CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Hyelim Chun; Prabhjot Grewal

Project Number

34840

Project Title

An Analysis of the Effects of Carbon Dioxide on the Dissolution of Calcium Carbonate in Marine Organisms

Abstract

Objectives/Goals

Ocean acidification is when carbon dioxide (CO2) is absorbed by seawater and chemical reactions occur, which reduce seawater pH, due to a higher concentration of hydrogen ions and therefore increases the carbonate ion concentration. This process is detrimental to the environment because many organisms are relying on the stable pH and a change would result in many organisms' inability to adapt to rapidly changing environment. Different sections of the ocean experience varying levels of temperature, subsequently varying levels of pH. If there is a constant rate of carbon dioxide dissolution that acidifies the solution, then the higher the temperature would result in a higher pH and lower calcium carbonate dissolution.

Methods/Materials

In the experiment, the masses of shells before and after being introduced to the acidic conditions were compared with each beaker experiencing the same rate of carbon dioxide dissolution. Temperature was the independent variable, as tropical, polar, and room conditions were measured, and the mass loss was the dependent variable. Surface of the shells were also observed to indicate other consequences of ocean acidification.

Materials: Carbon dioxide tank, Aquarium mix, Beakers, Distilled water, Shells, Electronic Scale, Microscope, Dry bath, Water bath, pH meter, Stock pH solution (4.0 pH and 7.0 pH), Rod/ scrapper, Gloves, Rubber stoppers, Eye goggles

Results

The beakers that experienced a temperature of 22 degrees Celsius had a pH of 6.0, the beakers that experienced a temperature of 30 degrees Celsius had a pH of 6.45, and the beakers that experienced room temperature (25 C) had a pH of 6.3.

Conclusions/Discussion

As a result, the shells from the higher temperature underwent a lower amount of dissolution because the water molecules contain a higher amount of energy, through the form of heat, which creates an environment that is difficult for the carbon dioxide to dissolve into. Another factor that contributes to the effects of ocean acidifcation is the surface area to mass ratio, where the smaller the shell (the has a larger surface area) would lose the most mass because more of the shell is being exposed to the acidic water.

Summary Statement

Carbonic acid creates a higher ocean pH, leading into oceaan acidifcation, and our project analyzes the effects of ocean acidification on shells. which affect microscopic organisms that are the basis of the marine food web.

Help Received

Mrs. Jennings allowed us to use the dry and water bath in her classroom.