Chromatography

Name: _____

Purpose: Examine and use chromatography, a mixture separation technique.

Materials:

1 full piece of Filter Paper	¼ wedge of filter paper	Water (tap)
4 different brands of black markers	Plastic Cup	Metric ruler
Laptops/internet access	Pencil	Unknown Samples

Part A. Creation of Radial Chromatograms

1. Label each full disk at one edge with your name **in pencil**- Write small, your name should not be more than 0.5 cm from the edge of the paper. If in doubt see the example posted on the front board.
2. Fold the disk in quarters. Mark the center with a pencil.
3. Measure out from this center point one centimeter and put four dots in pencil (one in each of the four quadrants you made by folding. Label each quadrant 1-4 or A-D.
4. Place one dot of black marker on your pencil dot. Each type of marker goes on a separate dot. Be sure to record the brand and type of marker represented by each quadrant on a separate sheet of paper.
5. Allow the dots of ink to dry for 15 sec.
6. Place a second dot of black marker on top of the first. And allow to dry for another 15 seconds. Repeat once more for a total of 3 dots of black marker on each spot. **NOTE: Make sure you are using the same marker on the same spot each time!**
7. Allow your paper to dry completely while you work on the next step.
8. Fill a plastic cup to within approximately one centimeter of the top with Tap water.
9. Take your ¼ wedge of filter paper and roll it to create a wick. See example at board if necessary.
10. Create a small hole in the exact center of your filter paper disk using a pin, paper clip or your pencil point.
11. Insert the wick you created from the ¼ wedge into the hole.
12. Place the filter disk, large wick side down into the cup. Make certain there are no drops of water on the edge of your cup.
13. Record your observations as the water is drawn up the wick and across the filter disk.
14. Remove the disk from the water once the water has advanced to within one centimeter of the disk edge.
15. Mark the edge of the water, the entire circumference of the disk, with a pencil.
16. Place your disk on paper towels to dry.
17. Once the paper is dry, record detailed descriptions of what you see for each type of marker.
18. Present your data in a chart for the lab report.
19. Attach your chromatogram to your lab report.

Part B. Some Background on Chromatography

1. Read Radial Chromatography, as background information on chromatography. This should assist in answering some of the questions posed by the last section of the lab.

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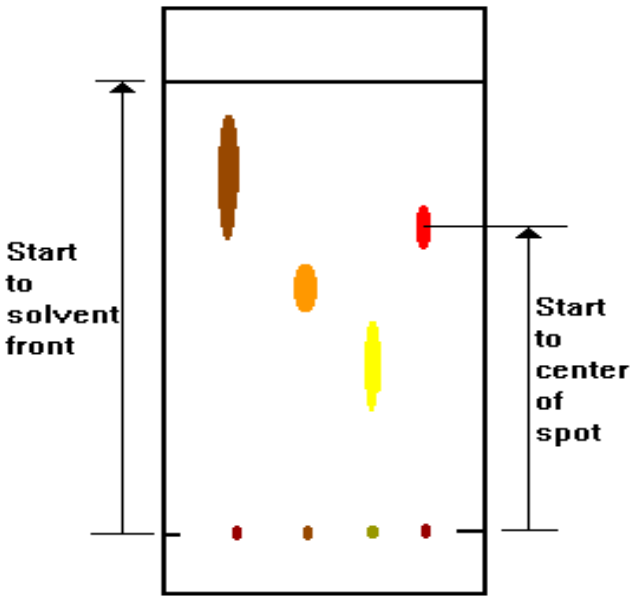
2. Look up Paper Chromatography on the internet. Provide the website address for one site that you found to be helpful in answering any questions you still had about chromatography. **Even if you had no questions, provide an address where you could find information on Chromatography**.

Part C. How to Quantify Chromatogram Data

The Rf value is a way to quantify data represented in a chromatogram. Rf stands for "ratio of fronts" and is a numeric representation of what you see in the chromatogram. Rf values tend to be characteristic for individual material and can therefore be used to identify unknowns when Rf values for the unknowns are compared to the Rf values for the known substances. The calculation of Rf is as follows:

$$R_f = \frac{\text{Distance from start to center of substance spot}}{\text{Distance from start to solvent front}}$$

The following graphic for Rf value was taken from
http://inst.sfcc.edu/chemscape/catofp/chromato/paper/paper.htm#interpret



1. Using the above diagram, calculate the R_f value for all four dots.
2. Start with the small one on the right, label that one red. Moving across from right to left they are yellow, orange and brown.
3. Create a chart of your data showing the measurements taken and the calculations used to determine the R_f value of the dots.

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Part D. Identification of Unknowns

1. Determine which marker created each of the unknowns A-D.
2. Record your process for determination and your answers.
3. Include a description of your process for determination in your report.
4. Your answers should be represented in a table.

Part E. Questions Involving Chromatography

1. Define Chromatography.

2. What type of mixture is represented by the black inks you tested today?

3. Knowing that water is a very polar solvent, what can you infer about the relative polarities of the various pigments?

4. Today you used paper chromatography. List two other types of chromatography that chemists use to help identify unknowns. (you may have to research this one)

5. What is the difference between an absorbent and an eluent?

6. In your experiment today, what was the absorbent? What was the eluent?

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Radial Chromatography

Chemistry with an Artistic Flair!

Catalog No. AP8687 Publication No. 8687

Introduction

Use radial chromatography to separate the components in various black ink mixtures and watch as brilliant patterns of pigments form on the radial chromatograms.

Chemical Concepts

- Chromatography
- Separation of mixtures
- Physical properties

Background

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 absorbance. The two important components of chromatography are the *absorbent* and the *eluent*. A good absorbent is usually a solid material that will attract and absorb the materials to be separated. Paper, silica gel, or alumina are all very good absorbents. The eluent is the solvent which carries the materials to be separated through the absorbent 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 absorbent. 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 absorbent is what separates the molecules.

Paper chromatography is commonly used as a simple analytical separation technique. In paper chromatography, the absorbent 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.

Many materials, such as the ink in felt-tip pens, are actually mixtures made up of several different organic compounds, or pigments. Each of these pigments has a different molecular structure and, usually, a different polarity. Many of these pigments can be easily separated using paper chromatography, because even when mixed together, they tend to maintain their own characteristic physical properties.

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