Name(s)

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Project Number

31424

Project Title

Green Gold: Maximizing Algal Biomass Production of Chlorella and Scenedesmus for Use in Biofuel

Abstract

Objectives/Goals

The world's intensive use of costly and nonrenewable fossil fuels and the dangerous greenhouse gas emissions that result from burning it has created need for an economically viable and environmentally-friendly alternative fuel. Algae biofuel is a promising future solution to our energy problems but faces engineering challenges. My goal was to investigate maximizing algal biomass production for cost-efficiency and for cleaning up the environment by varying growth conditions. I hypothesized that biomass production of Chlorella and Scenedesmus algal strains would be maximized by providing them with additional CO2, phosphate, and iron, and a secondary goal was to determine the relative importance of each of the nutrients to growth.

Methods/Materials

My constants: light intensity, temperature, and pH of solution. Independent variable: nutrient added; dependent variable: algal biomass production; control: culture with no additional nutrient. Stock cultures were prepared in Erlenmeyer flasks, two for each strain. Cultures were aerated and agitated continuously. Cell density was measured using a hemacytometer every day. After seven days of good stock growth, I subcultured and started tests in triplicates with additional CO2, phosphate, and iron. I then tested different concentrations (1% and 2%) of phosphate and iron.

Results

For Chlorella, all three test agents maximized biomass production. CO2 induced the most growth (192%), followed by phosphate(18-33%), and lastly by iron(11-23%). For Scenedesmus, all three test agents also maximized biomass production. CO2 induced the most growth(53%), followed by phosphate(9-17%), and iron(6-16%).

Conclusions/Discussion

CO2 induced the most biomass production because it is essential for photosynthesis; CO2 addition resulted in faster cell division and hydrocarbon production. Phosphate was next because it is a macronutrient for algal growth, as opposed to iron, a micronutrient. All three test agents increased biomass production compared to the control. My hypotheses were thus supported. Picking the right strain for a set of growth conditions is critical for maximizing biomass. Algae sequestrate atmospheric CO2 while increasing biomass production as well. My experiment suggests that better matching of algal nutrient requirements with their supply could play an important role in increasing cost-effective algal biomass production.

Summary Statement

I investigated maximizing algal biomass production by varying growth conditions; my project could combat engineering challenges for cleaning the environment and increasing cost-effective algal biomass production to get our #green gold."

Help Received

I thank my science teacher for her guidance; Schmahl for their lab use; and Dr. Quinn from Berkeley National Laboratory for answering my numerous questions.