

Discovering chromatography

STEM at home

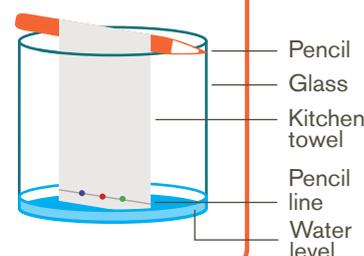
Chromatography is one way that **individual substances** in a mixture can **be separated**. It's a process often used in labs, like at GSK, to check that medicines contain the right ingredients.

You will need

- A glass and water
- A pencil
- White kitchen towel (thick paper or coffee filters work even better if you have them)
- Scissors
- Different coloured water soluble felt tip pens
- Sticky tape
- Paper or notebook to record your findings
- White vinegar
- Acetone (nail polish remover)
- Glass or window cleaner

 30 mins

Set up



Instructions

1. Measure the height and width of the inside of the glass and record this on your paper or notebook
2. Cut a strip of kitchen towel or filter paper into a rectangular shape based on the dimensions of the glass – you will need to check that it fits in the glass like the diagram above, with approximately 3cm of extra length coming out of the top which you'll use later
3. Use a pencil to draw a horizontal line across the kitchen towel or filter paper, 1 cm up from the bottom
4. Select three different coloured pens and draw three spots at equal distance apart on the pencil line – being careful to use a light touch, don't spot too hard
5. Roll the top of the kitchen towel or filter paper around the pencil and fix it in place with some tape
6. Check the water level is not too high. When you insert the kitchen towel or filter paper into the glass, the pencil will rest on the rim of the glass, so the water level needs to be below the pencil line, but just touching the bottom of the paper
7. Suspend the paper in the water, resting the pencil along the top of the glass like in the diagram
8. Watch as the water travels up the paper, dragging the colours up with it. Remove the paper when the water is approximately 1 cm from the top
9. Repeat the experiment, this time using a different solvent to water; try vinegar first. Compare results - you'll notice the resulting "spread" (which is called a chromatogram) is different this time
10. Play around with your solvents. You can even make a mixture (e.g. a 50/50 mix of water and acetone)

What do you notice?

- Q. Can you tell how many colours exist within each pen?
- Q. How do you know?
- Q. Which solvent gave you the clearest spread of inks?

Take it further

You can try this out with different samples instead of using pens. Why not try:

- Food colouring
- Brightly coloured sweets (add a couple of drops of water to the sweet to get some colour from it)

The science in the real world

Chromatography is used to split up substances, revealing the different components inside. If one of your sample spots split up into three spots as it travelled up the paper, that particular sample must contain three substances. If the spots haven't clearly separated, we can change the solvent and this will change the degree of separation of the spots.

By measuring how far up the spots have travelled, we can calculate something called R_f value. Each different substance will have its own unique R_f value. So, if we know the R_f value, we can look up what that substance is, which helps scientists in labs identify different substances. High-performance liquid chromatography (HPLC) is a technique that scientists in labs often use to separate, identify, and quantify each component in a mixture. This can be used for many different things including how to check what is in a medicine, to test pollution in water or to analyse blood samples.

