Ink Chromatography Experiment

Safety and First Aid

This section will only deal with the specific safety issues regarding the chemicals involved and used in the video; other safety data may be required depending on the chemicals used. There are likely to be other safety issues that will need to be addressed outside the scope of this section and a full risk assessment should be performed prior to undertaking the experiment.

- Students should not ingest any of the experiment; good lab practice starts young!
- Rubbing alcohol is toxic if ingested and flammable. Avoid prolonged inhalation of fumes.
- *First Aid* – wash the affected area with water. If rubbing alcohol is ingested, DO NOT induce vomiting; rinse mouth with water and seek medical assistance.

Glossary

- *Chromatography* – a set of laboratory techniques used for the separation of mixtures
- *Capillary action* – the ability of a chemical to flow into narrow spaces without the assistance of an external force, often against the force of gravity

Suggested Teaching Points

- *Analytical science* – this experiment will introduce students to analytical science by investigating the chemical composition of inks
- *Chromatography* – this experiment will introduce a simple method for chromatography
- *Investigative technique* – this experiment will allow students to compare the chemical composition of different inks
- *Problem solving and data interpretation* – please see the 'Murder Mystery' section of the "Suggested improvements / student challenge" section

What to Expect

Please see the video for a detailed depiction of the experiment.

In this experiment, we will be investigating the different chemical compositions of a selection of inks. In order to achieve this, we will use an analytical technique, known as chromatography, to separate out the different mixtures of chemicals present in the ink. For this experiment, filter paper and a solvent (either water or rubbing alcohol in our case) will separate out the chemicals.

A small sample of the ink to be investigated is placed on the bottom of the filter paper and the solvent allowed to be drawn through the filter paper *via* capillary action. As the solvent passes the ink, any chemicals that dissolve in the solvent will be carried along as the solvent continues up the filter paper, while insoluble chemicals will remain at the bottom. The distance that each separate chemical travels up the filter paper is dependent on how well it dissolves in the solvent and how strongly it binds to the filter paper. For a chemical that dissolves well in the solvent and does not bind to the filter paper, it will travel much further than a chemical that dissolves well but binds strongly to the filter paper. Once the solvent has reached the top of the filter paper, each ink will leave behind a specific characteristic pattern showing the mixture of chemicals that were contained in the ink.

Equipment and Chemicals

- Water
- Rubbing alcohol
- Filter paper
- Pencil
- Selection of different inks

Supplementary Instructions

- The baseline must be drawn in pencil. If you use a pen, the ink may move and mix with the inks you are investigating.
- It is essential that the level of solvent is below the pencil baseline and does come into contact with any of the inks you are investigating.
- To increase the rate at which the solvent travels through the filter paper, cover the top of the container to make an airtight seal.
- Try and handle the filter paper as little as possible while wet to prevent tearing.

Suggested Questions for Students

- *What use could chromatography have in chemical industry?* – chromatography is an essential technique utilised by a wide of analytical professions. For example, synthetic chemists use chromatography to purify chemicals before they are allowed into use (e.g. pharmaceutical drugs). Other uses include forensic science and checking the purity of water.

- *Why do inks have different coloured chemicals in them?* – inks tend to have a variety of different coloured dyes to give the desired overall colour. This is demonstrated in the video showing that green highlighters are made of a blue and yellow dye.

Suggested Improvements / Student Challenge

- *Use other solvents* – students could investigate how other solvents separate out the different chemicals present in ink. Ethyl acetate and acetone (found in different types of nail varnish remover; see the ingredients label for which) could be used; *remember to complete a new risk assessment for this!*
- *Murder mystery* – a scenario could be set up in which students undertake the role of a forensic scientist. The students could be given a sample of ink and told that this was found on the 'victim'. The students should then be given a selection of other inks, which provide unique dye patterns when separated, that have been obtained from the 'suspects'. The students would then compare the 'victim' sample with those of the 'suspects' to discover who was responsible.

Clean up and Waste Disposal

The specific waste disposal protocols for this experiment will depend upon the choice of liquids used.

Spillages can be cleaned with water and paper towel.

Filter paper can be disposed of in the bin.