

The solubility of aspirin – student sheet

Introduction

The more soluble a medicine is, the more quickly it passes from the digestive system into the bloodstream after being swallowed. In this activity you find the solubility of aspirin by titrating a saturated solution of it with aqueous sodium hydroxide. Aspirin is a weak acid so the solution has a pH greater than 7 at the end-point and phenolphthalein is a suitable indicator to use.

Method

1. Weigh accurately about 0.5 g of aspirin into a 100 cm³ conical flask, add exactly 50 cm³ of distilled water (use a pipette or burette) and swirl for 5 minutes. Filter the solution into a dry 100 cm³ conical flask.
2. Using a 10 cm³ pipette, transfer four separate 10 cm³ samples into 100 cm³ conical flasks.
3. Add four drops of phenolphthalein to each of the flasks and titrate with 0.020 mol dm⁻³ aqueous sodium hydroxide until the first permanent pink colouration.
4. Carry out one rough, and at least two accurate, titrations and record your results in a table.
5. Find the mean volume, V cm³, of aqueous sodium hydroxide needed to react with the aspirin dissolved in 10 cm³ of solution.

Calculations

1. Write an equation for the reaction of sodium hydroxide with aspirin. How many moles of sodium hydroxide react with one mole of aspirin?
2. Find the number of moles of sodium hydroxide (NaOH) contained in V cm³ of 0.020 mol dm⁻³ aqueous sodium hydroxide.
3. Find the number of moles of aspirin contained in 10 cm³ of solution. What is the mass in grams of this amount of aspirin?
4. How does this compare with the original mass of aspirin?

Conclusions

Write a short paragraph setting out your results. You should explain why it is important for aspirin to be soluble in water and what your results show. How could you attempt to make aspirin more soluble? Carry out a simple experiment to test your suggestion.

Suggest a method you might use to increase the solubility of aspirin without losing its effectiveness as a painkiller. Does the fact that stomach acid contains about 2% hydrochloric acid have any bearing on your conclusions?