Learning about Color with Paper Chromatography

Did you know that many colors are actually made up of several other colors mixed together?

In this experiment, you'll learn about two related scientific principles: chromatography—the separation of colors into their component parts, and capillary action—the movement of water in porous material.

Materials Required:

2 DRIP COFFEE FILTERS – WHITE, NOT BROWN (OR USE TWO PIECES OF WHITE PAPER TOWEL)

1 LARGE JAR LID – ABOUT THE SIZE OF A MAYONNAISE JAR

A SELECTION OF WATER-SOLUBLE MARKERS

A SMALL CUP WITH ABOUT 3 OUNCES OF WATER

A PENCIL

A PAIR OF SAFETY GLASSES

Procedure:

With the first piece of coffee filter paper:

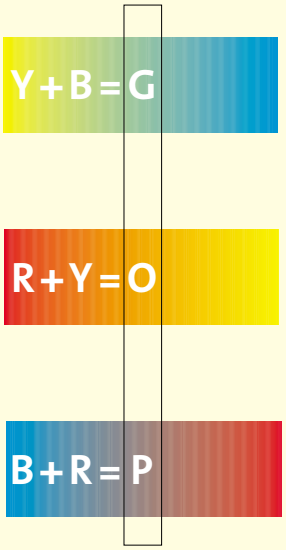
1. Fold the coffee filter in half, like a half moon, then in quarters, to make a triangle with a 'curved' side. Open the filter back up and place a small dot in the center, where the two folds cross, using the pencil.
2. Use a marker or several markers to place small dots in a ring about ½ inch from the center of the coffee filter (where the pencil dot is).
3. This will become your chromatogram.

With the second piece of coffee filter paper:

4. Fold the coffee filter in half, then in fourths lengthwise.
5. Unfold the filter and tear along the folds. Discard the outer two sections.
6. The two longer strips will be made into wicks.
7. To make a wick, take one of the two strips that you made and wrap it tightly around the middle of the pencil, starting with the shorter side of the rectangle.
8. Insert the pencil with the wick wrapped around it through the first piece of coffee filter at the pencil mark in the center of the filter.
9. Push the pencil into the coffee filter until half of the wick is on each side of the coffee filter.
10. Carefully remove the pencil and leave behind the wick.

The jar lid

11. Place the jar lid upside down on a flat surface with the top against the surface.
12. Fill the jar lid half full of water.
13. Place the first piece of coffee filter containing the wick onto the jar lid with water so that the 'dots' of color are facing up. The filter paper should rest on the rim of the jar lid.
14. You have now created a "chromatogram!"
15. Watch the water enter the wick and travel out across your chromatogram, carrying the ink as it travels.
16. Note how some of the inks begin to separate into different colored dyes.
17. When the water nearly reaches the edge of your chromatogram, remove it and place it somewhere clean and safe to dry.
18. Discard the wick into the wastebasket.



Understanding the Science

Chromatography is a method for separating the colors in complex mixtures such as ink, dyes and pigments. Many inks are water soluble, which means they will dissolve in water. When water touches them, they spread apart and you can see the different colors or dyes they contain.

During this experiment, you will notice that the ink colors travel across the coffee filter. This is due to capillary action, which is the movement of water in porous material. Capillary action occurs because water is sticky—water molecules stick to each other and to other substances. That's why water—and the inks that dissolve in it—travel across the coffee filter. Capillary action is the same force that permits leaves at the top of a tree to get water and nutrients from the roots in the ground. Capillary action also helps your blood to flow through your body.

Questions to consider

Look at your chromatogram.

1. What color of ink contains a mixture and which are single colors? *(Results will vary depending on the colors you used.)*
2. What color travels the farthest? Why?
3. What color travels the least? Why?

(Answers are printed upside down at bottom of this page.)

Science Safety

- Wear safety glasses when you conduct an experiment.
- Clean up any spills immediately to avoid slip hazards.
- Wash hands immediately after completing any experiment. Do not put hands or fingers in mouth, or rub eyes, until after hands have been washed.

Answers:
2. Blue travels the farthest because it is the most soluble of the three inks that are mixed together in the black marker.
3. Yellow is the least soluble, and therefore travels the least.

This experiment was developed by research scientist Michael Gavaghan of Rohm and Haas's Spring House Technical Center and Upper Dublin High School teacher Linda Schweitzer.