

## The extraction and purification of paracetamol from tablets

This can be used to find out which brand of paracetamol contains the greatest quantity of active ingredient.

### Health, safety and technical notes

- Read our standard health and safety guidance <https://rsc.li/48aqMfd>
- Wear eye protection.
- Propanone - volatile, highly flammable, keep away from flames, do not inhale vapour.
- Paracetamol tablets - do not ingest.
- A full risk assessment should be carried out prior to starting the experiment.

### Chemicals (per group)

- Two paracetamol tablets
- Propanone

### Apparatus and equipment (per group)

- Two conical flasks
- Measuring cylinder
- Warm water bath
- Filter funnel and filter papers
- Beaker
- Pipette
- Small piece of cotton wool
- Glass funnel
- Hot and cold water
- Bunsen burner, tripod and gauze
- Access to melting point apparatus
- Access to a balance
- Eye protection
- This activity could be set as an open-ended investigation.

### Method

- Warm two paracetamol tablets with propanone (20 cm<sup>3</sup>) in a small conical flask by placing the flask in warm water.
- Once the tablets have broken up, the undissolved material (binding agents and filler) should be removed using a filter paper and funnel.
- Allow the propanone to evaporate, either overnight or on a warm water bath in a fume cupboard.
- The white solid is crude paracetamol. Keep a small amount of the solid to determine its melting point later. The material can be purified by recrystallisation from water.
- This process relies on the fact that paracetamol is not very soluble in cold water (1.4 g/100 cm<sup>3</sup>) but very soluble in hot water (5 g/100 cm<sup>3</sup>).
- When the crude solid is heated in water it will dissolve and any insoluble impurities can be filtered off.
- The impurities which are soluble will also of course dissolve. When the hot solution is cooled down, it reaches the temperature at which paracetamol reaches its limit of solubility and therefore starts to crystallise out. However, the soluble impurities are only present to the level of a few percent and so never reach their limit of solubility and thus stay in solution.

- Heat the solid in about 10 cm<sup>3</sup> of water to dissolve it, and filter off any insoluble
- material through a very small piece of cotton wool in a warm glass funnel. (Pour
- hot water through the funnel and cotton wool first.)
- Cool the filtrate, and filter off the crystals that form.
- Dry the pure paracetamol by either pressing with filter papers or gently warming in an oven.
- Take the melting point, and compare it with that of your crude sample and the quoted melting point of pure paracetamol.

### **Question**

Why might the melting points be different?

### **Answer**

The initial crude sample contains impurities or ingredients that were not removed in the extraction process. A purer compound has a higher melting point. Impurities present in compounds lower the melting point by affecting the crystal structure, so the crystals do not pack together as well.