



Coffee Filter Rainbows

Primary Audience: K – 2nd

Description: Use a coffee filter to observe and separate the different colors of pigment in black and green ink.

Keywords: Rainbow, Light, Chromatography, Spectrum, Color

Materials:

- Coffee filter
- Paper clip
- Black and green water-soluble pens
- Saucer

Instructions:

1. Fold the coffee filter into half.
2. Fold it again one more time.
3. Draw a dark green line about one inch (2-3 cm) from the round edge of the filter. (Be sure to save room for a black line next to it).
4. Proceed to draw a dark black line one inch (2-3 cm) from the other side of the round edge. (Do not let the lines touch each other).
5. Make the filter into a cone shape by securing the edge of the paper filter with the paper clip.
6. Place water in the saucer.
7. Put the round edge of the filter in the water.
8. Let the filter stay in this position for one hour and then observe the results.

What's Going On?

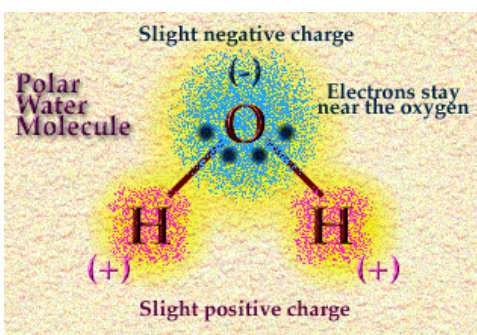
- Most inks are not a single color, but are mixtures of many colors.
 - Mixtures are two or more components that once mixed, can be separated again.
 - Some mixtures are easy to separate: a salad, for example, can easily be separated with your fingers by sorting out the lettuce, tomatoes, croutons, etc.
 - Other mixtures are not easy to separate with our hands, like the marker ink. There are many different techniques to separate mixtures, but the one we're using today is called **chromatography** (kroh-muh-tog-ruh-fee).

Light and Optics

- Chromatography is a separation technique using a moving medium and stationary medium to pull apart mixtures.
 - In this case the water is moving and the paper is stationary.
- As the different pigments dissolve at different rates, the water carries them through the paper. The inks are re-deposited on the paper as the water evaporates.

Note: The motor spinning the paper is not necessary for chromatography to take place; it just speeds up the process and makes a pretty souvenir for the guests. (This activity is just like “Watercolors” from the Science Menu in Gadgets Café with an added spin.)

Digging Deeper:



Water is a polar molecule, meaning that there is a slight separation in the charges that make up water. The negative electrons gather around the oxygen, leaving the positive protons of the hydrogens exposed on the other side of the molecule. Now there is a slight positive pole and negative pole that can attract other polar molecules such as other water molecules. [This is why we say “water is sticky” in the Just Add Water science menu

activity.] If the dyes dissolved in the water has poles, then it will stick with the water as well. So with our black marker mixture, the blue dye is the most polar, dissolved the fastest, and therefore moved the farthest along with the water. Also, other methods of separating mixtures include: filtration, decanting, distillation, crystallization, and evaporation.

Relevant Ohio Science Content Standards:

Physical Science: 1.3, 4.1