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CHEM 121L
Section 1
June 21, 2009
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Paper Chromatography of a Metal Cation Mixture

The metal cations in an unknown solution were separated and identified using Paper Chromatography. We found Unknown solution A contained the cations Fe^{3+} and Cu^{2+} .

Introduction

Separation of chemical species is a critical step in many chemical procedures and processes. Paper Chromatography is a quick and useful technique for separating pigments and other substances. Here, we use Paper Chromatography to separate the metal cations in an aqueous mixture that possibly contains Fe^{3+} , Ni^{2+} and Cu^{2+} . On the same chromatogram we run known solutions of each of these cations. This is done for comparative purposes, to identify the cations present in our unknown mixture based on the chromatographic results, and to confirm the method is indeed working correctly for this set of cations.

Experimental Data

The chromatogram was prepared and run:

- Prepared eluting solution from 19mL Acetone and 6mL 8M HCl.
- Dotted Unknown solution A and known solutions onto the chromatography paper.
- Ran the chromatogram in a 1 L beaker.

The chromatogram was developed:

- Developed the chromatogram with Ammonia vapor and DMG.
- Results were:

Distance Solvent Front Runs = 25.0 cm

<u>Sol'n Used</u>	<u>Color of Spot</u>	<u>Dist. Run [cm]</u>	<u>Breadth of Spot [cm]</u>
Fe^{3+}	Rust	24.5	1.0
Ni^{2+}	Pink	4.5	5.3
Cu^{2+}	Blue-Green	12.0	1.7
Unknown A	Rust	24.0	0.9
	Blue-Green	12.5	1.9

Data Analysis

The cations in Unknown A were identified by comparing the colors and Retention Factors for the spots produced by the known cation solutions with those spots produced by the unknown mixture.

The Retention Factor for the Fe^{3+} cation, based on results for the known solution, was calculated according to:

$$R_f = \frac{\text{Dist. Spot Runs}}{\text{Dist. Solvent Runs}} = \frac{24.5 \text{ cm}}{25.0 \text{ cm}} = 0.980$$

The Retention Factor for each cation and the spots produced by Unknown A were likewise calculated and are tabulated below:

<u>Sol'n Used</u>	<u>Color of Spot</u>	<u>Retention Factor</u>
Fe^{3+}	Rust	0.980
Ni^{2+}	Pink	0.18
Cu^{2+}	Blue-Green	0.480
Unk. A	Rust	0.960
	Blue-Green	0.500

Comparison of the results for the known solutions with those of the unknown indicated Unknown A contained Fe^{3+} and Cu^{2+} .

Conclusion

Even though the chromatographic spots were fairly broad, the results were unambiguous. We can say with a high degree of certainty that the identification of the metal cations in Unknown A was correct. This demonstrated the usefulness of even this low resolution technique in the identification of chemical species in a mixture.

Post Lab Questions

All post lab questions are answered.