EXPERIMENT NO. 13

AIM: Determination of Cu^{+2} ion content.

OBJECTIVE: To determine the Copper (Cu^{+2}) ion content in the given sample of copper ore (blue vitriol) by titrating it against standard N/25 sodium thiosulphate solution using KI and starch as indicator by Iodometeric titration.

THEROY: The given solution of copper ore when mixed with KI solution in presence of dil. acetic acid then a dark brown colour solution is obtained and following reactions occur.

$$CuSO_4.5H_2O + 2KI \rightarrow \mathbf{CuI_2} + K_2SO_4 + 5H_2O$$

Copper (II) iodide

CuI_2 formed is unstable and reduces into cuprous iodide with the liberation of I_2

$$2CuI_2 \rightarrow \mathbf{Cu_2I_2} + I_2$$

Copper (I) iodide

The liberated iodine is titrating against standard N/30 sodium thiosulphate till the colour of the solution becomes pale yellow.

Now 2-3 drops of freshly prepared solution of starch is added when the blue colour complex is formed and is further titrated with hypo solution till the blue colour disappears.

$$STARCH + I_2 \rightarrow STARCH - IODINE\ COMPLEX$$

Blue black in colour

$$2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$$

Sodium thionate — sodium tetra thionate (milky colour)

EXPERIMENTAL SETUP:

APPARATUS: Burette, Pipette, Conical flask, Beaker.

CHEMICALS: Copper Sulphate ($CuSO_4$) solutions, Standard N/30 Sodium thiosulphate solution ($Na_2S_2O_3$), KI, dilute acetic acid and freshly prepared starch solution.

INDICATOR: Freshly prepared starch solution.

EXPERIMENTAL PROCEDURE:

1. Fill the burette with standard sodium thiosulphate solution.
2. Pipette out 10 ml of copper ore solution in the conical flask with the help of a pipette and add half test tube of acetic acid solution to make it acidic.

3. Now add 2 ml of KI solution to it when a dark brown color of the solution is obtained.
4. Titrate it with sodium thiosulphate solution slowly with constant stirring till pale yellow or light-yellow color appears; now add 2-3 drops of starch solution and stir the conical flask content when the solution changes to blue black color.
5. Again, titrate this blue colored solution with N/25 hypo solution dropwise with constant stirring till the blue color just disappears. The disappearance of blue color marks the completion of the titration.
6. Note the reading of the burette.
7. Repeat the same process with the given sample solution of copper ore till two concordant readings are obtained and record your observations in observation table.

OBSERVATIONS:

S No.	Volume of sample solution taken in conical flask (10 ml)	Burette readings (ml)		Volume of N/25 $Na_2S_2O_3$ used (ml)
		Initial	final	
1				
2				
3				

CALCULATIONS:

$N_1V_1 = N_2V_2$

$N_1 \times 10 = 1/25 \times$ (X ml)

$N_1 = N/10$ x N/25 N

Strength in g/l = Normality x Equivalent Weight

= Normality x 63.5

RESULT: The Cu^{++} ion content in the given sample of copper ore =.....gm/litre

RESULT ANALYSIS AND DISCUSSION: - The amount of copper present in the given ore (blue vitrol) is -------gm/L. which is much less than the standard value (50%). So, the ore is not suitable for the extraction of the Cu from it.

INFERENCE AND CONCLUSION:

Copper is found in the form of oxides ores such as cuprite Cu_2O, carbonate ores such as malachite $CaCO_3$. $Cu(OH)_2$ or azurite $2CuCO_3.Cu(OH)_2$ and in the form of sulphide ores such as

copper glance, Cu_2S or copper pyrite or $CuFeS_2$ ($Cu_2S+Fe_2S_2$), But copper pyrite is the main ore of copper which is found in India in Singhbhum district of Bihar, Dharwar and Matigara.

The main objective of this experiment is to find out the %age of copper in a given sample of Copper ore so that we could establish whether the extraction of Cu from the given ore is economical from industrial point of view or not. Because if the amount of Cu present in the ore is low then it will not be convenient for us to extract Cu from it as the cost of production will be too high. As we all know that copper is one of the most important technical metal used for making electric cables, electrical appliances, copper sheets for making utensils, making alloys like brass, electroplating and for making coins as well.

LEARNING OUTCOME: This experiment is used to find out amount of Cu^{++} ion from copper ore and its industrial applications.

APPLICATIONS:

The metal is used in the manufacture of electrical equipments used in medicinal and agricultural industries.

PRECAUTION:

(i) Glass apparatus should be properly cleaned before the start of experiment
(ii) Solution of copper ore should be made acidic by adding 2-3 ml of dilute acetic acid solution.
(iii) Do the titration drop wise and continuous shaking.