

Gas Exchange in Green Plants

The purpose of this activity is to determine if there is any evidence of gas exchange between a green plant and its environment when the plant is exposed to light and when it is placed in the dark. Bromothymol blue is a pH indicator that turns yellow in an acidic solution ($\text{pH} < 6$) and blue in a basic solution ($\text{pH} > 7.6$). It is greenish between these two points. All plant cells undergo respiration continuously (24 hours per day). In addition, they undergo photosynthesis if they contain chlorophyll and are exposed to light. When both reactions are occurring simultaneously, the rate of photosynthesis is much greater than the rate of cell respiration.

Materials

water plants (*Elodea*, hornwort or filamentous algae)
4 large test tubes (25 x 140 mm)
4 No.5 rubber stoppers
4 mL bromothymol blue stock solution
plastic drinking straw
medicine dropper
250 mL beaker

Procedure

1. Fill 4 large test tubes about 3/4 full with tap water. Number the tubes.
2. Add 1 mL of bromothymol blue to each test tube.
3. Using a straw, blow into the solution until it just turns yellow.
4. Slowly add tap water to each of the test tubes until the solution just turns green. The color in all four tubes should be about the same. This establishes the neutral point for the indicator.
5. Place an 8 to 12 cm shoot of *Elodea* in tubes 1 and 2 and stopper all four tubes.
6. Place tubes 1 and 3 in the dark and tubes 2 and 4 in strong light.
7. Observe at 15 minute intervals during the class and record any changes. If no change is observed, keep the tubes under the experimental conditions longer.

Questions

- a) Why did blowing into the indicator solution cause a color change?
- b) Account for any color change in tubes 1 and 2.
- c) What is the purpose of using tubes 3 and 4? Explain.