CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Abbie Maemoto

Project Number

S1518

Project Title

Nutrient Removal Efficiency of Nitrates and Phosphates by N. oculata through Increased Infusion of Carbon Dioxide

Abstract

Objectives

With a significant increase in global agricultural runoff in the past decade, microalgae have emerged as an important catalyst for effluent treatment and a potential alternative clean energy source. Nannochloropsis oculata is a species of green microalgae that has been utilized in the industry for both its rapid growth rates and its ability to absorb both nitrates and phosphates, the two main compounds found in farm runoff. An increase in algal growth may lead to greater lipid extraction yields for the synthesis of biofuels. As carbon dioxide is a key reactant in photosynthesis, and thus essential for algal growth, this experiment was designed to see if there is a correlation between carbon dioxide levels and nutrient absorption, maximizing both algal growth and effluent purification.

Methods

This experiment took place at the Cabrillo Marine Aquarium laboratory during the month of November. Algal cultures were initially infused with varying levels of carbon dioxide in sealed flasks and then placed on stir plates at a low speed for six days. Each day, cultures were filtered to measure nitrate and phosphate levels using the HACH 900; in addition, cell counts were taken using the hemocytometer and pH levels were monitored.

Results

The results indicate that there is a direct positive correlation between carbon dioxide concentration and cell density, thus increasing nutrient absorption rates. The study shows that there may be a critical carbon dioxide level that maximizes algal cell growth, which would improve algae s potential as a biofuel and source of effluent treatment. However, pH may also play an important role in affecting these variables, warranting further research in this area.

Conclusions

This study proposes a real-life solution that is beneficial to both the ecosystem and the fuel industry; as it was found that higher carbon dioxide levels were optimal for both maximum nutrient absorption and colony growth, flue gas can be utilized in wastewater treatment facilities to both remediate the effluent and maximize algal growth for maximum lipid extraction. Thus the promise of this experiment is multifaceted and is critical for researchers in the industry.

Summary Statement

In this project, I focused on the effect of increased carbon dioxide on nutrient absorption and algal growth, determining an optimal pH growth condition for N. oculata.

Help Received

Cabrillo Marine Aquarium