

Milk Art Experiment

Safety and First Aid

This section will only deal with the specific safety issues regarding the chemicals involved; there are likely to be other safety issues that will need to be addressed outside the scope of this section. A full risk assessment should be performed prior to undertaking the experiment.

- Students should not ingest any of the experiment; good lab practice starts young!
- There are no specific safety hazards associated with any of the chemicals used in this experiment
- *First Aid* – wash the affected area with water

Glossary

- *Surface tension* – a contractive force that allows the surface of a material to resist an external force

Suggested Teaching Points

- *How soap works* – the hydrogel used in this experiment is a synthetic plastic
- *Surface tension* – this experiment involves gels, solids and liquids
- *Investigative techniques* – students can be allowed to investigate various aspects of this experiment

What to Expect

Please see the video for a detailed depiction of the experiment.

This experiment will demonstrate how soap works by creating colourful patterns in milk using food colouring and washing up liquid. There are a number of factors at work in this experiment needed to fully explain what occurs. Firstly, depending on the brand of food colouring you use, the droplet will either sink or float on the surface of the milk, but in neither case will it mix with the milk. This is because milk has a high surface tension and resists alterations to the surface; this is the same effect that allows small insects to run along the surface of water without sinking. As a result of this high surface tension, the food colouring simply sits on the top of the milk. However, when soap is added, this reduces the surface tension of the milk and allows the food colouring to mix with the milk. At the same time, the soap causes fat and protein molecules in the milk to change shape and become

move around. This change in shape and movement pushes the food colouring around, creating the observed swirls of colour.

Equipment and Chemicals

- Full fat milk
- Food colouring
- Washing up liquid
- Cotton buds
- A shallow container

Supplementary Instructions

- Food colouring that is less dense than milk and floats on the surface of the milk is easier to use first time around. While this experiment will also work with food colouring that sinks, it requires a little more practise to work every time
- Do not use an excessive amount of soap as this can cause complications

Suggested Questions for Students

- *Why does the food colouring move away from the cotton bud?* – when the soap is added to the surface of the milk, it forms a very thin layer (only a single molecule thick!). As more soap is added, this pushes the soap already present on the surface further out from the cotton bud. As the soap moves away from the bud, it affects the surface tension allowing the food colouring to mix with the milk, thus giving the appearance that the food colouring moves away from the bud
- *Why does some food colouring float and some sink?* – whether the food colouring sinks or floats is dependent on the density of the food colouring. Density is a physical property of many materials that relates the amount of mass in a given volume. For food colouring that is less dense than water (i.e. there is less mass in the same volume), the food colouring will float. Conversely, food colouring that is more dense (i.e. there is more mass in the same volume) will sink.

Suggested Improvements / Student Challenge

- *Change the fat content of the milk* – students could investigate how the pattern is altered when skimmed, semi-skimmed or cream is used instead of full fat milk

- *Investigate alternatives to washing up liquid* – students could investigate alternative to washing up liquid (i.e. soap)
- *Change the temperature* – students could repeat the experiment with cold and warm milk to see how this effects the pattern
- *Challenge students to make a specific pattern*

Clean up and Waste Disposal

No specific waste protocols are required for this experiment; all the waste can be either washed down the sink or disposed of in a bin.

Spillages can be cleaned with soapy water and paper towel.