

Hidden Colors

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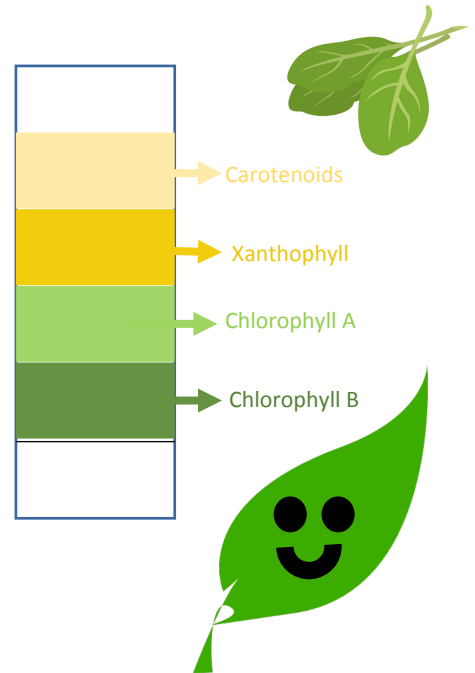
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Hidden Colors

Materials

- Paper towel or white coffee filter
- Rubbing alcohol
- Penny or Quarter (preferably Quarter)
- 1-2 spinach leaves or other dark green leaves
- Clear glass or clear plastic cup or mason jar
- Pencil (no pen!)
- Skewer or marker or straw that is longer than the glass/ cup diameter
- Ruler and timer
- Scissors to cut paper towel or coffee filter
- Plastic wrap or aluminum foil
- Plate (to avoid stains)
- Tape



Warning: Do not drink or inhale the rubbing alcohol. Plant pigment can stain.

Procedure

(Pictures in supplement on page 4)

1. Cut a strip from the paper towel that is about 3 cm (~1 ¼ inch) wide and has a length a little longer than the height of the glass.
 2. Carefully draw a horizontal line with a pencil (NOT with a pen or marker) 2 cm (~¾ inch) above the bottom of the paper towel strip. (Picture 2)
 3. Put a spinach leaf (or stack 2 leaves) on the paper towel strip.
 4. Press the edge of the coin on the spinach leaf at the height of the pencil line. Repeat this 3-4 times with a different part of the leaf until you have a dark green line on the paper towel. Avoid pressing a hole through the paper towel strip. (Picture 3 and 4)
 5. Tape the paper towel strip onto the skewer and make sure that the bottom of the strip doesn't touch the bottom of your glass. Leave about 2 ½ cm (1 inch) between the bottom of the glass and the paper towel strip.
 6. Pour enough rubbing alcohol in the glass to reach the bottom of the paper towel strip. Make sure it does not reach the green line (about 1 cm -less than ½ inch- below the line).
 7. Lower the paper towel strip in the glass and place the plastic wrap or aluminum foil over the glass. Let it stand for 5 minutes. (Picture 5)
 8. Take out the strip after 5 minutes.
 9. You have now separated the different pigments (colors) contained in the leaf (Picture 6)
- Note: Try with leaves of different colors. What colors would you get on the paper towel if you used red or yellow leaves?

Why are leaves GREEN?

Chlorophyll is the pigment that makes leaves green. Chlorophyll helps the plant turn sunlight into food energy in a process called photosynthesis. Chlorophyll is stored inside the chloroplasts, which are found in plant cells.

How many colors in a spinach leaf?

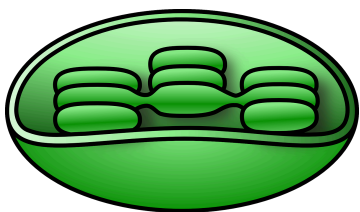
2 greens - *chlorophyll a and b*

1 yellow - *lutein*

1 orange - *beta-carotene* (vitamin A).

A leaf seems to have only one color, but is actually made up of a mixture of pigment molecules. The green pigment overpowers the other pigments.

In the Fall, when the leaves on trees change color, they no longer make food energy and stop making chlorophyll (green pigment). That is why other pigments become visible at this time.



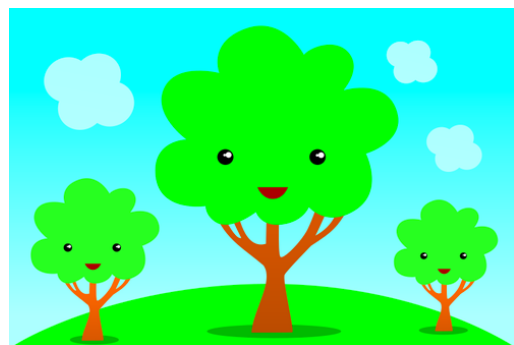
Chloroplast

Leaves get their color from 4 main compounds: *chlorophyll a and b* make leaves look green, *carotenoids* give leaves an orange color, *xanthophylls* are yellow pigments and *anthocyanins* give the leaf a red pigment.

Plants can make their own food

All animals (including humans) cannot make their own food. But plants are special, they can use sunlight to transform the air we breath out (carbon dioxide) and water into sugar and oxygen.

This is why plants are so important: they give us food and oxygen to breath!



WATER + SUNLIGHT + CARBONE DIOXIDE =
SUGAR + OXYGEN

History:

Chromatography was developed in 1906 in Russia by the Russian-Italian botanist Mikhail Tswet for studying plant pigments. Nowadays it is also used to monitor pollution, in pharmaceutical, food and cosmetic industry

What is Chromatography

Chromatography is a method to analyze mixtures by separating them into the different substances from which they are made. By using chromatography the colors (pigments) in a leaf separate and are absorbed by the paper towel or coffee filter. The mixture of pigments separates by size and color. Smaller pigments can travel farther along the paper than larger ones.

"Silly Science" is organized
by
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www.lucalab.wayne.edu



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Credits:

Content:

- https://lakewood.jeffcopublicschools.org/UserFiles/Servers/Server_836664/File/Morgan/Plant%20Pigment%20Chromatography.pdf
- <https://www.education.com/science-fair/article/find-color-pigments-hidden-green/>
- <https://www.childrensmuseum.org/blog/saturday-science-leaf-chromatography>
- <https://www.scientificamerican.com/article/bring-science-home-leaf-colors/>
- <https://www.explainthatstuff.com/chromatography.html>
- <https://www.reference.com/world-view/pigments-found-spinach-3f0b5879507da92b>
- <https://ib.bioninja.com.au/standard-level/topic-2-molecular-biology/29-photosynthesis/chromatographs.html>

Pictures:

- <https://clipartix.com/spinach-clipart-image-56540/>
- <https://clipartstation.com/person-thinking-clipart-new-people-thinking-cliparts-free-download-clip-art-3/>
- http://clipart-library.com/clip-art/88-887575_fall-leaves-clip-art-free-fall-transparent-leaves.htm
- Freesvg.org

Supplement

1.



Materials

2.



Pencil line on
paper towel

3.



Press coin on leaf
on pencil line

4.



Pigment on pencil line

5.



Bottom of paper
towel strip soaking
in rubbing alcohol

6.



Result: Leaf pigment
chromatography
after 5 minutes