

The chemical properties of hydroxybenzene

Topic

Organic compounds, chemical properties.

Timing

20 min.

Description

In this experiment students observe and interpret some of the chemical reactions of hydroxybenzene (phenol).

Apparatus (per group)

- One clear plastic sheet (eg ohp sheet)
- One plastic petri dish (9 cm diameter).

Chemicals (per group)

Solutions contained in plastic pipettes, see 'Apparatus and techniques for microscale chemistry' handout.

- Deionised water
- Full-range indicator solution – diluted 1:1 with deionised water
- Nitric acid 1 mol dm⁻³
- Iron(III) nitrate 0.1 mol dm⁻³
- Sodium carbonate 1 mol dm⁻³
- Sodium hydroxide 1 mol dm⁻³
- Hydrochloric acid 1 mol dm⁻³
- Hydroxybenzene (phenol).

The students should sample the bottle of hydroxybenzene (phenol) using the method 'Apparatus and techniques for microscale chemistry' handout.

Observations

1. Hydroxybenzene (phenol) is partially soluble in water and oily drops should be observed. An acidic solution is formed and the indicator solution should turn red.
2. The mixture turns dark as the hydroxybenzene (phenol) reacts with the nitric acid to give a mixture of nitrophenols.
3. A violet coloration is seen which is characteristic of the reaction between iron(III) and phenolic OH groups.
4. No reaction is observed with sodium carbonate solution indicating that hydroxybenzene (phenol), although acidic, is not a strong enough acid to liberate carbon dioxide from carbonates.



5. Hydroxybenzene (phenol) dissolves readily in sodium hydroxide to form sodium phenoxide. The hydroxybenzene (phenol) is liberated and oily drops should be observed when this solution is acidified with hydrochloric acid.

Health & Safety

Students must wear suitable eye protection (Splash resistant goggles to BS EN166 3). Hydroxybenzene (phenol) is hazardous and gloves should be worn.

Nitric acid, $1 \text{ mol dm}^{-3} \text{ HNO}_3 \text{ (aq)}$, is CORROSIVE.

Sodium hydroxide 1 mol dm^{-3} is corrosive

Iron(III) nitrate, $0.2 \text{ mol dm}^{-3} \text{ Fe(NO}_3)_3 \cdot 9\text{H}_2\text{O (aq)}$, Sodium carbonate 1 mol dm^{-3} and Hydrochloric acid, $1 \text{ mol dm}^{-3} \text{ HCl (aq)}$, are of low hazard.

Hydroxybenzene (phenol) is CORROSIVE, TOXIC by all routes and causes damage to organs on repeated or prolonged exposure. Dangerous if in contact with sodium nitrate.

Depending on the formulation of the Universal indicator, a 1:1 dilution with water might still be flammable. Keep away from sources of ignition.

Credits

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Health & safety checked May 2018

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