

The analysis of aspirin tablets

Topic

Organic chemistry/chemical analysis.

Timing

20 min.

Description

In this experiment students measure the amount of free 2-hydroxybenzoic acid (salicylic acid) in 2-ethanoxyloxybenzenecarboxylic acid (aspirin) tablets.

2-hydroxybenzoic acid (salicylic acid), being a substituted phenol, reacts with Fe^{3+} ions to produce a purple colour. The colour is matched against that produced by a set of standard solutions of 2-hydroxybenzoic acid (salicylic acid) in a well-plate.

Apparatus (per group)

- One 24-well plate
- One 100 cm³ beaker
- Cotton wool
- One plastic pipette (standard form, eg Aldrich ref: Z13, 500-3)
- Two plastic pipettes (fine tip, eg Aldrich ref: Z13, 503-8).
- Sheet for microscale filtration technique.

Chemicals (per group)

- Various 2-ethanoxyloxybenzenecarboxylic acid (aspirin) tablets Solutions contained in plastic pipettes (fine-tip), see p. 2
- Iron(III) nitrate solution
- 2-Hydroxybenzoic acid (salicylic acid) (working) solution
- Deionised water.

1. Stock 2-hydroxybenzoic acid (salicylic acid) solution (0.1% w/v)

Dissolve 0.100 g of 2-hydroxybenzoic acid (salicylic acid) in ca 20 cm³ of a 1:1 mixture of ethanol and deionised water in a 100 cm³ beaker. Make up to 100 cm³ in a volumetric flask.

2. Working 2-hydroxybenzoic acid (salicylic acid) solution (0.0025 g 2-hydroxybenzoic acid (salicylic acid) /25 cm³)

Dilute 2.5 cm³ of the stock solution to 25 cm³ in a volumetric flask with a 1:1 ethanol/water mixture.

3. Iron(III) nitrate solution, 0.1 mol dm⁻³.

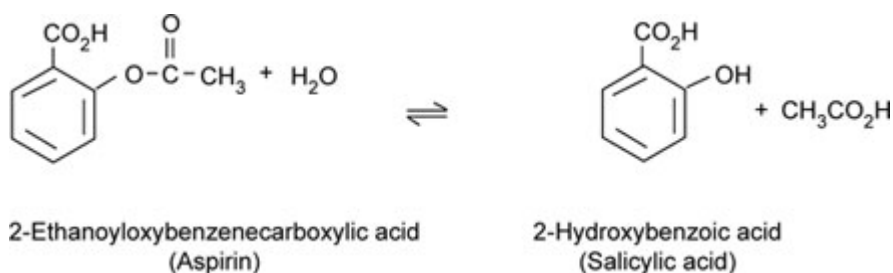
Observations

The set of standard solutions should give a range of intensities of a bluish colour. Students should be careful to add the correct number of drops as indicated. The experiment works best with old tablets



containing some free 2-hydroxybenzoic acid (salicylic acid). New tablets with minimal free acid do not give any blue coloration but merely the colour of iron(III) in solution (yellow) so they do not fit into the range of standards.

The equation by which 2-hydroxybenzoic acid (salicylic acid) is formed is:



This experiment gives students an opportunity to consider the practical effect of equilibrium. Old 2-ethanoyloxybenzenecarboxylic acid (aspirin) tablets, which may have become damp with time, will contain more free 2-hydroxybenzoic acid (salicylic acid) because the presence of water causes the position of equilibrium to be shifted to the right in the above equation.

Reference

This experiment is based on a similar procedure given in the publication G. Rayner- Canham and A. Slater, *Microscale chemistry – laboratory manual*. Don Mills, Ontario: Addison-Wesley, 1994.

Health & Safety

Advise students not to ingest the aspirin tablets.

Iron(III) nitrate, 0.2 mol dm⁻³, Fe(NO₃)₃.9H₂O (aq) and 2-hydroxybenzoic acid (salicylic acid) solution (0.1% w/v) are of low hazard.

1:1 Ethanol/water mixture is FLAMMABLE.

Credits

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Health & safety checked May 2018

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