Preparation of zinc sulfate

Student worksheet

Making zinc sulfate

Zinc sulfate is a complex fertiliser. This simple salt is a source of the micronutrient zinc and the secondary nutrient sulfur. However, it is as a source of zinc that it is important.

Zinc sulfate is produced by reacting zinc carbonate with sulfuric acid:

$$ZnCO_3(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2O(l) + CO_2(g)$$

Zinc sulfate used for pharmaceutical preparations is made from the reaction of sulfuric acid with high purity zinc oxide:

$$ZnO(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2O(l)$$

Zinc sulfate crystallises from aqueous solution as a heptahydrate, zinc sulfate-7-water, $ZnSO_4.7H_2O$.

You can make zinc sulfate-7-water in the laboratory by reacting zinc carbonate with dilute sulfuric acid.

Equipment and materials

- Weighing bottle (or small beaker)
- 250 cm^3 beaker
- Bunsen burner, tripod and gauze
- 25 cm^3 measuring cylinder
- Hot water bath
- Filter funnel and filter paper
- Thermometer (0 – 110 °C)
- Evaporating basin
- Spatula
- Sample bottle
- 1 mol dm^{-3} sulfuric acid
- Small granules of zinc carbonate

Method

Care: Wear eye protection. 1 mol dm^{-3} sulfuric acid is an irritant.

1. Weigh out about 3.5 g of zinc carbonate into a weighing bottle or small beaker.
2. Using a measuring cylinder, measure out 25 cm^3 of 1.0 mol dm^{-3} sulfuric acid into a 250 cm^3 beaker.
3. Use a spatula to add zinc carbonate to the acid. Add the solid a little at a time, stirring between additions and allowing any effervescence to die away before adding more.
4. Filter the solution into an evaporating basin. This removes any unreacted zinc carbonate from the mixture.
5. Put the evaporating basin on a tripod and gauze. Slowly evaporate the solution until it is about one-fifth of its original volume. Caution: Do not boil the solution as it may spit.
6. Allow the concentrated solution to cool until crystals form.
7. Filter off the crystals and put the filter paper and crystals on a watch glass and dab dry with another piece of filter paper. Cover them with a piece of clean filter paper and leave them to dry at room temperature.

8. Label a sample tube with the name of the product, your name and the date. Weigh the labelled sample tube and record its mass.
9. Tip your dry product into the sample tube. Weigh the tube again. Record its mass.

Calculations

You used an excess of zinc carbonate and so the theoretical yield depends on the volume of 1 mol dm^{-3} sulfuric acid used.

Calculate

1. the theoretical yield of zinc sulfate-7-water;
2. the percentage yield of zinc sulfate-7-water.