The formation of 2,4,6-trichlorohydroxybenzene by the reaction between hydroxybenzene and chlorine gas

Topic

Reactions of organic molecules, reactions using chlorine.

Timing

20 min.

Description

This experiment is done in a plastic petri dish. 2,4,6-Trichlorohydroxybenzene (2,4,6-trichlorophenol, TCP) is detected by its distinctive antiseptic smell.

Apparatus (per group)

- One clear plastic sheet (eg ohp sheet)
- One plastic petri dish (*eg* 5.5 cm diameter)
- One plastic pipette.

Chemicals (per group)

Solutions contained in plastic pipettes, see apparatus and element solutions handouts.

- Bleach
- Hydrochloric acid 1 mol dm^{-3}
- Sodium hydroxide 1 mol dm^{-3}
- Hydroxybenzene (phenol).

Tip

Use method of sampling a bottle of hydroxybenzene (phenol). See ‘Apparatus and techniques for microscale chemistry’ handout.

Method

Students cut off the end of the plastic pipette to make a reaction vessel for generating the chlorine gas using bleach and hydrochloric acid. After about 15 min the lid is taken off the petri dish and a strong antiseptic smell should be detected. At the end of the experiment students add drops of sodium hydroxide solution to the hydroxybenzene (phenol)/TCP residue to dissolve it and then mop up the contents of the petri dish with a tissue.

Health & Safety

Students must wear suitable eye protection (Splash resistant goggles to BS EN166 3).

Hydroxybenzene (phenol) is Toxic, Corrosive and a Mutagen: gloves should be worn.

Sodium hydroxide solution, 1 mol dm^{-3} NaOH (aq), is corrosive.

Hydrochloric acid, 1 mol dm^{-3} HCl(aq), is low hazard

2,4,6-trichlorohydroxybenzene is harmful if swallowed, irritant to skin, eyes and respiratory system and a probable carcinogen (category 2) – care should be taken to inhale only the smallest amount needed for identification.

Household bleach solutions (containing sodium chlorate(I) / sodium hypochlorite) sold for the domestic market may be corrosive but is commonly more dilute and irritant. Check the label. Even quite dilute bleach is irritant if more than 0.15 M NaOCl. Some bleaches also contain detergents and thickening agents, which may cause excessive frothing in this experiment so choose a thin bleach. Note that nowadays some commercially available bleaches do not contain any chlorine and are based on peroxy-compounds. They should not be used here.

Eye protection is essential, and should be goggles to BS EN166 3 (not safety spectacles) if corrosive.

Credits

Health & safety checked May 2018

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