Name _____ Period _____ Date _____

Plant Pigments And Photosynthesis

Reference: Pearson Education

Overview:

In this lab you will:

1. Separate plant pigments using chromatography, and
2. Measure the rate of photosynthesis in isolated chloroplast using the dye DPIP.

The transfer of electrons during the light-dependent reactions of photosynthesis reduces DPIP, changing it from blue to colorless.

Objectives:

Before doing this lab you should understand-

- How chromatography separated two or more compounds that are initially present in a mixture
- The general process of photosynthesis
- The function of plant pigments
- The relationship between light wavelength and photosynthetic rate
- The relationship between light intensity and photosynthetic rate

After doing this lab you should be able to-

- Separate pigments and calculate their R_f values
- Describe a technique to determine photosynthetic rates
- Compare photosynthetic rates at different light intensities or different wavelengths of light using controlled experiments
- Explain why the rate of photosynthesis varies under different environmental conditions

Background:

Paper chromatography is a useful technique for separating and identifying pigments and other molecules from cell extracts that contain complex mixtures of molecules. The solvent moves up the paper by capillary action, which occurs as a result of the attraction of solvent molecules to the paper and the attraction of solvent molecules for one another. As the solvent moves up the paper, it carries along any substances dissolved in it. The pigments are carried along at different rates because they are not equally soluble in the solvent and because they are attracted to different degrees, to the fibers in the paper through the formation of intermolecular bonds, such as hydrogen bonds.

Beta carotene, the most abundant carotene in plants, is carried along near the solvent front because it is very soluble in the solvent being used because it forms no hydrogen bonds with cellulose. Another pigment, xanthophyll, differs from carotene in that it contains oxygen. Venting Phil is found further from the solvent front because it is less soluble in the solvent is been slowed down by hydrogen bonding to the cellulose. Chlorophylls contain oxygen and nitrogen and are bound more tightly to the paper then the other pigments.

Chlorophyll *a* is the primary photosynthetic pigment in plants. A molecule of chlorophyll a is located at the reaction center of photosystems. Other chlorophyll *a* molecules, chlorophyll *b*, and carotenoids (that is, carotenes and xanthophylls) capture light energy and transferred to the chlorophyll a at the reaction center. Carotenoids also protect the photosynthetic system from damaging effects of ultraviolet light.

Procedures:

Go to http://www.phschool.com/science/biology_place/index.html then click on **Lab Bench**. Click on **Lab 4**.

Go to Lab 4a: chromatography and follow the lab along. Answer the following questions.

1. Explain what chromatography is.
2. How does paper chromatography work?
3. Name the pigment that we would expect to see near the solvent front and explain why it moves so quickly.
4. Which pigment would be nearer the middle of a chromatography paper and why?
5. Which pigment would be nearer the bottom of a chromatography paper and why?

Now watch the pigment separation.

6. Draw and label what you see. Look at the molecular structures of the pigments.
7. What is the purpose of the chlorophyll *a* molecule in the plant?
8. What is the role of the other pigments?
9. Write a formula for determining the reference front of a pigment.

Do analysis I. Write your score here _____.

Go to lab 4b: plant photosynthesis and follow the lab along. Answer the following questions.

10. What is DPIP?
11. If DPIP is a blue color, has light been absorbed by the chlorophyll?
12. What instrument will be used to measure the transmittance of light so that we can measure the amount of photosynthesis occurring?
13. Do you expect to see more of less transmittance of light if photosynthesis is actually occurring?
14. Four cuvettes will be used in this experiment. Describe the purpose of each of the four tubes?
15. What is the purpose of the water flask?
16. How should the cuvettes be handled and why is this necessary?
17. Why do we need to prevent light from entering one of the cuvettes?
18. Which cuvette do you expect to end up with the lighter color, the one that has boiled chloroplasts or the one with unboiled chloroplasts?