

## Effects of Biodegradable Wastes on Dissolved Oxygen

### Objectives:

- To understand the relationship between biodegradable waste and dissolved oxygen in water.

**Pre-Lab Activities:** You must complete the following in order to understand the basic concepts investigated in this lab.

Background information:

1. What are microorganisms or microbes? List two examples.
  
2. What are biodegradable wastes? List two examples.
  
3. Describe the general process of photosynthesis.
  
4. Describe the general process of cellular respiration.
  
5. Read through and discuss the methods with your partners.
  
6. How will you know when the dissolved oxygen in the water sample is consumed?
  
7. When do you start timing?
  
8. After reading and discussing your answers to the background questions and the methods with your group, write a hypothesis about the relationship between the amount of organic matter, the amount of bacteria and the oxygen levels in a water sample.

Hypothesis:

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**Materials needed:**

2 beakers	stirring stick
2 mL dry yeast	one 5-mL pipet or eye dropper
10-mL graduated cylinder	Methylene blue solution
3 test tubes in rack	milk

**Methods:**

1. Fill a beaker about half full of milk. Take it to your lab table.
2. Clean three test tubes, place them in a rack, and put masking tape numbers (1,2,3) on them.
3. Use the pipet or eye dropper to add the amount of materials to each test tube shown below. (Approximately 15 drops equals 1 mL.)

Test tube	Milk (mL) or Drops	Water (mL) or Drops
1	2.5      37	0      0
2	1.0      15	1.5      22
3	.2      3	2.3      35

4. Before you continue, check the liquid's height. It should be the same in all three tubes. You should have exactly 2.5 mL of solution in each tube.
5. Add three drops of methylene blue to each test tube. The methylene blue is an "indicator" solution. It will change from blue to white when the oxygen in the tube is used up.
6. Mix each tube by putting your thumb over the top and inverting it (turning it upside down) quickly four times.
7. Prepare a sample of yeast by adding 2 mL (about ½ teaspoon) dry yeast to 20 mL of warm water in a beaker. Mix the yeast and water thoroughly with your stirring stick.
8. You are now ready to mix the yeast and milk solutions. Follow these directions carefully:
  - a. Watch the clock for exact timing. Proceed to the next step (b) when the second hand passes the "12." Record the exact time of mixing – on the minute – in the Table below, next to test tube 1.

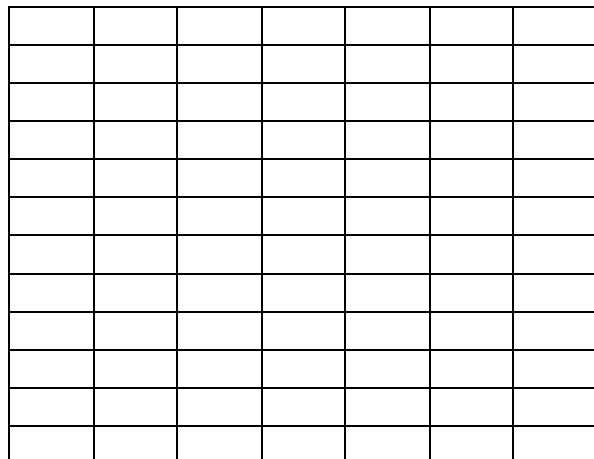
Test tube	Time of mixing (on the minute) (A)	Time when tube changes color (B)	Total time for the color change to occur (B minus A)
1			
2			
3			

- b. Mix the yeast solution vigorously with the tip of your pipet or eye dropper. Then carefully put exactly 2.0 mL (30 drops) of yeast solution into test tube 1. Mix by inverting four times.
  - c. Now repeat the procedure with test tubes 2 and 3. Be sure you record the exact time you added the yeast to each tube.
9. Watch until each tube's color changes from blue to white. It usually takes 15 minutes for a color change to occur. (Note: the surface of each tube always will remain blue. Can you guess why?)
10. Start to work through the following questions as you watch for the color change.

### **Conclusion Questions:**

1. Name the gas "inhaled" by microorganisms.
2. Name the gas "exhaled" by microorganisms.
3. Where do microorganisms living in water get the oxygen they need to live?
4. Where do green plants living in water get the carbon dioxide they need to live?
5. Shake one of the test tubes that turned white. What happens to the color? Why does the color change?
6. Air is added naturally to rivers when water goes through rapids and over falls. How does shaking the test tube prove that air is added to water when it tumbles over rocks?
7. Why is the oxygen in this experiment "used up?"
8. Name the part of the experiment that represents microorganisms.
9. Name the part of the experiment that represents waste.
10. In which test tube did you have the most waste? The least waste?
11. Which test tube contained the most oxygen? Which test tube contained the least oxygen?

12. Graph your results here using a line graph. Remember to correctly label the graph and provide a title.  
Independent variable = \_\_\_\_\_ Dependent variable = \_\_\_\_\_



13. What does the line you plotted tell you about the relationship between the amount of waste and oxygen in a body of water?
14. Does the data collected support your hypothesis? Why or why not?
15. If large amounts of waste were dumped in a river, what would be the effects of the dissolved oxygen in the water?
16. Some bacteria, given ample food and water, can multiply every 20 minutes. Compute the number of bacteria present after eight hours at this rate (starting with one bacteria cell). Example, in 20 minutes there would be two bacteria; in 40 minutes, four; in 60 minutes, eight bacteria, etc.
17. Write a short paragraph explaining the relationship between oxygen levels, bacteria and the breakdown of organic matter. What can you conclude about the dissolved oxygen levels and the amount of bacteria found in a water sample?