

Lab: Testing Water for Hardness

name: _____

Introduction

When soap is added to “hard water”, curds form, causing a greasy ring around sinks and bathtubs. It is “hard” (difficult) to get a lather to form because the soap molecules combine with dissolved ions (calcium, magnesium, iron) in the water. These ions are dissolved into the water as it comes into contact with rock materials. For example, water that drains a limestone canyon would probably contain an abundance of calcium ions (limestone is primarily made up of CaCO_3). To get a lasting lather, these curd-forming ions must be removed by adding more soap molecules to combine with them. Eventually lather will form. The more soap that is needed to cause lather . . . the “harder” the water is.

Purpose: To compare the hardness of several samples of water, including tap-water, well water, bottled water, distilled water, etc.

Pre-Lab Questions

1. What is an “ion”?
2. Which three ions are usually to blame if water is “hard”?
3. How do these get into surface water and groundwater?
4. How is distilled water different from other water?
5. Most people prefer to have some minerals dissolved in their water, especially drinking water. But why is it undesirable to have water that is too hard?

Materials: 5 test tubes (in a cup), a small bottle of soap solution, and an eye-dropper

Procedures

1. Take a test tube to one of the water sample stations. Use the beaker and graduated cylinder to obtain 5 ml of water sample at that station. Pour it into the test tube, and then return to your lab table. Make a data table and then write the name of the water sample on your data table.
2. Add 3 drops of soap solution to the test tube, cover the end of the tube with a finger, and then shake vigorously for 5 seconds. Check to see if there is a “lasting lather” (still present after 5 seconds). If not, add another 3 drops of soap, and repeat the shaking. Keep doing this until a lasting lather appears. On the data table, record the number of drops of soap needed to cause the lather.
3. Repeat procedures 1 & 2 for nine more water samples. If you use a test tube more than once, be sure to rinse it between trials.
4. Design a bar graph to show your results.

Data Table

Put names of water samples here.

Number of drops of soap needed to cause lather:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

**Number
of drops
of soap
needed**

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Sample Number

Follow-Up Questions

1. As you added soap to some of the harder samples of water, what formed instead of a soapy lather?
2. According to your results, which water sample was the “hardest”?
3. Which sample was the “softest”?
4. Why would the distilled water be considered the “control” in this experiment?
5. Which is typically “harder”, groundwater, or surface water? Explain.
6. Would you expect water in a limestone cavern to be hard, or soft? Explain.
7. If you spilled some really hard water on a dark countertop, and then let it evaporate, what would the spill area look like after the evaporation?