



Leaf Color Chromatography

Time needed: 2 hours and 30 minutes.
Reveal the secret colors of leaves with this science experiment.

Activity compiled by Kristin Cook
University of Delaware Extension
Kristin@udel.edu

Supplies Needed

Leaves –**Find a variety of colors**

Jars or glasses

Rubbing Alcohol

Butter knife (or other item that can “mash leaves”)

Large bowl or dish that fits the jars

Hot water

Coffee filters

Plates

Scissors

Pencils or Straws and Tape (optional)

Directions

1. Collect leaves

Collect several different types of leaves in different stages of color change. When you find your leaves to pick, gather 5-6 of each one.

2. Set up Your Experiment

Set out one jar or glass for each leaf you collected. Begin ripping up your leaves and placing them in the jar or glass. You will want to get them very small.

3. Add Alcohol and Mash

Add just enough rubbing alcohol to cover the leaves, then using a knife or other utensil mash up the leaves into the alcohol even more. You should start to see the rubbing alcohol turning a bit green.

4. Heat the Jars

Set the jars in a large dish or bowls. Add hot water to the bowl or dish and cover the jars with lids or plastic wrap.

5. Wait

Now let them sit for approximately one hour. Give the jars a little swish every once in a while to help release the chlorophyll. Your alcohol should be turning a nice green. You can also refresh the hot water if it cools too much.

6. Add the Filter Paper

Cut a coffee filter into quarters and place on a plate. Using a teaspoon or dropper add a couple of drops of the liquid to the tip of the filter. You could also tape the filter around a pencil and allow to barely touch the leaf solution in the jar or glass.

7. Wait

Wait approximately 30 min to one hour to see how the colors move up the filter paper and separate. Pretty cool!

8. Wait longer

What happens if you leave it in the solution even longer? Maybe overnight? The colors will become more bold and larger, making the colors easier to see.



The Science Of Leaf Color Changes In Fall

Let's dig into the big question: *Why do leaves change color?*

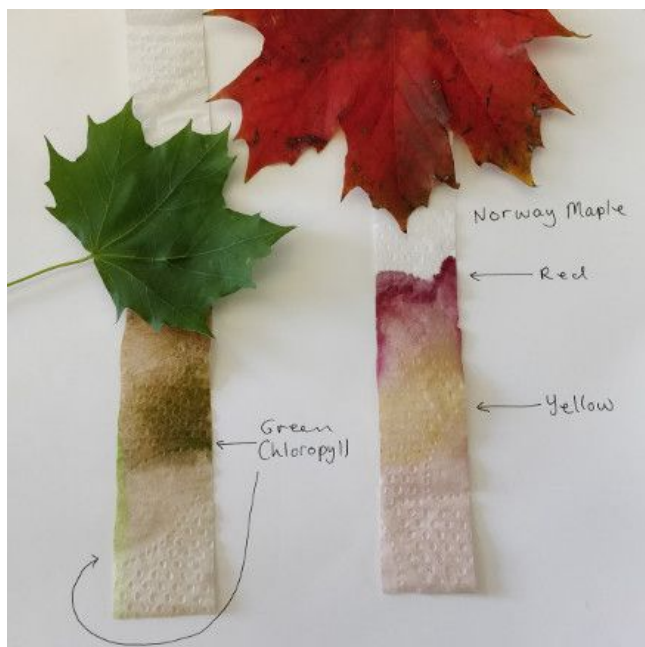
Leaves, like all green plants, contain Chlorophyll. Chlorophyll is the molecule that traps the energy of the sun and is called a photoreceptor. It is found in the chloroplasts of green plants, and is what makes green plants, green. It is also a key part of photosynthesis which is what allows plant to get energy from sunlight.

Leaves are actually more colors than just green but Chlorophyll is so dominant most of the summer that its green color covers up all the other natural colors in the leaves. We can separate the colors of a leaf by doing this leaf chromatography science experiment.

In this science experiment we used rubbing alcohol and two types of energy to separate the colors. We used mechanical energy by ripping up the leaves and mashing them, plus heat energy from the hot water.

Look closely at the rubbing alcohol, do you see any other colors in there? Most commonly you will see green, but depending on the type of leaf you may also see purple, red, yellow, or orange.

What about Purple Leaves?



First a bit of science behind purple leaves. Some plants have a lot of compounds called anthocyanins which can be red or purple in color. If a plant has enough anthocyanins, the purple will block out the green color even though the chlorophyll is still there. With this particular type of tree we see that in action because the leaves are green in the spring and turn purple for the summer.

