Testing Water Samples

Overview

In this activity, students test water from 4 local sources to determine its purity.

Background

As the 'universal solvent,' water dissolves lots of things, including some things that make it less useful for washing or drinking. Some water impurities can even corrode pipes. Common measures of dissolved compounds include 'hardness' (calcium and magnesium salts), acidity or alkalinity (low or high pH), chlorine (added to kill bacteria), iron, copper from pipes, or coliform bacteria. Although a particular type of coliform bacterium may not be dangerous, the presence of coliform bacteria in a water sample indicates that other potentially dangerous organisms may be present. Any sample that tests positive for bacteria should not be consumed.

EPA recommendations for limits on water contamination are summarized below:

- Alkalinity – should be < 180 ppm
- pH – should be between 6.5 and 8.5
- Hardness – should be < 50 ppm
- Iron – should be < 0.3 ppm
- Copper – should be < 1.3 ppm
- Total Chlorine – should be < 4 ppm

Materials

*Materials to be supplied by the teacher or the students are marked with an asterisk.

Materials for the whole class

- 4 sterile collecting bottles for collecting water samples
- *4 water samples in bottles from different locations, labeled by location
- 4 bacteria tests
- 1 pair of rubber gloves
- 1 pair of safety glasses
- *10 % chlorine bleach solution (teacher wearing rubber gloves and safety glasses should make this)

Materials for small groups (Groups of 2)

- 1 hardness test strip
- 1 pH test strip
- 1 chlorine test strip
- 1 iron test strip and sulfite tablet
- 1 copper test strip
- 1 1-oz cup containing a water sample labeled with the location from which it was taken
- an empty 1-oz cup to collect used test strips
- 1 Water Analysis Test Instructions sheet
- *paper towels

Preparation

- Collect water samples from 4 different locations. Try to include samples from outdoors, such as a pond or stream, and some from drinking water sources. Take care when collecting samples not to pollute them by touching the inside of the cap or bottle. Do not let your hand touch water that may go into the collecting bottle.
- The bacteria test takes 48 hours, and even a strong positive may appear negative for the first day. However, it retains its positive color for several days after the 48 hours. Once sealed for the test, the vials should only be opened for disposal. Discard all completed bacteria tests as biohazards by disinfecting as follows:
    - Fill a container with a 10% chlorine bleach solution (1 part bleach to 9 parts water).
    - Empty the contents of each bacteria test vial into the bleach.
    - Immerse each vial and cap in the bleach.

Be sure that students have learned a little about bacteria in water, including how potentially harmful bacteria can get into water and what problems these bacteria can cause. Let students see you put water samples in the bacteria test vials. Follow the instructions with the vial. Let students know that the class will read the test in 2 days.

Procedure (for students)

Notes to Students about the Test Strips

These tests are very sensitive, so be careful not to touch anything that comes in contact with your sample. Note the following peculiarities with these test strips:

- Each strip can be used only once.
- Follow directions on the Water Analysis Test Instructions sheet for each test strip. Pay attention to how long you dip the strip in the sample before removing it. Don't shake off excess water. Hold the strip level (parallel to the floor), and read the results after the amount of time specified.
- The **pH test** looks reddish before use, and it appears not to change very much in a liquid of pH 4. However, the color strip *is* accurate, and that reddish color indicates pH ≤ 4. Pure neutral pH (7) water placed on the strip turns it brownish.

The group does the following steps in this order:

1. Test the sample *1-test-at-a-time*. In your notebook, record the name of the sample (location from which it was taken), the type of test, and the result in ppm. Use the table below to note whether you think any action should be taken.

   EPA recommendations for limits on water contamination are summarized below:
   - pH – should be between 6.5 and 8.5
   - Hardness – should be < 50 ppm
   - Iron – should be < 0.3 ppm
   - Copper – should be < 1.3 ppm
   - Total Chlorine – should be < 4 ppm

2. Do all of the following tests, and record the results of each in ppm. After each test, place the used strip in the empty 1-oz cup.
   - pH test strip
   - hardness test strip
   - iron test strip and sulfite tablet
   - copper test strip
   - chlorine test strip