

# Visualizing Chlorophyll

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## **Standards of Learning**

Science 6.1, LS.3, LS.4, LS.6

## **Objective**

Students will:

- Show and understand that plants contain many pigments necessary for photosynthesis

## **Materials**

- Fresh spinach leaves
- Rubbing alcohol
- Popsicle sticks
- Paper coffee filters cut into 3x5 cm strips
- Baby food jars
- Coins

## **Background Knowledge**

Not all of the light from the Sun makes it to the surface of the Earth. Even the light that does make it here is reflected and spread out. The little light that does make it here is enough for the plants of the world to survive and go through the process of photosynthesis. Light is actually energy, electromagnetic energy to be exact. When that energy gets to a green plant, all sorts of reactions can take place to store energy in the form of sugar molecules. We already spoke about the structure of chloroplasts in the cells tutorials. We want to reinforce that photosynthesis happens in the chloroplast. Within this cell organelle is the chlorophyll that captures the light from the Sun. Chlorophyll is the magic compound that can grab that sunlight and start the whole process. Chlorophyll is actually quite a varied compound. There are four (4) types: a, b, c, and d. Chlorophyll can also be found in many microorganisms and even some prokaryotic cells. However, as far as plants are concerned, the chlorophyll is found in the chloroplasts. The other big molecules are water (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), oxygen (O<sub>2</sub>) and glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>). Carbon dioxide and water combine with light to create oxygen and glucose. That glucose is used in various forms by every creature on the planet. Animal cells require oxygen to survive. Animal cells need an aerobic environment (one with oxygen). The whole process doesn't happen all at one time. The process of photosynthesis is divided into two main parts. The first part is called the light dependent reaction. This reaction happens when the light energy is captured and pushed into a chemical called ATP. The second part of the process happens when the ATP is used to make glucose (the Calvin Cycle). That second part is called the light independent reaction.

Green leaves contain more than one pigment used in photosynthesis. Photosynthetic pigments can be separated in alcohol (or Acetone) because of different molecular weights and other molecular characteristics. These characteristics determine the speed at which the molecule can travel along the surface of the filter paper.

## **Procedure**

1. Take your filter paper and draw a line across it in the middle.
2. Place the spinach leaf on top of the filter paper so that it is overlapping the line you drew.



3. Take your coin and rub it over the spinach leaf that is laying on the filter paper until you have something like a leaf rubbing on top of the line that you drew.
4. Take your jar and stick and place the stick across the top of the jar so that it rests on the rim.
5. Attach the filter paper strip to the stick with tape but make sure that the line and leaf rubbing are not touching the bottom of the jar. The bottom of the filter paper should be barely touching the bottom of the jar.
6. Slowly add rubbing alcohol to the container. The bottom edge of the filter should be submerged in the alcohol and the alcohol line should be below the line and leaf rubbing you made.
7. Wait 10-15 minutes while the filter is sitting in the alcohol. Remove the filter paper when liquid has traveled  $\frac{3}{4}$  of the way up the strip.
8. You should see bands of different colors where the alcohol has reached the leaf rubbing and line. This is called a Chromatogram.

### **Extension**

- Complete chromatogram using different types of leaves.
- Measure the distances traveled by the pigments.
- Research plants used by Indians to produce natural dyes.
- Discuss the process of leaves changing color in the fall and fruit changing color in the fall and fruit changing color when it ripens.

