

Investigation: Do Plants Consume CO₂?

We often see the process of photosynthesis written as an equation.



This simple equation does not take into account that photosynthesis occurs in two parts: the light dependent reactions and the light independent reaction (Calvin Cycle). From the equation above, H₂O, light, and O₂ are part of the light reactions, CO₂ and C₆H₁₂O₆ are part of the light independent ones.

The light dependent reactions are also used to supply the energy (ATP and NADPH) to run the Calvin Cycle, where carbon fixation happens. Because the cycle requires the energy from the light-dependent reactions, the carbon fixation stage of the Calvin cycle occurs in daylight because of that energy needed, even though it is called the light-independent reaction.

In this lab, we will observe a plant fix carbon by using an indicator called Phenol Red. Phenol Red turns yellow if the pH is lower than seven. To observe this, blow bubbles into a container of phenol red until it turns yellow. The carbon dioxide in your breath lowers the pH (making it basic). Removal of the carbon source will return the indicator to its red color.

Materials

Phenol red (.02 aqueous solution) | Plants (elodea or kale leaves)
200 ml erlenmeyer flask | 3 test tubes with caps (or parafilm to seal)

Procedure:

1. Fill an erlenmeyer flask with 100 ml of phenol red.
2. Use a straw to gently blow into the flask until the solution turns yellow. (Stop as soon as the color changes.)
3. Divide the solution into three test tubes, ~30 ml each.
4. Add leaves from kale or elodea to two of the test tubes. Try to keep the volume equal.
5. Place the empty tube (control) and a second tube containing a plant under a bright light; wrap the third tube in foil.

DATA: Record the colors of the solutions in the test tubes after 30 minutes

Test Tube #	Contents of Tube	Initial Color	Final Color
1			
2			
3			

ANALYSIS

1. Why does the phenol red change color when we blow bubbles into the tube?

2. If carbon fixation occurs during the light independent stage of photosynthesis, why did the procedure call for placement of the test tubes under the light banks?

3. Did you see a change in color of the phenol red test tube with no elodea added? Why or why not?

4. How does a plant use carbon? What is meant by the term "carbon fixation"?

5. Identify and explain the control in this experiment.