

## **Houston Startup Company Produces Crude Bio-Oil from Algae**

**23 September 2009 – Houston, Texas** Sunrise Ridge Algae announced today that it has produced and tested a one liter sample of crude bio-oil from algae. The bio-oil appears suitable for use as a refinery feedstock, where it would be processed to become diesel, jet fuel and gasoline. The company is working with a large refiner and refining technology licensor for further testing, and is developing plans to scale up to commercial size.

Algae-derived bio-oil is seen by many industry experts as a high-potential “third generation” renewable fuel. Algae grows quickly, and can be grown using brackish water or wastewater. Unlike corn-derived ethanol, algae-derived biofuels do not compete with food. Large investors, including the Department of Energy and several major petroleum companies, have directed hundreds of millions of dollars into research in this area.

Sunrise Ridge Algae used its patent-pending catalytic thermolysis process for converting low-lipid algae to crude oil with high yields. Lipids are naturally occurring vegetable oils. The process starts with algae containing only 4% lipid – typical of most algae grown at large scale or in open ponds. In the process, the whole algae biomass was converted to crude oil using moderate temperatures and a specialized catalyst. The bio-oil yield was approximately 25% of the original algae – far larger than the original lipid content. Other algae-to-fuel processes are limited to extracting only the original lipid content.

Sunrise Ridge Algae’s CEO, Norman Whitton, said, “After more than three years of research and development, we have achieved a major milestone by producing sample quantities of crude bio-oil from algae. Our process is surprisingly efficient, and we plan to move rapidly to demonstration scale-up at a site in Texas.”

Whitton, 49, started the company after a career in petroleum and management consulting. He has been involved in four other startups. Whitton also serves as the co-Chair of the Greater Houston Partnership’s Biofuels Task Force.

Whitton elaborated, “One of the main challenges in the current algae-to-fuels industry is that it is difficult to continuously grow algae with high lipid content, at large scale. On the other hand, it is easy to grow low-lipid algae. Previously, the industry required 20% or more lipid content for economic operation. Now, with our process, we can use algae with only 4% lipid. It is much more readily available and cheaper to grow. And, the overall economics for production of renewable fuels are much improved.”

The algae oil, which the company calls “bioleum,” appears suitable to displace crude petroleum in existing refineries. The company has delivered samples to a major

petroleum company and a refining technology licensor, where they are currently being tested.

Dr. Robert Weber, the company's Chief Technology Officer, provided more detail on the conversion process. "We actually chemically convert the whole algae – we are not just extracting the lipids. That is key to our high yields."

The product is a heavy crude oil, similar to vacuum gas oil (a heavy intermediate in the refining process). It does not contain triglycerides, which are the main components of vegetable oil. David Griffith, Senior Vice President for Licensing and Ventures for the company and former employee of ConocoPhillips, said "Bioleum looks something like heavy Venezuelan crude oil that is run routinely in Gulf Coast refineries today."

The bioleum has a sulfur content of only 0.22%, much less than the 2-4% sulfur in a typical Venezuelan crude oil. On the other hand, the bioleum contains about 4% nitrogen, and the company is currently examining options to reduce this level. Griffith also noted that the oil contains less than 2 ppm phosphorus, which is fully acceptable for refinery processing. "Some other crude vegetable oils contain much higher phosphorus levels, which makes them hard to process in a petroleum refinery."

Algae-derived bioleum is superior to pyrolysis oil from wood. For example, the heating value of Sunrise Ridge Algae's bioleum is 38 MJ/kg, which is similar to diesel fuel (42 MJ/kg), and almost double the value for wood pyrolysis oil which is typically around 20 MJ/kg.

Weber elaborated, "Our process is highly efficient. The catalyzed thermolysis keeps almost all of the algae's original energy content in our products. About half of the incoming heating value in the raw algae is converted to crude bioleum. Another third is converted to a char that could displace coal. Only about 10-15% is lost in the process. We also operate at moderate temperatures, so we can use waste heat from third party industrial processes to operate our unit. And, because we start with whole algae, we obviate the need for lysing and extraction, which are expensive steps used in other algae-to-fuel processes."

Sunrise Ridge was founded in Houston in 2006 and has algae-growing operations in Austin, Texas, at the City of Austin's Hornsby Bend wastewater sludge treatment plant. The company has demonstrated that algae can remove nutrient pollutants from the waste water. Nutrient pollutants cause harmful anoxic zones that kill sea life in the ocean. Reduction of these pollutants will be increasingly important as new 2012 wastewater standards phase in. Algae also consume carbon dioxide, a greenhouse gas that has been implicated in climate change.

The company is working to integrate wastewater treatment, carbon dioxide consumption and bio-oil production to create a highly efficient process for cleaning up pollution while generating revenues from bioleum sales. This process may be interesting to municipal utilities, industrial companies and agricultural firms, since it helps solve many of their

pollution issues. At the same time, the bioleum can help reduce the amount of imported oil and reduce dependence on foreign oil sources.

Sunrise Ridge Algae is a client of the Houston Technology Center (HTC), in the Energy program. About 60 other companies currently participate in the program. HTC is a business accelerator and the largest technology business incubator in Texas. HTC was founded to accelerate the commercialization of emerging technology companies in the greater Houston area by providing in-depth business guidance, access to capital and service providers, and entrepreneurial education.

In 2008, Sunrise Ridge Algae received an investment by the State of Texas Emerging Technology Fund. The company has also received substantial seed capital from its founders, and has obtained further revenues from federal and private research contracts.

Sunrise Ridge Algae has collaborated in leading algae industry research with Texas institutions, and continues to work closely with experts including Dr. Jerry Brand, Director of the UTEX Culture Collection of Algae at the University of Texas at Austin, and Dr. Mike Harold, Director of the Texas Diesel Testing and Research Center at the University of Houston.

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