



CALIFORNIA STATE SCIENCE FAIR 2004 PROJECT SUMMARY

Name(s) Vinay Tripuraneni	Project Number S0899
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Project Title

CO₂ and the Greenhouse Effect: Can Highly Efficient Freshwater Phytoplankton (Algae) Reverse a Potentially Deadly Process

Abstract

Objectives/Goals

The basis of this project was to determine which algal species produces the most Oxygen, thereby removing an equal amount of Carbon Dioxide by means of Photosynthesis.

Methods/Materials

This two-part eight week study was conducted using a self-designed apparatus. The apparatus consisted of a 250 mL I.V. bag that connected to tubing. The tubing was then connected to a 100 mL gas measuring tube through a rubber stopper. Once the apparatus was constructed, 5 different 25%/100 mL algal cultures were injected into each I.V. bag along with 100 mLs of pond water and 50 mLs of a 2.5 % Sodium Bicarbonate solution. After all of the six assemblies were prepared (this includes a control) they were placed into an Environmental Chamber. The algae were allowed to photosynthesize for a period of two weeks, for 10 hours a day. Once the two week period concluded a syringe was used to measure the amount of Oxygen produced. Then each culture was extracted from the I.V. bag and the percent transmittance was determined through the use of a spectrophotometer. This experiment was repeated twice with two of each algal culture in each experiment; this totaled to four sets of data for each algal culture.

Results

From the data acquired from both two week studies Oscillatoria was determined to be the species that performed the best. Oscillatoria boasted a production series of {4.5,5.0,4.8,5.0} mL of oxygen (O₂), while the next highest producer, Volvox, produced a respectable {4.7,4.7,4.7,4.6} mL of O₂ throughout the experiment. Spirogyra was the third most productive producer, producing {4.6,4.2,3.8,4.2} mL of O₂. Chlorella and Anabaena were the least productive with an O₂ output of {2.0,1.8,1.9,1.5} and {1.8,1.9,1.6,1.7} mL of oxygen respectively. The Chi#s Square method indicated that Oscillatoria performed much better than all the other species with a 99.0% confidence level.

Conclusions/Discussion

The final analysis showed that Oscillatoria consistently outperformed all of the other algal species. One of the possible explanations may be that Oscillatoria has the most efficient chloroplast. Oscillatoria must have an enzyme that is more effective at binding/transferring energy. This superior enzyme binds energy from the chloroplast to the H₂O molecules to split them much more efficiently. If this enzyme were manipulated the efficiency of photosynthesis in an algal cell could be greatly improved.

Summary Statement

This study focuses on determining which algal species is the most adept at producing O₂ and removing CO₂ by means of Photosynthesis.

Help Received

Conducted at Clovis West High School with on-site lab equipment. Mr. Wayne Garabedian and Dr. Bert Tribbey both provided invaluable advice. Father helped assemble board.