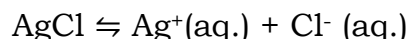


## Determine the solubility and solubility product of sparingly soluble, AgCl conductometrically.

**Requirements:** 10 mL AgNO<sub>3</sub> (N/10); 8mL KCl solution (N/10); Conductivity cell; Conductometer, beaker, Stirrer.

**Theory:** Solution of AgNO<sub>3</sub> and KCl when mixed, they formed AgCl salt, which is insoluble in water and get precipitated. AgCl is in equilibrium with its ions in aqueous solution and the solubility product  $K_{sp}$  is expressed by reference to the equilibrium.



If 'S' be the solubility in g.eq/L of a given salt and K is the specific conductance of saturated solution, the equivalent conductance ( $\Lambda_{eq}$ ) of the solution is given by:

$$\Lambda_{eq} = \frac{1000 K}{S}$$

$$\text{and, } \Lambda_{eq} = \Lambda_{Ag^+}^{\circ} + \Lambda_{Cl^-}^{\circ}$$

In general, the solution will be sufficiently diluted for the equivalent conductance to be similar with the value of infinite dilution ( $\Lambda_{eq}^{\circ}$ ) which can be obtained from the ionic conductance of the constituent ions.

It follows that since ' $\Lambda_{eq}$ ' is known and K for the saturated solution can be determined (conductometrically) experimentally, it is possible to calculate the solubility 'S' by means of the above equation.

### Procedure:

- 1) 10 mL of AgNO<sub>3</sub> (N/10) solution was taken in a beaker. 8 ml of KCl (N/10) solution was added in it to get the solid precipitate of AgCl.
- 2) The precipitate was washed with hot distilled water many times to remove excess Cl<sup>-</sup> ions, which may be accumulated on AgCl.
- 3) The precipitate was then equally divided into 2 parts and then mixed with 100 ml distilled water (in 150 mL beakers).
- 4) The conductance of distilled water was taken first in conductivity cell. Then the conductance of prepared two AgCl solutions were taken while stirring the solution for 1 hour.

**Observation:** *(values are given as an example)*

Cell constant (*check it*) = 0.98 cm<sup>-1</sup>

Conductance of distilled water:       $\mu\text{S}$

Conductance of saturated aq. AgCl solution in beaker 1:       $\mu\text{S}$

Conductance of saturated aq. AgCl solution in beaker 2:       $\mu\text{S}$

**Calculations:** *(values are given as an example)*

After correcting the conductance for water:

Conductance of saturated aq. AgCl solution in beaker 1: - =  $\mu\text{S}$

Conductance of saturated aq. AgCl solution in beaker 2: - =  $\mu\text{S}$

Average Conductance of the saturated aq. AgCl solution: =  $\mu\text{S}$

According to Kohlrausch law:

$$\begin{aligned}\Lambda^\circ(\text{AgCl}) &= \Lambda^\circ(\text{Ag}^+) + \Lambda^\circ(\text{Cl}^-) \\ &= 61.92 + 76.34 \\ &= 138.26 \text{ S.cm}^2 \text{ mol}^{-1} \text{ at } 25^\circ\text{C}.\end{aligned}$$

Specific conductance (K) for AgCl solution = conductance x Cell constant  
= x 0.98 =  $\text{Scm}^{-1}$ .

If the solubility of AgCl is denoted by S, then

$$S = (K \times 1000) / \Lambda^\circ$$

$$= ( \quad \times 1000) \text{ S cm}^{-1} / 138.26 \text{ S. cm}^2 \cdot \text{mol}^{-1} = \quad \text{mol.cm}^{-3}$$

For, solubility product,  $K_{\text{sp}} = [\text{Ag}^+] \times [\text{Cl}^-] = S \times S = S^2 = ( \quad )^2 = \quad \text{mol}^2 \cdot \text{cm}^{-6}$

Results: The solubility and solubility product for AgCl in water were found to be  $\quad \text{mol.cm}^{-3}$  and  $\quad \text{mol}^2 \cdot \text{cm}^{-6}$  at laboratory temperature ( $X^\circ\text{C}$ ).