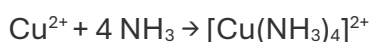
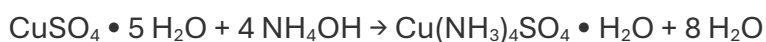


Determination of copper from concentrate with UV-VIS spectrophotometer

THEORY

Copper content in solution (copper-ion concentration) can be determined with UV-VIS spectrophotometer when a reference solution of known concentration is used. A copper-containing solution can be prepared, for example, from crystalline copper sulphate ($\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$). An aqueous solution of copper sulphate is relatively colourless, but the situation changes when sufficient amount of ammonia (NH_3) is added to it. Copper ion and ammonium ion form a dark blue complex according to the following reaction equation:



PROCEDURE

Sample Pretreatment

1. Weight accurately approximately 1 g of samples into beakers.
2. Add approximately 25 mL of concentrated hydrochloric acid (HCl) to the samples and boil nearly to dryness.
3. Add carefully approximately 20 mL of concentrated nitric acid (HNO_3) and boil until the sample has dissolved.
 - If the sample does not dissolve, small amounts of hydrochloric acid and nitric acid may be added alternately while boiling. The objective is to dissolve the entire sample.
4. Remove the beakers from the hot plate and carefully add approximately 50 mL of deionized water.
5. Boil until only approximately 25 mL of solution remains.
6. Add 30 mL of 25 % aqueous ammonia solution initially, and add more, if necessary, until

the pH is above 9.

7. Filter the solution into 100 mL volumetric flasks using a funnel and filter paper. Rinse with a small amount of water.
8. Before filling to the mark, check that the pH is above 9 and, if necessary, add more ammonia solution.

Preparation of reference solutions (standards)

1. Add approximately 100 mL of deionized water into a 400 mL beaker.
2. Prepare the stock solution (1 g/L) by accurately weighing 785,855 mg of copper (II) sulphate pentahydrate ($\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$). Add it to the beaker and stir until the powder has dissolved.
3. Measure 10 mL of concentrated ammonia solution and 10 mL of deionized water into a graduated cylinder.
4. Slowly pour the solution from the graduated cylinder into the beaker while stirring intermittently (the colour changes to a dark blue).
5. Rinse the graduated cylinder with 2 x 10 mL of deionized water and add the rinsing water to the beaker.
6. Stir the mixture and transfer it into a 200 mL volumetric flask using a funnel. Rinse the beaker with a small amount of deionized water. Finally, fill the volumetric flask to the mark.
7. Prepare additional standards from the stock solution (1 g/L) with concentrations of 0,5 g/L and 0,25 g/L.

Spectrophotometric analysis

Measure the reference solutions and samples using a UV-VIS spectrometer at a wavelength 607,30 nm, using deionized water as the blank sample.

This laboratory work was prepared as part of Development of the Extractive Industry in Central Ostrobothnia project.