CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

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Project Number

S0898

Project Title

Iron Fertilization and Eutrophication of Phytoplankton on Dissolved Oxygen Content

Abstract

Objectives/Goals

The goal was to test the affects of increased phytoplankton growth due to iron fertilization on the amount of dissolved oxygen below the water surface of an ocean environment. Numerous experiments have already proven iron fertilization increases phytoplankton populations, but these tests failed to study the side affects of such fertilization on the environment near the bottom of the testing area. The experimental hypothesis was that if the iron concentration in ocean water is increase, then the oxygen below the surface will decrease because of eutrophication and replacement of oxygen by carbon dioxide.

Methods/Materials

Four identical systems were constructed to mimic certain ocean conditions (light gradient, oxygen gradient, salt content) and to allow for testing at a substantial depth. After an initial stabilizing period, a plankton concentrate was added to each of the four systems and allowed time to establish. Ferrous sulfate was added to three of the tubes in different amounts. One system, the control, received no iron. The four environments were titrated over a five month period for dissolved oxygen content.

Results

For the first phase of the experiment, the collection design was flawed and most of the data is inconclusive. However, after the collection method was corrected, the four tubes had an equal amount of dissolved oxygen before the iron was added. After the iron was added, the dissolved oxygen in the tube with the 0.1g of ferrous sulfate for 3.2L saltwater increased greatly while the other systems, including the control with no iron decreased slightly. During the second test, the DO concentration of the control and the systems with the two highest iron concentrations remained constant. (Constant based on measurable change. The color of the solution to be titrated indicated a slight decrease in both systems.) The system with 0.1g ferrous sulfate increased in DO content.

Conclusions/Discussion

The results do not support the hypothesis fully. The higher iron concentrations did decrease DO content observably but not measurably. From our experiment, it appears there is an optimal amount of iron to promote dissolved oxygen in the ocean. The implications of these results are great. If there is an optimal level of iron concentration to increase phytoplankton and dissolved oxygen, then iron fertilization could be safe and affective to help reduce global warming and increase fish populations.

Summary Statement

The experiment tested the affects of iron fertilization of phytoplankton on deep-ocean dissolved oxygen content, with a focus on environmental safety.

Help Received

Kent Schulter for supplies and board construction; Centennial High School chemicals and lab space; Kristin Hudlow for lighting instruction and microscopes