Water: Is it Safe to Drink?

Objectives:

Students will construct, use, and compare simple filters to attempt to purify polluted water. Students also will use the Safe Drinking Water Act poster to predict and prevent the effect of water pollution on their community's drinking water.

National Academy of Sciences Standards Addressed:

As a result of activities in grades 9-12, all students should develop understandings of the following concepts:

- personal and community health;
- environmental quality;
- scientific inquiry;
- natural resources;
- natural and human-induced hazards.

Desired Outcomes:

After completing the lesson, students will:

- recognize the source(s) of their community's drinking water;
- understand the potential threats to their drinking water;
- recognize their role in protecting their drinking water at its source(s).

Class Time:

45 – 90 minutes

Materials Needed:

- 5-gallon aquarium or large, clear container filled with clear tap water;
- 1 lb. dirt or sand;
- 1 lb. leaf litter or grass clippings;
- 1 cup gasoline;
- 1 drop or cup motor oil;
- 1 cup dissolved fertilizer;
- 1 cup pesticide;
- small trash items;
- for every 2-3 students: clear plastic 2-liter bottle, plastic funnel (each of which can be cut from *other* 2-liter bottles), pantyhose, cotton balls, coffee filter paper, activated charcoal, and clean sand (see Figure 1 below);
- appropriate lab safety equipment;
- Safe Drinking Water Act poster;
- observation sheet (reproducible).

Reproducible:

- Filtering a Water Supply: This handout contains a table on which students should record lab observations and results.

Lesson Steps:

1. Describe a sunny day at the local river, lake, or other source from which your community draws its drinking water. Then ask students whether activities they enjoy in or around that source could potentially threaten their drinking water. You could ask students "Has anyone taken a car ride on a road beside a lake?"
2. Add a small drop or cup of motor oil to the demonstration water supply, and ask students to infer why you did this after having asked your question.
3. Ask students for other possible pollutants and continue to add pollutants you have prepared. By the end of the demonstration you should

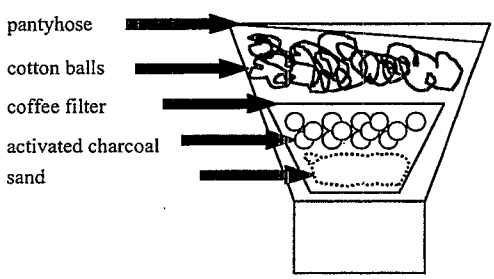
be able to point out several things: The water looks different (physical pollution should be visible); not all sources of chemical pollution (gasoline, fertilizer runoff) may be visible; and the water no longer is safe to drink.

4. For dramatic effect, pour some of this polluted water into a drinking glass and ask students whether they would drink the water. After they say "no," tell students that all these pollutants potentially threaten their drinking water (although not necessarily in the same quantities as used during the demonstration.)
5. Divide the class into pairs or trios. Give each group one clear plastic 2-liter bottle and a funnel, or have them make a funnel from another 2-liter bottle by simply cutting a 2-liter bottle in half and discarding the bottom half. Label each bottle with the group number.
6. Explain to the class that each group will build one of five slightly different filters. Each filter will be used in an attempt to decontaminate the same polluted water supply. Use Table 1 to assign the different filters to each group. Use Figure 1 to see how the most complex filter might look.

Table 1: Filter Construction

Filter Materials
Filter 1. funnel lined or covered with pantyhose only
Filter 2. funnel, pantyhose, cotton balls
Filter 3. funnel, pantyhose, cotton balls, coffee filter
Filter 4. funnel, pantyhose, cotton balls, coffee filter, activated charcoal
Filter 5. funnel, pantyhose, cotton balls, coffee filter, activated charcoal, sand

Figure 1: Filter Construction



7. Make sure each group covers the top or bottom of the funnel so large particles will be caught. For example, the pantyhose should be stretched across the top of the filter and the coffee filter should be opened up to line the bottom of the filter (see Figure 1).
8. Once all filters have been constructed and each has been placed on top of a bottle, stir the polluted water supply and pour the same amount of polluted water through each filter.
9. Have students observe the results and record their observations on the reproducible. Students should compare the original polluted water to each filtered bottle.

Note: Please do not pour any pollutants down the drain!

10. Discussion Questions:
    - Which type of filter appeared to work best and why? [**The most complex filter worked the best because it contained materials of many different sizes to catch or remove different-sized particles from the polluted water.**]
    - Why is it good to have materials of different sizes or textures in a filter? [**The advantage of having materials with different size**

pores in a filter is so all the various-sized particles suspended in the water supply can be removed. If a filter just used the smallest-sized pores (like the coffee filter's), then it might become clogged with larger particles and not work as effectively.]

- What pollutants did the filter materials obviously capture? **[It captured objects suspended in the water like trash, grass, leaf litter, sand, and oil.]**
- What pollutants got through the filter materials? **[Objects that dissolve in the water or that are small enough to pass through the filter pores like dissolved fertilizer or gasoline. Students may need to smell the filtered water to detect these substances.]**
- What else might you need to do to the water used in this experiment before it is potable (drinkable)? **[Before drinking this water you still would want to try to remove any gasoline or high levels of chemicals dissolved in the water. The water also may need to be chemically treated to kill any harmful microorganisms.]**

11. Using the poster as a springboard, students first should identify and describe potential drinking water threats on the poster (in red), and then do the same in their community.

12. Help students recognize their roles in protecting drinking water at its source. Assign students any of the Academic Extensions below:

- Stage a mock town meeting. Invite a water treatment facility manager to discuss how pollutants such as those used during the lab are removed from drinking water.
- Research how polluted water affects people's health, and discuss these issues with local leaders.
- Create a pamphlet to teach community members how to prevent potential threats to drinking water.
- Tour a local water treatment facility. Compare your lab filters to the plant's filtration system.
- Research the most deadly pollutants that can be found in a drinking water source. Are there any lakes or rivers in your state that have warnings for high amounts of these materials?
- Create a poster, similar to the one used in class, that represents your community.

Additional Resources On:

Safe Drinking Water
http://www.epa.gov/safewater/
This EPA Web site provides information about local drinking water quality and source water protection.

Lab Activity: Filtering a Water Supply

Name: _____ **Date:**_____

Background: *Filtering is the process of removing solids from water. People must filter water sources for many reasons. Some chemicals found in water supplies can make humans or pets sick. Many of the organic materials found suspended in water supplies provide surfaces or nourishment for harmful bacteria or other microorganisms. After water is filtered, it usually is treated with chemicals such as chlorine to kill potentially harmful microorganisms. Filters can be constructed with simple materials to demonstrate the effectiveness of filtering systems in removing pollutants from water supplies.*

Purpose: to construct, use, and compare filtering systems to observe how water is filtered of pollutants. Each group will construct a slightly more complex filter. Students then will record observations and compare results.

Observations and Results: Effectiveness of Various Types of Filters

Group	Filter Materials	Observations: How effective was each filter?
1	pantyhose	
2	pantyhose, cotton balls	
3	pantyhose, cotton balls, coffee filter	
4	pantyhose, cotton balls, coffee filter, activated charcoal	
5	pantyhose, cotton balls, coffee filter, activated charcoal, sand	