Ocean Water Properties

Introduction

What is the difference between water of high salinity and water of low salinity? What effect does density have on water currents? Perform simple activities to answer these questions.

Concepts

- Salinity
- Density
- Buoyancy

Materials

Food coloring, red
Water, cold
Water, warm
Carrot, 2″ piece
Ice cube, dyed red
Plastic cups, clear, (or 600-mL beakers), 3
Plastic spoon
Potato, 2″ piece
Salt

Safety Precautions

Although this demonstration is considered nonhazardous, always follow appropriate laboratory safety rules. Use caution with wet surfaces, as they can become slippery. All food-grade items that have been brought into the lab are considered laboratory chemicals and should not be consumed.

Preparation

Prepare a red ice cube by adding red food coloring to water placed in an ice cube tray. Place the ice cube tray in a freezer and allow the water to freeze.

Procedures

Salinity

1. Obtain two clear plastic cups. Fill each cup half-full with cold water.
2. Place a small piece of carrot (approximately 2″) into the first cup. Have students note whether the carrot floats or sinks.
3. Using a plastic spoon, add salt, one spoonful at a time, to the cup of water with the carrot in it. Stir the solution and have students record their observations and the number of spoonfuls of salt added to the cup until the carrot floats.
4. Place a small piece of potato (approximately the same size as the carrot) into the second cup of water.
5. Repeat steps 3 and 4 for the potato. Have students record the number of spoonfuls of salt added until the potato floats.
6. Have students compare the amount of salt added to each cup. Which object, the carrot or the potato, required the most amount of salt before it would float? What happens as the salt is added to the water? If you were swimming, would it be easier to stay afloat in an ocean or a freshwater lake?

Water Temperature and Density Currents

7. Fill a clear plastic cup about half-full with warm water.
8. Have students look at the water at eye level and add a red-colored ice cube.
9. Have students observe what occurs. In which direction are the red color streams heading?
10. Based on observations, ask the students if cold water is less dense or more dense than warm water.

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Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures, and review all federal, state and local regulations that may apply, before proceeding. The water may be rinsed down the drain according to Flinn Suggested Disposal Methods #26b. All other materials may be placed in the trash according to Flinn Suggested Disposal Methos #26a.

Tips

- These activities may be done as a demonstration or as a classroom activity. Plan ahead and have enough materials as needed.
- Allow enough time for the red-colored ice cube(s) to freeze thoroughly.
- As an extension, demonstrate or have your students experiment with the differences in density of low salinity water ver sus high salinity water. Prepare a solution of high salinity, dyed blue, and also a distilled water sample dyed red. The water with the lower amount of salinity will be displaced and rise to the surface by the water with the higher concentration of salt. Flinn Scientific's Density Box Demonstration, AP4784, works well for this demonstration.

Discussion

Ocean water is a combination of freshwater and a variety of dissolved ions of salts and other trace elements. While local differences in salinity and temperature of ocean water occur, the composition of seawater is fairly uniform around the globe, and has been for a major period of geologic time. Salinity is a measure of the amount of dissolved salts in seawater, and is measured in parts per thousand. Typically, seawater has a salinity of 35 parts per thousand (3.5%) and a density of between 1.026 and 1.028 g/mL. Variations in the salinity of seawater can be seen in regions with high versus low rates of evaporation, such as the Mediterranean Sea versus the deeper locations of the Pacific Ocean. Variations in salinity can be measured through conductivity (the ability to conduct an electrical current), evaporation, the refraction of light, or through the use of a simple hydrometer.

Ocean currents are the large-scale water movements that occur at the surface and in the depths of the oceans. Surface currents are driven primarily by global wind patterns while subsurface currents are driven by ocean water density differences. Subsurface currents may also be caused by differences in the salinity or by temperature variations. As very saline or cold water sinks, the less saline or warmer water is displaced and rises to the surface. Ultimately, global stratification of water throughout the ocean water column is formed, where circulation varies depending on the location, temperature, and salinity of the ocean water.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Systems, order, and organization
Evidence, models, and explanation
Content Standards: Grades 5–8
Content Standard B: Physical Science, properties and changes of properties in matter
Content Standard D: Earth Science, structure of the Earth system
Content Standards: Grades 9–12
Content Standard B: Physical Science, structure and properties of matter, motions and forces
Content Standard D: Earth and Space Science, energy in the Earth system, geochemical cycles

Materials for *Ocean Water Properties* are available from Flinn Scientific, Inc.

Catalog No.	Description
V0003	Vegetable Dyes
AP6543	Clear Plastic Cups, 16 oz
AP4784	Density Box Demonstration

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.

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