

POLLUTING INGREDIENT IN DETERGENT

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Abstract

Scientists have been cautioning consumers that the use of detergents and their disposal in our rivers, lakes and oceans are creating a problem for these delicate ecosystems. With the rapid increase of human populations, it is becoming an urgent problem. The source of much of the pollution is said to be detergents. This experiment is designed to identify the responsible ingredient(s) in the detergents.

Introduction

Scientists have been cautioning consumers that the use of detergents and their disposal in our rivers, lakes and oceans are creating a problem for these delicate ecosystems. With the rapid increase of human populations, it is becoming an urgent problem. The source of much of the pollution is said to be detergents. There is something in the detergent that causes a rapid growth in the algae, with in turn reduces oxygen in the water as it dies and decays. Water ecosystems with reduced oxygen will support fewer individuals and less variety of organisms. If the ingredient was known, steps could be taken to improve the quality of our waters. What is the ingredient in detergent that does this?

There are a number of possible explanations for this increase in the growth of algae when detergents are a pollutant. Some plausible factors include, but are not limited to:

1. Presence of phosphate in the detergent.
2. Presence of dyes in the detergent.
3. Presence of bleaching agents in the detergent.

In this exercise, your lab group should decide on a plausible hypothesis and then design an experiment to test it.

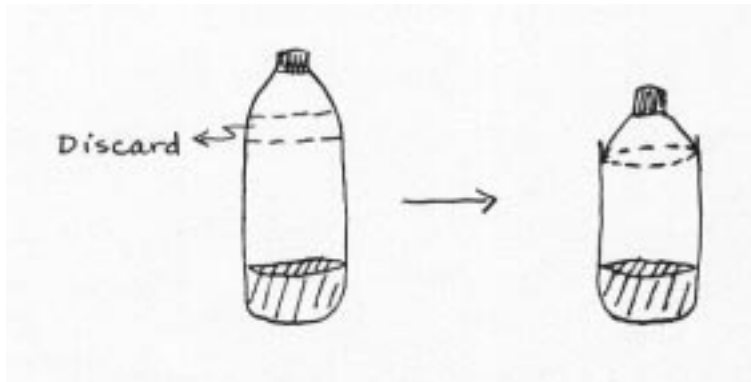
A possible method is to weigh *Spirogyra* algae. Grow it in water polluted with the selected detergent, and then reweigh the algae after three weeks. As you design your experiment, be sure to have only one variable and to use a control.

Materials

3 -2 liter plastic soda bottle aquaria
Spirogyra algae
pond water
1 g detergent with selected pollutant
1 g detergent without pollutant
paper towels
balance scale
150 watt lamp

Procedure

1. To make the bottle aquarium, cut across the plastic soda bottle to form a cylinder with straight sides. Cut a section approximately one centimeter from the top of the bottle. Discard this cut section. The top section of the bottle should be curved and able to slide into the bottle section to form a lid. The label can be peeled off after filling the bottle with hot water. Leave the base on the bottle. See illustration.



2. Prepare three aquaria and fill each $\frac{2}{3}$ full of pond water. Into one aquarium, put detergent with test ingredient, into another put detergent without test ingredient, and into the third aquarium, add no detergent.
3. Remove *Spirogyra* from the culture and place it on a paper towel to remove excess water. Weigh out three samples of 15 grams each. Place one sample in each aquarium. Cover the aquaria and place them 20 centimeters from the light source.
4. Observe twice weekly for three weeks and record your observations in a chart. The chart should include the color of *Spirogyra*, position of *Spirogyra* in aquaria, odor of aquaria, presence of bubbles, and any other details noted. Design your own data chart.
5. After three weeks, remove the *Spirogyra* and place briefly on paper towels to absorb excess water. Weigh the *Spirogyra* from each aquarium.

Calculations

1. Calculate the increase in mass of *Spirogyra* in each aquarium by subtracting the original mass from the final mass.
2. List your data on a chart of class data

Analysis and Conclusion

1. Form a conclusion based on your group's hypothesis and experiment.
2. Compare your results with other groups. Which aquarium had the greatest increase in mass?
3. Look at the data posted from other classes. What are factors that may account for differences in the data among the different groups testing the same hypothesis?
4. Research the term "eutrophication".
5. If you were a marine biologist working for the Chesapeake Bay Foundation, you would be concerned about maintaining the balance of algae and oxygen in the waters of the estuary. What are some recommendations you might make to consumers regarding detergent choices?
6. Suggest other ways in which you could reduce the level of contaminants in our waterways.

Teacher's Notes

This lab exercise is designed for tenth grade biology students enrolled in a regular level class. Although that is its target population, advanced level students could use this lab procedure to compare various brands of detergents, investigate other pollutants of our streams, or take water samples from various locations for comparison. In working with basic level classes, the experiment may be done as a large group project. Because this activity does not involve complex procedure, set-up, or calculations, students of all ability levels should gain an understanding of the effects of detergent on our streams, lakes, and rivers.

This activity would work well as an introduction to the study of aquatic biomes. It would also link well with a study of pollution in the Chesapeake Bay. Additionally, it could be used as a closing activity for the ecology unit. The lab exercise demonstrates how fragile the aquatic ecosystem is and leads students to recognize ways they can make small changes in their behavior that can have important consequences for our environment.

The Protist unit could be another place to use this activity. A comparison of detergents on various types of algae could be related to algal blooms in polluted water. Alga farming to augment the world's food production could also be investigated.

Because of local government regulation of phosphate-containing detergents, locating the various detergents in certain areas may prove difficult. Generally, detergents used in automatic dishwashers contain phosphorus. Many laundry detergents now have versions produced with bleach or without dyes. Careful reading of the list of ingredients on the products on the grocer's shelf will yield various detergents to use in this lab exercise.

Tap water can be used in this experiment if it has been allowed to sit out for 24 hours.

Various additives in detergent may cause an increase in mass of the algae. Students should look for the factor which causes the greatest increase in mass. Statistical analysis using data from several classes should show that the phosphate is more responsible for the algal growth.

References

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