CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

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Project Number

J1702

Project Title

Seeking the Green Gold: Optimizing Growth Parameters for Algae Biofuels

Abstract

Objectives/Goals

With a price over $8 per gallon for algae biofuels, companies across America are seeking to reduce the costs. Knowing the best conditions for growing algae may help make algae a viable option. My objective was to investigate which combination of light and nutrients would produce the fastest growth rate and highest yield of algae. My hypothesis was that algae grown in the standard enriched seawater f/2 Media would grow faster than algae in other nutrient sources. The test solutions included wastewater, recycled water and ocean water alone. I also believed the algae would grow fastest under the highest light conditions.

Methods/Materials

The algae I tested was Nannochloris oculata, a salt water strain of microalgae known for its high lipid content (up to 60%) and recommended for biofuel. I tested more than 600 samples, over 34 days in two separate trials. The first nutrient I tested was f/2 Media, the standard media used in laboratories to grow algae. It served as my control. I also tested wastewater mixed with 3% NaCl. I tested recycled water from a municipal water district also mixed with 3% salt and I tested ocean water alone. The 3 experimental light levels were: high (381.05 micromol Quanta/ 31.75 k Lux), medium (211.96 micromol Quanta/ 17.66 k Lux), and low light (127.01 micromol Quanta/ 10.58 k Lux) representing varying light levels during different seasons of the year. I constructed a shelving apparatus, placing light sources at each shelf with screens to alter light levels. To monitor algae growth, I measured the fluorescence of chlorophyll a, the primary photosynthetic pigment present in all forms of algae.

Results

To my surprise, I found that algae grown in wastewater or in recycled water at medium light levels had the fastest growth rates. The f/2 Media samples grew best under 'high' light conditions, but showed far less growth than waste or recycled water under medium light conditions. Wastewater nutrient samples exhibited 56% more algal growth than was seen in the f/2 media samples while recycled water algae exhibited 45% more growth.

Conclusions/Discussion

Based upon my findings, using wastewater or recycled water may be a cheaper and more effective option for growing algae cultures. It would eliminate the cost of raw material and time to formulate f/2 nutrient media. My experiment showed we could make positive use of waste nutrients as we produce algae biomass for renewable biofuel.

Summary Statement

My objective was to investigate which combination of light and nutrients would promote the greatest growth and highest yield of algae biomass for Nannochloris oculata, a microalgae recommended for biofuel production.

Help Received

I received the fluorometer and miscellaneous lab supplies including the algae strain and f/2 Media to be able to set up and run the experiment in my garage from the Scripps Institute of Oceanography Photobiology Lab, Dr. Greg Mitchell. My dad helped me build the shelves. Teacher reviewed my report.