R06797 **TLC Kit** **NFU 1250**

Background

Chromatography is a method used for separating mixtures by passing it through a medium in which the constituents move at a different rate. The word 'chromatography' comes from the Greek words *khroma*, meaning colour, and *graphia*, meaning writing. The history of chromatography is somewhat contentious, however, the first use of true chromatography is usually attributed to a Russian-Italian botanist called Mikhail Tsvet for his work around the turn of the twentieth century. He first printed the term in 1906 whilst describing how he separated some different colours he found in plants.

There are a variety of types of chromatography, including thin-layer, gas, and liquid chromatography. This kit covers thin layer chromatography (TLC)

Investigation

This kit provides equipment for a simple experiment on an ink mixture.

Contents:

- TLC plates 40 x 80mm x 50
- 5ml vial of brown ink
- 5ml vial of blue ink
- 5ml vial of scarlet ink
- 5ml vial of green ink
- 5ml vial of blue ink
- 5ml vial of black ink
- Pipettes x 5
- Glass rods x 10
- Teacher notes

Additional items required:

- 250ml beaker
- water

The ink and water represent minimal hazards to the students. However, it would be good practice to provide the students with safety goggles or spectacles.

Method

1. measure 2cm up from one of the ends of the TLC plate. Use your pencil to draw a line across the TLC plate. Put a cross on the middle of the line. (You may want the student to write their name, in pencil, on the other end for ease of identification later.)

2. Using the dropper put 1cm depth of water in the beaker.

3. Touch your glass rod into the surface of the ink mixture. Gently transfer the drop on the end to the cross on the TLC plate. (It is a common mistake to use the dropper to do this but this puts too much ink on the plate.)

4. When the drop has dried put another drop onto the same place, when this has dried put this end of the TLC plate into the beaker ensuring the rest of the plate remains dry. Do not let the coloured mark go into the water.

5. Watch what happens as the water creeps up the TLC plate. (The ink should start to separate out into its different pigments.)

6. When the water gets to within 1cm of the top remove the TLC plate and allow to dry.

Scientific explanation

The simplest explanation is to say that those pigments that dissolve better in water travel further than those that only dissolve a little, however the reality is much more complicated. The pigments are adsorbed onto the TLC plate (adsorption is a surface phenomenon involving the penetration of one substance onto the bulk of another, which is different to absorption). As water passes over those substances that are weakly adsorbed, they are carried further than those that are strongly adsorbed.

Follow on activities

Food dyes - It is possible to do a similar experiment with food-dyes.
Sugar coated sweets used to produce some very colourful results but food substances now rarely contain more than one or two pigments. It is important to trial these experiments before doing them with your class to make sure you get suitable results. Dampening the sweet with a drop of water and then rubbing it on the TLC plate is usually enough to transfer the dye. You may want to ask the children why they think food colourings have changed in this way. (Science has improved sufficiently to produce single pigment colours where a blend was required before, and concern over food additives in the late 1980's led many manufacturers to reduce the numbers of colours they were putting in food.)

Inks - felt-tip pens can produce interesting results, but even the cheapest of these are now often made from a single pigment so you may need to trial the experiment several times before you find the right colours (improvements in science again). A crime scene using four different inks, one of which has been used to create a forgery is often very motivational.

Indicators - Universal Indicator pH 1-14 contains a range of dyes, not all of which are visible at pH7 (neutral water). Interesting results can be obtained using acidified and alkaline solvents. Please take appropriate safety precautions including wearing goggles when handling chemicals and carry out the experiment in a glass test-tube.

Taking it further

A good 'modern' example of a different type of chromatography is electrophoresis. Electrophoresis apparatus can be used to demonstrate how scientists are able to:

- Produce a 'DNA fingerprint' from evidence found at scenes of crimes
- Prove paternity
- Determining if a person may be carrying a genetically inherited disease
- Explore evolutionary history with genetic evidence

The method can be easily demonstrated with a glass slide, a low voltage power pack with wires and crocodile clips, chromatography paper, a weak salt solution and a concentrated potassium manganate (VII) solution.

1. Soak the paper in the salt solution and place on the glass slide; fix in place using the crocodile clips on the wires.

2. Put a drop of the potassium manganate (VII) solution in the middle of the paper and apply 1 to 2 volts.

The manganate ion is coloured and negatively charged and will slowly spread out in the direction of the positive terminal. The potassium ion will move towards the negative terminal however it is colourless so this will not be seen.

Please ensure that you take suitable safety precautions, including goggles.

Supplier details

Philip Harris Education, 2 Gregory Street, Hyde, Cheshire SK14 4RH

Orders and Information:
Tel: 0345 120 4520
Fax: 0800 138 8881

Technical Support:
E-mail: techsupport@philipharris.co.uk

www.philipharris.co.uk