

Paper Chromatography Lab

FORENSICS

Chromatography is a method for analyzing complex mixtures by separating them into the chemicals from which they are made. Chromatography is used to separate and identify all sorts of substances in police work. Drugs from narcotics to aspirin can be identified in urine and blood samples, often with the aid of chromatography. In today's lab you will be using chromatography to analyze the ink found on a ransom note. The police have received a ransom note written in black ink. You will test the ink to see if it is a homogeneous mixture or if its made up of a single dye component. In addition you will measure the Rf factors of the component parts. Several known suspects have been apprehended. Samples of ink have been obtained from the correspondence of each suspect and the ink will be compared to that of the ransom note. To aide you in your investigation, you will determine the characteristic Rf factors of several inks first before testing the ink from the ransom note.

Materials

- Paper coffee filters or chromatography paper
- water
- Isopropyl rubbing alcohol
- Tape/stapler
- Ink pens/markers
- Small glasses ,plastic containers, or beakers
- Pencils
- Scissors

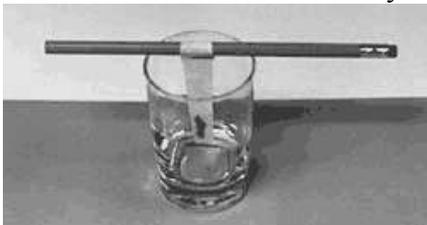
Instructions

Part I -Testing Inks. (Quantitative test)

1. Cut a strip of coffee filter or chromatography paper into strips.
2. Fold one end of each strip over then staple it to form a loop. Measure the height of your container and trim the length so that the other end just hits the bottom of your container



3. Draw a **pencil** line 1.5 to 2 cm above the tip. Place a small dot of ink to be tested on the pencil line.
4. Poke a pencil through one of the loops you just made. Use the pencil to suspend the strip (s) in a small glass or container.
5. Carefully add the solvent to the glass until it reaches the bottom of the paper strip just below the ink dot. Be sure the ink stays above the liquid and the paper stays in the solvent.

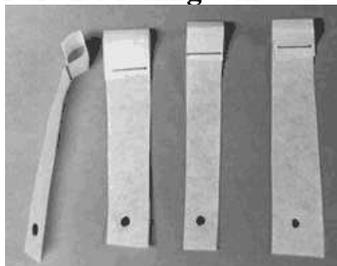


6. Allow the solvent to soak up the strip(s) and watch what happens to the ink spot.

Paper Chromatography Lab

7. If the ink you are testing does not spread out, re-test it using pure rubbing alcohol. (This means that the ink is not water soluble)
8. When the solvent reaches the top, quickly remove the strip(s) of paper and mark WITH PENCIL the solvent front and the position of each color dye. (If your dye is a pure substance, you may have only one color spot to mark. If it is a mixture of several dyes, you will have multiple pigment fronts.)
9. Let the strip (s) dry and staple or tape this into your lab report. Label this as the test strip. Using a cm ruler, measure and record the Rf factor for each color spot on the chromatography paper. Show the math involved for each calculation.

Part 2-Making a match. (A qualitative test)



1. Obtain from your teacher samples of ink from the two suspects pens. Two suspects have been apprehended and they each had in their possession a notebook with paper similar to the ransom note and black pens.
 2. Again cut and shape the 2 strips of chromatography paper so that it will fit your container.
 3. Mark in pencil a line 1.5 to 2.0 cm above the tip of the paper and place a dot of ink from each of the suspect's pen on the pencil line. Then place the strips from the suspect's pen and the sample from the ransom note into the container so that the ink spots are just above, but not touching the solvent.
 4. Allow the solvent to travel up the papers. Again when the solvent reaches the top, remove the paper and quickly mark in pencil the solvent front and the position of the pigment(s). Record the colors of ink seen from each suspect's pen. (You do not have to calculate the Rf factors for the pen).
 5. Using the sample obtained from the ransom note, compare the suspects pens to the Ink found in the ransom note.
- Can you make a match between the ransom note and the suspects? Does each pen contain the same dyes?

What's Happening

Because molecules in ink and other mixtures have different characteristics (such as size, charge, and solubility), they travel at different speeds when pulled along a piece of paper by a solvent (in this case, water or alcohol). For example, many black inks contain several colors. When the water flows through a word written in black, the molecules of each one of the colors responds differently to the mobile phase (solvent) and the stationary phase (paper), allowing the component parts to separate.

Many common inks are water soluble and spread apart into the component dyes using water as a solvent. If the ink you are testing does not spread out using water, it may be "permanent" ink. In such cases, you will have to use a different solvent such as rubbing alcohol.

Paper Chromatography Lab

Date:

I) PURPOSE:

II) DATA

Test Strip 1 Color of Ink _____

	Ink Front (Distance the ink spot(s) moved)	Solvent front (Distance the solvent moved)	Rf factor (Ink Front divided by Solvent Front)

Was this ink a pure substance or a mixture?

Test Strip 2 Color of Ink _____

	Ink Front (Distance the ink spot(s) moved)	Solvent front (Distance the solvent moved)	Rf factor (Ink Front divided by Solvent Front)

Was this ink a pure substance or a mixture?

Suspect 1

Suspect 2

Paper Chromatography Lab

III) Questions:

Below are list of Rf factors for several food colors.

Yellow dye 40	Yellow Rf = 0.50	
Purple dye 96	Blue Rf = 0.40	Red Rf =0.30
Red dye 30	Red Rf =0.30	
Green dye 60	Blue Rf = 0.80	Yellow =0.50
Blue Dye 19	Blue Rf =0.40	
Yellow dye 15	Yellow Rf = 0.60	

1. Using the chart above, which dyes are homogeneous mixtures?
2. Is the Blue dye found in the purple food color the same as the blue dye found in the green food coloring? How can you tell?
3. If a green dye is subjected to a chromatography test and it separates into 2 spots, blue with Rf of 0.40 and yellow with an Rf of 0.60, is this the same food color that called Green dye 60?
4. A yellow dye is found at a crime scene. It is put through a chromatography test and the solvent front moves 6.8 cm while the yellow pigment only moved 4.1 cm. Calculate the Rf factor for this dye. Which yellow dye does it belong to, Yellow dye 40 or Yellow dye 15?