**ACTIVITY: Food colouring**

**Activity idea**

In this activity, students use a simple paper chromatography method to separate and identify the components present in commercially available food colouring.

By the end of this activity, students should be able to:

* successfully use paper chromatography as a method of separation
* identify some of the typically used food colouring agents
* describe in simple terms the food additive numbering system
* research the reported effects colour additives have on children’s behaviour.

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**Introduction/background**

Many soft drinks, processed foods and confectionery items have artificial colouring added to them. The colour enhances the appeal of the item, particularly when children are the main consumers of the product. Most of the colouring agents are synthetically produced and have undergone rigorous testing to prove their suitability for use in foods and soft drinks.

In recent times, there has been a lot of concern over the safety of food additives and synthetic food colours in particular. The stringency of the testing procedures that are applied in New Zealand and Australia leads to the conclusion that the food colours permitted now are at least as ‘safe’ as the more ‘natural’ components of our diet. However, more recent research indicates that a very small percentage of the population may show intolerance and, in some cases, allergy to certain synthetic food colourings.

This activity is designed to allow students to use a simple separation method (paper chromatography) that will establish the components present in commercially available food colouring. The results obtained can then be used to identify the colouring agent with its food additive number as well as its chemical name. Some of the colourings available are mixture of two or more individual compounds. By selecting a variety of food colourings, the individual components can be separated out and identified using paper chromatography.

Food colouring agents can be readily purchased from supermarkets and dairies. The label on the food colouring container has ingredient information including the food additive number(s) that clearly identifies the chemical(s) used.

Numbers 100–199 are reserved for food colourings. For example, additive 102 is lemon yellow and is the compound tartrazine.

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| --- | --- | --- | --- |
| **Additive number** | **Colour** | **Name** | **Type of compound** |
| 102 | Yellow no. 5 | Tartrazine | Azo dye |
| 122 | Red no. 10 | Carmoisine | Azo dye |
| 124 | Red no. 2 | Ponceau 4R | Azo dye |
| 132 | Blue no. 2  | Indigotine | Indigoid |
| 142 | Green S | Green S | Triarylmethane |



Azo compounds all contain this functional group (R and R’ stand for either aryl or alkyl groups).

A typical azo dye is Ponceau 4R, which has this structure.

Note the N=N group linking the two aryl groups together. The presence of the sulfonate groups SO3- Na+ confers a water solubility on the structure.

**What you need**

* Small bottles of food colouring – black, yellow, red, blue and green work well
* Chromatography paper (Whatman) or filter paper squares
* Small fine-tipped paintbrush
* 250mL beaker
* 100mL beaker
* Glass rod
* Cellotape
* Pencil and ruler
* Hair dryer
* Food colouring identification chart (see below)

**What to do**

* 1. Cut out a 15cm by 10cm piece of chromatography paper.
	2. Draw a pencil line 1cm from the bottom of the paper.
	3. Draw small pencil dots 1cm from the ends and 2cm apart on the line to create five dots. Below each dot, record the colour that it represents. e.g. Bl = black, Y = yellow etc.
	4. Using a small fine-tipped paintbrush, place a very small dot of food colouring on the appropriate pencil dot. Allow to dry – a hairdryer could be used to speed up the process. Do not allow the coloured dot to expand beyond 5mm in diameter. Repeat this process between drying to build up the depth of colour.
	5. Rinse the brush in a small beaker of water.
	6. Repeat the dotting process until all of the samples have been loaded on the paper.
	7. Attach the paper to a glass rod using cellotape.
	8. Place a 2cm depth of water in the 250mL beaker.
	9. Carefully lower the paper into the beaker, without touching the sides, until the bottom of the paper is just in the water and the glass rod rests on the rim of the beaker.
	10. Leave to develop until the solvent front is 2cm below the top of the paper.
	11. Remove and allow to dry.
	12. Compare the separation of colours that has occurred. Ask the students to try to identify the combination of colours that some of the food colourings are made up of.
	13. Ask students to refer to the ingredients label on the food colouring bottle, note the colouring and its food additive number and then look up food additive tables to locate the name of the colouring agent used ([Food Standards Australia New Zealand](https://www.foodstandards.govt.nz/) provides the [Food additives – numerical list PDF](https://www.foodstandards.govt.nz/sites/default/files/consumer/additives/additiveoverview/Documents/Food%20additives%20-%20numberical%20May%202019.pdf), which may help with this).

**Extension ideas**

1. Some parents and caregivers are concerned about the reported effects certain food additives like food colouring can have on the health and wellbeing of their children. For example, it has been reported that a very small percentage of the population may have intolerance to certain food colouring agents. Combinations of food colourings have also been implicated in causing behavioural changes in some children.

Students could identify what scientific evidence there is to uphold the claim that consumption of artificial food colourings via soft drinks and confectionery can have a negative effect on children’s behaviour.

Some useful websites are listed below. It is beneficial to read the entire webpage rather than the opening paragraph for some of the sites.

* [Food colours and hyperactivity](https://www.nhs.uk/conditions/food-colours-and-hyperactivity/) – NHS.uk
* [How food dye can affect children](https://health.osu.edu/health/mental-health/food-dye) – The Ohio State University
* [Synthetic food colours](https://www.mpi.govt.nz/food-safety-home/food-additives-preservatives/synthetic-food-colours/) – Ministry for Primary Industries
* [Food colours](https://www.foodstandards.govt.nz/consumer/additives/foodcolour) – Food Standards Australia New Zealand
* [Understanding Food Dye Allergies](https://www.healthline.com/health/allergies/understanding-food-dye-allergies#common-allergies) – Healthline.com
1. Students could also use this topic as a means of building their scientific literacy:
* How do you know if the website you are using is trustworthy?
* What criteria do you use to make this decision?
* Have you found examples of websites that promote opinions rather than research?
* How are you able to spot the difference?