Photosynthesis: Demonstrating Oxygen Production

Photosynthesis is the process where producers, primarily plants and algae use carbon dioxide and water to produce oxygen and a carbohydrate. The general equation is usually written something like this:

$$CO_2 + H_2O \rightarrow (CH_2O)_n + O_2$$

Oxygen is a measurable product of photosynthesis. It is produced within the chloroplast, in a reaction called photolysis. An enzyme associated with a photosystem splits a molecule of water to release hydrogen ions, electrons and oxygen.

In this activity you will observe oxygen production by water plants under different light conditions.

Materials

3% Sodium bicarbonate solution
Beakers – 5 (can be any size, 250 mL)
Funnels – 5 (must fit inverted into beaker)
Erlenmeyer flask – 500 mL
Test tubes
Colored lights (green, red, blue, white) or cool lights with filters
Marker
Elodea, water/aquarium plant
Phenol red (optional)

Procedure

1. From the supply table pick up 5 beakers, 5 funnels, 5 test tubes.

2. Return to the supply table and pick up the Erlenmeyer flask. Fill the flask with approximately 300 mL of 3% sodium bicarbonate solution ($NaHCO_3$). If you are using phenol red, add several drops and swirl the flask to disperse the pH indicator. Phenol red is yellow below pH 7, orangeish around pH 7 and red above pH 7. What color is your flask now? _____

3. Add water plants to the bottom of each beaker. The amount you add will be determined by the size of your beaker, but it should be a significant amount, enough to fill the beaker at least one quarter to one third full.

4. Invert the funnel, so that the wide end of the funnel is pointing down and insert the funnel into the beaker. The funnel should cover and hopefully not crush the plant material. Repeat this step for each beaker.

5. Pour the bicarbonate solution from the flask into each beaker. Fill the beaker about ¾ full.

6. Fill a test tube completely with bicarbonate solution. Place your finger over the top of the test tube and invert the tube. Now carefully, lower the test tube over the funnel stem as quickly as possible. Some of the liquid will escape, but most should remain in the tube. Mark the level of the air space in the tube. Repeat this procedure for each beaker.

7. One beaker will sit on the benchtop under ambient light. One beaker should be placed in front of a green light. One beaker should be placed in front of a red light. One beaker should be placed in front of

a blue light. The final beaker should be placed in front of a white light or grow light. If your lab is not equipped with special filters or plant lights you may need to place a water filled barrier (beaker) between the light and your experimental beaker. To keep your experimental beaker cool. The lights can get very hot.

8. Allow the reaction to proceed for 1 hour. Mark the displacement of liquid on the test tubes at 1 hour. Note the color of phenol red. Record your results below.

9. After the second hour, measure the displacement of liquid on the test tubes. Note the color of phenol red. Record your results below.

	Displacement of Liquid (mms)		Color of Phenol Red	
	1 Hour	2 Hour	1 Hour	2 Hour
Bench Top				
Red light				
Green light				
Blue light				
White light (grow light)				

1. Why was sodium bicarbonate used instead of water?

2. Why was phenol red used? What caused the color change?

3. From your results, under which condition did photosynthesis happen the most?

4. What is the independent variable in this experiment?

5. What is the dependent variable?

6. Graph your results below.