

Colors of a Leaf

Essential Question(s):

Why are plants green?

What gives leaves their color?

Why are leaves different colors?

Background Information:

Most plants' leaves are green. Plants use a green pigment called chlorophyll to capture the energy of the sun and store that energy as sugar. That stored energy can be used later at night when the plant needs energy and cannot photosynthesize. The main pigments for photosynthesis are chlorophyll a and b, and to a lesser extent, the yellow pigments, or carotenoids. Leaves may also have red pigments, the xanthophylls. The role of these red pigments is not always known. Scientists have suggested that the red pigment may protect young leaves from ultraviolet light or that it is a signal to herbivores that these young leaves have high concentrations of protective chemicals and are not good to eat. In any case, it is interesting to have children explore the existence of several different pigments in a leaf.

It is useful to first remind children that the light we see (visible light) is actually a mixture of colors (like a rainbow). When we see a color, that color is the type of light reflected by the object. The object absorbs all the other colors.

Pigments are really interesting chemicals. When we see green from the pigment chlorophyll, it means that all the colors of light are absorbed except green, which is reflected and therefore visible to the eye. Although chlorophyll gives leaves their green color, it is the energy from the other colors of light that the plant uses to make its sugars.

The technique of chromatography is used to separate mixtures of chemicals such as those found in plants. These chemicals have different sizes or structures that cause them to move at different speeds when the alcohol used in the process moves past them. In this activity, children will use a simple method of paper chromatography to separate leaf pigments from several different species of plants.



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Location: Collect leaves from school site; learners work in classroom

Objectives: *Learners will*

- 1) discover that leaves have several different kinds of pigments that produce leaf color.
- 2) Explain the role of pigments in photosynthesis.
- 3) understand that green leaves have more than one pigment.

Skills: communication, data collection, listening, analysis

Supplies:

- sturdy plastic cups
- popsicle sticks
- alcohol
- chromatography paper (a strip of filter paper or high quality coffee filters will also work)
- pencils
- tape

Subjects: language arts, science

Time: Collecting leaves: 10 minutes; Chromatography: 25 minutes; Sharing and discussion: 10 minutes

Getting Ready:

Try this experiment yourself before trying it with the learners. Through experimentation, you will find that some leaves give better results than others. It would be good to have an example for your learners to see.

Procedure:

1. Gather appropriate leaves from the forest. Do not collect leaves that are leathery and tough. Some leaves should be all green, other leaves can have some red pigment. It is a good idea to include Red Maple as an example. It has at least three pigments present and they separate well.
2. Give each child or group a strip of chromatography paper. The length of the strip depends upon the size of the cup used for the experiment. The strip should be about two centimeters shorter than the cup.
3. Approximately two centimeters from the bottom of the paper strip, draw a line with pencil across the width of the paper.
4. Lay the leaf over the bottom of the paper strip where the pencil line appears.
5. With the popsicle stick, rub the leaf until the color of the leaf makes a clear line over the pencil line. A dark line of green is good. It is important that the children try to make a straight narrow line when they rub. If it is too wide, the pigments will not separate clearly.
6. Tape the paper strip to the popsicle stick so that the paper hangs straight when the popsicle stick is flat.
7. Fill the plastic cup to a depth of about one cm with alcohol.
8. Place the paper strip into the cup. Be sure that the strip does not touch the sides of the cup. Be sure that the alcohol contacts the paper, but does not touch the line with the plant extract. The paper will absorb the alcohol.
9. Leave the strips for about ten minutes. Check to see if the pigments have separated. Check every five minutes until the pigments have moved about 3/4 of the distance up the paper strip.

Discussion/Assessment:

How many different pigments did you get from your leaf?

Which color pigment stopped first? second? last?

Did all leaves have the same pigments?

Did the leaf have any colors that you didn't think were there?

What does the plant use these chemicals for?



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