

Ink Analysis

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Ink from most ball-point pens and markers can be developed by paper chromatography using 70% isopropyl rubbing alcohol as the eluting solvent.

Materials:

- Assorted pens
- Chromatography paper (either one sheet 10 cm x 20 cm, or single strips)
- Beaker, 600 mL or plastic 8 ounce (or larger) cups
- Stapler
- Watch glass or plastic wrap
- Isopropyl rubbing alcohol
- Pencil
- Rulers, 12 inch
- Safety glasses or goggles

Safety Precautions

Wear safety glasses or goggles to protect your eyes from the alcohol vapors or any splashes.

Isopropyl alcohol is flammable. Avoid sparks or flames. Dispose of waste alcohol in a safe manner.

Procedure

Obtain a sheet of chromatography paper. Hold the paper by the edges to avoid fingerprints which will interfere with the chromatography process.

Draw a pencil line on the chromatography paper about 1 cm from the bottom. This will be the origin.

Using the test pens available, place a small spot of ink on the pencil line. Directly above each spot, label the paper, in pencil, with the name or identification of the pen used. (See Figure I-1)

Place a spot of ink from the “crime scene note” on the pencil line and label the paper accordingly. (Note: you may have someone select one of the pens used to spot the paper as ink from the “crime scene note”.)

Roll the paper into a cylinder, butt the ends together, but do not overlap them, and staple the paper together.

Add about 25 mL of isopropyl alcohol to the 600 mL beaker. Place the chromatography paper into the beaker. Cover the beaker with a watch glass or with plastic wrap. (See Figure I-2)

Allow the beaker and chromatography paper to sit for up to 30 minutes for the inks to separate. Do not disturb the beaker during this time.

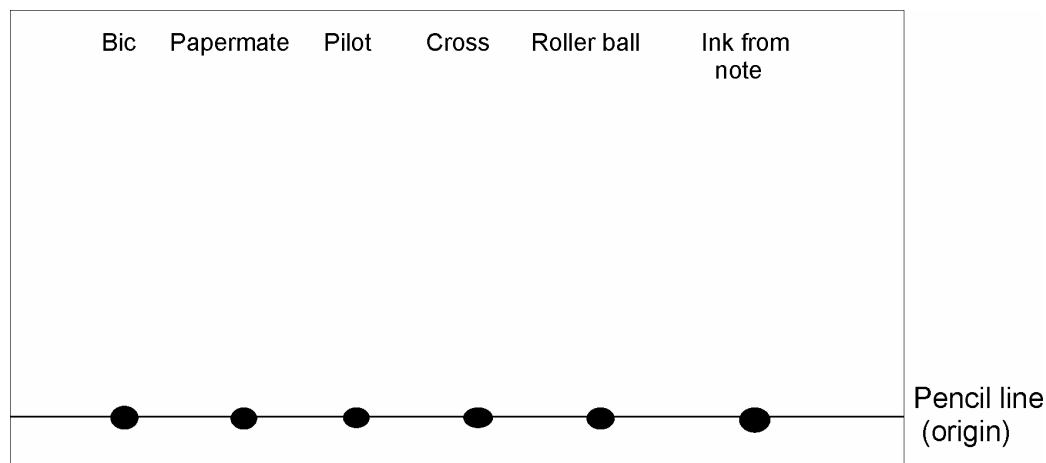
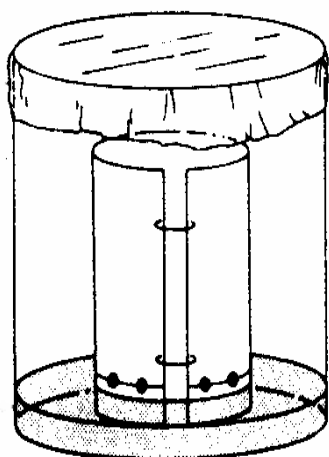


Figure I-1. A sheet of chromatography paper for analyzing ink from several pens at one time.

When the inks have separated sufficiently or the ink smears have moved approximately $2/3$ of the way up the paper, remove the chromatography paper from the beaker. Open it flat and place it on a paper towel to dry.



Does the ink from the "crime scene note" match any of the inks from the known pens?

Figure I-2. The chromatography paper placed in a container of alcohol to separate inks.

As an alternative procedure, inks can be placed on separate strips of chromatography paper. (Author's Note: Use the same method for all ink samples to insure reproducible results.)

