Dissolution of aspirin tablets

Student worksheet

Health and safety note

Wear eye protection. 0.1 mol dm^{-3} sodium hydroxide solution is irritant.

Principle

The rate at which drugs taken orally dissolve in the stomach and other regions of the gastrointestinal tract is an important factor in determining how quickly a drug can be absorbed into the bloodstream and carried to where it needs to act. Rate of dissolution can be measured using the paddle method. This experiment is based on a method published in *The International Pharmacopoeia Fourth Edition*.

Equipment and materials

For the dissolution

- 1 dm^3 beaker
- 1 dm^3 measuring cylinder
- 1 cm^3 pipette (or plastic syringe)
- Paddle stirrer
- 300 mg aspirin tablet – Harmful
- Deionised water
- Stopwatch
- For extension work (optional):
  - aspirin capsule – Harmful
  - dispersible aspirin – Harmful
  - various buffer solutions to mimic pH found in different regions of the gastrointestinal tract

For the colorimetric analysis

- Calibration graph for the colorimetric determination of aspirin (see *Colorimetric analysis of aspirin*)
- Colorimeter, suitable filter and a 6 cm^3 cuvette
- Boiling tubes (x6) and rack
- 0.1 mol dm^{-3} sodium hydroxide solution – Irritant
- Dropper pipette
- 0.02 mol dm^{-3} iron(III) chloride solution
- Water bath at 70 °C
- 10 cm^3 pipette (or a 10 cm^3 measuring cylinder)

Method

1. Use a measuring cylinder to measure 600 cm^3 of deionised water into a 1 dm^3 beaker. Place a mechanical stirrer in the beaker so that its paddle or fins are well below the surface of the water. Switch the stirrer on and stir the water gently. Record the temperature of the water.
2. Choose a spot about 4 cm below the water surface and about 2 cm from the side of the beaker from which to withdraw samples.
3. Drop an aspirin tablet into the water (try to avoid splashing – hold the tablet near to the water surface before dropping). Start the stopwatch and immediately withdraw a 1 cm^3 sample. Put it into a boiling tube labelled ‘zero time’.
4. Withdraw further 1 cm^3 samples every two minutes for 10 minutes and transfer them to boiling tubes labelled ‘2 min’, ‘4 min’, ‘6 min’, ‘8 min’ and ’10 min’.

For ‘zero time’ and each of the other samples:

5. Add 2 drops of 0.1 mol dm^{-3} sodium hydroxide solution and warm the mixture for 10 minutes in the 70 °C water bath.
6. Allow to cool and add 10 cm^3 with 0.02 mol dm^{-3} iron(III) chloride solution.
7. Measure the absorbance of the solution and use it to calculate the concentration of aspirin.
8. Now calculate the concentration of aspirin in the solution from which the sample was taken.

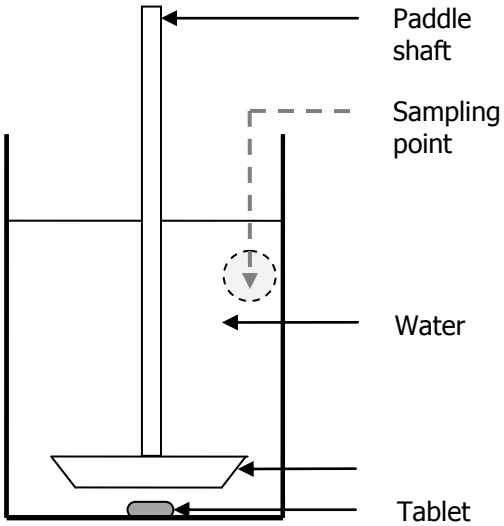

Figure Experimental set up.

Possible extension ideas

Compare the rates of dissolution of various aspirin formulations, e.g. capsules and dispersible (‘soluble’) aspirin.

Repeat the experiment using buffer solutions that reflect pH values found in the gastrointestinal tract instead of water.

Processing data

1. Plot a graph of the concentration of aspirin in solution against the time the sample was taken. Describe the shape of the graph obtained.
2. Depending on what, if any, of the extension ideas were tried, comment on:
   a) differences in rates of dissolution of different aspirin formulations;
   b) the effect of pH on the rate of dissolution.