

The microscale synthesis of azo dyes – teacher notes

Topic

Organic chemistry – azo dyes.

Timing

20 min.

Description

In this experiment students prepare an azo dye and use it to dye a piece of cotton. The synthesis is unusual in that whereas most organic syntheses require ambient or elevated temperature, this synthesis requires low temperatures.

Apparatus

- Beakers, 10 cm³, x3
- Thermometer
- Tweezers

Chemicals

- Ice
- Aminobenzene (aniline)
- Hydrochloric acid (concentrated)
- Sodium nitrite
- 2-Naphthol (also called β-Naphthol; naphthalene-2-ol)
- Sodium hydroxide solution 2 mol dm⁻³
- Ethanol
- Urea

Observations

The orange-red azo dye forms in the fibres of the cotton, dyeing the cloth. The melting point of 1-phenylazo-2-naphthol is 133 °C.

Note

The urea decomposes excess HNO² formed and prevents many side reactions from occurring. A better 'red' dye is usually produced.

Reference

S. W. Breuer, Microscale practical organic chemistry. Lancaster: Lancaster University, 1991.

Health, safety and technical notes

- Students must wear suitable eye protection (splash resistant goggles to BS EN166 3).
- This experiment should be done in a fume cupboard.
- Aminobenzene (aniline) is TOXIC by all routes, a carcinogen and mutagen, a skin sensitiser, causes eye damage and is toxic to aquatic life.
- Hydrochloric acid, HCl (aq), is CORROSIVE and a respiratory irritant.
- Sodium Nitrite, NaNO₂ is an OXIDISER, toxic if swallowed and hazardous to aquatic life.
- 2-Naphthol is HARMFUL if swallowed or in contact with skin and toxic to aquatic life.

- Sodium hydroxide solution, $2 \text{ mol dm}^{-3} \text{ NaOH (aq)}$, is CORROSIVE.
- Ethanol is highly FLAMMABLE.
- Urea is of low hazard.