EXPERIMENT

AIM

To prepare crystals of copper sulphate from the commercial sample of copper sulphate (blue vitriol).

THEORY

Hydrated copper sulphate is also called blue vitriol. It is a blue coloured pentahydrate of copper sulphate having formula $CuSO_4.5H_2O$. As explained in the theory of experiment 3, the soluble impurities are removed while filtering the saturated solution of the crude sample and soluble impurities get removed with mother liquor. During the preparation of crystals, dil. H_2SO_4 is added to prevent hydrolysis of the salt. The crystals are triclinic in shape.

MATERIAL REQUIRED

Powdered copper sulphate (crude sample), distilled water, dil. H_2SO_4 and filter paper, funnel

PROCEDURE

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

(i) 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 some time. Now add 2-3 ml of dilute sulfuric acid to make the solution clear. This prevents the hydrolysis of the copper sulphate.

(ii) Filtration of the solution and concentration of the filtrate to the crystallisation point

Filter the solution and collect the filtrate in China impurities are left as residue on the filter paper. Heat the China dish in 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 a 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 been reached. Now turn off the Burner and stop heating. Transfer the hot saturated solution to a crystallizing dish.

(iii) Cooling the hot saturated solution

Place the crystallization dish containing hot saturated solution on a beaker containing water filled to the brim and allow it to cool slowly for some time. Deep blue crystals of copper sulphate will appear.

After about half an hour, the crystallisation is complete.

(iv) Separation of crystals and drying

Decant off the mother liquor carefully. Wash the crystals with a little ethyl alcohol containing a small amount of cold water. Remove the crystals on filter paper which soaks the solution. Transfer the crystals to another filter paper and dry them by pressing gently between the folds of the filter paper or by spreading them on a porous plate. Transfer the crystals to a dry test tube and cork it (Fig.1).

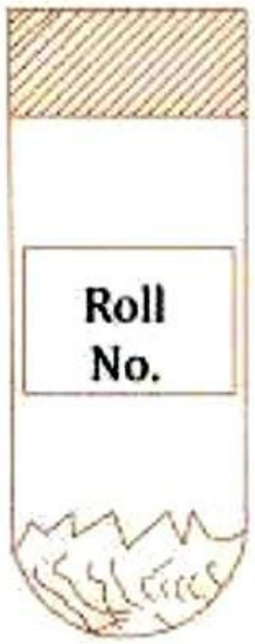

Fig. 1 Preserving of crystals

RESULT

Yield of the crystal = _____ g

Colour = Blue

Shape of the crystals = Triclinic

PRECAUTIONS

(i) The filtrate should be evaporated slowly by gently heating during concentration.

(ii) The filtrate is to be evaporated only up to the crystallization point. It should never be heated to dryness. Avoid overheating the solution.

(iii) The solution should be cooled slowly without disturbing it. It should never be cooled rapidly.

(iv) Wash the crystals with the washing liquid 3-4 times using a very small amount of the liquid each time.

(v) In case the crystals obtained are very small, it means that the solution has been concentrated more than that required at the crystallisation stage.

VIVA VOCE

Q 1. What is the chemical formula of copper sulphate?

Ans. The chemical formula of copper sulphate is $CuSO_4$.

Q 2. Why is it important to prepare crystals of copper sulphate from a commercial sample?

Ans. Commercial samples of copper sulphate may contain impurities, which can affect its properties and applications. By preparing crystals of pure copper sulphate, we can ensure its purity and suitability for various uses, such as in agriculture, electroplating, and laboratory experiments.

Q 3. Describe the process of preparing crystals of copper sulphate from a commercial sample.

Ans. The process typically involves dissolving the commercial sample of copper sulphate in water to form a solution, followed by purification through techniques such as recrystallization or fractional crystallization to obtain pure crystals of copper sulphate.

Q 4. What properties of copper sulphate make it suitable for crystallization?

Ans. Copper sulphate has relatively high solubility in water, making it suitable for dissolution and subsequent crystallization. Additionally, it forms well-defined crystals, making it easy to obtain pure crystals through crystallization techniques.

Q 5. What properties of potash make it suitable for crystallization?

Ans. Potash compounds, such as potassium carbonate or potassium hydroxide, have high solubility in water, making them suitable for dissolution and subsequent crystallization.

Q 6. How can the purity of the obtained crystals be determined?

Ans. The purity of the obtained crystals can be determined through various analytical techniques, such as melting point determination, elemental analysis, or comparison with known standards.

Q 7. Can impurities be removed from the commercial sample of potash through any other methods besides crystallization?

Ans. Yes, impurities can be removed through techniques such as filtration, evaporation, precipitation, or chemical treatments, depending on the nature of the impurities and the specific properties of the potash compound.

Q 8. What factors might affect the yield and quality of the obtained crystals?

Ans. Factors such as the purity of the commercial sample, the choice of solvent, the temperature and rate of cooling during crystallization, and the effectiveness of purification techniques can all affect the yield and quality of the obtained crystals.

Q 9. What are some common uses of pure potash in industrial and laboratory settings?

Ans. Pure potash is used in a variety of applications, including fertilizer production, glass manufacturing, soap production, and as a precursor for other potassium compounds in chemical synthesis.

Q 10. Are there any safety considerations when working with potash or its solutions?

Ans. Yes, precautions should be taken to avoid contact with skin or eyes, as potash solutions can be corrosive. Proper ventilation and personal protective equipment should be used when handling potash or its solutions. Additionally, appropriate disposal methods should be followed for any waste generated during the process.