

Investigating the fastness of dyes

Background

There are many desirable properties of dyes but one of the most important is how well they adhere to materials and how well they stay attached. This property is known as fastness.

Fabrics can be broadly divided into three types

- Protein (e.g. wool, silk)
- Cellulose (e.g. cotton, linen)
- Synthetic (e.g. polyester, nylon)

Dyes can be broadly divided into four types

- Acidic
- Direct
- Disperse or vat
- Fibre reactive

You can investigate the adherence and /or fastness of different types of dye to different types of fabric.

Practical Techniques

You need to find out about colorimetry.

Where to start

Make solution of the dye and then prepare a series of more dilute solutions to construct a calibration curve from colorimeter measurements.

You can then use the undiluted dye solution to dye the fabric and use the colorimeter to record the amount of dye left in the solution after dyeing. This will give you an indication of the amount of dye absorbed into the fabric.

To measure the fastness of the dye you can soak the fabric in cold water and measure the amount of dye that transfers into the water. You can use the colorimeter to determine this.

Possible Investigations

- Investigate the fastness of the dye in hot water

- Investigate the fastness of the dye in hot/cold water after several “washes”
- Investigate the effect of adding a mordant to the dye solution
- Investigate the polarity of the dye using electrophoresis/chromatography

Sources of Information

- Denby D., Dyes and Dyeing, *Chemistry Review*, September 2000 (This article also gives several other useful references)
- Hill G. C. and Holman J., (2001), *Chemistry in Context Laboratory Manual (Fifth Edition)*, Nelson Thornes
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- Brown T.M. et al, Alizarin – the forgotten dyestuff, *Education in Chemistry*, January 1999, Vol 36/1
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- Ainley D., Experimenting with Dyes, *Education in Chemistry*, November 1995, Vol 32/6
- Hughes N., Designing the right dye for the job, *Chemistry Review*, March 1994
- Parker E., Using Natural Dyes, *Chemistry Review*, May 1995
- Barker V., Get Real! Chemistry’s in Fashion, *Chemistry Review*, February 2002
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Teachers' Notes

General

This investigation needs to be planned carefully as it is easy to make the investigation too broad. Students should be guided to make their initial investigation fairly narrow to avoid having too many variables to consider. Students may wish to use commercially produced dyes and /or those extracted from natural products. They could also consider preparing their own dye. Examples of suitable dyes to use are given in the article by Derek Denby. Students may wish to analyse the dyes by chromatography and /or electrophoresis.

Chemical Principles

Azo Dyes, Chemical Bonding, Colour.

Essential Equipment

Colorimeter.

Essential Chemicals

Dyes, fabrics

Safety

No risk assessment has been given. It is essential that students prepare a detailed risk assessment before they start. Teachers must be satisfied that this is suitable for the proposed investigation.