CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
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Project Number
34360

Project Title
Capturing Carbon Dioxide with Saltwater Hydroponics

Abstract

Objectives/Goals
Global warming caused by CO2 emissions is a threat to mankind. Plants have been absorbing CO2 since the dawn of time. But the answer is not planting more trees. Land is limited, energy used to grow plants typically emit CO2 and are geographically limited. The objective of this project is to develop a sustainable carbon capture method through the use of marine plants. Our solution is an algae hydroponic barge using solar power, the ocean for nutrients and space to create a self-sustaining, energy efficient, environmentally-safe carbon-capture method.

Methods/Materials
For this project, we need a fast growing plant with a high O2 release/CO2 absorption, a wide habitat, an energy source(solar power), a natural source of nutrients all which is economically viable. All these aspects are combined in my project - Algae Hydroponic Barge. The barge is designed with a pump and a valve to provide a nutrient flow. The barge is solar-powered and can be an open or closed environment - with LED lights providing an ideal light cycle. The design also includes plans for communications, overflow control and maritime lights. This project also researches conversion efficiencies of various micro and macroalgae and a financial analysis. Macrocystis Pyrifera(M.Pyrifera) is ideal for fast growth, while green algae is the suitable for biofuel production. We used Chaetomorpha Algae as a research substitute to M. Pyrifera.

Results
Algae Growth: Chaetomorpha Algae was grown in a contained environment that simulated ocean conditions - saltwater, light and nutrients. The experiment shows that algae growth can be scaled using a hydroponic barge.
Barge Design: A design duplicating the basic idea of an aquarium-refugium system was constructed. A prototype of a scalable, net carbon-negative, open/closed hydroponic barge with a constant flow of nutrient, solar power and LED lights ideal for micro/macroalgae growth was constructed.

Conclusions/Discussion
Plants absorb CO2 from air, but when they decompose they release it right back. A way to get plants into the energy cycle is to convert them into biofuel. Agricultural crops such as corn are already being converted to biofuel but net carbon capture is low and they use land, water, energy. On the other hand, the ocean is an untapped resource with nutrients and space. Through the self-sustaining hydroponic barge that requires virtually no management, we can reduce global warming.

Summary Statement
My project is about net carbon capture through saltwater hydroponics.

Help Received
My project adviser helped me understand certain concepts and proofread my work.