Chromatography

# Introduction

Chromatography, as used in chemistry, is the separation of different constituents in a solution (technically “or in a mixture”). The name comes from some early experiments where different chromophores (chemicals that have a visual color) were separated by scientists working on the biochemistry of plants (1).

In the modern chemical laboratory, chromatography is achieved using very specialized instruments such as GC (gas chromatography) and HPLC (high pressure liquid chromatography). In this lab, however, we will use index cards as our chromatographic instrument.

# Scenario

As a backstory for this lab – put yourself in the character of a forensic scientist trying to solve a crime.

A “bad guy” has done something nefarious and left a ransom note at the scene of the crime. Five different potential suspects were arrested, and each had a different pen on them.

Your job is to perform chromatography experiments to determine which pen was used to write the note.

# Materials and Methods

Three 150 mL (or larger) beakers [you probably want these to be the same size]

Three cut index cards

mm scale rulers

The ransom note

Solvents:

Ethanol - Flammable, Reproductive Toxin

Acetone – Flammable, Reproductive Toxin

50:50 Hexane/ Ethyl-Acetate – Flammable, Mutagenic, Toxic

**Caution:** Ensure adequate ventilation. Remove all sources of ignition. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, or tiredness.

# Procedure

Part 1: Determine the Rf of five different inks in 3 different solvents.

1. Using each of the five suspect pens, put “spots” on each of three index card pieces (already cut for you) along the first (lowest) line on the card
2. Put the card into a beaker with the spots close to the bottom of the beaker
3. Add one of the solvents to the beaker. You should add just enough to make sure the bottom of the beaker is covered, and the card’s edge is submerged– but it is important that the solvent is NOT in contact with the spots themselves
4. Watch the solvent as it wets the card and “crawls” from bottom to top. [Pick a “finish line” to watch for, do not let it get to the very top of the card]
5. When your solvent reaches the “finish line” on the card, immediately remove the card from the beaker
6. For each ink spot, measure the distance that the ink traveled (or different parts of the ink if it separates), then measure the total distance travelled by the solvent front (measure from where the ink spots started to the “finish line” for this last part).
7. The distance your ink traveled will be ***‘D’*** and the distance the solvent travelled will be ***‘F.’*** Calculate the Rf for each ink, or each component of inks, that separated by the following equation:
8. Repeat this for each of the remaining solvents.

Part 2: Testing the Note

1. You should now have an Rf for each ink (or each component of some of the inks) in each solvent. Decide how you should use “The Note” provided to you (the “evidence” left at the scene from the scenario) and the solvents to decide which pen was used to write it
2. Write out your procedure for how you will test this note.

# References

1. Ettre, L.S., Sakodynskii, K.I. M. S. Tswett and the discovery of chromatography I: Early work (1899–1903). *Chromatographia* **35**, 223–231 (1993). <https://doi.org/10.1007/BF02269707>