

Natural dyeing

- Your task

Dye a piece of cloth in as many colours as possible using natural materials.

- The cloth will be tested for fastness (to cold and hot water), brightness of colour and variety of colours produced.

Time

60 minutes to dye the cloth after planning. This experiment is best carried out during autumn.

Group size

2–4.

Equipment & materials

Eye protection and wear a lab coat! Based on a suggestion by J. Crellin.

General

Beakers (all sizes), pestles and mortars, glass stirring rods, tongs, string. Buckets for rinsing cloth. Bunsen burners, tripods, gauzes, heatproof mats, clampstands.

Undyed woollen cloth (appeal for a very old blanket). Alternatively cotton may be used.

A selection of plant material, eg onion skins, red cabbage, beetroot, rhododendron leaves, acorns, used coffee grounds, pine cones, blackberries, redcurrants.

Mordanting salts: eg potassium aluminium sulphate(alum), iron(II) sulphate, copper(II)sulphate, tin(II)chloride.

Health & Safety notes

This is an open-ended problem solving activity, so the guidance given here is necessarily incomplete. Teachers need to be particularly vigilant, and a higher degree of supervision is needed than in activities which have more closed outcomes. Students must be encouraged to take a responsible attitude towards safety, both their own and that of others. In planning an activity students should always include safety as a factor to be considered. Plans should be checked by the teacher before implementing them.

You must always comply with your employer's procedures and in some cases may decide that a particular activity is inappropriate in your situation. Further information on Health and Safety should be obtained from reputable sources such as CLEAPSS [<http://science.cleapss.org.uk>] in England, Wales and Northern Ireland and, in Scotland, SSERC [<https://www.sserc.org.uk>].

Warn students about danger from boiling liquids and steam.

Care should be taken if pupils go to collect their own plant samples, to ensure they don't pick dangerous plants such as hogweed or deadly nightshade.

Mordanting salts:

Potassium aluminium sulphate(alum), $\text{AlK}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ is of low hazard.

Iron(II) sulphate $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ is harmful if swallowed and a skin/eye irritant.

Copper(II) sulphate, CuSO_4 is causes eye damage, is harmful if swallowed and is HAZARDOUS to the aquatic environment.

Tin(II) chloride, SnCl_2 is CORROSIVE to skin and eyes, harmful if swallowed and hazardous to the aquatic environment.

It is probable that the dyeing solution will be of low hazard unless some of the mordanting salts are used at very high concentration.

Eye protection should be worn.

Disposal: If copper or tin salts are used as mordants (or chromium) then solutions should be kept for disposal rather than washed down the sink. (It may be easier to precipitate as the carbonate, filter and store the solid).

It is the responsibility of the teacher to carry out a suitable risk assessment.

Curriculum links

Dyeing. Mordants. Indicators.

Possible approaches

Dyeing can be used to supplement a unit on plants or one on colour & light, or it could be part of a cross-curricular unit on ancient civilisations. The dye is extracted by simmering a large quantity of the plant (flowers, berries, leaves or bark) in water. To create a stronger bond between the dye and the material, dyers often use mordants (*ie* fixing agents). As well as helping the dyes stick to the fibre, mordants also increase the colour range of the dye (many dyes give different colours with different mordants). Copper or iron pots may also act as mordants and affect the colour of the dye. You could add cream of tartar (acid potassium tartrate) to your materials list - it is used as an additive to brighten the colours.

NB There is a large quantity of stained glassware to wash up and some dyes are very difficult to remove.

Evaluation of solution

Credit could be given for:- Fastness (to cold and hot water), brightness of colour and variety of colours produced. (Judges could also select their own criteria.)

Extension work

It is fun to dye other fabrics apart from wool, *eg* silk, cotton *etc.* Staple pieces of the various cloths together and immerse in the dye-bath.

Natural dyes work best with natural fibres. Find out about synthetic dyes (1850s onwards). Students use dyed silk in various art projects: *eg* make a colourful scarf or tie using the knowledge they have gained. A T-shirt promoting chemistry could be produced.

Colour fastness: Investigation of whether coloured cloth affected by light, heat, chlorine (important for swimwear) or perspiration?

References

KG Ponting "A Dictionary of Dyes and Dyeing" (London: Bell & Hyman Ltd., 1981); Jean Fraser "Traditional Scottish Dyes and how to make them" (Canongate Publishing Ltd., 1985); Lesley Bremness "The Complete Book of Herbs" - Chapter on Herbal dyes (London: Dorling Kindersley Ltd., 1988).

Credits

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Health & safety checked May 2018

Page last updated October 2018