Going Green (3870)

OriginOil looks to improve the methodologies surrounding algae production in unlocking its profit and application potential as an oil source.?

by Jeff Reinke
Recent data shows investments in biofuels rose from $5 billion in 1995 to $38 billion in 2005, and is expected to top $100 billion by 2010. And while the altruist in each of us would like to think that this stems purely from a concentrated effort focused on environmental concerns, the reality of the situation is that finding a way to produce oil and limit Middle Eastern imports represents a profitable opportunity. This is where the story starts for OriginOil, a Los Angeles-based company that was founded with the mission of developing a technology for producing oil from algae that is simple, clean and universally applicable.

“Over the years I became close to a group of private investors in the green tech field,” explains Riggs Eckelberry, president and CEO of OriginOil. “In May 2007 we agreed to pursue algae – but not agricultural algae, industrial algae that would be produced in a setting more similar to a brewery than an algae farm.” Eckelberry wouldn't have to look far for the necessary support.?“I was very fortunate that my brother Nicholas had spent the previous 15 years developing technology around micronization, or microbubbles. It turned out that microbubbles had application in the production of algae, and that became our first patent filing. ?“Nick then recruited Steven Shigematsu, who has a background in electrical and civil engineering. They looked at the entire spectrum of algae challenges, which led to a series of inventions – five patent filings altogether. With these breakthrough intellectual property assets in place, we are now focusing on engineering, process development, quantifying the technology and scaling up the prototypes,” offers Eckelberry. ?Much of the world’s existing supply of oil and gas is made up of algae deposits that, thanks to time and compression, turned into oil or petroleum. So although not a new concept, the use of algae as a feedstock for oil production continues to gain more universal acceptance, and for good reason:?While corn can produce about 30 gallons of oil/acre/year, soybeans 50 and canola about 140, algae can produce more than 1,850 gallons per acre per year. The use of this plant also helps to avoid the food vs. fuel controversy that the processing of corn in ethanol production has created.?Algae are some of the fastest growing organisms on the planet, and consume large amounts of carbon dioxide, which makes it doubly appealing as a way to capture CO2 emissions. And just like any other plant, it also releases oxygen as a by-product.?Up to 60 percent of an algae cell

Making It Fit

Although the benefits of algae are easy enough to understand, the production and extraction of oil is not that simple. Currently, algae is either harvested off of ponds for processing or grown on “farms.” These farms use a collection of plastic bags

that are usually stacked horizontally and hung vertically as high as the given space allows, with access to sunlight. Algae are continuously pumped from a holding tank into the bag where it’s exposed to sunlight. These approaches offer their own challenges, as well ?as an opportunity for OriginOil's new technology:
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The concepts driving OriginOil's algae production scheme entail lowering costs and accelerating production rates though the use of a controlled environment that can be standardized and replicated, regardless of weather or geography. It centers around two key developments: Quantum Fracturing and the Helix BioReactor.

Quantum Fracturing

Before we get to the where, here's some insight on the how. Quantum Fracturing takes place at the microscopic level to unlock biological and chemical properties that OriginOil feels will enhance the efficiency of algae production and oil extraction. ?Water, carbon dioxide and other nutrients are fractured efficiently to create a slurry of micron-sized bubbles. These bubbles that are then injected into the algae culture waiting for it in a lower-pressure growth vessel, or bioreactor. This produces instantaneous distribution of nutrients to every algae cell without disruption or aeration that could damage the plant. ?The pressure differentials between the two zones increase contact and exchange between the micronized nutrients and the algae cells in the Helix BioReactor.

Helix BioReactor

The design of the Helix BioReactor tackles a limitation of some algae systems in allowing for the advanced growth of multiple layers of algae biomass around-the-clock, and with daily harvests. In a pond, the sun only illuminates one layer of algae growth, down to about half an inch below the surface. ?In contrast, this reactor features a rotating vertical shaft with low-energy fluorescent light arranged in a helix, or spiral pattern that produces a theoretically unlimited number of growth layers. Each lighting element is also engineered to produce specific waves and frequencies for optimal growth, while turning at a specified speed to help ensure ideal light exposure. ?This nutrient delivery system is also embedded into the BioReactor, ensuring even distribution to the entire algae ?culture. Energy and material costs are also held in check, as the lights provide less than 10 percent of the spectrum, ?in accordance to what the algae wants and needs.

The System

The Eckelberrys and Shigematsu are especially proud of the system they've developed for housing the BioReactor, which will also aid in enhanced algae production and oil extraction. “
Growth can be initiated at the production location or in a laboratory where health and colony strength is monitored daily, much like seedlings in agriculture,” offers Nicholas Eckelberry. ?He continues, “When the stock is ready for production, a proportional amount of algae starter is introduced to a production tank. Algae mass, through mitosis or division will double, triple or divide up to 16 times within a 24-48 hour period, creating clusters of families. ?“This colony expansion, or log, is proportional to space, light availability, temperature and nutrients. The growth tank

utilizes a series of Helix BioReactors in lieu of sunlight, which drive production levels beyond that of an open pond or other algae cultivation scheme. ?“Optimum growth temperature is controlled through tank design and built in spot-chillers/heaters. These insulated tanks, which can be sized according to end user requirements, offer lower costs and can address more extreme ambient temperatures, according to system location. ?“From rail car to flatbed to the preferred 40’ container, (housing four 8' by 8' tanks), quick-disconnect PVC or CPVC couplers and piping are used throughout to connect the tanks. Embedded probes and solenoids relay information to a CPU that then takes pre-determined actions that mesh with the data being supplied. Automation of all algae life support is monitored from within a container, via the internet, where operations will ultimately be controlled remotely,” he states.?“While micro-algae is a simple organism, its microscopic size makes volume production difficult, especially when looking at controlling energy and manpower costs. That's why it's so complex and requires close management,” Riggs Eckelberry continues.?Lysing, or breaking down the algae cell walls to release the oil, has always been a challenge. But instead of solvents or mechanical methods, the OriginOil system sends algae biomass through a shielded wave guide system where it receives low-wattage, frequency-tuned microwave bursts that break the cell walls. Quantum fracturing is then applied to the pre-cracked cells to complete the oil extraction. ?“Our business model will call for licensing the technology widely,” states Eckelberry. “We're not looking to be a producer and marketer of algae-based oil for fuel. We are a technology company, and we believe that everyone will eventually be able to produce algae, so there's no sense in trying to monopolize the manufacturing process. ?“We only plan to build the standardized Base Modules, which will stem from a 40’ shipping container platform. This will be for trial and entry-level applications. Larger systems will then be built on a project or co-venture basis. Our go-to-market model is to work with vertical partners in developing applications, and then distribute them through geographic partners who can provide local manufacturing, installation and support services.”?Anytime there's a call for a paradigm shift, risk is involved. However, with higher gas prices and markets that are already looking for alternatives, the options offered by algae could be attractive to processing, transportation and power generation companies.?“We felt that in order to succeed as a feedstock that can even partly replace the trillions of kilowatts generated daily through petroleum, algae production must become simple, automated, easy ?to manage, low in energy requirements and replicable. That's our mission,” states Eckelberry. n

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