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 cm$^3$ 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 HNO$_2$ formed and prevents many side reactions from occurring. A better ‘red’ dye is usually produced.

**Reference**

**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 sensitisers, 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 mol dm\(^{-3}\) NaOH (aq), is CORROSIVE.
• Ethanol is highly FLAMMABLE.
• Urea is of low hazard.