Explore How Chromatography Can Unmix Mixtures

https://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p009/chemistry/paper-chromatography-advanced-version-1 (http://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p009/chemistry/paper-chromatography-advanced-version-1)

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Experimental Procedure

Separating the Ink Components

Note: To make sure you can compare your results, as many of your materials as possible should remain constant. This means that the temperature, brand of solvents used, size of paper strips/chalk, where the ink is placed onto the chalk/paper etc. should remain the same throughout the experiment.

1. Take a piece of chalk and etch a small ring two cm from the end.
2. Take the black marker and thinly trace inside of the etched ring.
3. Pour a small amount of your your first solvent (water) into the 100 mL beaker.
4. Place the chalk upright in the beaker with the ink on the bottom (the ink should be above the solvent level, it must not be submerged or touching the liquid).
5. Let the solvent rise up the chalk until it is almost at the top.
6. Remove the chalk from the dish and mark how far the solvent rose with a pencil.
7. Analyze the separated ink components.
    a. Measure the distance the solvent and each ink component traveled from the starting position, then calculate the R_f value for each component. (If there are not different colors in the ink, you should use a different marker.)
8. Repeat the experiment for each brand of marker three times.

Changing the Stationary and Mobile Phase

Note: Using your knowledge of polarity and the results from your first trial for this marker brand, predict the order this ink will separate for each solvent and stationary phase.

1. Repeat the experiment, but instead of water, use a different mobile phase, such as isopropyl alcohol, nail polish remover, or turpentine. Again, repeat the chromatography procedure for each solvent and marker three times.
2. Next, repeat the experiment with paper as stationary phase instead of chalk. Instead of etching into the paper, use a ruler and pencil to draw a line across it horizontally two cm from the bottom. Place a small dot of ink onto the line. Then use the mini binder clips and wooden splints to hang the paper strip into the beaker of solvent so it is barely touching. For more details on how to do this, see Paper Chromatography: Is Black Ink Really Black? (http://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p008/chemistry/paper-chromatography)
3. Experiment with different combinations of stationary and mobile phases. Which combination results in the best separation?

Questions

For all of these questions, be sure to consider molecular structures and polarity.

- Which ink components were the most polar for each brand? Least polar? How do you know?
- How did the separation order differ for each solvent system, marker brand, and solid phase? Why?
- How did the R_f values differ for each solvent system, maker brand and solid phase? Why?
- Which combination of solid phase and solvent separated out each brand of marker the best?
- Were your initial predictions correct?

An example of the experiment:
http://www.ias.ac.in/resonance/Volumes/06/05/0083-0091.pdf (http://www.ias.ac.in/resonance/Volumes/06/05/0083-0091.pdf)