Converting CO2 into High Value Renewable Chemicals

27 billion metric tones of carbon dioxide are being emitted each year. Using renewable energy, Mantra's Electroreduction of Carbon Dioxide (ERC) technology combines captured CO2 with water to produce high value materials, including: formic acid, formate salts, oxalic acid, and methanol. In addition, companies adopting ERC stand to make significant profit from its by-products.

Formic acid, for example, currently sells for $1,450/ton into a 600,000 ton market – an $870M marketplace.

In November 2007, Mantra acquired the 100% outright ownership of a chemical processing technology developed by the University of British Columbia's Clean Energy Research Center, entitled the Electroreduction of Carbon Dioxide (ERC). Powered by electricity, ERC combines captured carbon dioxide with water to produce high value materials that are conventionally obtained from the thermochemical processing of fossil fuels, including: formic acid, formate salts, oxalic acid, and methanol.

Mantra successfully completed a prototype capable of processing 1 kg of CO2 per day in Oct. 2008, and its first commercial scale reactor is schedule for completion by Q2 2010. In the spring, Mantra announced that it was in final negotiations with KC Cottrell to construct its first commercial scale carbon recycling demonstration unit. Together, the companies aim to combine Mantra's Carbon Recycling (ERC) technology with KC Cottrell's proprietary Carbon Capture technology. The demonstration unit, set for installation at Korean Southern Power Co., Ltd.'s (KOSPO) Hadong power plant, would be the first of its kind in the world.

To better understand the opportunities in the formic acid and CO2 remediattion markets, Biotech Digest spoke with Mantra's CEO, Larry Kristof.

BTD: Tell us a little more about the background for Mantra.

LK: It was a year ago today we were awarded our first grant, and got underway with development program at the lab. We've successfully gone through the development program, and have been awarded a secondary grant . All through the year, we've been receiving
constant calls, as the technology started to materialize and with the growth in public awareness. We steadily made advancements on R&D, and started entertaining offers on new demo plants worldwide. It all came to a head with the Korea signing.

BTD: What has been the priority?

LK: The number one thing has been getting out of the lab and moving into industrial environments. It's the next stepping stone, but its huge.

BTD: Why Korea?

LK: The fact is Korea doesn't have a lot of alternatives. It can't bury CO2
algae is a tough battle, and there's a lot of coal fire, a lot of industrial, and a lot of steel.

BTD: Why KC Cottrell?

LK: It's a fantastic opportunity and KC Cottrrell is fantastic to work with. The deal offers quick deployment if we're successful, and the fact that they are capturing CO2 today at this facility, that's a key.

BTD: What's the timeline?

LK: In will take us 6 months to land the demo project, to build and engineer, then we've got a 6 month program built into that to test, to see how our system works with raw co2 [in the labs Mantra is using bottled CO2], get the bugs out if any, and understand the process in the field.

BTD: Then?

LK: Next, we'll start engineering towards 1-10 tons per day, versus versus 1 kg in the lab
or 50 to 100 kg per day. That's year 2. Year 3 to 5 we think the asian market is as good as any, and we do have some other things in the pipeline.

BTD: What's the market like for formic acid, why are you focused there, and what happens when you are producing at scale globally?

LK: We have better economics than our competitors. Long term, if we're successful, we'll be bathing in formic acid, and overwhelm the market today. But if produced at much cheaper rate and greener, we can displace the harsher acids. Formic is the strongest organic acid. The market today is pushing upwards every year, price and demand go up every year.

BTD: What are the efficiencies like?

LK: Per ton of CO2, its the best thing about the process. We are getting great yields – up to 90 percent on the electroreduction of CO2. We get a small stream of hydrogen.

BTD: What about other products?

LK: We can change a catalyst, change a membrane, and make other chemicals, other fuels.
We're getting requests — can you make this, can you make that, can you make ethylene, methanol. It is all plausible, but it will it take time to develop those processes.

BTD: How does this compare to carbon capture and storage?

LK: I started off the conversation saying that the public finally awoke this last year. For them, the simplest thing to do is to ask what is the easiest way to deal with problems. Now, I am not against CCS. If you've got carbon credits – there are opportunities in storing it. some of the CCS ideas are crazy. but what they are doing with EOR – great – making use of it – good economics. more carbon parking. Those make sense. That cap and trade. If carbon is trading at $100 per ton, you can do it. Bottom line, we've got to deal with the problem. What did you see on the TV all year? Typhoons, fires, and heat waves. if people aren't on to the fact that climate change is real they are crazy.

BTD: What kind of scale could you look at?

LK: The scale will vary from massive 600 tons per day down to niche applications for it. For example, I received an email from Switz. This is a company producing hydrogen on demand from formic acid. Their project might require 1 ton units.

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