During our walk about collecting leaves we came upon a tree with purple leaves. These trees are quite common around here and we were excited to see how it performed in this experiment.





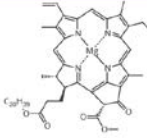
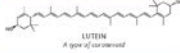

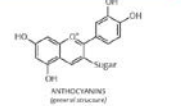



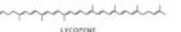
It was interesting to note that the rubbing alcohol turned green initially, then became purple over time.

Another cool fact about purple leaves, the purple color protects the leaves from sun damage. It's like tree sunscreen! So cool!


Chemistry makes the colors!

Yellow leaves have pigments called **xanthophyll**. **Carotenoids** are the pigment in orange leaves. **Anthocyanins**, give leaves intense red and purple coloring. Plus of course we have **chlorophyll** which gives leaves their green color. When looking at your chromatography, each color in your papers is created by those molecules.

THE CHEMISTRY OF AUTUMN LEAF COLOURS

CHLOROPHYLL	CAROTENOIDS & FLAVONOIDS	CAROTENOIDS	ANTHOCYANINS & CAROTENOIDS
			
 Chlorophyll a A type of chlorin	 LUTEIN A type of carotenoid	 β-CAROTENE A type of carotenoid	 ANTHOCYANINS General structure
Chlorophyll gives plant leaves their green colour. Plants require warm temperatures and sunlight to produce chlorophyll. In autumn, the amount produced begins to decrease, and existing chlorophyll is slowly broken down, liberating the green colour of the leaves.	Carotenoids and flavonoid pigments are always present in leaves, but as chlorophyll is broken down in the autumn their colour's come to the fore. Xanthophylls, a subclass of carotenoids, are responsible for the yellows of autumn leaves. One of the major xanthophylls, lutein, is also the compound that contributes towards the yellow colour of egg yolks.	Carotenoids also contribute orange colours. Beta-carotene is one of the most common carotenoids in plants, and absorbs green and blue light strongly reflecting red and yellow light and causing its orange appearance. It is also responsible for the orange colouration of carrots. Carotenoids in leaves start degrading at the same time as chlorophyll, but they do so at a much slower rate; some fallow leaves can still contain measurable amounts.	Anthocyanin synthesis is kick-started by the onset of autumn. As sugar concentration in the leaves increases, sunlight induces anthocyanin production. The purpose they serve isn't clear; it is suggested that they may play a light protective role. It was previously thought they might delay leaf fall, but this has been discounted.
 FLAVONOL General structure	 FLAVONE General structure	 XANTHOXANTHIN A type of carotenoid	 LYCOPENE A type of carotenoid

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So why do leaves change color in the fall?

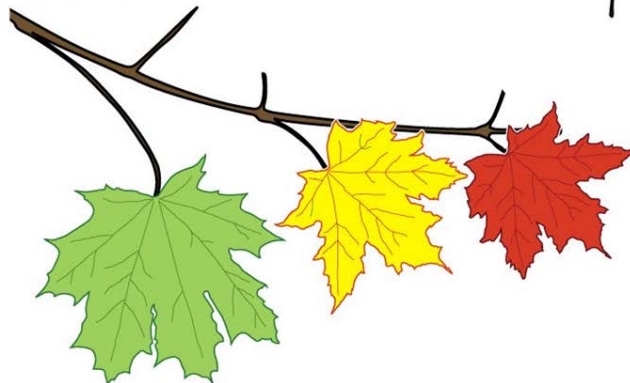
As we know, Chlorophyll gives leaves their green color and is so dominant that it hides the other colors in the leaves during the spring and summer. But in the fall, chlorophyll in the leaves breaks down, finally allowing the it's other natural colors to have their moment in the sun!

The beautiful reds, yellows, and oranges might be short lived before the leaves fall to the ground. This year, think about the amazing science behind those changing colors as the trees around you put on their colorful fall displays.

Changing colors

Weather plays a minor role in fall foliage.
Lack of light is the main reason leaves change.
What happens:

*Example shown
is a maple tree:*



- 1. Chlorophyll makes leaves green,** absorbs sunlight and water to feed trees glucose.
- 2. Trees stop producing chlorophyll as days shorten,** exposing yellow and orange pigments.
- 3. Veins connecting leaves to trees start to close,** trapping sugar in some leaves and creating brilliant reds.

SOURCES:

USDA Forest Service; sciencemadesimple.com; Environmental Information Service; todayifoundout.com

JENNIE GEISLER and CHRIS SIGMUND/Erie Times-News

<https://extension.unh.edu/blog/learn-science-behind-fall-foliage>
<https://www.playdoughtoplato.com/leaf-chromatography/>