CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

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Project Number

S1403

Project Title

Enhancement of Algae Lipid Composition through the Manipulation of Temperature, Light, and Nutrient Levels

Abstract

Objectives/Goals

Despite advances in technology, modern fossil fuel powered cars still contribute significantly to pollution and the greenhouse effect, emitting CO2 and other pollutants and leaving an immense ecological footprint on the environment. The use of fossil fuels, a non-renewable and diminishing resource, along with a reliance on foreign countries for this commodity have further led to international tension and pose a threat to national security. Many experts believe that phytoplankton lipids are by far the most promising source for a bio-fuel. In an effort to better comprehend how physical and chemical processes affect the biosynthesis of energy-rich lipid compounds in algae, the goal of this study was to experimentally vary temperature, light, and nutrient levels to find conditions optimal for lipid production.

Methods/Materials

For the temperature and nutrient study, a standard curve was calculated to produce an optical density to cell count conversion. Twelve flasks under each of the three temperatures were setup with triplicates of each nutrient level. All cultures were kept under a 12-hour light/dark cycle. Each day, optical density readings were taken and converted to cell counts.

For the light study, cultures were inoculated in 6 polycarbonate bottles consisting of 200ml algae, 40ml nutrients and 1800ml of autoclaved seawater. Bottles were strategically place at various distances from a light source to create a gradient in light levels. An 8ml sample was taken daily from each bottle and tested for cell count, in vivo fluorescence, lipid content and optical density.

Results

Results from the temperature and nutrient study indicated that 2% nutrient content was the most efficient nutrient level. Additionally, optimal growth for the cultures was achieved at a temperature of 28C. While an increase in lipid content was observed across all light levels during the light experiment, an intensity of 250 uEin appeared optimal for lipid production.

Conclusions/Discussion

Through these experiments, ideal physical and chemical conditions for algae growth and lipid production were found for this unidentified algae isolated from the SD Bay. It was concluded that because of its nature, this species does not have a lipid yield high enough to be used as a source of oil for bio-fuel. In the future, it is proposed that different species of algae are tested using the same experimental procedures.

Summary Statement

An external condition alteration study on algae completed in an effort to better comprehend the effect of physical and chemical processes on the biosynthesis of energy-rich lipid compounds and the possible uses of algae as a biofuel.

Help Received

Used lab equipment in CALCOFI and Mitchell labs at the Scripps Institution of Oceanography under the supervision of Dr. Greg Mitchell, Ben Neal, Mattias Cape and Brian Seegers. Tests were run at General Atomics under the supervision of Ben Neal. Used equipment in the High Tech High Biotechnology lab.