

Investigation of Mixture: A Paper Chromatography Study

INTRODUCTION

Chromatography is a technique used to separate mixtures based on the adsorption differences among the mixture's components. There are several methods of chromatography: paper chromatography, thin layer chromatography, column chromatography, gas chromatography, and high performance liquid chromatography.

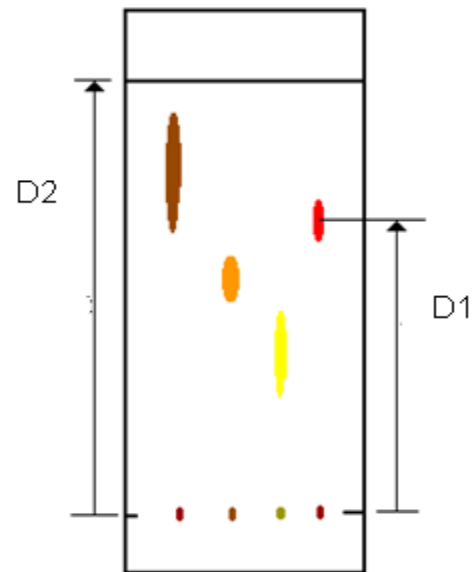
The method of chromatography chosen depends upon the desired results. Regardless of the method of chromatography chosen, the principle remains the same. All methods employ two phases: a stationary phase and a mobile phase. Although the stationary and mobile phases vary from one method to another, their purpose remains the same. The mobile phase carries the sample over the stationary phase, which is where the mixture is separated. Separation occurs due to the interaction of the components of the mixture with the stationary and mobile phases.

Paper chromatography uses a slightly porous paper and is often filter paper. That is considered the stationary phase, which is placed in a liquid mobile phase. The mobile phase is carried over the stationary phase by capillary action.

Each component of a mixture can be identified once it is separated by determining the retention time or R_f value of the components. If the sample is removed from the stationary phase as in column, gas, and high performance liquid chromatography, the retention time is used. This is a measure of how long the component was retained on the column before eluting with the mobile phase. In paper and thin layer chromatography, the components are identified by the use of calculated R_f values. The R_f value is calculated using the following equation:

$$R_f = \frac{D_1}{D_2}$$

where D_1 is the distance from the point of application of the sample to one of the components and D_2 is the distance from the point of application of the sample to the solvent front.



PURPOSE

The purpose of this laboratory is to use paper chromatography to separate inks from a mixture and calculate the retention factors for each ink in the markers.

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PRE-LABORATORY QUESTIONS

1. What is chromatography?
2. What are the various types of chromatography?
3. What is paper chromatography?
4. What are homogeneous mixtures?
5. What are heterogeneous mixtures?
6. What is the stationary phase?
7. What is the mobile phase?
8. What is capillary action?

PROCEDURE

1. Obtain paper chromatography paper from lab bench.
2. Measure from the bottom approximately 2 centimeters and draw a line with a pencil.
3. Using the marker provided by the teacher, place a dot of ink on the pencil line. Dot the paper several times to ensure there is enough ink on the chromatography paper.
4. Take a pencil, wrap the other end around the pencil and secure with tape.
5. With the spotted ink on the bottom of the paper, carefully stand the paper in the water. **Make sure that the sides of the paper do not touch the beaker. Make sure that the ink spots are not submerged into the water.**
6. **Allow the solvent to rise within 1 centimeter from the top of the chromatography paper. Once it has risen to that level, remove the chromatography paper, mark the solvent line, and allow it to dry completely.**
7. Once dry, measure the distance, in centimeters, that the solvent (water) traveled up the chromatography paper (D_2).
8. Once dry, measure the distance, in centimeters, that each color traveled up the chromatography paper (D_1).

CALCULATIONS

1. Calculate the retention factor for each ink present in the marker.

ANALYSIS

1. What is the purpose for doing chromatography?
2. Is the ink that was used for the laboratory considered a homogeneous or heterogeneous mixture?
3. How would you know a manufacturer used the same dyes in their product? How would you test it?
4. What happens if the water is altered by adding sodium chloride to it? Do you think it will cause any changes in the movements of the dyes or effectiveness of the separation method?