

CHM 102
Paper Chromatography

BACKGROUND

Chromatography is a technique used to separate and analyze mixtures based on the differing physical properties of the components of the mixture. In general, the mixture of substances to be separated, known as analytes, are applied to a solid material called the stationary phase. A solvent, the mobile phase, then passes through the stationary phase. Analytes will move down the stationary phase in the direction of the mobile phase. The relative speed that these compounds move is determined by the physical interactions between the analytes, the mobile phase, and the stationary phase. Analytes with a strong affinity for the stationary phase will tend not to move much. Analytes with a strong affinity for the mobile phase will tend to move far down the stationary phase.

In this lab, we will be investigating some of the properties of chromatography by separating inks into their component dyes. We will use paper as the stationary phase and a variety of different solvents as the mobile phase.

PROCEDURE

Caution: The solvents used in today's lab are both volatile and flammable. Please keep all solvent containers covered and dispose of all solvent waste in the organic waste container in the hood.

Cut three rectangular strips of filter paper to be about 2" wide and as long as possible. Use a pencil to lightly draw a line about 3/8" from the bottom of the paper. Choose six different colored markers from those available and make evenly spaced spots of ink along the pencil line. Record in your notebook the order of the ink spots, because they may be difficult to tell apart at the end of the lab. Prepare three identical samples in this manner.

Obtain three 250 mL beakers and place a small (1/8") layer of a different solvent in each beaker. Mark each beaker and record the solvents you use in your laboratory notebook. Place the prepared paper sample in the beaker so that it just touches the solvent in the bottom of the beaker and the paper does not touch the sides of the beaker. It may help to bend the top of the paper to keep it in this position. Cover the beaker with a watch glass or larger beaker to minimize evaporation of the solvent, and observe the samples as the chromatograms develop. This process is called elution.

When the solvent has moved to close to the top of the paper, remove the paper from the beaker and make a light pencil mark at the solvent front. Allow the chromatogram to dry in the fume hood and dispose of your excess solvent in the organic waste container in the hood.

REPORT

Your results section in this laboratory should consist of labeled sketches of each chromatogram. Outline the shape of the spots due to individual color components and describe their color the best that you can.

The discussion section of your report should consider the following points:

Do the inks consist of single component dyes or mixtures of dyes? Explain how you know this.

Do some of the different inks use the same component dyes?

Which dyes appear to have a high affinity for the paper?

Which dyes appear to have a high affinity for the solvents?

Which solvent gave the best (cleanest looking) separation?

QUESTION

Rank the solvents you used in order of increasing polarity (recall intermolecular forces in chapter 12). Explain. Do you suppose the inks in this lab tend to be polar or nonpolar? Explain.