CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
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Project Number
S1124

Project Title
What's Your SHELLf Life: The Effect of CO(2)-Induced Carbonic Acid on Calcium Carbonate in Sea Water

Abstract

Objectives/Goals
The goal of this experiment was to demonstrate what high acidity levels in the ocean will do to calcium carbonate sea shells.

Methods/Materials
1500 milliliter samples of sea water were obtained from 3 different locations near Monterey, CA: open ocean, Elkhorn Slough, Monterey Harbor. 110 small clam shells were weighed and labeled according to sample group. Using a Vernier pH probe, the initial pH level was determined for the five control groups (no added CO2): tap water (pH 6.82), alkaline (pH 8.2), open ocean (pH 7.9), slough (pH 7.9), and harbor water (pH 7.72). Using a Planet Bike Airflation CO2 bike tire inflator, CO2 was bubbled into solution to reduce the pH for each of the 3 test groups (open ocean, slough, harbor). A sample set with pH 7.0 and a second sample set with pH 7.5 were created for each of the three test groups. Twenty milliliters of each sample set for both control groups and test groups were placed in a closed cup with a clam shell. The clam shells remained in the solutions for ten days before being removed, dried, and weighed again. Final pH levels were recorded for all control groups and test groups.

Results
The slough water samples dissolved the most sea shell material at both the 7.0 and 7.5 pH levels. The alkaline solution samples demonstrated the least amount of shell loss. Every sample demonstrated an increase in final pH level after 10 days. All 3 sea water test groups had final pH levels near 7.7 for both the 7.0 and 7.5 pH levels. The final alkaline sample pH was 8.42. The tap water control group showed the largest increase in pH from 6.82 to 7.87.

Conclusions/Discussion
There appears to be no correlation between the amount of shell loss and change in pH during the testing period. The experiment did not support the hypothesis that the harbor water samples would dissolve the greatest amount of sea shell material. Adding CO2 to a solution does effectively increase the acidity by reducing the pH level. There are other factors that may affect calcium carbonate breakdown besides pH level, including water temperature, time of exposure, and water source.

Summary Statement
This experiment explored the effect of CO2-Induced carbonic acid on calcium carbonates in sea water.

Help Received
My CART advisor, Staci Bynum, provided me the pH buffers and probe. Dr. Kenneth Clifton of Lewis and Clark College provided mentoring and suggestions for project modifications.