposal of livestock manure."

Advanced BioRefinery's system attracted ACA because it is designed specifically for poultry operations, Kennie explains.

"This technology will reduce the amount of poultry manure being applied to agricultural lands, which is a positive from an environmental aspect. It will also provide a product, which can be burned in a modified furnace to provide heat for buildings," says Kennie.

"Our goal is to work with this relatively new technology and further develop it to reduce our dependency on the practice of putting animal manures on farmland that cannot support it while, at the same time, provide a product that can be used in a commercial application of supplying heat."

Peter Fransham, president of Advanced BioRefinery Inc., says nutrient management concerns and providing income from a perceived waste are the major reasons why his company has researched and developed this technology. It evolved from previous work with wood-based systems.

"There is increasing competition for Canadian farmers," he says. "Energy prices are increasing, especially for the chicken broiler industry, because the barns must be ventilated as the chickens mature, they must be kept warm in the winter, day-old chicks must be kept warm, etc."

In addition to the increasing cost of power, Fransham predicts that poultry producers may face increased competition in the future through removal of Canadian marketing boards. This would force Canadian broiler farmers to compete internationally with very large companies. His company's pyrolysis-gasification technology could help poultry farmers remain competitive.

Fransham stresses there's little use in new agricultural technology that requires a major on-going time and energy investment by producers. "The goal of the project is to turn a perceived waste into a revenue stream with cost return achieved in five years or less with minimal work and time investment for the farmer on a permanent basis," he says. "Combined pyrolysis and gasifier systems are coming to economic feasibility for farmers."

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The pyrolysis/gasification system is currently being constructed in Ottawa. Cost of the 15 foot by 30 foot machine is expected to come in under $150,000. Fransham says this size of system is suitable for an average-sized operation of 70,000 to 100,000 birds. Partners in the research and development have included Agriculture and Agri-Food Canada (AAFC), Natural Resources Canada, the National Research Council, Laplante Farms and Verido Ltd. The Farm Pilot Project Corporation, based in Florida, provided the initial research funding.

How the technology works

The first step of the process involves placing the litter-manure into a hopper,

Before the pyrolysis process can begin, the poultry litter needs to be reduced from about 25 percent moisture content to 10 percent.

The char powder left after the pyrolysis process is completed is separated, stabilized and placed into barrels or bags. It is intended for use as fertilizer, boasting proportions of 4-4-5.

where its moisture content is brought down from about 25 to 10 percent. The material is then placed in the reactor, where it undergoes pyrolysis (rapid heating in an oxygen-depleted environment). The products are char, gas and bio-oil. Fransham says it is useful to think of the system as a distillation process. "We're distilling all these chemicals that become a fuel."

The three products are separated very quickly. "The bio-oil and gas come off together, and condense out of a pipe into a liquid," explains Fransham. "What doesn't condense is the gas (methane, carbon monoxide, carbon dioxide, and hydrogen), which is used to generate process heat in a small furnace." This heat is also used for initial moisture removal.

The char powder left over is separated, stabilized and placed into barrels or bags. It is intended for use as an income-generating fertilizer, boasting fertilizer proportions of 4-4-5.

In the second step, the bio-oil, which has a similar heating value to propane, is gasified into mostly carbon monoxide (CO) and hydrogen (H) and burned in a diesel generator engine.

"The combustion of this gas produces all the heat and power needed on the poultry farm," says Fransham. He notes 50 percent of litter-manure put into the system can be turned into bio-oil at 80 percent efficiency.

Besides providing on-going nutrient management, the system provides income in a flexible manner. "The advantage of our process is that we can adjust the unit so that it produces the maximum amount of the maximum value product," says Fransham. "If char is providing the best profit at the time, we can maximize char output. By tailoring these things within a certain range, we can provide the maximum return for the individual farmer."

This tailoring is accomplished mostly through temperature control. "The higher the temperature, the more gas we produce," says Fransham.

Advanced BioRefinery is also working on additional systems designed to maximize farmer income from agricultural waste. Fransham says his company is partnering with AAFC scientists to refine methods for extracting phosphorus and other high value chemicals from bio-oil prior to burning. "The world supply of phosphorus is limited," he says. "There is also potential for pharmaceutical products to be derived."

The company also recently received approval to build a 50 ton per day unit in Saskatchewan in partnership with Titan Clean Energy Projects and with government support. The unit will accept oat hulls, and the fuels generated will be sent to mining operations in the northern region of the province to offset fuel requirements there. MM

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