Name : Jannatul Ferdous Umama
ID : 20-42616-1
Sec : R

Exp. 5 : Estimation of copper (Cu) contained in a supplied Solution of copper salt By Iodometric method.

Method : Oxidation-Reduction titration.

Experimental Data :

(A) Standardize sodium thiosulphate solution as Expt. No. 4

The reaction takes place in two steps:

(1) $2CuSO_4 + 4KI = 2K_2SO_4 + 2CuI \downarrow + I_2$

(2) $2Na_2S_2O_3 + I_2 = S_4O_6^{2-} + 2I^- + 4Na^{2+}$

for Step 1 :

a) $2I^-(aq) \longrightarrow I_2(aq) + 2e^-$ (oxidizing half reaction)

(b) $2Cu^{2+}(aq) + 2e^- \longrightarrow 2Cu^+(aq)$ (reduction half reaction)

for Step 2 :

(a) $2S_2O_3^{2-}(aq) \longrightarrow S_4O_6^{2-} + 2e^-$ (Oxidation half reaction)

(b) $I_2(aq) + 2e^- \longrightarrow 2I^-(aq)$ (reduction half reaction)

Table-1 : Standardization of supplied $Na_2S_2O_3$ solution against standard $K_2Cr_2O_7$ solution by oxidation-reduction titration.

No of reading	Vol. of $K_2Cr_2O_7$ (in mL)	Vol. of $Na_2S_2O_3$ (burette reading) (in mL)			Mean (in mL)
		Initial	Final	Difference	
1	10	0.00	10.30	10.30	10.25
2	10	10.30	20.50	10.20	

weight taken (in gm) = 0.066 g

The strength of $K_2Cr_2O_7$ solution

$$= \frac{0.66 \times 0.1}{0.49} N$$

$$= 0.066 N$$

$$= 0.07 N$$

The strength of supplied $Na_2S_2O_3$ solution (S):

$V_{thio} \times N_{thio} = V_{dichromate} \times N_{dichromate}$

$\Rightarrow 10.25 \times N_{thio} = 10 \times 0.07$

$\Rightarrow N_{thio} = \frac{10 \times 0.07}{10.25} N.$

$= 0.0682 N$

$= 0.07 N.$

(B) Estimation of Cu ions :

Table-2 : Determination of the amount of copper in a supplied solution of blue vitriol by iodometric method.

No. of reading	Vol. of Copper salt solution (in ml)	Vol of $Na_2S_2O_3$ (burette reading) (in ml)			Mean (in ml) (V)
		Initial	Final	Difference	
1	10	0.00	3.50	3.5	3.38
2	10	3.50	6.80	3.3	
3	10	6.80	10.20	3.4	
4	10	10.20	13.55	3.35	

Calculation :

$$2CuSO_4 \equiv I_2 \equiv 2Na_2S_2O_3$$

1 ml 1N $Na_2S_2O_3$ $\equiv$ 0.06354 gm of Cu^{2+}

Amount of copper ions in 10 ml of copper salt solution = 0.06354 × V × S gm

= 0.06354 × 3.38 × 0.07

= 0.0150 gm

= 0.02 gm

Amount of copper ions in 500mL of copper salt solution $= 0.06354 \times V \times 5 \times 50$ gm

$= 0.06354 \times 3.38 \times 07 \times 50$

$= 7.5167$ gm $= 7.52$ gm. 0.7516 $= 0.75$ gm

Observed value of Cu^{2+} (in 500 mL)

$= 7.52$ gm. 0.75 gm

Known value of Cu^{2+} (in 500 mL)

$$= \frac{63.54 \times 5.70}{249.68} \text{ gm}$$

$= 1.4505$ gm $= 1.45$ gm

Results:

The amount of copper ions in 500 mL of copper salt solution is

Percentage of error:

$$\frac{\text{known value} - \text{Observed value}}{\text{known value}} \times 100$$

$$= \frac{1.45 - 7.52\ 0.75}{1.45} \times 100$$

$= 0.75$ 0.4827

$= 47\%$ $= 48\%$