The oxidation of cyclohexanol by nitric acid

Topic
Alcohols, carboxylic acids, oxidations.

Timing
20 min.

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 (per group)
- One 100 cm³ beaker
- Hot plate
- Three plastic pipettes
- One 50 cm³ beaker
- One test-tube.

Chemicals (per group)
- 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.

Reference

Health & Safety
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.

Nitric acid, 5 mol dm⁻³ HNO₃ (aq), is CORROSIVE.