



Ocean acidification and dry ice

Explore the chemical reaction between frozen carbon dioxide (dry ice) and water and compare this to changes that are occurring in ocean ecosystems, as excess carbon dioxide in the atmosphere is absorbed by the ocean.

Background

- Our ocean acts as a carbon sink and absorbs carbon dioxide from the atmosphere.
- In the past 200 years, the amount of carbon dioxide in the atmosphere has increased by more than 40% due to human activity such as burning fossil fuels (e.g., car emissions) and changing land use (e.g., deforestation).
- The ocean absorbs about 30% of the carbon dioxide that is released in the atmosphere. Carbon dioxide reacts with ocean water molecules to form carbonic acid, causing a decrease in the pH of the ocean water.
- This increased acidity negatively impacts the ability of many marine organisms to form their shells and other structural frameworks.
- In the demonstration the increased carbon dioxide levels, resulting from the dry ice, and the decreased pH as shown by the pH indicator, represent ocean acidification that is occurring due to human influences.

Materials

- 2 transparent containers
- 2 drinking straws (preferably reusable or compostable) or hollow pasta or hay
- Bromothymol blue indicator solution
- Dry ice
- Tap water

Instructions

- Add water and a few drops of bromothymol blue indicator solution to each container. Be sure to use tap water, as distilled water has a slightly lower pH. The solution should be a light blue.
- Use the straw to blow bubbles into the water of one container until it starts to change to a yellowish-green color. This represents the pre-industrial revolution ocean.
- Add a small piece of dry ice to the second container. It should change to bright yellow. This represents the post-industrial revolution ocean, where there is much more atmospheric carbon dioxide.

Extensions

- Instead of dry ice, bubble smoke from a candle into the indicator solution.
- Investigate and discuss activities that students can do to reduce their carbon footprint.
- Use a pH meter to measure the pH.



NOAA Education: Hands-on activities

Related resources

- NOAA Education ocean acidification resources:
<https://www.noaa.gov/education/resource-collections/ocean-coasts/ocean-acidification>
- Data in the Classroom: Ocean acidification (online lessons):
<https://dataintheclassroom.noaa.gov/content/ocean-acidification>
- Understanding ocean acidification activities:
http://www.cisanctuary.org/ocean-acidification/hands_on_activities.php
- NOAA Ocean Acidification Program: <https://oceanacidification.noaa.gov/>
- Pacific Marine Environmental Laboratory: Ocean acidification:
<http://www.pmel.noaa.gov/co2/story/Ocean+Acidification>