Chromatography Paper Lab Instructions

Additional Supplies Required for Lab:

- Pencil
- Binder clip, clothespin, or tape
- Washable (non-primary color) markers
- Tall cup or large beaker
- Water

Need more strips?
Order online by scanning the QR code ⇒

Or visit
bartovation.com/product/MSP01P50

Background Information:

Have you ever heard that “nothing is ever as simple as it appears?” Chromatography is all about seeing what is below the surface!

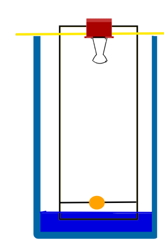
The word ‘chromatography’ is based in the Greek roots ‘chroma’ and ‘graphein’ which translates to ‘to write in colors.’ The process of chromatography was first developed by Russian botanist Mikhail Tswett in 1903 and utilized to separate plant pigments. Although the field of chromatography has developed greatly since then, the fundamental principle stays the same.

All chromatography experiments involve a stationary phase (the chromatography paper) and a mobile phase (a liquid solvent that flows through the paper). For accurate paper chromatography results it is crucial that the paper is uniform and absorbent.

Experiment:

This experiment uses a method called the ascending strip technique. To begin, grab one strip of chromatography paper for each marker you wish to test from the bag. You can repeat this process with as many strips as you would like, we recommend testing at least three different marker types/colors. Draw a line in pencil one centimeter from the bottom of the strip, across the strip. This line will be referred to as the “origin.” In the middle of this line place a small dot with your marker. You can repeat this on as many strips as you would like; we recommend doing this test on three strips.

After you have marked your chromatography paper, it is time to fill your cup with liquid. We recommend using tap water, though oil or isopropyl alcohol can be used as alternatives. Fill the cup with approximately half a centimeter of water. Next, use a binder clip, clothespin or tape to attach the unmarked side of the paper strip to the center of your pencil. Hang the pencil over the cup so that the paper strip hangs into the cup, as shown in the diagram to the right. The tip of the paper strip should be submerged in the water. Ensure that the origin line and marker dot are above the water line. Leave the paper in the cup until the pigments from the markers travel up 75-80% of the paper. This usually takes five to ten minutes.



The speed at which the pigments get carried up the chromatography paper is determined by two factors:

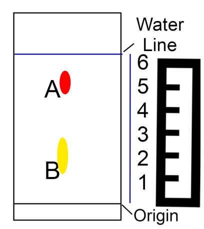
1. How much attraction there is between the pigments and the solvent.
2. How much attraction there is between the pigments and the stationary phase.

This technique has been used for decades to determine if ink from two documents is the same. This simple testing technique thwarted many forgeries over the years!

Do you see new colors you had not previously? If you do, this is because the chromatography paper separated those pigments from each other! People who make colors for inks and paints make them by mixing multiple colors together, and you just separated them successfully.

If you would like to take this lab one step further, you can calculate the retention factor (Rf) value for each pigment. This step is more complicated and is typically taught in High School level Chemistry. The Rf value is the distance traveled by the pigment divided by the distance traveled by the solvent.

First, we need to measure the distance from the origin line we drew to the top of the solvent (also known as the mobile phase). This is the highest point that the water has reached on the paper. Next, measure the distance traveled by the different pigments (calculated as the distance between the origin and the center of the spot left by each pigment). We will use point A in the diagram for our sample calculation. Pigment A traveled 5 cm and the water line traveled 6 cm. In this example you can calculate the Rf as follows: Rf=5/6=.833



The Rf value should always be between 0 and 1 and be recorded as a decimal value. Rf is a relative figure comparing the solvent with the components being tested. As a result, the Rf value is not time dependent.

The more a pigment travels the more non-polar they are. The less a pigment travels the more polar they are and the more attracted they are to the stationary phase. Pigments with a smaller Rf are more polar while pigments with a higher Rf are less polar.

This lab can easily be adapted to test natural dyes or permanent markers (if you use isopropyl alcohol instead of water as the solvent).