CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)

Raman V. Nelakanti

Project Number

S1713

Project Title

Inducing Anaerobic Conditions for Hydrogen Production in Chlamydomonas reinhardtii

Abstract

Objectives/Goals

With the world facing an enormous energy crisis, it is necessary to develop renewable energy sources. Chlamydomonas reinhardtii is a potential source of renewable hydrogen energy, but its use is practical only if vital steps in the hydrogen evolution process are improved. The requirement for anaerobic conditions is a major obstacle for hydrogen production by these algae in real world applications. The objective of this experiment was to explore anaerobic hydrogen production using sulfur deprivation to initiate anaerobic conditions.

Methods/Materials

The algae were cultured in TAP media with four different concentrations of sulfur. Oxygen concentration and cell density was measured over a 140-hour period. Additionally, a fuel cell was implemented to determine the amount of hydrogen energy the algae were producing.

Results

There was a statistical difference in the rate of oxygen consumption across the various concentrations of sulfur. Algae cultures with 6.727mM and 13.455mM sulfur had the greatest rates of oxygen consumption, compared to the control with 20.182mM and the group where no sulfur was added.

Conclusions/Discussion

Sulfur concentrations of 6.727mM and 13.455mM exhibited the most promising results for improving the initiation of anaerobic conditions. Sulfur deprivation inhibited algae cell growth, while concentrations of 6.727mM and 13.455mM did not. The experimental setup accounted for algae reproduction and growth in low sulfur conditions, which could help design self-sustainable hydrogen production methods using C. reinhardtii. This research proposes an alternative method for anaerobic hydrogen production by C. reinhardtii that may help the algae become a renewable energy source.

Summary Statement

The purpose of this study was to develop conditions that would improve the anaerobic production of hydrogen by Chlamydomonas reinhardtii for energy applications.

Help Received

Ms. Alonzo supervised me during my work at school; Dr. Elizabeth Harris of Duke University provided the C. reinhardtii algae and growing media; Dr. Prinz of Stanford University supervised my work with fuel cells.