CHEMISTRY LAB: INTRODUCTION TO CHROMATOGRAPHY

WHAT TO TURN IN, PER GROUP:

SET OF TWO PAPER STRIPS (ONE SET PER GROUP), labeled in pencil, attached to one person's lab paper

*** If you do not have the papers, please write the name of person who has them.***

WHAT TO TURN IN, PER PERSON:

HYPOTHESIS, SKETCHES of each paper strip in color and labeled with numerical measurements, ONE SAMPLE CALCULATION OF R_f, DATA TABLE, CONCLUSION, ERROR ANALYSIS, QUESTIONS 1-4

Introduction

Chromatography is a process of separating small quantities of a substance in a mixture (often a solution) through *selective adsorption*. For example, the components of solutions of metals, dyes, blood, urine, and antibiotics are separated effectively by chromatography. Once separated, the components can be identified. The process is fast, simple, and generally yields good results.

In conducting a separation, a small amount of the mixture is placed on a strip of adsorbent paper. The solvent, as the carrier, is allowed to pass through the substance. As the carrier passes through the mixture, those particles held loosely on the adsorbent will be picked up by the solvent and be moved away from the point of application. Colors or color bands will appear if the mixture was colored. The paper can also be treated with certain chemicals that will produce characteristic color bands on the adsorbent.

The ratio or quotient R_f ("representative fraction") compares the distance traveled by an ion in solution to the distance traveled by the solvent. R_f is calculated for each ion by dividing the distance traveled by each substance, D_s by the distance traveled by the solvent, D_f.

$$R_f = \frac{D_s}{D_f}$$

Objectives

- perform paper chromatography separations
- measure the distance traveled and calculate R_f values
- compare the travel rates

Materials

chromatography paper
250 mL Erlenmeyer flasks
stoppers
metric ruler
small graduated cylinder
colored markers, not permanent or washable
pencil
acetic acid-water solution
colored pencils, crayons, markers

Procedure

1) Rinse out two Erlenmeyer flask(s).
2) Pour approximately 10 mL of acetic acid-water solution in each flask used. The solution must cover the bottom of the flask completely. If shorter strips of paper are used, use 50 mL.
3) Stopper each flask and set aside.
4) Obtain two strips of chromatography paper.
5) You must do two separate types of ink: one black and one dark color of your choice. Label the top of each strip in pencil; specify which type of ink is to be used.
6) Draw a pencil line about 5 mm from the bottom of the paper. Put a small dot of ink from one of the pens in the middle of the line.

7) Remove the stopper from the flask. Carefully place the strip of paper spot-down in the flask. The paper must not sag downward below the water level. Do not dunk the dot! Stopper the flask again with a small portion of the paper held by the stopper.
8) Observe the behavior of the spot as it travels upward. The solvent will take a 5-20 minutes to travel a sufficient distance.
9) When the solvent is near the stopper, remove the strip of paper. Lay on a paper towel to dry.
10) Give the paper towel and strips to the teacher to dry overnight. Since the solvent will continue to move up the paper for a while after the paper is removed, the teacher will mark the new solvent line before the papers dry completely.

Measurements

1) Measure the distance traveled by the solvent for each paper, to the nearest 0,1 mm (D_f). This value will be used for all colors on the same paper
2) Measure the distance traveled by each color band from the bottom pencil line to the top of each region, to the nearest 0.1 mm (D_{s1}, D_{s2}, etc.).
3) Calculate the R_f values for each pigment color.

Sketches

1) Sketch each paper using colored pencils, crayons, or markers. Show the colors as accurately as possible. The drawing does not have to be to exact scale.
2) Label all numerical measurements.

Data Table

Trial #	Brand name of felt ball-point marker	Developed color of spot(s)	Distance moved by spot (s) Ds (mm)	Distance moved by solvent Df (mm)	Rf (Ds / Df)
1	_____	_____	_____	_____	_____
		_____	_____	"	_____
		_____	_____	"	_____
2	_____	_____	_____	_____	_____
		_____	_____	"	_____
		_____	_____	"	_____

Questions

1) In which common substance is acetic acid found?
2) Why do color bands appear at different positions on the paper?
3) Why is it recommended to let the flasks sit with stoppers on, after pouring in the vinegar, before inserting the paper?
4) Give two practical applications for this type of chromatography.