

Identification of unknown substances using paper chromatography

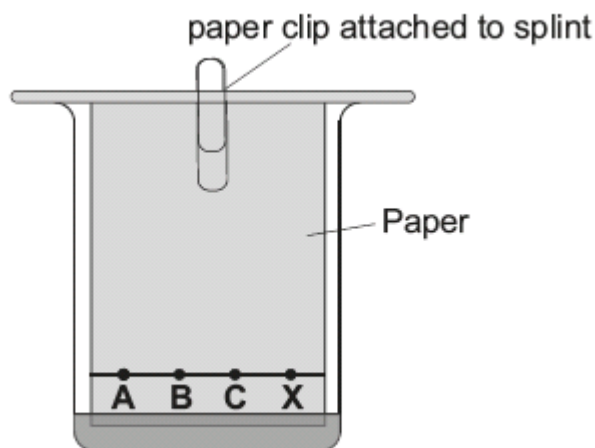
Introduction

Black ink is a mixture of colours and different black inks contain different amounts and types of coloured dyes and thus give a different pattern in a chromatograph. Chromatography is used in forensic science. In this experiment you will examine a ransom note and ink from three pens. The objective is to identify which pen's ink matches the ransom note.

Apparatus

3 × black pens (water soluble)
 part of a ransom note
 beaker
 splint
 paper clip
 chromatography paper
 dimple tray (or small watch glass)
 dropping pipette
 capillary tube

Diagram of Apparatus



Method

1. On a rectangular piece of chromatography paper, draw a line **in pencil**, 1 cm from a short edge and mark 4 evenly spaced points.
2. **In pencil**, label under the points **A,B,C** and **X**.
3. Mark a spot with each pen labelled A, B and C on each of the corresponding points.
4. Take the sample of the ransom note and place in the well of a dimple tray.
5. Add a small amount (1-2 drops) of water to the sample. The ink should come out of the paper.
6. Use a small capillary tube to apply some of this ink to the point labelled X.
7. Attach the chromatography paper to the splint with a paper clip.
8. Place some water into the beaker making sure that the water does not go over the spot line on the chromatography paper.
9. Suspend the chromatography paper in the beaker and allow the water to travel up until it almost touches the splint.
10. Remove the chromatography paper and allow to dry.

Analysis

1. Identify which pen has the same ink as on the ransom note.

Risk Assessment

Hazard	Risk	Control measure
Broken glass can cut	The capillary tube can snap when applying sample to chromatography paper and have sharp edges	Care to be taken when collecting sample from dimple tray, no pressure is required when applying sample to paper

Teacher / Technician notes

Whatman chromatography paper is available in a long roll and can be pre-cut into strips of approximately 6-7 cm for the class.

Pens should all be black and water soluble, fibre tip pens work better than ball point pen as a greater amount of ink is released. Permanent markers and some whiteboard pens are not suitable as they are insoluble in water.

It is important that the minimum amount of water is used to dissolve the ink from the sample note.

Beaker can be 100 or 250 cm³.

Extension activity – calculate the R_f values for the ransom note. Students will need to mark the position of the solvent front in order to do this. The dyes do not completely separate and this can be a discussion point in evaluation.

Working scientifically skills covered

1. Development of scientific thinking

Explain every day and technological applications of science; evaluate associated personal, social, economic and environmental implications and make decisions based on the evaluation of evidence and arguments.

2. Experimental skills and strategies

Apply a knowledge of a range of techniques, instruments, apparatus and materials to select those appropriate to the experiment.

Make and record observations and measurements using a range of apparatus and methods.

3. Analysis and Evaluation

Interpret observations and other data including identifying patterns and trends, making inferences and drawing conclusions.