

CHROMATOGRAPHY OF MAGIC MARKERS

Introduction:

The colors in magic markers are often due to a mixture of several compounds. These inks can be separated using paper chromatography. Porous paper serves as the stationary phase. Depending on the type of ink, the mobile phase will vary. Permanent inks require isopropyl alcohol to separate, while washable markers require only water. After separation, one can observe the different colors that make up a particular color of magic marker.

Purpose:

The purpose of this experiment is to separate the inks in magic markers using paper chromatography.

Materials:

large test tubes	isopropyl alcohol (opt.)	water
magic markers	scissors	ruler
large test tube racks	chromatography paper	

Safety:

- Always wear safety glasses and an apron in the lab.

Procedure:

1. Obtain large test tubes (one for each marker to be tested), and place them in a test tube rack.
2. Cut strips of chromatography paper slightly longer than the test tubes and slightly narrower than the diameter of the test tubes.
3. In the center of each strip about 3 cm from the pointed end, place a dot of the marker to be tested. The dot should be about 0.2 cm in diameter and dark enough to be clearly visible.
4. Place about 1.5 cm of water in each test tube.
5. Carefully insert the chromatography paper into the test tube, dotted end down. The dot must be above the water, and the sides of the chromatography paper cannot touch the sides of the test tube.
6. Allow the test tube to remain undisturbed until a good separation is obtained or until the solvent front reaches the top of the test tube. In a good separation, the colors are separated and the solvent is clearly above the top color.
7. Remove the chromatogram.
8. Mark the solvent front with a pencil.
9. Calculate the R_f values ($R_f = \text{distance solute moved} / \text{distance solvent moved}$).
10. Repeat for as many different colors as assigned.
11. Repeat using a 1:1 isopropyl alcohol to water mixture as the solvent.(opt.)

Data Table:

Marker color and brand	
Colors absorbed top to bottom (Solvent: water)	Colors observed top to bottom (Solvent: alcohol)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Questions:

1. What marker colors were mixtures?

2. Why is isopropyl alcohol a better mobile phase than H₂O for permanent markers?

3. Why does the spot need to be above the level of the solvent when the chromatogram is placed into the solvent?

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TEACHER NOTES

Standards Met:

- 3.1.7.E** – Identify change as a variable in describing natural and physical systems.
- Describe the effect of making a change in one part of a system on the system as a whole.
- 3.4.10.A** – Explain concepts about the structure and properties of matter.
- Apply knowledge of mixtures to appropriate separation techniques.
- 3.1.4.E** – Recognize change in natural and physical systems.
- Describe the change to objects caused by heat, cold, light or chemicals.
- 3.2.7.B** – Apply process knowledge to make and interpret observations.
- Describe relationships by making inferences and predictions.
- 3.2.10.C** – Apply elements of scientific inquiry to solve problems.
- Design an investigation with adequate control and limited variables to investigate a question.
 - Conduct a multiple step experiment.
- 3.4.7.C** – Identify and explain the principles of force and motion.
- Describe the motion of an object based on its position, direction and speed.

Lab Time: 30 to 45 minutes

Answers to Questions:

1. What color markers were mixtures?
Answers will vary.
2. Why is isopropyl alcohol a better mobile phase than H₂O for permanent markers?
Permanent ink is insoluble in water, so it will not move with the water
3. Why does the spot need to be above the level of the solvent when the chromatogram is placed into the solvent?
The spot will "wash" into the solvent.

Considerations:

This lab is very simple. It demonstrates the concepts of chromatography well, even at a very low chemistry level while giving the students practice with the general skills of paper chromatography. This lab is also a very good predecessor to any of the paper or thin layer chromatography labs in this section. This lab is easily adapted to elementary students. Students often enjoy using their own markers for this lab. This lab can be done by students at home using coffee filters for chromatography paper.

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