Alternate Algae Fuel

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Abstract

Hold your nose as we dive into the aquatic world of microalgae. Conducting research seeking a renewable energy source, I found algae has the potential to change the world for the better. The oil from algae species can be turned into a biofuel, fuel produced from agricultural processes that can be used in transportation engines. This fuel and overall process of algae production has been found to be a safer and more environmental friendly process than fossil fuels. Also, algae grows in water, making it farmable in many different ways, each system holding their own unique advantages. What stands in the way of commercial viability is the amount of money needed to build enough mechanisms that make algae a cheaper and more available fuel than the current fossil fuel, but scientist remain determined and believe it can work.

Keywords: Biofuel, Algae Oil, Alternate Energy

Alternate Algae Fuel

"We are going to exit the fossil fuel era. It is inevitable." says Elon Musk, CEO and lead designer of multiple prodigious projects (Felix, 2015). Musk is the head developer of Space-X, a multi-billion dollar private spacecraft company with goals of colonizing Mars. He also invented the hyperloop, a machine that will carry passengers from Los Angeles to San Francisco in thirty-five minutes, normally a seven hour drive. The superstar inventor also works closely to refine Tesla, Inc., an automotive electric car company. Needless to say, Musk is in touch with the current environmental needs of the world and his thoughts on drastically reducing the use of fossil fuels is a commonly shared opinion among a greater part of the science community. Over the last century, humans, or more precisely, the United States, have been burning fossil fuels and emitting carbon dioxide into the atmosphere at an exponential rate. Carbon dioxide (CO2) is a greenhouse gas that radiates energy from the sun towards earth's surface, raising the temperature and coining the term "global warming". The damaging effects of global warming have only just begun and scientists predict that there will be many environmental catastrophes if no changes are made. Thankfully, scientists, engineers, and several large companies around the world have shown interest in refining the processes involved in generating safer alternative fuels, an intriguing one being algae fuel. Algae fuel is a biofuel that uses algae's energy-rich oils to produce fuels, most commonly biodiesel, a fuel that can be used in any vehicle that operates on petroleum-based diesel. Among all biofuels (corn, sugar, soy, etc.), algae is the easiest to grow and cultivate. It's also a "carbon neutral" process, meaning the CO2 emitted when burned is the same CO2 the algae consumed in order to grow, improving the environmental crisis mentioned earlier. While the benefits sound promising, this is a new process and needs to be further developed before being implemented to a commercial scale. In order for it to be found in gas stations nationwide, much more research must be done which means the largest impediment is

time and money. On a relatively small scale it has been proven to be far more beneficial than other fuels (bio and fossil) in virtually every aspect. With strong efforts and diligent research in the science community, algae fuel can be used across the world as a superior alternative to fossil fuel.

Algae are microorganism that can be turned into a biofuel which produces a significant amount of safe, usable energy. In 1942 two men, Richard Harder and Hans Von Witsch thought microalgae could be grown as a source of lipids for food or fuel. With advances in technology their idea to utilize algaes oils has become a practical way of renewable energy. In the 1990s, algae fuel research by many companies was abandoned due to low prices of petroleum and a fear that commercializing biofuels was not practical with their current systems. A biofuel is an alternative to liquid fossil fuels like petroleum. It is renewable and agriculturally produced. Algae grow in water and when farmed are typically held in a module, pond, or raceway, converting sunlight into energy. The energy is stored in the oils and that oil is what is converted into biofuel. The U.S Department of Energy released a video summarizing their knowledge on algae fuel in which they say, “algae can potentially produce up to 60 times more oil per acre than land based plants” (Energy, 2012). Meaning 1,000 acres of algae that is grown in ponds, wastewater, or closed loop systems, could produce oil equivalent to that of 60,000 acres of land crops like corn. Algae is separated into oil and biomass and then refined to produce biodiesel, ethanol, and jet fuel. A globally focused renewable energy company, Algae.Tec claims, “Algae Tec fuel can be produced at approximately half the price of current crude oil” (Biofuels 2012). While this has been proven true on a small scale, having a safe and renewable source of fuel like this is globally is the end goal.

Algae fuel is much easier to grow and cultivate than alternate sources of energy. The main thing that separates algae cultivation from that of any other fuel source is simply, water.

Algae thrives in water and can be grown in places not suitable for traditional crops. The main cultivation techniques currently are open pond system with paddle waves, or a photobioreactors. Photobioreactors are engineered devices that utilize a light source to cultivate phototrophic microorganisms, like algae, that use photosynthesis to create biomass that turns into fuel (Wasanasathian, 2007). In addition, different ways of growing the algae hold their own advantages. A turf scrubber grows algae much faster and can be harvested every two weeks. In an article published by the American Institute of Biological Sciences, "turf scrubbers can produce 18 metric tons of biomass per year" (Adey, H., Kangas, C., & Walter, 2011). Exxon Mobil, the largest international oil and gas company in the world, worth roughly $275 billion, is on board with the implementation of algae fuel. They released a scientific article expressing why they stand strongly behind the production of algae stating, "The major inputs for phototrophic algae production are sunlight and carbon dioxide, two resources that are abundant, sustainable, and free." (Mobil, 2017). In fact, algae production plants can be placed next to a factories emitting large amounts of CO2 benefit from it. The CO2 is captured and then bubbled into the water that algae use to grow.

Algae fuel is safer for the environment than the current bio and fossil fuels. Fossil fuels provide great amounts of energy, and are overall a very valuable resource. The problem with them stems from the amount of carbon they produce. The concentration of CO2 in the air is exponentially increasing and becoming unsuitable for the planet. The National Renewable Energy Laboratory released a report stating, "Algae biofuels have the potential to replace a significant portion of the total diesel used today with a smaller environmental footprint" (Murthy, 2010). What makes algae a great alternative is that its process is "Carbon neutral". As American Energy puts it in an article dissecting carbon neutral operations, "When biofuels release carbon into the atmosphere the emissions are considered to be carbon neutral because the

carbon is continuously recycled from the atmosphere as new energy crops are grown each season to make more biofuels" (Energy A, 2017). Another environmentally friendly aspect about algae is its ability to utilize run off, or wastewater. This is water that has been affected by humans, consisting of pollutants like phosphates, nitrates and ammonia that provide nutrients for the algae. When growing in wastewater, bacteria must go through a process call anaerobic digestion where it breaks down the biodegradable material and acts as a fertiliser to feed the algae. Water that would normally kill crops can now be used for an effective purpose and benefit the environment immensely.

Algae fuel has not been implemented into a large enough scale to meet the current energy needs. As we've seen, there are plenty of aspects about algae that solve current issues, the findings are remarkable, but the problem is expansion. According to the U.S Energy Information Administration, "17.67 million barrels of petroleum are produced per day" (Energy 2019). This number is so incredibly high that one company alone cannot produce that much biofuel with the current technology. As with any advancement in the world, it is going to take thousands of selfless hours invested by an entire community into improving the process in every step of the algaes lifespan. Scientists want to advance projects proven to be a better option on small scale.

The only thing holding humanity back from a great leap in science, using microalgae to power transportation, is research and money. Scientist have been searching for a dependable renewable energy resource for years and finally have a serious contender for alternative to fossil fuels, algae.

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