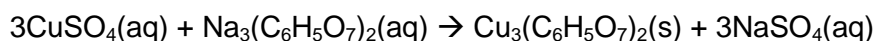


Preparation of copper(II) citrate

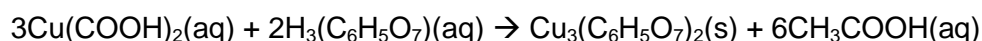
Student worksheet

Copper(II) citrate is one of the various forms in which the micronutrient copper is supplied in a fertiliser.

Copper(II) citrate is produced by reacting copper(II) sulfate with trisodium citrate:



or by reacting copper(II) ethanoate with citric acid:



Copper(II) citrate forms a pentahydrate, Copper(II) citrate-5-water, $\text{Cu}_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 5\text{H}_2\text{O}$.

You can make copper(II) citrate-5-water in the laboratory either by reacting copper(II) sulfate with trisodium citrate or by reacting copper(II) ethanoate with citric acid.

Making copper(II) citrate from copper(II) sulfate

Equipment and materials

- Weighing bottle (or small beaker) (2)
- 100 cm³ conical flask (2)
- Suction filtration apparatus and filter paper
- Sample bottle
- Trisodium citrate-2-water
- Copper(II) sulphate-5-water

Method

Care: Wear eye protection. Copper(II) sulfate is harmful if swallowed, is irritating to the eyes and skin and is very toxic to aquatic organisms.

1. Weigh 2.94 g (0.01 mol) of trisodium citrate-2-water into a 100 cm³ conical flask and add the minimum volume of deionised water to dissolve it. Swirl the contents of the flask between additions of water to dissolve the salt. (The solubility of trisodium citrate dihydrate is about 400 g dm⁻³).
2. Weigh 3.75 g (0.015 mol) of copper(II) sulfate-5-water into a 100 cm³ conical flask and add the minimum volume of deionised water to dissolve it. Swirl the contents of the flask between additions of water to dissolve the salt. (The solubility of copper(II) sulfate-5-water is about 300 g dm⁻³).
3. Mix the two solutions. If a precipitate does not form immediately, cover the mixture and leave it overnight.
4. Filter off the precipitate by suction filtration. Put the filter paper and precipitate on a watch glass. Cover the precipitate with a piece of clean filter paper and leave it to dry at room temperature.
5. Label a sample tube with the name of the product, your name and the date. Weigh the labelled sample tube and record its mass.
6. Tip your dry product into the sample tube. Weigh the tube again. Record its mass.

Calculations

- Calculate the theoretical yield of copper(II) citrate-5-water.
- Calculate the percentage yield of copper(II) citrate-5-water.

Making copper(II) citrate from copper(II) ethanoate

Equipment and materials

- Weighing bottle (or small beaker) (2)
- 100 cm³ conical flask (2)
- Suction filtration apparatus and filter paper
- Sample bottle
- Citric acid monohydrate
- Copper(II) ethanoate-1-water

Method

Care: Wear eye protection. Copper(II) ethanoate is harmful if swallowed, may cause serious damage to eyes and is very toxic to aquatic organisms.

1. Dissolve 3.0 g (0.015 mol) of copper(II) ethanoate-1-water in 30 cm³ of deionised or distilled water in a 100 cm³ conical flask.
2. Weigh 2.1 g (0.01 mol) of citric acid monohydrate into a 100 cm³ conical flask and add the minimum volume of deionised water to dissolve it. Swirl the contents of the flask between additions of water to dissolve the salt.
3. Mix the two solutions. Cover the mixture and leave it overnight.
4. Filter off the precipitate by suction filtration. Put the filter paper and precipitate on a watch glass. Cover the precipitate with a piece of clean filter paper and leave it to dry at room temperature.
5. Label a sample tube with the name of the product, your name and the date. Weigh the labelled sample tube and record its mass.
6. Tip your dry product into the sample tube. Weigh the tube again. Record its mass.

Calculations

- Calculate the theoretical yield of copper(II) citrate-5-water.
- Calculate the percentage yield of copper(II) citrate-5-water.