Do Plants Consume or Release CO2?

Introduction

The rate of photosynthesis can be determined by measuring the rate of production of sugar or oxygen or by measuring the rate of decrease in carbon dioxide concentration. A common aquarium plant called, Elodea, can be used to show fast carbon dioxide is being removed from the water in which the Elodea is submerged.

6CO2 + 12H2O + light energy ---> C6H12O6 + 6O2 + 6H2O

In this lab, you will use phenol red as an indicator to show whether CO2 is being consumed or produced in a reaction. It is well known that in the presence of light, plants perform photosynthesis. At the same time, plants are also performing cell respiration. To demonstrate this, we will determine whether CO2 is consumed or produced as Elodea is placed in either a light or dark environment. The change in CO2 will be detected by the pH indicator phenol red. Phenol red is yellow under acidic conditions (high H+ ion concentration), pink to magenta under basic or alkaline conditions (low H+ ion concentration), and orange under neutral conditions. A change in the amount of CO2 will cause a directly proportional change in H+ ion.

If the CO2 concentration decreases, the H+ ion concentration will also decrease, and the solution will change to pink, becoming basic.

If the CO2 concentration increases, the H+ ion concentration will also increase, and the solution will change to yellow, becoming acidic.

Neutral solutions of phenol red will be orange.

Materials:

phenol red solution, 4 sprigs of Elodea, soda straw, 4 test tubes, labeling marker, 100 ml graduated cylinder, beaker, aluminum foil

Procedure:

Create a solution of phenol red by adding concentrated phenol red to about 100 ml of water in a beaker. The phenol red may change color as a result of adding water (depending on how acidic your tap water is). Your goal is to make your solution a neutral orange color. You can do this by gently blowing into the solution with a straw.

Label 4 test tubes 1, 2, 3, and 4.

Once you have the solution at an orange color, transfer it to 4 test tubes (they should be filled about 2/3 full with your orange solution).

Place a cut piece of Elodea (cut end up) into tubes 2 and 4 and tightly cap.

Test tubes 3 and 4 will not have Elodea. Cap and then cover these tubes with aluminum foil so no light can enter.

Place tubes 1 and 2 in bright light.

Place tubes 2 and 4 in the dark.

After 24 hours, uncover and examine all 4 test tubes and record the results.

Data:

Test Tube # Contents of Tube Initial Color Final Color

1

2

3

4

Conclusion:

1. What test tubes served as the controls in this experiment. Why?

2. What was the dependent variable?

3. Do you think there would have been any change in any of the test tubes if they were left for 48 or 72 hours? Explain.

4. Describe and explain what happened in the test tubes.

5. Why did the color change occur?

6. Where does the carbon dioxide that is removed from the solution go?

7. What other process goes on in plant cells that requires oxygen and produces carbon dioxide?

8. What was the purpose in tightly capping all four test tubes?