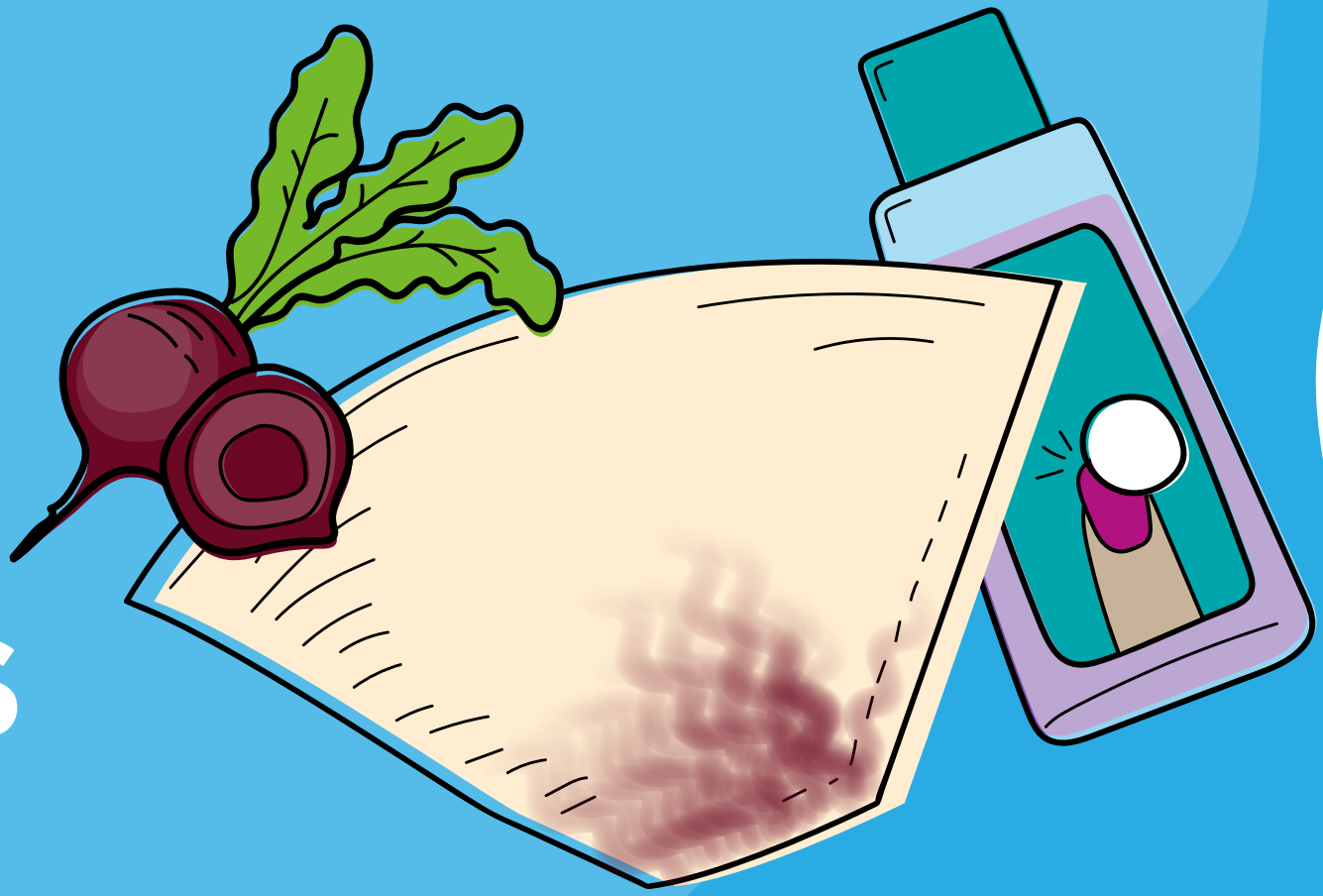
ACTIVITY 12

CHEMISTRY AT HOME

PRETTY PIGMENTS



MEDIUM | 6-12 | 1.5-2 HRS

1. Learn about different plant pigments
2. Separate plants pigments using basic chromatography
3. Investigate how pigments can be used as dyes

ENCOURAGING TOMORROW'S CHEMISTS TODAY

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PRETTY PIGMENTS

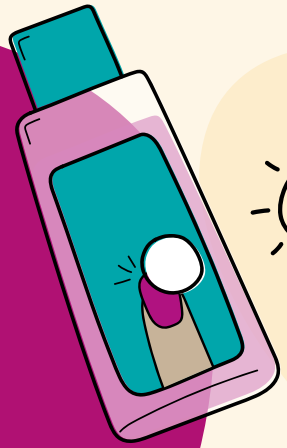
Pigments are naturally occurring coloured molecules, found in plants and animals. They are different to synthetic dyes, which are made from chemicals and do not occur naturally. Plant pigments have been used as natural dyes for centuries. The first synthetic dyes were not invented until 1856.

