AgOil International
THE GREEN OIL COMPANY™

GEORGIA ALTERNATIVE FUELS
ADVANCED ELECTRO-CATALYSIS TECHNOLOGY

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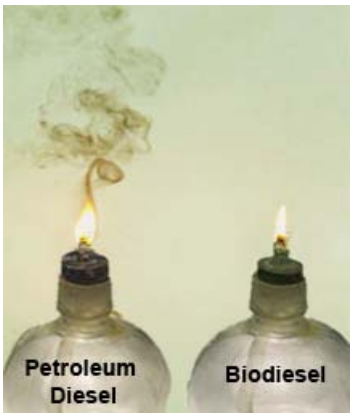
From the Test Tube to the Fuel Tank:

Two Innovative Small Businesses Partner to Produce Biodiesel from Algae

A St. Petersburg, FL company, AgOil International, LLC, has teamed up with a Pendergrass, GA company, Georgia Alternative Fuels, LLC (GAF), to generate a start-to-finish renewable fuel production system. It all starts with growing algae, specific types of high-oil concentration algae (which, incidentally, are not the same species that plague our swimming pools). Each of these businesses has independently achieved breakthrough technological advancements and developed their own unique methodologies. Their fields of focus are separate, but complementary—one is expert in growing the feedstock and the other in processing raw oils to biofuel. By undertaking this joint effort, they can link together their processes in sequence and deliver home-grown biodiesel that meets the ASTM fuel standard. This means their biodiesel output can serve as a replacement for petroleum diesel, in whole or in part, for cars, busses, trucks, boats, tractors, and generators.

The term “biodiesel” applies to any diesel fuel derived from a source we can grow. The US consumes approximately 45 billion gallons of diesel fuel annually, 99% of it from petroleum. By substituting home-grown biodiesel for traditional petroleum diesel, we can reduce our dependency on foreign oil, support environmentalist objectives for reducing CO_2 emissions, alter the balance of trade, de-centralize fuel production away from the oil company monopolies, and boost the economy by creating jobs here in the US that cannot be outsourced. In addition, biodiesel doesn’t smell bad when burned, is biodegradable, non-toxic to wildlife, and extends the life of an engine by burning cooler with greater lubricity. The photo at left, comparing the smoky emissions of petroleum diesel next to clean-burning biodiesel, clearly illustrates the point. No. 2 petroleum diesel emits large quantities of particulate emissions to the environment that pose serious health hazards to humans. We’ve all been offended by the black smelly smoke spewing from truck and bus exhausts. That smoke is harmful, not just unpleasant. Burning biodiesel instead of petro-diesel would reduce automotive emissions by 80%. All-in-all the success of this joint effort would have a transformational impact on the status quo of diesel fuel – source, price, engine performance, environmental effects, and market demand by businesses, organizations, and consumers going green.



Algae: The Unsurpassed Source for Biodiesel

There are more than 100,000 different species of microalgae, a realm of aquatic plants comparable to the diversity, breadth, and richness of terrestrial plants. Algae are a virtually untapped source of immeasurable, yet-to-be-exploited resources. One of those resources is oil. For more than thirty years, it has been recognized in the scientific community that some species of microalgae are composed of 50% to 60% oil. Algal oil has already been extracted, tested, and found to be highly suitable for conversion to fuel. This knowledge is a matter of record.

In 1978, largely in response to the fuel shortage of the early 70's, the U.S. Department of Energy (DOE) started an extensive research project entitled "Biodiesel from Algae". This project was terminated in 1996 due to curtailed funding. The 300-page landmark publication documenting the results of the DOE study, performed by the National Renewable Energy Lab (NREL), NREL/TP-580-24190, was published in 1998. Thousands of species of microalgae were evaluated, and more than 300 were identified as having high oil concentration. Although the DOE-NREL project was not successful in designing and deploying the ideal mass culture system, results were sufficiently positive to ascribe long-term viability to the concept of producing biodiesel from algae.

The advantages of growing algae versus terrestrial crops for biodiesel are overwhelming. Algae yields 50 to 100 times more oil per acre; consumes carbon dioxide as it grows; requires no fresh water irrigation; involves no pesticides or herbicides; adds no fertilizers to the land; grows in brackish or salt water; remediates contaminated waters; and is not a food commodity.

Growing algae is not just environmentally-friendly; it's environmentally-beneficial. Today's priority initiatives for the development of renewable clean fuels, achieving energy independence, and combating greenhouse gas emissions make deployment of this new biodiesel production system even more crucial. Algae consumes carbon dioxide (CO_2) while it grows, thereby directly reducing the excessive levels of CO_2 being emitted into our atmosphere. In fact, for every one ton of algae produced, 2.2 tons of CO_2 are removed from the environment.

The production of oil from algae will reduce the prevailing pressure for offshore drilling and oil exploration in wildlife refuges. Because biodiesel is non-toxic and biodegradable, it poses no threat of catastrophic oil spills from transport tankers. Algal oil is a renewable rather than a fossil fuel, therefore, we can grow it perpetually and never run out.

Why Hasn't This Been Done Already?

This is the key question. If some algae are naturally composed of half oil; if algal oil is highly suitable for conversion to biodiesel; if algae grow faster and denser than any other biofuel crop, if algae consume CO_2 as food; if algae are the ideal renewable fuel crop, then why hasn't this been done already? Given the level of technological achievement extant in the world, along with the effort and capital already invested in this idea, why isn't algal oil already a commercial commodity?

During the past three decades, oil from algae has been successfully extracted, processed, and converted into biodiesel, but only in limited quantities in research and demonstration projects,

and, invariably, at great expense per unit. However, a reliable cost-effective mass culturing system to grow algae for fuel oil, and then extract and purify it has not yet been developed – *until now*.

