



Title: Decaying Substances and Water Pollution

Time: 5 class periods

Objectives:

- ◆ Observe oxygen consumption caused by natural pollutants.
- ◆ Understand the use of a control when conducting experiments.



Introduction:

Wastes such as fertilizers and detergents that are carried into a waterbody can cause rapid growth of algae. The algae flourish for a short time and then die. But then decomposers cause the dead algae to decay. The decay process uses up oxygen in the water. After a while, fish living in the water die due to lack of oxygen. The change in the water as the oxygen is used up may be detected by using a chemical called bromothymol blue. Bromothymol blue that is added to the water will become yellow as the oxygen is depleted.

Advanced Preparation:

Fill test tube racks with four test tubes for each student or each group to do experiment. Gather pollutants (dead grass, dead leaves, mud, etc.) for each student or group.

Materials Needed

1. 4 corks
2. dead grass
3. 4 test tubes
4. medicine dropper
5. glass-marking pencil
6. water
7. dead leaves
8. test tube rack
9. mud from a puddle
10. bromothymol-blue solution

Procedure:

The procedure can be done in pairs but each student must record their own results.

1. Fill four test tubes about half full of water. Add four drops of bromothymol-blue solution to the water in each test tube. Place the four test tubes in the test tube rack.
2. Fill each tube with the designated pollutant:

Test Tube	Pollutant
1	Dead grass
2	Broken-up dead leaves
3	Mud
4 Control	No materials

3. Use the glass-marking pencil to label each test tube, describing the substance added. Label the 4th tube Control. Fill all 4 test tubes with water leaving just enough room to cork the top. Put a cork in each test tube.
4. Observe the test tubes for 5 days. Record any color changes that take place.



Evaluations:

Discuss the results of the experiment.

Remind students that pollutants can be a variety of materials including mud, grass, and leaves.

Have students brainstorm ways to prevent this type of pollution.



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- Explain that some of the wastes soak into the ground and pollute the water underground also.
 - Tell the students that this is a lesson will show them how too many nutrients can cause too much algae growth.
 - Explain that animal wastes also have nutrients (such as nitrogen and phosphorous) in them and those nutrients are released as the waste “breaks down” over time.
 - Since animal wastes also contain bacteria, which can be harmful to humans and other animals, explain that you will use another source of nutrients for the experiment rather than animal waste. Plant fertilizer will be used as the nutrient source.
 - Emphasize that when the plants absorb animal wastes and plant fertilizers, they do not cause water pollution problems. If more nutrients are applied than the plants can absorb, the excess nutrients end up in the surface water and groundwater.
1. As the class watches, select volunteers to help you fill two fish aquariums with 5 gallons of pond or stream water.
 2. Label one aquarium “A” and one “B” on an index card taped to each one (see illustration).
 3. Place 6 tablespoons of plant fertilizer in aquarium “A” as you explain that you are adding nutrients in the form of fertilizer in the water.
 4. Aquarium “B” gets one half teaspoon of fertilizer.
 5. Place aquariums near a window for light. If sunlight is unavailable use a grow light or sun lamp. Note: Do not place them in a cold place.
 6. Have students record their observations on a daily basis for a week.

Evaluations:

Discuss the results of the experiment. Have the students guess why there is a difference in the two aquariums. Ask them which aquarium looks more polluted.

Discuss how nutrient pollution could affect aquatic life. (Plants use oxygen to grow or respire and oxygen is used to decompose the dead plants. Lots of plant use lots of oxygen and this makes the oxygen unavailable to other aquatic life. When this happens, the other animals can't breath and sometimes get sick or die.) Have the students imagine they are fish and decide which bowl they would rather live in. Explain that after algae dies the oxygen in the water is used up, which the fish also need to breath to stay alive. Ask which bowl will use up the most oxygen when the algae dies. Conclude that small amounts of nutrients are beneficial, but too many are not good. Animal wastes washed into water bodies is a nonpoint source pollution problem that needs to be prevented.



Title: Too Many Nutrients

Time: 5-6 class periods

Objectives:

- ◆ Observe algae growth caused by excess fertilizer use.
- ◆ Discuss how using too much fertilizer can be detrimental to aquatic life.



Introduction:

Farmers, foresters, homeowners, and business people can pollute water by improperly using chemical fertilizers. For example, in urban areas, homeowners often apply more than the recommended amounts of fertilizer to lawns, gardens, and flowers. Farmers applying too much manure or fertilizer at the wrong time can cause similar problems. For instance, it is not good to apply fertilizer during the rainy season. After heavy rains, fertilizer can wash into rivers and lakes and supply the aquatic plants with too many nutrients. As a result, algae can multiply faster and cause algae blooms. Algae blooms can reduce the supply of oxygen in the water because oxygen is required for algae respiration and growth. During the day, algae photosynthesize and produce more oxygen than they can use. But at night when photosynthesis ceases, algae may use more oxygen to grow than may be available. This can deplete the supply of dissolved oxygen in the water. When the algae dies, oxygen is required to break down or decompose the dead algae. Both respiration and decomposition can make oxygen unavailable to fish and other aquatic life and may cause fish kills. When plants and animals die, they settle to the bottom. Under normal conditions this causes the water body to gradually fill with sediment and organic material. This process is called eutrophication. This process is accelerated when excess nutrients and sediment are added to a water body.

Advanced Preparation:

Gather materials necessary to conduct activity.

Procedure:

Introduction

- Explain that plant fertilizer and animal wastes have nutrients in them that make plants grow.
- Discuss how small amounts of fertilizer help plants grow stronger and faster and how animal waste is also a fertilizer because they contain the same nutrients.
- Tell the students that animals on farms leave a great deal of waste material. (With very young students, discuss pet wastes in yards to help them understand the situation.)
- Often animal wastes are washed into nearby streams, or worse yet, the animals are allowed to stand in the stream, and their wastes go directly into it. These wastes enter the water at many different locations, so it is considered nonpoint source pollution.
- Have the students guess what types of problems this can cause. (Messy, smelly, health problems, etc.)

Materials Needed

1. Two 5 gallon aquariums or similar containers
2. Surface water to fill aquariums
3. Index cards
4. Permanent ink pen
5. Tape
6. Plant fertilizer
7. Measuring spoons
8. Grow light or sun lamp (optional)