Estimation of Ferrous Iron in Mohr's salt

Theory

Potassium dichromate quantitatively oxidises ferrous iron (Fe^{2+}) of Mohr's salt to ferric iron (Fe^{3+}) in acid medium.

$$Cr_2O_7^{2-} + 6Fe^{2+} + 14H^+ \rightleftharpoons 2Cr^{3+} + 6Fe^{3+} + 7H_2O$$

The solution of Mohr's salt can be titrated with standard $K_2Cr_2O_7$ solution in the presence of H_3PO_4 and 2(N) H_2SO_4 using Barium diphenylamine sulfonate as indicator.

Procedure

1) Preparation of standard $(\frac{N}{10})$ $K_2Cr_2O_7$ solution

Weigh out accurately 1.225 gm $K_2Cr_2O_7$ in a 250ml volumetric flask. Dissolve it and make the volume up to the mark with distilled water.

Equivalent weight of $K_2Cr_2O_7$ solution = 49.03

1000 ml 1(N) $K_2Cr_2O_7$ solution ≡ 49.03 gm of $K_2Cr_2O_7$

250 ml $(\frac{N}{10})$ $K_2Cr_2O_7$ solution ≡ 1.225 gm of $K_2Cr_2O_7$

Table 1: Preparation of standard (N/10) $K_2Cr_2O_7$ solution

Weight of the bottle with $K_2Cr_2O_7$ (W_1 gm)	Weight of the bottle after transfer (W_2 gm)	Weight taken ($W_1 - W_2 = W$ gm)

$$\text{Strength of } K_2Cr_2O_7 = \frac{\text{Weight taken}}{\text{Weight required}} \left(\frac{N}{10}\right)$$

$$= \frac{W_1 - W_2}{1.225} \left(\frac{N}{10}\right)$$

$$= \frac{W}{1.225} \left(\frac{N}{10}\right)$$

$$= f\left(\frac{N}{10}\right), \quad f = \text{factor}$$

2) Titration of Mohr's salt (Fe^{2+} solution) with standard $K_2Cr_2O_7$ solution

Rinse the burette with (N/10) $K_2Cr_2O_7$ solution and then fill it. 25 ml of the Mohr's salt solution is pipetted out in a 250 ml conical flask, diluted to 150 ml with distilled water, 5 ml of conc. H_2SO_4, 5 ml of syrupy phosphoric acid are added followed by 4-5 drops of BaDS indicator. The mixture is titrated with standard $K_2Cr_2O_7$ solution with constant shaking until the colour of the solution just changes from green to reddish-violet.

Table-2: Titration of Fe^{2+} solution vs standard $K_2Cr_2O_7$ solution

Sl. No.	Volume of Fe^{2+} solution taken (ml)	Volume of $K_2Cr_2O_7$ solution required (ml)	Mean volume of $K_2Cr_2O_7$ (ml)
			V ml

Calculation

25 ml of Fe^{2+} solution $\equiv$ V ml of f $(\frac{N}{10})$ $K_2Cr_2O_7$ solution

$\equiv$ V × f ml of $(\frac{N}{10})$ $K_2Cr_2O_7$

1000 ml of $(\frac{N}{10})$ $K_2Cr_2O_7$ solution $\equiv$ 1000 ml of $(\frac{N}{10})$ Fe^{2+} solution

$\equiv$ 5.585 gm of Fe^{2+}

$\therefore$ 1 ml of (N/10) $K_2Cr_2O_7$ $\equiv$ 0.005585 gm of Fe^{2+}

V×f ml of $(\frac{N}{10})$ $K_2Cr_2O_7$ $\equiv$ V × f × 0.005585 gm of Fe^{2+}

Now,

25 ml of Fe^{2+} solution contains V×f×0.005585 gm Fe^{2+}

250 ml of " " " V×f×0.005585×10 gm Fe^{2+}