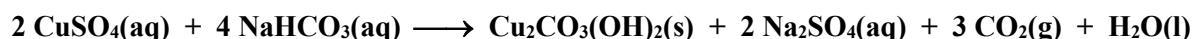


Preparation of copper carbonate-dihydroxide

Copper(II) carbonate-dihydroxide occurs in nature in the form of the mineral *malachite*, which is one of the most beautiful minerals known. Malachite is usually green in color, which can vary in shades from light green to black-green. From a chemical point of view, it is a combination of copper carbonate and copper hydroxide, $\text{CuCO}_3 \cdot \text{Cu(OH)}_2$. Malachite has been used as a mineral pigment in green paints since ancient times. It is very sensitive to acids.

Another mineral of the composition $\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$ – *azurite* – is deep blue in color. Both minerals are used as starting compounds in the preparation of other copper salts.

Copper(II) carbonate-dihydroxide is a green microcrystalline substance, poorly soluble in water. It is prepared by the precipitation reaction of a highly soluble copper salt with bicarbonate according to the equation:



Work

Prepare copper(II) carbonate-dihydroxide from 4.5 g of copper(II) sulphate pentahydrate.

Chemicals

- copper(II) sulphate pentahydrate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, light blue crystalline substance,
- sodium bicarbonate, NaHCO_3 , white crystalline substance,
- ethanol, $\text{C}_2\text{H}_5\text{OH}$, colourless liquid.

Procedure

In a tall 200 cm³ beaker, dissolve 4.5 g of copper sulphate pentahydrate in 25 cm³ of water. Similarly, in another beaker, dissolve approximately 3 g of sodium bicarbonate in 25 cm³ of water. Gradually add sodium bicarbonate solution to the copper sulphate solution until carbon dioxide gas is observed to escape from the reaction mixture. Then place the beaker in a water bath at 50 °C to expel dissolved carbon dioxide, and allow the precipitate to settle for about 20 minutes. Purify the precipitate by decanting with water. Then filter the precipitate under reduced pressure on a Büchner funnel, wash thoroughly with water and finally with ethanol. Dry in air at room temperature.

Copper(II) sulphate pentahydrate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$



- H302** Harmful if swallowed.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H410 Very toxic to aquatic life with long lasting effects.
P273 Avoid release to the environment.
P302+P352 IF ON SKIN: Wash with plenty of water and soap.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Sodium bicarbonate, NaHCO_3

Not a hazardous substance or mixture according to Regulation (EC) No 1272/2008.

Sodium sulphate decahydrate, $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$

Not a hazardous substance or mixture according to Regulation (EC) No 1272/2008.

Basic copper carbonate, $\text{Cu}_2\text{CO}_3(\text{OH})_2$



- H302+H332** Harmful if swallowed or inhaled.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
H410 Very toxic to aquatic life with long lasting effects.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P270 Do not eat, drink, or smoke when using this product.
P273 Avoid release to the environment.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Carbon dioxide, CO_2



- H280** Contains gas under pressure: may explode if heated.
P403+P410 Store in a well-ventilated place. Protect from sunlight.
Asphyxiant in high concentration.

Ethanol, $\text{CH}_3\text{CH}_2\text{OH}$



- H225** Highly flammable liquid and vapour.
H319 Causes serious eye irritation.
P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P240 Ground and bond container and receiving equipment.
P305+P351+P338 IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P403+P233 Store in a well-ventilated place. Keep container tightly closed.