Bloomin' Algae!

Grade Level: 6th - 8th; **Type:** Ecology, Chemistry

Objective:

This project models a real world scenario and ecological issue: eutrophication, which results in bodies of water that are depleted of oxygen and are in a sense “dead”. The goal of the project is that the student becomes aware of a real ecological issue and how humans can inadvertently create damage to the natural environment. The student will also research and understand the far reaching effects of this issue and how we can work to prevent it.

Research Questions:

- What is eutrophication?
- What is an algal bloom and what are the environmental effects of an algal bloom?
- What are examples of point source pollution and non-point source pollution?
- How do fertilizers, phosphates, nitrates, etc. lead to oxygen depletion in the water?
- What are the long term effects of a body of water being depleted of oxygen?
- What is the experimental control in your experiment? What are some of the variables to consider in your project?

Eutrophication occurs when extra nutrients are added to a body of water. The algae or plant life in the body of water grows at a very fast rate or “blooms”. As the plants grow they begin to deplete the oxygen dissolved in the water. The other living things in the water requiring this oxygen begin to die off. Eventually the body of water cannot sustain life and it becomes a “dead” body of water. Eutrophication is mainly caused by fertilizer runoff from intensive farming practices, and improper sewage treatment. As the need for food rises with the country’s population we become dependent on farming practices different than those that have been traditionally used. This includes using more fertilizer on our crops to increase production. Chemical fertilizers are full of soluble phosphates and nitrates that run off of the land during heavy rains and irrigation. The chemicals make their way into bodies of water where they cause algal and plant blooms, hence eutrophication. When sewage runs into waterways the decomposers in the waste use the oxygen in the water and this also leads to eutrophication. In order to prevent this from happening we need to be more careful about what we use to fertilize crops and how we handle our sewage. Natural fertilizers like manure decompose more slowly so that the nutrients are not washed away quickly in run off water like the chemical fertilizers. We need to treat sewage properly before it makes its way back into the water cycle.

Materials:

The materials for this project can be found at the grocery store, an aquarium supply shop and around the home.

- 7 jars
- Cheesecloth
- Rubber bands
- Masking tape
- Pond water (pond water is best, but if it is not available water from a slow moving stream, or a lake should work as well)
- Spring Water (bottled water)
- Measuring cups and spoons
- Dissolved oxygen kit (from aquarium shop)
- Fertilizer (powdered or granulated, like Miracle Gro)
- Powder Detergent containing phosphates (like Cascade)
- Rubber gloves
- Camera (optional)

Experimental Procedure:

1. Label the jars 1-7 with the masking tape.
2. Fill each jar with a mixture of ½ pond water and ½ spring water. Use the measuring cups to be sure you put the same amount of water in each jar.
3. Jar 1 will be your control. Do not add fertilizer or detergent to this jar.
4. Following the safety precautions on the fertilizer and detergent packaging wear gloves and wash hands as necessary as you follow the next steps.
5. Jars 2, 3, and 4 will be fertilizer jars.
6. Add ¼ tsp fertilizer to jar 2.
7. Add ½ tsp fertilizer to jar 3.
8. Add 1 tsp fertilizer to jar 4.
9. Jars 5, 6 and 7 will be detergent jars.
10. Add ¼ tsp detergent to jar 5.
11. Add ½ tsp detergent to jar 6.
12. Add 1 tsp detergent to jar 7.
13. Cut 7 squares from the cheesecloth, large enough to cover the openings of the jars.
14. Cover each of the jars with a square of cheesecloth and secure with a rubber band.
15. Keep track of what is in each jar by making a chart in your notebook. See the example below. (Table 1)

16. Set the jars in a sunny location.
17. Observe the jars for 14 days. You may want to take photographs of the jars each day to show the changes. Make a written observation of what you see in the jars each day. Keep your data organized in a chart. See example below. (Table 2)
18. On day 7 test the dissolved oxygen in each of the jars. Follow the directions that came with the dissolved oxygen kit. Note the dissolved oxygen measured in parts per million in your notebook.
19. Continue to make daily observations.
20. On day 14 test the dissolved oxygen in each jar again. Note the dissolved oxygen measured in parts per million in your notebook.
21. Use your observations and dissolved oxygen data to draw some conclusions about what is happening in the water.
22. You may want to use a line graph to show your results. See example below. (Figure 1)

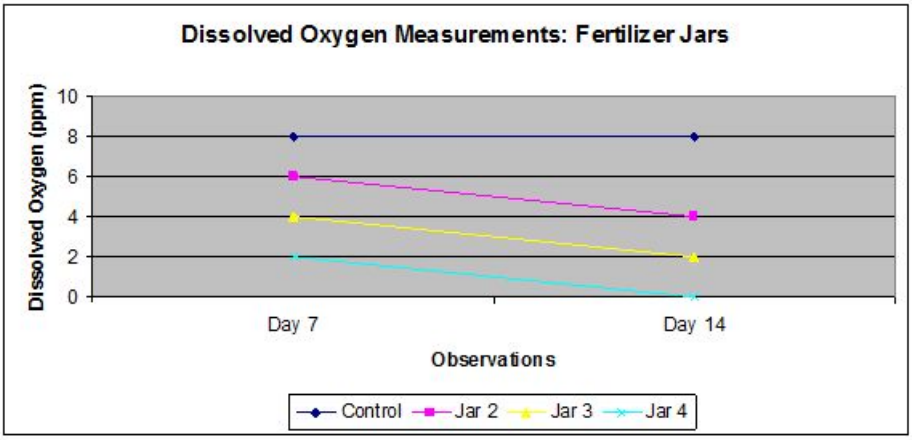
Table 1

Jar 1	Control
Jar 2	1/4 tsp fertilizer
Jar 3	1/2 tsp fertilizer
Jar 4	1 tsp fertilizer
Jar 5	1/4 tsp detergent
Jar 6	1/2 tsp detergent
Jar 7	1 tsp detergent

Table 2

Jar	Observations	Percentage of jar filled with visible algae
	1	
	2	
	3	
	4	
	5	
	6	
	7	

Figure 1



Terms/Concepts: Eutrophication; Algal bloom; Dissolved Oxygen; Phosphates; Nitrates; Fertilizer; Decomposition; Rain runoff; Point source pollution; Non-point source pollution; Experimental control; Variables; Line graph

References:

- Building a Bloom: Algal Bloom Activity http://www.bigelow.org/edhab/building_bloom.html
- Eutrophication definition http://www.merriam-webster.com/dictionary/eutrophication
- Pollution: Point and Non-Point Source http://www.waterencyclopedia.com/Po-Re/Pollution-Sources-Point-and-Nonpoint.html

Project adapted from: “Eutrophication Lab” D. Gioffre, Hillsborough Middle School, Hillsborough, NJ 08844Funded by the National Science Foundation, Biocomplexity in the Environment Program, Award #0120453

Author: Sarah Benton