Ink Investigation

Introduction

Did you know that pens can be identified by separating their pigments by a process known as chromatography? Identify a writing instrument using paper chromatography.

Concepts

- Chromatography
- Separation of mixtures
- Physical properties

Materials

Water, tap
Cup, clear plastic, 9-oz
Chromatography sample evidence
Filter paper, 12.5-cm diameter
Filter paper "wick," wedge-shaped
Markers, water-soluble, various types, numbered
Pencil tip (or sharp object such as a pushpin)
Scissors

Safety Precautions

While this activity is considered nonhazardous, follow all appropriate laboratory safety guidelines.

Procedure

Part A. Chromatography

1. Obtain a piece of filter paper. Use a sharp pencil tip or pushpin to puncture a small hole into the center of the filter paper.
2. Select a pen and make a dot on the filter paper about 1 cm from the center hole.
3. Using a pencil, write the corresponding number that is on the pen on the filter paper near the edge so it can be identified later. See Figure 1.

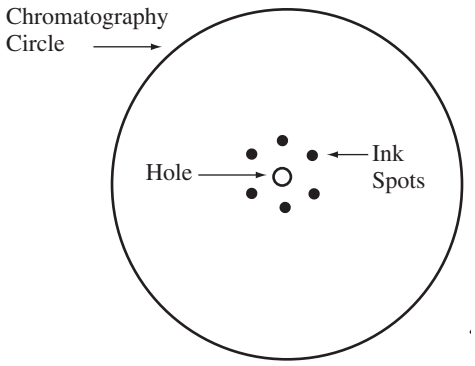

Figure 1.

4. Repeat steps 2 and 3 with the remaining pens.
5. Fill a plastic cup roughly ¾ full with tap water. Use a paper towel to dry off any water drops that are on the rim.

Publication No. 11313
030117

6. Roll up a wedge-shaped filter paper "wick" into a tight cone and insert it into the center hole. See Figure 2.

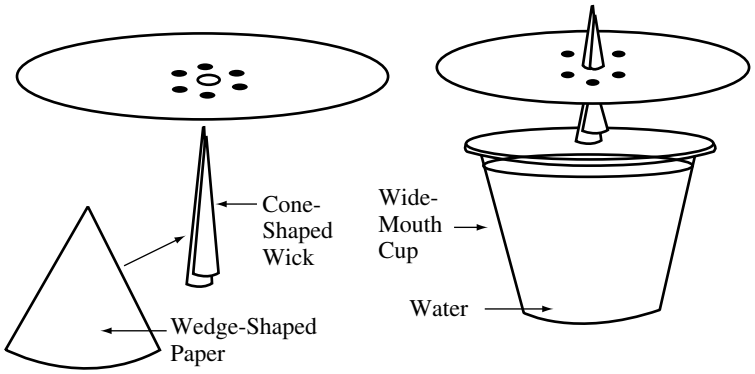

Figure 2.

7. Set the prepared filter paper circle on top of the water-filled cup and observe as the water is soaked up through the wick and then outward radially across the paper. Observe how the advancing water front acts on the spots of black ink.
8. When the water has advanced to within 1–2 cm of the outer edge of the circle (should take 10–12 minutes), carefully lift the chromatogram up and set it on a paper towel to dry.

Disposal

Dispose of the water down the drain. The filter paper disks may be saved or discarded in the trash. Save all other materials for future use.

Tips

- Experiment with a variety of different water-soluble markers of felt-tip pens to determine the composition of each. Many different brands are available at local stores.
- Try this activity with colors other than black.
- Pens such as Vis-a-vis®, Expresso, Le Pen, Papermate Flair™, Prang and Vis-Aid work well.
- Avoid excessive handling of the filter paper circles. Oils from the skin can interfere with the capillary action that draws the water through the paper.
- This activity is available as a student lab kit: Forensic Files—Ink Inspection (Catalog No. AP7745).

Discussion

Chromatography is probably the most useful method of separating organic compounds for identification or purification. There are many different types of chromatography, but most work on the principle of *adsorbtion*. The two important components of chromatography are the adsorbent and the eluent. A good adsorbent is usually a solid material that will attract and bind the components in a mixture. Paper, silica gel or alumina are all very good adsorbents. The *eluent* is the solvent that carries the materials to be separated through the adsorbent via capillary action.

Chromatography works on the principle that the compounds to be separated are slightly soluble in the eluent and will spend some of the time in the eluent (or solvent) and some of the time on the adsorbent. When the components of a mixture have varying solubilities in the eluent, they can then be separated from one another. The polarity of the molecules to be separated and the polarity of the eluent are very important. This affinity for the eluent versus the adsorbent is what separates the molecules.

Paper chromatography is commonly used as a simple analytical separation technique. In paper chromatography, the adsorbent is the paper itself. The eluent can be any number of solvents; in this lab, the eluent is water. Water is a very polar molecule. The polarity of the eluent is very important in paper chromatography since a small change in polarity can dramatically increase or decrease the solubility of some organic molecules. The organic pigments in the inks, which will be "spotted" on the filter paper, separate out as they are carried with the water at different rates. Those molecules that have a polarity closest to the polarity of the water will be the most soluble and will move outward on the radial chromatogram the fastest.

References

Cesa, I., *Elements, Compounds, and Mixtures—Flinn ChemTopic™ Labs.* Batavia, IL: Flinn Scientific, Inc., 2005; Volume 2, pp. 37–44.

Materials for *Ink Investigation* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP7745	Flinn Forensic Files—Ink Inspection
AP3104	Filter paper, Qualitative, 12.5 cm

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.