OBJECTIVES

The student will do the following:

1. Define potable and identify water that is potable.
2. Compare pollution amounts in the same quantity of water.
3. Explain how even small amounts of pollution in a given water supply can be harmful.

BACKGROUND INFORMATION

When water falls out of the sky as rain, the water is in its purest and cleanest form. It is potable, or clean enough to drink. However, as the water picks up dirt and waste from roofs, soil, roads, and other surfaces, these items make the water dirty, or polluted.

Water pollution is often difficult to detect. Large bodies of water such as lakes, rivers, and oceans have the capacity to dilute and disperse wastes. As a result of dilution and dispersion, the color, smell, and taste of contaminated water may not be any or much different than uncontaminated water.

Swimmers in polluted areas can become ill with a variety of infections. Large amounts of contaminants can kill fish or make them unfit to eat. Shellfish have the ability to concentrate certain toxins from polluted water in their tissues, making them harmful to eat. Algal blooms flourish in waters polluted with sewage and fertilizers. Much of the oxygen in water is used up during an algal bloom. This oxygen deficiency causes large amounts of fish to die and large deposits of slimy, odorous muck from dead vegetation on the bottom.

Terms

Pollution: contaminants in the air, water, or soil that cause harm to human health or the environment.

Dilution: the act of making thinner or more liquid by adding to the mixture; the act of diminishing the strength, flavor, or brilliance of by adding to the mixture.

Potable: fit or suitable for human consumption, as in potable water.

ADVANCE PREPARATION

A. Prepare a water filter using a plastic liter soda bottle with the bottom cut off, the label peeled off, and a one-hole stopper carrying a short length of glass tube inserted into the small end of the soda bottle. Put a little cotton wool in the bottom and then a layer of small clean pebbles.
Wash some coarse sand well and place a layer above the pebbles. Next wash some fine sand and make a thicker layer in the filter. Grind up some wood charcoal and make it into a paste with water. Spread the charcoal paste evenly over the surface of the sand. Secure some very muddy water and pour in the top of the filter. Collect the filtrate in a clean glass placed below the filter. (See diagram.)

PROCEDURE

I. Setting the stage

A. Conduct the above experiment and ask for volunteers to drink the potable water.
B. Ask the class to brainstorm ideas of what potable water is. Ask them what word they might confuse with potable.
C. Give the class the correct definition of potable water for their notes. Ask the class to brainstorm ways their school gets potable water.
D. To introduce the water treatment cycle, read The Borrowers A float by Mary Norton.
E. Produce the overhead and compare it to the borrowers’ journey and the conducted experiment
F. Have students illustrate cartoons about the borrowers’ journey down the drain, thorough a pipe and into a river.

II. Activity

A. Explain to the students how they will recreate the water treatment system for their classroom.
B. Divide the class into cooperative groups.
C. Have each group make muddy water by mixing 1/4 cup of topsoil with water in a quart container. Put the lid on the container and shake.
   1. Now make a water filter by cutting the top off a soda bottle about 4 inches below the spout (the teacher should help). Turn the top upside down and rest it in the remainder of the bottle.
   2. Wet some sand and put a 1-inch layer in the coffee filter.
   3. Put a 1-inch layer of crushed charcoal on top of the sand. Then cover with another 1-inch layer of wet sand.
   4. Slowly pour about 1 cup of muddy water into your filter. Be sure to leave some muddy water so you can compare it to the filtered water.
   5. Time how long it takes the water to begin filtering. Is the water that passed through the filter cleaner than the water in the other container?
D. Have the groups present their findings and write them on the attached chart.

III. Follow-Up

A. Have the students answer the following questions.
   1. Compare the muddy water and the filtered water, explaining how sand can clean the water.
B. Discuss the methods students can use in their homes in order to make the water they get from the faucet or the river potable. Have them draw pictures of these methods.

1. Boiling is probably the best way to purify water. There is some debate about how long water needs to be boiled before it is safe to drink, but most say one minute of a rolling boil.

2. Iodine: Common household iodine from the medicine chest or first aid kit may be used to disinfect water. Add five drops of 2 percent approved tincture of iodine to each quart or liter of clear water. For cloudy water add ten drops and let the solution stand for at least 30 minutes.

3. Chlorine: Bleach will kill some, but not all, types of disease-causing organisms that may be in the water. If the water is cloudy, filter it through clean cloths or allow it to settle, and draw off the clear water for disinfection. Add 8 drops of regular, unscented, liquid household bleach for each gallon of water, stir it well and let it stand for 30 minutes before you use it.
Filter Set-Up:

Step 1: Cut the soda bottle off 10 cm below the spout. Turn the top upside down in the rest of the bottle. Put a coffee filter in the bottle.
Step 2: Wet some builder’s sand and put a 2.5 cm layer in the coffee filter.
Step 3: Put a 2.5 cm layer of crushed charcoal on top of the sand, then cover with another 2.5 cm layer of wet builder’s sand.
Step 4: Slowly pour 250 mL of muddy water into your filter. Save some muddy water to use as a comparison.
Step 5: Time how long it takes the water to begin filtering and record what the water looks like.
CHART: WATER FILTRATION

<table>
<thead>
<tr>
<th>Time</th>
<th>What the Water Looked Like</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 0</td>
<td></td>
</tr>
<tr>
<td>30 seconds</td>
<td></td>
</tr>
<tr>
<td>1 minute</td>
<td></td>
</tr>
<tr>
<td>1 minute, 30 seconds</td>
<td></td>
</tr>
<tr>
<td>2 minutes</td>
<td></td>
</tr>
<tr>
<td>2 minutes, 30 seconds</td>
<td></td>
</tr>
<tr>
<td>3 minutes</td>
<td></td>
</tr>
<tr>
<td>3 minutes, 30 seconds</td>
<td></td>
</tr>
</tbody>
</table>

Please answer the following questions:

1. How did the filter clean the muddy water?
2. Is the water potable? Why or why not?
3. What could still be in the water?
4. What parts of your experiment represent steps used by water treatment plants?