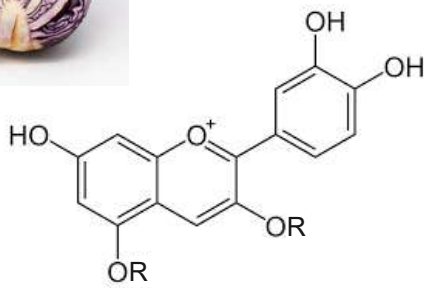
Plant pigments in nature

Anthocyanins are one of the most common classes of plant pigments and are responsible for blue/purple colours in some plants. All anthocyanins are pH sensitive, as acids and alkalis change the structure of the colour molecule, changing the colour we see. Therefore, pigments extracted from purple and blue flowers usually change in response to acids or alkalis.

Anthocyanin pigment found in red cabbage



The mysterious case of hydrangeas

Hydrangeas can sometimes drive gardeners mad when they buy a blue hydrangea only for it to change to a pink colour when planted in the garden. Hydrangeas contain the anthocyanin delphinidin 3-glucoside, the flowers become more blue in acidic soils and more pink in alkaline soils. However it isn't the pH itself that is responsible for determining flower colour, but the availability of aluminium in the soil which is altered by soil pH.

Aluminium is available to the plant only in acidic soils as the aluminium molecules are tightly held by alkali soils.

Acids (e.g. citric acid or vinegar) add a hydrogen atom to the colour molecule, changing the structure and turning it to pink or red. Alkalis (e.g. baking powder or chalk) cause a hydrogen atom to fall off the molecule, making it appear purple or blue. Flowers that have acid in their petals are shades of red or pink, while flowers that have alkali in their petals are purple or blue. Varying amounts of acid or alkali in petals create a variety of colours. Yellow and orange flowers often contain more yellow/orange pigments such as carotenoids (which also give carrots their colour).

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Extracting pigments from plants

Plants make a whole store cupboard of chemicals, many of which are useful to us. For example, coloured molecules known as pigments give flower petals their colours. Many of these plant pigments are used as dyes or food colourings.

Caution: Take care when choosing plant samples as some plants are very poisonous. We recommend using purple violas, cabbage, rose and iris.

You will need:

Alkali: Bicarbonate of soda (Solution: 3 tbsp in a half cup of water)

Acid: Citric acid (Soultion: 3 tbsp in a half cup of water). You can also use vinegar, lemon or lime juice but the reaction may be less "fizzy".

Washing up liquid

A ***flower*** to extract pigment from (some fruit and spices also work well)

Pestle and mortar or, a bowl and spoon

Method:

1. Choose a flower and crush it in a bowl with a little dribble of water until the water becomes coloured.
2. Transfer the coloured water into a mug or glass. If there is a lot of plant material, strain it through a coffee filter or sieve.
3. Add a spoonful of the bicarbonate of soda solution – does the colour change?
4. Add half of the citric acid (1/4 of a cup) – now does the colour change?
5. To make it fizz, mix 2 tbsp of bicarbonate of soda powder and a good dollop of washing up liquid into a slime. Spoon the slime into to your plant pigment solution, and give it a swirl.

You can also add a small amount of your freshly extracted plant pigment to some white paint to colour the paint. Does anything happen to the colour? Why do you think this is?

White paint is usually alkali so some plant pigments which are affected by acids and alkalis (such as the ones on our exhibit) will change colour when added to paint. Add a little bit of acid to return the paint to the original colour. Careful not to add too much and make the paint runny.