Teacher and Technician Sheet

In this practical students will:

- Observe and report on the findings from the experiment.
- Compare, contrast and group different materials based on results from the experiment
- Use their scientific understanding to explain the results of the experiment.

Introduction:

This is a demonstration linked to a discussion.

(Could be carried out as a class practical with dyes ready prepared as solution or post 16 students could prepare solutions from the solids).

Samples of different fabrics are placed in a single dye bath containing three dyes. The materials emerge dyed different colours.

After seeing the action of the dyes on, say, wool, students could be asked to predict the effect on silk and nylon, which are polyamides.

After seeing the effect of the dyes on polyester and cotton separately, students could be asked to predict their effect on the mixed fabric.

Point out that this experiment can help explain some odd effects in washing machine accidents where labels and trim may emerge a different colour to the rest of the garment.

Curriculum range:

Secondary students could do this for interest and entertainment, and post-16 students if the structures of the dyes and the types of bonding between dye and fabric are to be discussed in depth. It links with:

- reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions;
- using straightforward scientific evidence to answer questions or to support their findings;
- comparing and grouping together everyday materials on the basis of their properties;
- knowing that some materials will mix, while others will not;
- knowing that some liquids that do not mix can be turned into emulsions; and
- build a more systematic understanding of materials by exploring and comparing the properties of a broad range of materials.

Hazard warnings:

Wear eye protection.

Disperse Yellow 7 is a SKIN/EYE and RESPIRATORY IRRITANT. The others are of LOW HAZARD but may still irritate some people's skins and their dusts may irritate the respiratory tract.

Plastic gloves are recommended. It is the responsibility of teachers doing this demonstration to carry out an appropriate risk assessment.

Equipment:

- 4 beakers (400 cm^3) (or 3 beakers (250 cm^3))
- 4 disposable plastic pipettes
- Stirring rod
- 4 large watch glasses or Petri dishes
- 1 pair of tongs or tweezers
- 1 pair of scissors
- Access to a top pan balance weighing to 0.01 (if preparing from solid)
- Spatula (if preparing from solid)
- Weighing boat (if preparing from solid)
- Bottle of distilled water
- Thermometer
- Bunsen burner
- Tripod
- Gauze
- Heat resistant mat
- String and paper clips, to make a 'washing line'
- Crocodile clips or clothes pegs

The quantities given are for one demonstration. (Class practical indicated also)

- Samples of the following fabrics in white: wool, silk, nylon, cotton, polyester, cellulose acetate ('triacetate'), polyester/cotton mix. About 1 cm^2 of each fabric or a few cm of thread will be sufficient.
- 0.05 g of each of the following dyes:
    - acid blue 40 (low hazard)
    - disperse yellow 7
    - (skin/eye/respiratory irritant)

- direct red 23 (low hazard)
- or 10 cm^3 of solutions of the dyes ready prepared (per group)

- A little dilute hydrochloric acid (0.1 M)
- Sodium chloride (if carrying out the extension activity) (low hazard)
- Alum (if carrying out the extension activity) (low hazard)

Technical notes:

Nylon can be difficult to obtain and it may be necessary to try a second hand clothes shop.

Muslin squares (50 cm x 50 cm) are also available.

The dyes can be prepared as a solution for the students before use in a class practical.

Higher key stages can prepare the dyes using a fume cupboard.

Larger samples of material in larger volumes of dye can be used if the audience is large. A 'washing line' is useful, on which to hang samples to dry with clothes pegs, crocodile clips or paper clips.

Results:

This practical works well and can be adapted to use as both a demonstration, a class practical and for post 16 students to do for themselves.

Good results can be obtained on the following materials (both on threads and whole pieces for some of them):

- Cotton 100%
- Polycotton 65% 35%
- Polyester
- Nylon

Using a salt (mordant) in the dye produced a deeper colour.