

HOUSEHOLD CHEMISTRY

OCEAN ACIDIFICATION

QUESTION:

How does our carbon footprint affect marine life?

PERSONAL PROTECTIVE EQUIPMENT:

- Goggles/eye protection
- Gloves
- Long sleeves

HYPOTHESIS:

The more carbon dioxide in the atmosphere, the more acidic the ocean becomes, which affects shells and skeletons of marine life. To demonstrate, we expect that solutions with acidic vinegar will dissolve our samples.

MATERIALS:

- baking soda (1 cup)
- corn starch (1/2 cup)
- water
- 1 egg (more optional)
- vinegar (2 or more cups)
- 2 or more clear cups
- microwave-safe container
- stirring utensils
- nonstick surface (e.g. parchment paper)
- sculpting tools (e.g. pencils, toothpicks)
- paper towels
- oven mitts
- microwave

PART 1 PROCEDURE:

1. In a microwave-safe container, mix baking soda, corn starch, and 3/4 cup water.
 2. Microwave for 1 minute, then stir. Microwave again for 1 minute, then stir. Continue in 20 second intervals until mixture resembles mashed potatoes. CONTAINER WILL BE HOT.
 3. Once dough consistency is achieved, cover with a wet paper towel and set aside to cool (may take up to 1 hr, so monitor hot container with care).
 4. Once the dough has cooled, knead until smooth on easy-to-clean, non-stick surface - if too dry, add a little water, if too wet, add a very small amount of baking soda. Have fun and create some sea creatures! For best results, make similar size and thickness.
- Starfish - roll out 5 teardrop shapes and gently merge at the center. Add small spheres for texture on the limbs. (Alternatively, use cookie cutters to make basic shapes.)
 - Sand dollar - roll a ball and flatten. With a tool, outline flower; poke holes along edge.
 - Coral rocks - roll an uneven ball and use tool to poke holes in clusters.
 - Tube sponge - roll logs of different lengths and clump together as the base. Use a tool to poke holes at the tip of each one.
 - Shells - roll a ball, flatten, and pinch one end. Use tool to press or poke vertical lines.

PART 1 PROCEDURE CONTINUED:



1. The next steps of the experiment can be done using the wet dough immediately or after dough dries for a more realistic effect. To dry, leave for 1-2 days to air dry or heat in oven at 175 degrees Fahrenheit for 45 min (timing/coloration may vary).
2. Set up one cup of water (control sample) and one cup of vinegar; optionally, set up a cup of 50% vinegar solution. You may set up other solution ratios to experiment! Label on your cups or on paper towels.

3. Take your sculpted sea creatures and drop one into each of the cups. What do you notice? Watch the cups over the next few minutes or check back later to see the full effects. The samples will continue to react depending on the size and thickness of your creatures.

PART 2 PROCEDURE:

1. To see this demonstrated on a natural sample, place an egg into a cup of vinegar and let set for 24 hours. You may use multiple eggs in various solutions as above to experiment!
2. Check the egg after 24 hours. What do you notice? Optional: change the vinegar and leave for 1 week! Pour off the vinegar and carefully rinse with water. Only the membrane remains!

CLEAN UP: Waste can be rinsed down the sink with running warm water.

CONCLUSION:

While the ocean may not be as acidic as the vinegar, these experiments demonstrate the harmful effects that increasing acidity has on ocean life. Carbon dioxide from the atmosphere dissolves in ocean water to form carbonic acid. Increased acidity not only erodes existing calcium carbonate shells and skeletons, similarly to the baking soda creatures and egg shell, but also prevents organisms from forming new calcium carbonate to build their shells and skeletons. It is important that we do what we can to reduce our carbon footprint and protect our marine life!

Advanced Reading:

EPA - <https://bit.ly/3tc8sPd>

Woods Hole Oceanographic Institute - <https://bit.ly/3wKTba9>

University of Southampton - <https://bit.ly/3sbeTR2>

Procedure adapted from: KikiCo- bit.ly/323k3nP; Steve Spangler- bit.ly/3g7jt0n