Biodiesel - Algae

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In the past century, fossil fuels have served us as a cheap and effective source of energy. Now that we are running out of fossil fuels, and we are becoming more aware of the environmental consequences of their emissions, biofuels are emerging as an appealing alternative source for the future. Especially with recent breakthroughs involving algae as a possible source for biodiesel, many companies are looking to invest in algae-to-biodiesel technologies. This study investigates how algae can be incorporated as a significant part of US energy solutions. Specifically, we found two promising avenues for advancing algae biofuel prospects in today's society: co-production coal-burning plants, and cultivation in conjunction with sewage treatment.

In mid 2007 there were 3 companies developing bioreactor technologies to produce biodiesel from algae. They were Greenfuel Technologies, Solix Biofuels, and PetroSun. However, there was a 1998 program that investigated the production of biodiesel from algae grown in ponds utilizing the waste CO₂ from coal-fired plants. They found that some species were able to grow under extreme conditions of temperature, pH, and salinity. They developed a large surface area of 1000 m² capable of unitizing 90% of the CO₂ being put into the system. Despite all of the benefits and good findings from this test, they found it would be too expensive to make biodiesel algae on a large scale. It was around $65 per barrel of biodiesel algae, while oil was less than $20 per barrel then. However since 2000, oil prices have tripled and quadrupled, leading to biodiesel algae as a very plausible option.

**Problem**

Ever since the industrial revolution mankind has had a voracious appetite for energy. Many types of alternative energy were introduced to the world. The problems of other alternative energies are their price and their emissions. The US is still dependent on fossil fuels. The US has looked into many different types of alternatives, but none have been found to have any significant impact.

**Abstract**

In the past century, fossil fuels have served us as a cheap and effective source of energy. Now that we are running out of fossil fuels, and we are becoming more aware of the environmental consequences of their emissions, biofuels are emerging as an appealing alternative source for the future. Especially with recent breakthroughs involving algae as a possible source for biodiesel, many companies are looking to invest in algae-to-biodiesel technologies. This study investigates how algae can be incorporated as a significant part of US energy solutions. Specifically, we found two promising avenues for advancing algae biofuel prospects in today's society: co-production coal-burning plants, and cultivation in conjunction with sewage treatment.

**Algae for Biodiesel**

In comparison to traditional oil-seed crops, algae yields much more oil per acre. While soybean typically produces less than 50 gallon of oil per acre and rapeseed generates less than 150 gallon of oil per acre, algae can yield up to 10,000 gallon of diesel per acre. In particular, diatoms and green algae are good sources for the production of biodiesel.

**Biodiesel**

The majority of biodiesel production in the U.S. is from soybean oil, unlike Europe which uses mostly rapeseed due to their colder climate. There are 165 operational sites with a capacity of 1.85 million gallons per year. New plants are under construction which will add another 1.75 billion gallons per year. Some of these sites will be capable of producing 100 million gallons alone. It is estimated that biodiesel can yield 3.2 units of fuel product for every unit of energy off fossil fuel used to create it. Conventional diesel yields about 0.83 units of energy per unit of fossil fuel consumed. This shows undoubtedly that biodiesel fuels are much more efficient than regular diesel.

A study conducted by the Renewable Energy Laboratory concluded that B100 reduced CO₂ emissions by 74.5%, B20 reduced it by 15.7%. B100 completely reduces tailpipe emissions of sulfur oxides, it also reduced sulfur oxides 35%, CO 32%, and total particulate matter by 8%. However, NOₓ emissions as well as hydrocarbons were slightly increased with the use of B100.

**Results and findings**

There are two ways algae farms can be incorporated in the United States, each with its own benefits. Algae farm/Coal plant – Build algae farms next to coal plants and have the carbon dioxide emitted from the coal plants be used to feed algae in the algae pond next to it. You would then use the energy produced by the coal plant to maintain and harvest algae and then derive biodiesel from it. This plan would be especially effective if government is to pass a cap and trade policy for carbon dioxide, which would really encourage coal power plants to invest in algae ponds.

Algae farm/Sewage treatment – Build an algae farm with dual purposes in mind. Have the algae biologically clean sewage water of excess nutrients such as phosphates and nitrates, as it uses them to rapidly bloom. This plan could be very effective for building algae plants near cities, and have the plant both provide power to the city as well as clean its sewage.

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