There are 4 main groups of plant pigments[1]:

- The “chlorophylls” are mainly green (found in avocado, kiwis, apples, spinach)
- The “anthocyanins” can be blue, red or purple (found in plum, strawberry, blueberry)
- The “carotenoids” are orange and yellow (found in carrots, banana, mango, peach, orange)
- The “betaines” are mainly red (found in beetroot)

You will need

- Red cabbage
- Beetroot (either fresh or pickled)
- 2 white coffee filters
- 100ml nail polish remover
- 2 jam jar lids (not used for food use!)
- Large measuring jug
- Large tray
- Several 30cm lengths or white wool/fabric/strong paper towel
- Small cereal bowls (any material, the red cabbage water doesn’t stain!)
- White vinegar
- Bicarbonate of soda



Safety

Plant pigments stain – keep away from fabrics and furniture!

Use nail polish remover only in a well-ventilated space and away from naked flames.

This activity should be supervised at all times.

Instructions

Activity 1
How many pigments can you find in red cabbage and beetroot?

1. Ask an adult to finely chop the beetroot and red cabbage.
2. Open out each coffee filter and gently place into two different jam jar lids.
3. Put 2 tablespoons of chopped red cabbage into one coffee filter and 2 tablespoons of chopped beetroot into the other.
4. Now carefully fill each of the jam jar lids with nail polish remover. Top up the nail polish remover if the jam jar lids become dry.
5. Over 45 minutes, the nail polish remover pulls the colours from the chopped vegetables up the coffee filter, can you see the colours?

Did you know?

Pigments are often used as natural food colourings. Green and blue food colouring can be made from pigments extracted from algae. Yellow food colouring can be made using the spice turmeric. Red food colouring labelled with “carmine” or E120 will be made from dried and ground insects called Cochineal bugs. Vegetarian red food colouring can be made from beetroot extract.

Challenge 1

Using pigments as natural dyes

Warning: This can get very messy! Carry this out on a large tray and wear old clothes!

Paul has read that plant pigments were historically used to dye fabrics and that red cabbage water can turn different colours if it is added to vinegar (acid) or bicarbonate of soda (alkali). He wants to see if it is possible to dye a piece of wool multicoloured.

Can you make a multicoloured piece of wool? You could use red cabbage water to dye a length of strong white paper towel, white fabric or wool. Then place each end in either a bowl of vinegar or a bowl of bicarbonate of soda solution.

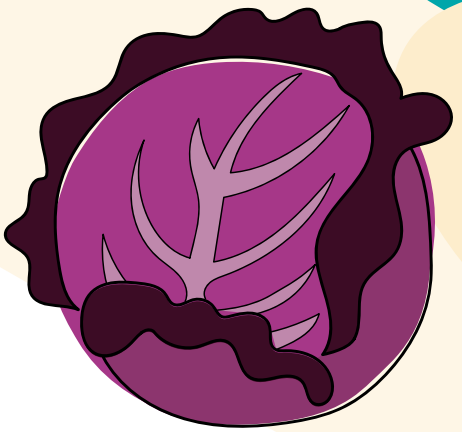
To make red cabbage water: Fill an empty 500ml measuring jug with chopped red cabbage, then add hot water from the tap up to the 500ml mark. Leave until the water is dark purple coloured.

Key words

Acids Acids can be described as sour and are normally found in foods e.g. vinegar or lemon juice.

Alkalis Alkalis are described as soapy and are normally found in cleaning products e.g. bleach or bicarbonate of soda.

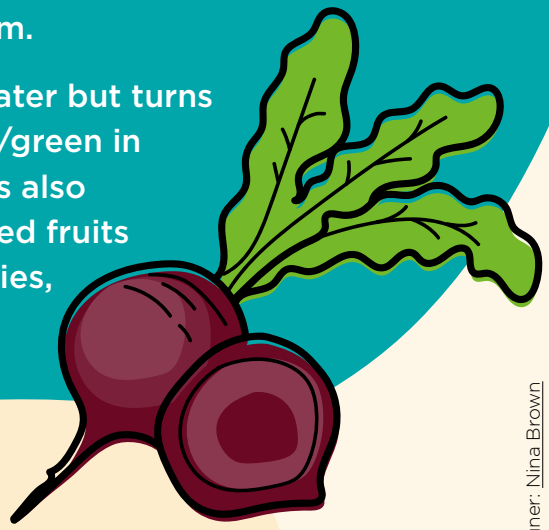
Acids and alkalis are chemical opposites of each other and will react together.



What's happening?

Red cabbages contain pink, blue and purple pigments. Beetroot contains red, orange and yellow pigments. The nail polish remover soaks into the coffee filter and draws the pigments upwards. Pigments that dissolve easily in nail polish remover travel further, but pigments that don't dissolve very well in the nail polish remover will appear at the bottom.

Red cabbage juice is purple in water but turns pink in acidic vinegar and yellow/green in alkaline bicarbonate of soda. This also works with other strongly coloured fruits and vegetables, such as raspberries, blueberries and red onion.



Did you know?

The spice turmeric comes from the root of a plant in the ginger family. When dried and ground, it looks like an orange powder. If you add turmeric to vinegar, it turns yellow. But if you add bicarbonate of soda, it turns red.

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