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Title: Effect of Acidification on Coral Reefs

Purpose: Examine the effect of pH from different solutions on coral. Discuss how the lab demonstrates the effect ocean acidification has on a coral reef.

Background: Coral reefs are extremely diverse marine ecosystems being host to over 4,000 species of fish, massive numbers of jellyfish, mollusks (shellfish), crustaceans (crabs, lobsters), and many other animals. Reefs are made up of calcium carbonate secreted by corals, a marine organism. Corals are highly sensitive to environmental changes, including temperature and pH. The corals that form the structure of the great reef ecosystems of tropical seas depend on a symbiotic relationship with photosynthesizing algae called zooxanthellae. These algae live within the coral tissues and give coral its coloration. Under stress from environmental changes, corals expel their zooxanthella, which leads to a lighter or completely white appearance, hence the term "coral bleaching." Scientists have predicted that over 50% of the world's coral reefs may be destroyed by the year 2030 due to changes in the ocean environment.

In addition to causing coral bleaching, changes in pH can deteriorate calcium carbonate: the building block of coral reefs as well as the makeup of the shells and skeletons of mollusks. Higher rates of bleaching and calcium carbonate damage have been linked to climate change, and once degradation occurs, it can continue to devastate the ecosystem.

The marine food chain depends on coral reefs. Humans eat a variety of seafood that come from, or develop in, coral reefs. A disruption in the coral reef ecosystem will affect the food chain, which, in turn can impact human health. A change in the pH of the oceans can affect the food chains and human health, including the increased presence of neurotoxins (chemicals that affect the brain) in fish, as well as a decreased supply of food, which can lead to malnutrition in people who depend on seafood. In this activity, you will explore how a change in ocean pH affects coral substrate, which is composed of calcium carbonate.

Hypothesis: write a statement expressing how you think the coral will be affected by the pH of various solutions.

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Materials:

- Coral substrate
- 20mL vinegar
- 20mL seawater
- 20mL baking soda solution
- 20mL soda
- 4 beakers
- Graduated cylinder
- pH strips

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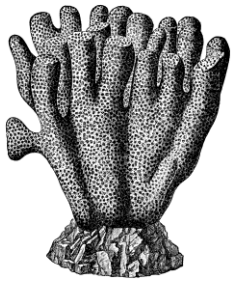

Procedure:

Day 1

1. Weigh a coral piece and record in the data table (initial mass).
2. Place 20mL of vinegar in a beaker. Label this beaker, "vinegar".
3. Check the pH of the beaker and record in the data table (initial pH).
4. Place the coral in the beaker and observe the immediate reaction (did it fizz/bubble/nothing/move).

5. Weigh a second coral piece and record in the data table (initial mass).
6. Place 20mL of seawater in a beaker. Label this beaker, "seawater".
7. Check the pH of the beaker and record in the data table (initial pH).
8. Place the coral in the beaker and observe the immediate reaction (did it fizz/bubble/nothing/move).

9. Weigh a third coral piece and record in the data table (initial mass).
10. Place 20mL of baking soda solution in a beaker. Label this beaker, "baking soda".
11. Check the pH of the beaker and record in the data table (initial pH).
12. Place the coral in the beaker and observe the immediate reaction (did it fizz/bubble/nothing/move).

13. Weigh a third coral piece and record in the data table (initial mass).
14. Place 20mL of soda solution in a beaker. Label this beaker, "soda".
15. Check the pH of the beaker and record in the data table (initial pH).
16. Place the coral in the beaker and observe the immediate reaction (did it fizz/bubble/nothing/move).
17. Place your beakers aside and leave them overnight.

Day 2

18. After 24 hrs: measure pH, check coral and make observations for each of your 4 beakers.
19. Record all data under Day2 of the data table.

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20. Remove coral from each solution and set down on labeled paper towel overnight.

Day 3

21. Weigh dry coral the following day (final mass).

22. For each piece of coral, calculate the % change in mass. And record in the data table.

To calculate % change in mass:

Percent mass lost = [(initial mass – final mass) ÷ (initial mass)] x 100

Data:

Record all observations and measurements in the following data table.

Solution	Initial pH	Initial Mass of Coral (g)	Day 1 Observations	Final pH	Final Mass of Dry Coral (g)(Day 3)	Day 2 Observations	% Change in Mass
20mL Vinegar			1. 2. 3.				
20mL Seawater			1. 2. 3.				
20mL Baking Soda			1. 2. 3				
20mL Soda			1. 2. 3.				

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Conclusions:

1.Which sample had the highest initial pH? Which sample had the lowest initial pH? What were these values?

2.Which sample had the highest final pH? What was it and why?

3.Which sample has the lowest final pH? What was it and why?

4.Which sample had the most significant change in pH over the 2 days? Why?

5.The bubbles in carbonated water come from CO_2 that has been added in. Was there a significant difference in pH between the soda solution before and after the addition of the coral? Why or why not?

6.How do you think the pH might change if you allowed the soda to go flat?

7.How low was the pH of the seawater at the end of the experiment? Could you make it go any lower? Why or why not?

8.How do coral reefs benefit humans? How would a loss of coral reefs impact humans?