**INVESTIGATION: What is the Effect of Biodegradable Waste on the Amount of Dissolved Oxygen?**

PURPOSE:

Biodegradable means that a substance can be broken down by living organisms (decomposers). Since decomposition is a form of respiration, oxygen is consumed. In this lab, you will learn that a great deal of biodegradable waste in water consumes much dissolved oxygen leaving little for plant and animal life.

HYPOTHESIS:

If more biodegradable material is present in a sample, then the dissolved oxygen level will decrease more quickly when decomposers are introduced.

MATERIALS (per group of 3 or less):

1. 3 test tubes of equal size (with caps)
2. test tube rack (see-through)
3. pipettes (3 per group)
4. yeast mixture (2 mL dry yeast and 20 mL water)
5. milk
6. methylene blue (dropper bottle)

PROCEDURE:

1) Label the three test tubes #1, #2, and #3. Place them in the test tube rack.

2) Using your pipette, add the amount of materials to each test tube as shown in the chart below:

|  |  |  |
| --- | --- | --- |
| **TEST TUBE #** | **# DROPS MILK** | **# DROPS H2O** |
| 1 | 37 | 0 |
| 2 | 15 | 22 |
| 3 | 3 | 34 |

Be sure that the height of the liquid in each of the three test tubes is exactly the same. You can adjust the height by adding drops of either milk or water to the tubes.

3) Add 3 drops of methylene blue to each test tube. Be sure to introduce the drops in the same fashion to each tube, with the dropper bottle as vertical as possible.

4) Mix the methylene blue with the milk/water mixture by screwing the cap onto the test tube and inverting each test tube 4 times.

5) For the next part of the lab, one of you will need to carefully time the experiment. As you mix each test tube with the yeast, you will need to begin timing **as soon as you put in the first drop of yeast mixture.**

6) Add 20 drops of the yeast mixture to test tube #1. Mix thoroughly by inverting 4 times and record the exact time that you add the yeast to the tube.

7) Now do the same for test tubes #2 and #3. Timing is critical. Begin timing each test tube as soon as you add the yeast. Record your time information on the data table below.

8) When the color has changed from blue to white in each test tube, record the exact time at which the change is complete. The surface of each test tube will remain blue? Why?

|  |  |  |  |
| --- | --- | --- | --- |
| **TEST TUBE #** | **MIXING START TIME (A)** | **TIME OF COLOR CHANGE TO WHITE (B)** | **TOTAL TIME FOR COLOR CHANGE (B-A)** |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |

Note: It can take as long as 15 minutes for the color change, but the average time is 4 to 5 minutes.

 9) BEFORE YOU CLEAN UP, SHAKE ONE OF THE TEST TUBES WHICH HAS TURNED WHITE. Record your observations.

ANALYSIS:

1) What is the gas taken in by the microorganisms?

2) What is the gas given off by the microorganisms?

3) Where do microorganisms living in water get the oxygen that they use in decomposition?

4) Where do the green plants living in water get the carbon dioxide that they need?

5) What happened in the tube you shook after it had turned white (step 9)? Why?

6) Why is the oxygen in this experiment used up?

7) Which part of your experiment represents the decomposers?

8) Which part of your experiment represents the sewage dumped into the water?

9) In which test tube did you have the most sewage?

10) Graph your results using Excel. What are the labels for your axes?

11) What does this graph tell you about the relationship between the biodegradable waste in water and the amount of dissolved oxygen in the water?

12) What would be the effects of dumping a great deal of raw sewage into a river as regard to the dissolved oxygen in the same river?

13) Write a conclusion as to what you learned by performing this lab. Be sure to include the following:

* Was the hypothesis supported or refuted? Why or why not?
* What were the sources of error in this experiment?
* What were the independent and dependent variables?