Suspend the chromatography paper into a plastic or glass tumbler which contains approximately 10 mL of the solvent that was effective in dissolving the ink from the note paper. (Either water or isopropyl alcohol.) (See Figure I-3)

When the ink has separated sufficiently or the ink smear has moved approximately $2/3$ of the way up the paper, remove the chromatography paper from the container. Lay it flat on a paper towel to dry.



Figure I-3. Chromatography of a thin strip of paper for single ink samples.

Analyzing ink from a written note

Any letter or note to be analyzed must be photographed before examination. The note should not be cut up or destroyed, however, a small piece of the note can be cut out to analyze the ink.

Ink from a note or letter can be removed and developed by paper chromatography. The ink is usually tested with methanol (wood alcohol), 70% isopropyl rubbing alcohol, or, stronger solvents, such as pyridine, as needed. For safety purposes, this procedure will only use water or alcohol as solvents.

Materials:

- A “crime scene note”
- Chromatography paper (either one sheet 10 cm x 20 cm, or single strips)
(Note: Strips of white, smooth surface coffee filters can be used.)
- Beaker, 600 mL (Note: A clear plastic or glass tumbler can be used.)
- Watch glass or plastic wrap
- Test tube or small container such as a 10 mL beaker
- Dropper
- Water
- Methanol (wood alcohol, available from hardware stores)
- Isopropyl rubbing alcohol
- Pencil
- Paper clip
- Scissors
- Safety glasses or goggles
- Capillary tube or small coffee stirrer straw

Safety Precautions

Wear safety glasses or goggles to protect your eyes from the alcohol vapors or any splashes.

Methanol and isopropyl alcohol are flammable. Avoid sparks or flames. Dispose of waste alcohol in a safe manner.

Alcohol used in this experiment should be placed in small containers, for student use, to minimize spills.

Procedure

Cut a small piece of paper from the “crime scene note” containing a dark sample of the ink. A strip containing a few words works well. (Do not cut up the original note into small pieces, it is needed for handwriting analysis. It is good practice to photograph or to make Xerox copies of any “crime scene notes” before cutting off samples.)

NOTE: Ball point pen ink is usually not water soluble. If you are certain the ink is from a ball point pen, go directly to the isopropyl alcohol procedure.

Place the piece of paper into a test tube or small container. Add one or two drops of methanol to wet the paper and the ink. There should be enough methanol so that all of it is not absorbed by the paper. Avoid a large excess of liquid or the ink solution produced will be too dilute for good results.

Allow the sample to sit for several minutes. If the ink is not soluble in the methanol, repeat the procedure with a fresh sample of ink from the “crime scene note” using isopropyl rubbing alcohol as the solvent.

Note: If the ink is not soluble in methanol or isopropyl alcohol, then this procedure cannot be used.

Obtain a piece (or several single strips) of chromatography paper. Hold the paper by the edges to avoid fingerprints which will interfere with the chromatography process.

Draw a pencil line on the paper about 1 cm from the bottom. This will be the origin. (See Figure I-1)

Using a capillary tube or a coffee stirrer straw, dip the end into the ink solution in the test tube, then, lightly touch the capillary tube to the chromatography paper to place a small spot of the ink solution on the pencil line. At the top of the paper, label it, in pencil, with the name or identification of the ink sample used. Note: The ink spot may not be dark, as compared to the ink on the original note. You can add additional spots of the ink solution directly on top of the spot on the chromatography paper. Be sure to allow the spot to dry completely before adding additional spots of ink solution.

If you are using a 10 x 20 cm sheet of chromatography paper, place small spots of ink from suspect pens on the paper spaced along the pencil line. Label the chromatography paper at the top with the identity of the pens. If you are using single strips of chromatography paper, then prepare strips for each pen and mark each strip with the proper identification.

When the ink has separated sufficiently or the ink smear has moved approximately $\frac{2}{3}$ of the way up the paper, remove the chromatography paper from the container. Lay it flat on a paper towel to dry.

Compare the chromatogram of the ink with samples from pens found at the crime scene. The colors and order of separation should match, but the individual sample most probably will not be as dark as ink samples from the pens.

INK ANALYSIS

Data and Results

Name _____ Course and Section _____

Partner(s) _____ Date _____

Ink Analysis

Attach the chromatography paper to this sheet.

Does the ink from the "crime scene note" match any of the inks from the known pens? Explain.

Analyzing ink from a written note

Was the ink soluble in alcohol?

Did the ink sample from the "crime scene note" match the ink from any of the pens you previously tested?