MAKING 'GREEN' ETHANOL

Canadian facility produces food-grade cellulose ethanol from pulp residuals

by Susan Reidy

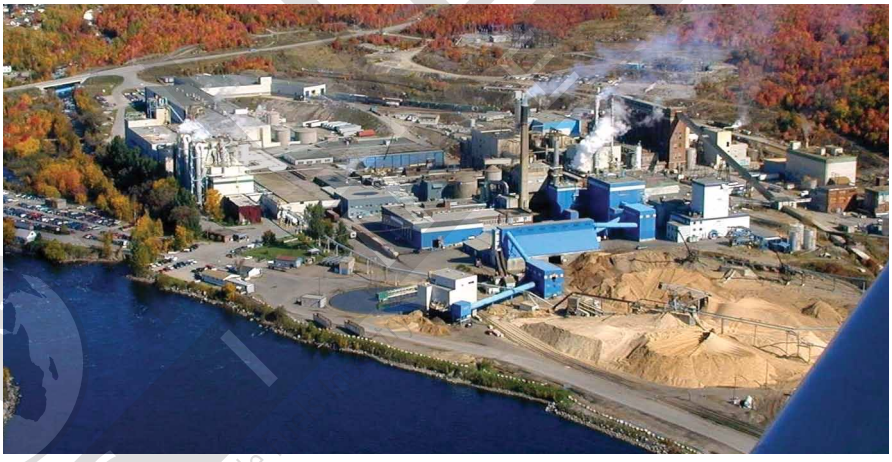
While others search for the solution to produce commercial amounts of cellulose ethanol, Tembec, Inc. has been quietly producing it in Canada.

The integrated forest products company jumped into the ethanol market in 1991 to capture the added value from the residual stream coming off its pulping process.

"The pulp was going to market, but everything else in the tree – the sugar and lignin – was underutilized and had to be environmentally treated," said Randy Fournier, senior vice president, chemical products group, Tembec, Montreal, Quebec, Canada.

Tembec's Tamiscaming, Quebec, Canada facility produces food-grade ethanol for serving the vinegar market in Eastern Canada. When the facility was first built, there was significantly less market interest in fuel ethanol compared to today. Thus the plant was sized to a capacity of 18 million liters to fit better with the food market.

"The food-grade markets are more specific," Fournier said. "It's an order of magnitude that allows us to compete. If we were fuel grade, we would be one of, if not the, smallest facilities in North America."



Tembec produces food-grade ethanol at its Tamiscaming, Quebec, Canada site using specialty pulp from the facility as a feedstock. Photo courtesy of Tembec.

MAKING ETHANOL

Tembec operates facilities in North America and France with total sales of $2 billion and 6,000 employees. It has more than 30 manufacturing units and produces wood products, pulp, papers, paperboard and chemical products.

Ethanol falls under Tembec's Chemical Products Group, which was established to create value-added products from its pulping process and eliminate the environmental impact surrounding disposal.

KATZEN International, Inc. designed the ethanol process for an earlier facility built in the 1960s, and then upgraded and expanded the process design and technology in the 1980s. Fournier said the amount of ethanol produced varies depending on the wood type and volume of residuals coming from the company's pulp mill.

"This is a product that would have ended up in a waste stream," Fournier said. "We're able to get another piece of the tree into the market, into a different value chain."

The facility uses residuals from its specialty pulp plant to produce the ethanol. Overall, Tembec's pulping capacity is 1.92 million tonnes, of which 430,000 tonnes is specialty cellulose and fluff pulps. Specialty pulps are used for non-paper purposes such as producing rayon for clothing and cellulose capsules for pharmaceuticals.

In the specialty pulp process, there is a greater liberation of sugars from the wood chips, Fournier said, which

makes it ideal for producing ethanol.

During the pulping process, wood chips enter a digester where they are broken down into pulp and a residual stream of chemicals, sugar and lignin. The pulp goes in one direction and the residual stream comes to the ethanol plant, Fournier said.

"We concentrate the stream up to a level that is fermentable, put it through three separate fermenters in the presence of yeast," he said.

The yeast consumes the sugar, producing the ethanol that is stripped off and distilled to a concentration of 95%, Fournier said. The residual lignin is further concentrated and used as an energy source to fire the plant's boilers or sold into lignolsulfonate markets for use in other value-added products.

"We do believe that we have a truly green ethanol," Fournier said. "We take something that was underutilized within existing infrastructure and capitalize upon it."

Tembec uses the "green" aspect to its advantage when marketing its finished ethanol.

Vinegar is a key market for Tembec's ethanol, where it is further fermented into dilute acetic acid. It also is used as a solvent in a variety of industries including pharmaceuticals, cosmetics, hygenic products and food processing.

Although its ethanol is food-grade, fuel ethanol producers can learn from Tembec's experiences, said Phil Madson, president of KATZEN. For one, it shows that high-level integration maximizes the value of all resources and co-products.

"Tembec's food grade ethanol is produced by a more sophisticated distillation process than is required to make fuel grade ethanol," Madson said. "The high-quality, high-value markets are very small compared to the fuel market. However, Tembec's experience proves that high value can be achieved, if by-products are managed as a bona fide business."

For Tembec, expanding ethanol production is directly tied to the facility's pulp capacity right now, Fournier said. The company has researched other cellulose technology, but each had a fatal economic flaw, he said.

"We will one day expand, but it will be when the economics allow for it," Fournier said.

CELLULOSE'S FUTURE

Part of its cellulose research has been in making ethanol from timber harvesting waste, he said. The company has had success in the lab, but the economics don't make sense to scale up to commercial levels.

"We're in an industry (pulp, paper and forest products) that must continue to focus on initiatives to improve the over-

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all rate of return," Fournier said. "If we can find complementary products that allow us to improve our bottom line, we're all for it."

Timber operations would be the logical participants in a wood-to-ethanol industry, Madson said. Few cellulose feedstocks are as competitive as pulp waste, he said.

"Municipal solid waste may represent a very low (or no) cost feedstock, but there will be no existing infrastructure to supply steam or power," Madson said. "The investment cost would be greater than bolting on a pulp waste plant at a pulp and paper mill."

Examples of two key economic hurdles, Fournier said, are the cost of enzymes used in the cellulosic ethanol process and the recovery of those costly enzymes.

"We'll let the researchers continue to chip away on the how. Once they've identified it, we will add on to our facility and use more of the forest residue than we do today," Fournier said. "Once we have an economic process as opposed to a scientific process, the infrastructure is already in place for us."

Existing infrastructure is an advantage for anyone already involved in biomass.

"I think the cellulosic ethanol success story will come from three walls and a roof, which means you bolt onto an existing facility versus blazing a completely new path as a stand-alone facility," Fournier said.

Fournier said without government support, stand alone cellulose ethanol facilities are a ways in the future. Not that government support or mandated blending levels are the answer, he said.

"Our business is not predicated on the government setting the floor price for ethanol or on the need to use a certain amount of ethanol," he said. "Look at the ethanol plants that started in the last five years and went bankrupt. That's a good indication of what happens when basic commercial principles are lost."

Tembec's view is that cellulose ethanol does have a future, but many economic conditions have to be addressed before commercial operation makes sense. He said research has come far enough that the most significant hurdles inhibiting commercial success should be objectively identified, and funding put toward resolving those specific issues.

"Government support should be given to working on parts of the process that kill the economics as opposed to a bunch of start-ups trying to do the same thing," Fournier said. "Some of the current cellulose research is hampering the ability to come out with a process that works because we've got the money diluted across too many ideas." BFB

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