

Paper chromatography

Activity

The Science

Chromatography is a technique used to separate substances. We use it to split up and study the small molecules found in our bodies. Usually we test blood, saliva and urine in large machines to understand many diseases. Chromatography works because some chemicals will attach strongly to water and others will not. Depending on their structure, some chemicals will travel with water and separate from the chemicals that do not. Now, as complex as this sounds, would you believe this could be done at home simply using a piece of paper? By following the instructions, you can separate the molecules found in spinach and red poinsettia leaves! These chemicals are colourful pigments and will separate based on how well they attach to the water or to the paper.

Materials

For both experiments

- Coffee filter(s) - (white work best)
- 25mL water
- Scissors
- Glass or beaker
- Cotton bud or toothpick
- Wooden stirrer or skewer
- Paperclip
- Pencil

For Ink experiment

- Colour felt tip pen

For plant experiment

- Spinach and/or red poinsettia leaves
- 1/2 teaspoon of sand
- Pestle and mortar
- 3ml surgical spirit or rubbing alcohol

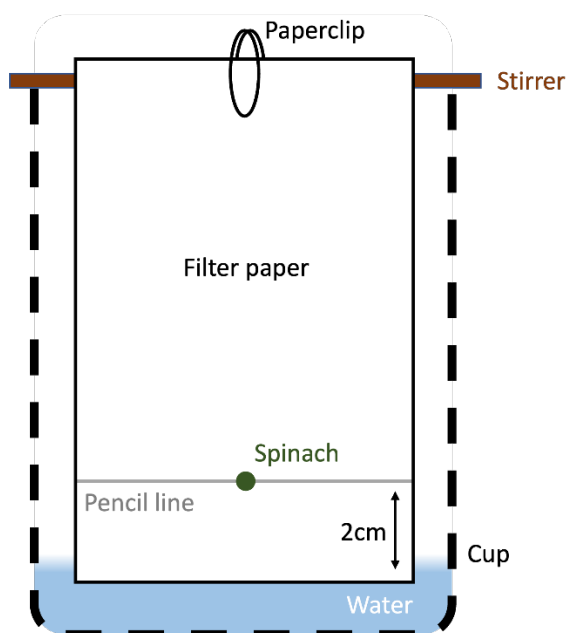
Instructions

Ink separation experiment

1. Prepare the coffee filter by cutting it into a rectangle as long as the cup and sized to fit within the cup (see diagram below)
2. Draw horizontal line 2cm from the base of the paper
3. Dot a colour pen in the centre of the pencil line
4. Attach the paper to the wooden stirrer with a paperclip
5. Add 25mL of water to the cup
6. Balance the stick with the paper hanging in the cup so it touches the water below the pencil line
7. Wait 3-4 minutes for the colours to separate
8. See the final result

Plant leaf separation experiment

1. Grind spinach leaves or red poinsettia leaves with sand (helps to grind up the leaf), in the pestle and mortar until it forms a pulp
2. Add surgical spirit and continue grinding to produce a spinach/poinsettia liquid (it may work better if the surgical spirit is chilled)
3. Prepare the coffee filter by cutting it into a rectangle as long as the cup and sized to fit within the cup (see diagram below)
4. Draw horizontal line 2cm from the base of the paper
5. Using the cotton bud, transfer a drop of the spinach/poinsettia liquid to the centre of the pencil line
6. Attach the paper to the wooden stirrer with a paperclip
7. Add 25mL of water to the cup
8. Balance the stick with the paper hanging in the cup so it touches the water below the pencil line
9. Wait 3-4 minutes for the colours to separate
10. See the final result!



Further investigation

- What else could be separated using this method? Try with red cabbage or flower petals.
- What would happen if the water was replaced with surgical spirit?

Things to think about

- How many pigments can you identify in the spinach/poinsettia/ink?
- Do the different pigments in plants attract different insects?
- Mass spectrometry is a technique used to identify the separated molecules based on the molecular weight, where would the lighter molecules end up?
- Water is a polar compound, so has distinct regions of positive and negative charges. Which types of chemicals would travel with the water on the chromatography paper?