CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
S1512

Project Title
Algae: The Oil Factory

Abstract

Objectives/Goals
The objective of my experiment was to examine the potential of algae in biofuel production based on oil content and growth rate.

Methods/Materials
I cultured four strains of algae including one high oil content / low growth rate, two medium oil content / medium growth rate, and one low oil content / high growth rate. Only two of the strains cultured consistently, so I transferred them into a photobioreactor and continued to grow them. I calculated the theoretical oil mass by measuring optical density of samples in a spectrophotometer and multiplying the total mass by the published percent of oil content. Actual lipid content was measured by preparing controls and samples with Nile red dye, incubating the samples and measuring fluorescence in a fluorometer. Fluorometer Units were converted to mg of lipid to determine actual amount of oil. I also observed the algae under a microscope. The photobioreactor was made with plastic tubing, a 4-way gang valve, motor,and a fluorescent light. The algae was cultured to meet the provider's specifications.

Results
Dunaliella Salina, the low oil content/high growth strain, did not culture in any of 8 attempts and only one sample of the Nannochloropsis cultured.
All starter cultures of Chlamydomonas and Tetraselmis cultured.
Although algal strains of high oil content tend to be slow growing, the Tetraselmis generated 8.5% more mass than Chlamydomonas, the medium oil content strain.
Based on calculated oil content, Tetraselmis produced 136% more oil than the Chlamydomonas.
Based on measured oil content, Tetraselmis produced four times more oil than the Chlamydomonas.
Chlamydomonas settled extensively while Tetraselmis remained buoyant.

Conclusions/Discussion
The selection process of algal strains for biofuel production needs to include the consideration of overall heartiness, physiology of the strain, environment for cultivation, and method of harvesting. While algal strains with high oil content are expected to grow slower than strains with lower oil content, this research project demonstrated that the high oil content strains can grow efficiently. The combination of strong growth and high oil content lead to higher total oil production and is a strong contender for further testing and development.

Summary Statement
This project helps to identify which algal strains can be used for biofuel production based on the combination of oil content and growth rate.

Help Received
Dr. Stephen Lyon explained directions for growing algae and analyzing oil content. I measured fluorescence of the algae at Cal Poly Pomona under the supervision of Dr. Marcia Murray. My mother bought supplies for me and swirled the flasks to minimize settling.