Chromatography Challenge
Science, Inquiry, and Art

Introduction

Reproduce beautiful, multicolor art patterns using paper chromatography! Various color pigments that make up black inks can be separated using radial chromatography. The inks are spotted onto a filter-paper circle containing a paper “wick” in the center, and the wick is placed into a cup of water. As water seeps outward through the paper, the different color pigments in the ink mixtures separate out in a circular or radial pattern, producing a brilliant, multicolor artistic effect. The challenge is to duplicate the pattern—to decide which pens were used and how they were applied to the paper.

Concepts
- Compound vs. mixture
- Physical properties
- Paper chromatography
- Separation of a mixture

Safety Precautions

Although the materials in this activity are considered nonhazardous, please observe all normal laboratory safety guidelines. Wash hands thoroughly with soap and water before leaving the lab.

Materials

- Cups, clear plastic
- 15 Filter paper, 12.5-cm diameter
- Markers, water-soluble, various types and colors
- Scissors
- Tape
- Water

Preparation

Test the pens or markers and use the observed color patterns to create patterns for the chromatography challenge. See below for examples. Manufacturers may change ink formulations without notice—always test the pens or markers beforehand.

General Procedure

1. Obtain a piece of filter paper. Using a sharp pencil or a pushpin, poke a small hole in the center of the filter paper.
2. Fill a plastic cup to within about 1 cm from the top with tap water.
3. Starting at least 5 mm from the center hole, place a small but concentrated spot of ink from a water-soluble marker or pen onto the paper. The “spot” may be a dot, a wedge, a short line, an arc, etc. See Figure 1 for an example.
4. Cut a piece of filter paper into eight pie-shaped wedges (see Figure 1).
5. Roll up a filter paper wedge into a tight cone and insert the cone-shaped “wick” into the hole in the center of the filter paper.
6. Set the prepared filter paper circle on top of the water-filled cup. When the water has advanced to within 1–2 cm of the outer edge of the filter paper (about 10–12 minutes), carefully lift the chromatogram and set it on a paper towel to dry.
7. Repeat as many trials as needed to identify the color pigments in different markers and to discover the patterns produced by different types of “spots.”

Discussion

Chromatography is a general term describing a variety of analytical methods for the separation and identification of the compounds in a mixture. In paper chromatography, a mixture is “spotted” onto a special type of highly absorbent paper, and a solvent is then allowed to seep through the paper by capillary action. The compounds in the mixture become separated as they dissolve in the solvent and travel up the paper at different rates, depending on their relative affinity for the paper versus the solvent.

Questions

1. Why does each ink separate into different pigment bands?
2. Choose one color (e.g., yellow, red, or blue) that is present in more than one type of ink. Is the pigment (compound) that gives this color always the same? Do any of the pens appear to contain common pigments? Explain.
3. Why are only water-soluble markers or pens used in this activity? How could the experiment be modified to separate the pigments in “permanent” markers or pens?

What To Turn In

1. Create a Title Page with your names and class period.
2. Answer the three questions on a clean separate piece of paper in ink with complete sentences.
3. Tape your Chromatogram(s) to a piece of white paper and then staple all of papers together

Figure 1

Cut a piece of filter paper into eight pie-shaped wedges.