To Prepare Crystals of Pure Copper Sulphate ($CuSO_4.5H_2O$) from a given impure sample of the blue vitriol

Theory

The given sample is shaken with water. A few drops of dilute sulphuric acid are added to it in order to prevent hydrolysis of copper sulphate. Copper sulphate present in the sample gets dissolved while the insoluble impurities are left behind. The solution is filtered. The filtrate is concentrated to the crystallisation point and then cooled. On cooling, crystals of copper sulphate ($CuSO_4.5H_2O$) separate out.

Requirements

Crude sample of copper sulphate, a 400 ml beaker, a china dish, a funnel, an evaporating dish and a policeman (glass rod).

Procedure

1. **Preparation of Solution.** Take about 25-30 ml of water and add to it small quantities of the powdered crude copper sulphate. Stir well to dissolve it. Make several additions of the powdered sample till a little of it remains undissolved even if it is stirred for sometime. Now add 2-3 ml of dilute sulphuric acid to make the solution clear. This prevents hydrolysis of the copper sulphate.
2. **Filtration of the Solution and Concentration of the Filtrate to Crystallisation point.** Filter the solution and collect the filtrate in a china impurities are left as residue on the filter paper.
Heat the china dish on a sand bath till the solution is reduced to about one-third of its original volume. As the solution gets heated up, it is stirred well with a glass rod to avoid crust formation on the side of the dish. If the crust is formed, it is dissolved into the solution by removing it with glass rod. Don't allow the solution in the dish to boil.
Remove a drop of the solution at the end of a glass rod and cool it by blowing. The appearance of a crust or tiny crystals on the glass rod shows that the crystallisation point has reached. Now turn off the burner and stop heating. Transfer the hot saturated solution in a crystallising dish.
3. **Cooling the Hot Saturated Solution.** Place the crystallisation dish containing hot saturated solution on a beaker containing water filled to the brim and allow it to cool slowly for sometime. Deep blue crystals of copper sulphate will appear. After about half an hour, the crystallisation is complete.

Fig. 5.12. Preserving of crystals.

4. **Separation of Crystals and Drying.** Decant off the mother liquor carefully. Wash the crystals with a little ethyl alcohol containing small amount of cold water. Re¬move the crystals on a filter paper which soaks the solution. Transfer the crystals on another filter paper and dry them by pressing gently between the folds of the filter
papers or by spreading on a porous plate. Transfer the crystals to a dry test tube and cork it (Fig. 5.12).

The crystals of pure copper sulphate ($CuSO_4.5H_2O$) are triclinic, transparent and blue.

Precautions

1. The filtrate should be evaporated slowly by gently heating during concentration.
2. The filtrate is to be evaporated only up to the crystallisation point. It should never be heated to dryness. Avoid over heating of the solution.
3. The solution should be cooled slowly without disturbing it. It should never be cooled rapidly.
4. Wash the crystals with the washing liquid 3-4 times using very small amount of the liquid each time.
5. In case the crystals obtained are very small, it means that the solution has been concentrated more than that required at the crystallisation stage.