10.9 Determination of copper – Colorimetric method

Apparatus

1. Heat resistant glass tube – of 50 ml capacity and marked at 30 ml.
2. Centrifuge – capable of clarifying the isoamyl alcohol phase.
3. Photoelectric colorimeter – capable of measuring the optical density at 430 nm.

Reagents

*   Sodium citrate solution – saturated
*   Ammonium hydroxide solution – 20 per cent (m/v).
*   Isoamyl alcohol – boiling point 129 to 132ºC
*   Sodium diethyldithiocarbonate solution – 0.1 per cent (m/v) aqueous.
*   Standard copper solution- Dissolve 0.393 g cupric sulphate pentahydrate ($CuSO_4 5H_2O$) of analytical grade in distilled water, add few drops of concentrated sulphuric acid and make up the volume to one litre in a graduated flask. Shake well. Pipette out of 10 ml of this solution into a one litre graduated flask and make up the volume. This solution contains 1 microgram of copper per ml.

Procedure

1. Pipette a suitable aliquot of the test solution as prepared in iron determination containing about 10 microgram of copper, in the glass tube marked at 30 ml. Add 3 ml of sodium citrate solution and ammonium hydroxide solution until just alkaline to phenolphthalein, followed by a 3 ml of ammonium hydroxide solution. Make up the volume to 30 ml with distilled water. Add 10 ml of isoamyl alcohol accurately measured and 1 ml of sodium diethyldithiocarbamate

Fig. 10.7 Centrifuge

solution. Stopper the tube and shake vigorously for 20 seconds. Transfer enough of the isoamyl alcohol phase meant for color measurement to centrifuge tubes and centrifuge for 2 minutes at about 3000 rpm in centrifuge machine (Fig. 10.7). Measure the absorption of the solution in a suitable photo-electric colorimeter at 430 nm, setting the reading of blank at zero absorption. The blank is prepared simultaneously by using the same quantities of acid employed in the digestion, making up the volume and developing the color in the same size aliquot and in the same manner as in the case of the test solution.

2. Prepare a series of standards by rating aliquots of the standard copper solution in the same manner as the test solution. From the absorption of the standard solutions prepare a standard curve plotting absorption values against concentrations. From this curve, obtain the mass of copper present in the test solution and calculate the quantity of copper present in 100 g of the material of moisture-free basis.

Reference: IS:7874 (part-II)-1975. Methods for animal feeds and feeding stuffs. Part-II. Minerals and trace elements.