

The solubility of aspirin – teacher notes

Introduction

This activity is a useful vehicle for reinforcing ideas relating to strong and weak acids, basicity and elementary chemical calculations. The worksheet leads students through the calculations, but it may be necessary to explain that not all of a sample of commercial aspirin is likely to dissolve. Students should also understand why phenolphthalein indicator is used in this experiment.

Apparatus

- Conical flasks (at least one of them must be dry), 100 cm³, x 6
- Filtration apparatus
- White tile
- Burette and stand
- Pipettes, 25 cm³ (or 50 cm³) and 10 cm³
- Access to a balance reading to 0.01 g

Chemicals

- Phenolphthalein indicator
- Aqueous sodium hydroxide, 0.020 mol dm⁻³

Health, safety and technical notes

- Read our standard health and safety guidance here <https://rsc.li/40NYx21>
- Wear eye protection
- For more information on phenolphthalein indicator see CLEAPSS Hazcard HC032.
- Sodium hydroxide can cause severe burns to the skin and is dangerous to the eyes, see CLEAPSS Hazcard HC091a

Results

- Using 0.020 mol dm⁻³ sodium hydroxide and 10 cm³ samples of dissolved aspirin the titres should be about 9 cm³ of sodium hydroxide at room temperature based on the solubility of aspirin being 0.33g in 100 cm³ at room temperature.
- The relative molecular mass of aspirin is 180 g mol⁻¹
- The solubility varies significantly with temperature and is in the range 0.2–0.4 g/100 cm³ at room temperature.

Conclusions

Increased solubility can be obtained by making the sodium or calcium salt by adding sodium hydroxide or calcium hydroxide to the mixture, or by raising the temperature.

Sodium acetylsalicylate or calcium acetylsalicylate are the usual forms of soluble aspirin sold. They reform aspirin when they come into contact with stomach acid and crystals of aspirin may then irritate the stomach lining.

Further investigation

- Repeat the activity, but leave the mixture to stand overnight to see whether more of the aspirin dissolves. Hydrolysis of the aspirin is likely to take place. How will this affect the results obtained? Try testing for 2-hydroxybenzoic acid in the solution.
- Plan and perform an experiment to find the solubility of aspirin at body temperature (37 °C).
- Find out about the problems of stomach ulcers caused by aspirin.