CHEMISTRY LAB

Polarity and Intermolecular Forces

Paper Chromatography

MATERIALS

Well plate

Chromatography strips (3)

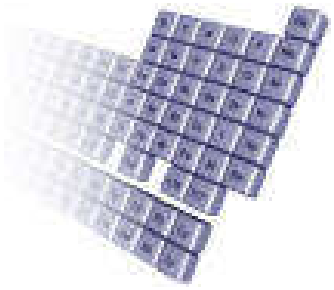
Vis-à-vis marking pen

Toothpicks or stirring sticks

NaCl

water

SAFETY GOGGLES



Chromatography is a technique of separation. There are many forms of chromatography; in this activity you will use paper chromatography. The separation of compounds in paper chromatography depends on how strongly the components of a mixture are attracted to a solvent and to the paper. In paper chromatography, the STATIONARY PHASE is the piece of paper. The MOBILE PHASE is the mixture to be separated, often a solvent in which a sample of unknown composition is dissolved. Your unknown sample will be the ink from a marking pen. Based on the results of the experiment, you will identify the different components of the ink mixture. You will also examine the relationship between separation and solvent polarity.

READ ALL INSTRUCTIONS BEFORE PROCEEDING

PROCEDURE

1. One by one, place each strip of filter paper in a **dry**, empty well of the microplate. Draw a PENCIL line on it even with the top of the well.

2. Press a small circle on the pencil line with the marker at your lab station. Allow the spot to dry and mark the spot again. Allow this to dry as well.

3. Fill well A1 halfway with water.

4. Carefully place 0.08 g of NaCl into well B1 of the microplate. Add water until the well is half full. Stir with a toothpick.

5. Carefully place 0.30 g of NaCl into well C1 of the microplate. Add water until the well is half full.

6. Using a PENCIL, label the tops of the paper strips with the solvents to be used: A1, B1, C1.

7. **Gently** place the marked strips in the appropriate wells in the microplate. *The circle should NOT be*

SAFETY NOTE

You may not perform unauthorized experiments such as mixing chemicals beyond the instructions provided. Such unauthorized experiments **will result in a zero** for this laboratory grade and the great displeasure of your instructor.

7. **Gently** place the marked strips in the appropriate wells in the microplate. *The circle should NOT be under the water.*

8. Allow the chromatogram to develop until the solvent comes close to the top of the paper, or until it stops moving completely.

9. Remove the paper chromatograms, and in PENCIL, make a mark at the furthest distance traveled by the solvent.

10. Choose spots of the same color on each chromatogram for your analysis. Measure the distance that the spot of this color moved from the original spot on each chromatogram. Record the distances in your data table.

11. Do NOT throw away your strips: these will be attached to your final lab reports. Dispose of the solutions and clean and dry the microplate.

12. Determine the R_f value for each of the colors in your chromatogram. The equation to calculate the R_f value is

$$Rf = \frac{\text{Distance dye spot moved}}{\text{Distance Solvent moved}}$$

QUESTIONS

13. How many spots did you have?

14. What is the difference between each component "spot"?

15. How are the three chromatograms similar?

16. The degree of separation is shown by the distance between the dye spots on the paper. Discuss which solvent was best at separating the different dyes and explain why.

17. Compare the Rf values for your spots. Do any two of these have the same value? Should they have the same value? Why or why not?

18. Water is more polar than salt, and the mixture is intermediate between the two. The most polar dye molecule will move the farthest in the most polar solvent. Explain which color dye is most polar, and which is least polar.

19. Explain how a polar solvent works in the separation of polar dyes.