The Solution is Here

A solution to the long-standing oil-from-algae dilemma lies in this cooperative endeavor currently in the planning stages. AgOil International holds the key to a practical methodology for the mass culture of the algae. And Georgia Alternative Fuels (GAF) has developed a patented electro-catalysis technology for the production of biofuels that will extract and process the algal oil into ASTM compliant biodiesel.

Growing the Algae: AgOil has developed a ground-breaking, high efficiency, low cost, environmentally beneficial methodology for the mass culture of algae (patent pending) that is totally unlike previous system designs. By incorporating the newest technologies for energy efficiency and applying the latest research findings for the maximization of oil production from algae, oil yields are expected to far surpass all prior undertakings in this arena. Frank Preg, AgOil CEO regards the reliability of their system as key to commercial success, noting that "Predictable harvests with consistently high yields are essential prerequisites in achieving cost effectiveness in a mass culturing system." Proprietary components and custom devices, a result of years of research and development, have been integrated into AgOil's system to maintain a fully controlled microbiological growth environment in large scale culture. This approach results in faster, denser cultures, higher oil yields, smaller footprint, and overcomes the shortcomings that have caused previous endeavors to fail. Research and testing by scientists in AgOil's lab (pictured) is ongoing.

The research and development phase of AgOil's new system has been successfully completed. This includes overall system design, testing of proprietary inventions, submission of two patent applications, culture of many strains of microalgae, production of algal oil, and methods for maximization of lipid (oil) production. Their next step is to build a pilot plant to grow and process the algae, demonstrating the full process from the test tube to the fuel-tank. "We are very excited about our new alliance with GAF," according to Preg. "Both companies are committed to developing a cost-effective solution to the fuel crisis while maintaining a priority on environmental friendliness."

Processing the Oil: After the algae reach maximum oil concentration, the biomass is harvested, and GAF's oil-processing knowhow takes over. This post-culturing part of the process, which includes separating the algae from the water, extracting the oil from the algae biomass, and then converting the oil into standardized biodiesel, has posed a significant hurdle in the past. GAF has extensive commercial experience with multi-feedstock biodiesel technologies using a wide variety of oils such as soybean, cottonseed, rapeseed, animal tallow, pine, and yellow grease. Photo at left shows chicken fat at room temperature before conversion, next to ASTM compliant biodiesel, processed from chicken fat. Although a myriad of vegetable and animal oils can be converted to biodiesel, a suitable feedstock for a commercial biofuel operation that produces millions of gallons per year must be inexpensive and consistently available in very large volumes. Readily available oils, such as soybean and cottonseed, are edible and too expensive to be used for fuel. At the present time, biodiesel refineries are producing well below capacities due to lack of available, inexpensive feedstock. The mass production of algal oil for biodiesel feedstock has the potential to 'fuel' a vital new industry.

Chicken Fat Biodiesel from Chicken Fat

The processing of the algae biomass will have no waste by-products, according to GAF CEO Alan Lawson. "Following the extraction of the oil for biodiesel, the algae solids will be used to produce cellulosic ethanol. The by-product remaining after ethanol production is a high-protein additive that can be marketed for animal feed." GAF carries out biodiesel conversion processes at atmospheric pressure, adhering to safety standards, in a sealed plant without emitting air pollution. The refining processes for biodiesel and ethanol are far cleaner than those used for refining petroleum.

GAF's Electro-Catalysis technology is superior to conventional biofuel conversion and purification systems in many ways. Their advanced proprietary methodologies accelerate reaction rate, speed cycle time, increase yield efficiency, and their output results in a product with enhanced BTUs, improved stability, and lower emissions. These outcomes have been validated with a wide variety of feedstocks. By carrying out processes at atmospheric pressure with reduced chemical dosing, GAF provides a safe environment while maintaining lower operating costs.

GAF and AgOil are currently pursuing major investment and venture capital opportunities to support the establishment of a pilot plant demonstration project. The vision is to build a clean, green, self-sufficient, wind-powered biofuel production system. Here's the way the system will operate: Using AgOil's proprietary mass culture methodology, the algae are grown in salt water that has been taken from an underground aquifer or brackish well. The culture is fed with free sunlight (that's photosynthesis) and carbon dioxide (an unwanted emission that power plants can't figure out what to do with). Wind turbines supply the power for pumps, media mixers, harvesting apparatus, processing equipment, and all electrical requirements. After processing using GAF's proprietary methodology, the algae culture yields biodiesel, ethanol, and high-

protein animal feed. After extraction of these algal products, the remaining water from the algae media is converted to potable water via reverse osmosis.

Using renewable energy (wind and sun) to produce renewable fuel (biodiesel and ethanol) is the ideal green model! Although wind power is constantly gaining ground worldwide, T. Boone Pickens' recently announced his intent to cancel plans for a large-scale wind farm in Texas, due to the high cost of transmitting the electrical power to populated regions. If wind power were re-directed to grow and process algae into a safe non-toxic, transportable fuel, creating in essence a 'bio-battery' to store power generated from wind energy, this paradigm would represent an environmentally-beneficial solution to alleviate our nation's fuel crisis. This visionary concept also establishes a foundation for a new core industry with the potential to generate a *de novo* regional economy. T. Boone is seeking alternate projects for utilization of his $2B investment in wind turbines. We hope this far-reaching biodiesel-from-algae idea reaches him.

For further information, please contact:
Frank Preg, President and CEO, AgOil International, LLC
Frank@AgOilInternational.com