The oxidation of cyclohexanol by nitric acid – teacher notes

Topic
Alcohols, carboxylic acids, oxidations.

Timing
This experiment should take 20 minutes

Description
In this experiment students convert cyclohexanol to 1,6-hexanedioic acid (adipic acid) using a ring opening oxidation with nitric acid. Since 1,6-hexanedioic acid is a solid a melting point measurement can be done on the product (mp 152 °C).

Apparatus
- Beaker, 100 cm^3
- Beaker, 50 cm^3
- Hot plate
- Plastic pipettes x3
- Test-tube

Chemicals
- Cyclohexanol
- Nitric acid (*ca* 5 mol dm^{-3}, concentrated nitric acid: deionised water 1:1)

Observations
A white crystalline solid should slowly form when the test-tube is cooled in the ice bath. The solid might be slightly brown in colour due to impurities when first filtered off, but this discoloration is removed by washing with water.

Health, safety and technical notes

- Read our standard health and safety guidance
- Students must wear suitable eye protection (splash proof goggles to BS EN166 3). The reaction should be done in a fume cupboard.
- Cyclohexanol is a skin and respiratory irritant and is harmful if swallowed or inhaled (see CLEAPSS HazCard HC084c).
- Nitric acid, 5 mol dm–3 HNO3 (aq), is CORROSIVE (see CLEAPSS HazCard HC067).

Reference
S. Breuer, Microscale practical organic chemistry, expt 26. Lancaster: Lancaster University, 1991.