LAB. 5

Determination of solubility product of slightly soluble salt

Introduction

When slightly soluble salts are dissolved to form saturated solutions, the solubility is described by a special constant, known as the ***solubility product*** **(K_{sp}).**

$K_{sp} = C_A * C_B$

An example of such solution is silver chloride. The solubility product of silver chloride can be expressed as:

$K_{sp} = [AG^+] [Cl^-]$

Where the brackets [ ] represents concentration in mole/liter.

In this case, K_{sp} is the multiplication of molar concentrations of silver and chloride ions. If the silver ion concentration is increased by the addition of soluble silver salt, the chloride ion concentration will decrease so that the solubility product remains the same. As a result, Silver chloride will precipitate (its solubility will decreased) in order to decrease chloride ion concentration.

The same thing occurs when chloride ion concentration is increased by the addition of soluble chloride salt, the silver ion concentration will decrease to maintain the same solubility product. Again this decrease in silver ion concentration is caused by the precipitation of silver chloride.

Materials and equipment

1. Potassium acid tartrate, 0.1 M Potassium chloride, 0.025 M sodium hydroxide, and phenolphthalein indicator.
2. Conical flask, burette, pipette, measuring cylinder, filter paper and balance.

Procedure

1. Into five 50 ml volumetric flasks, add 1 g of KHT (potassium acid tartrate) + 50 ml aqueous solution of different molarities of KCl (0, 0.02, 0.04, 0.06, and 0.08 M). The solutions are prepared from 0.1 M KCl solution.
2. Shake for 10 minutes, leave 15 minute for equilibration, and then filter.

3. Take 10 ml of the filtrate, titrate against 0.025 M NaOH using phenolphthalein as an indicator, and record the results.

Calculations

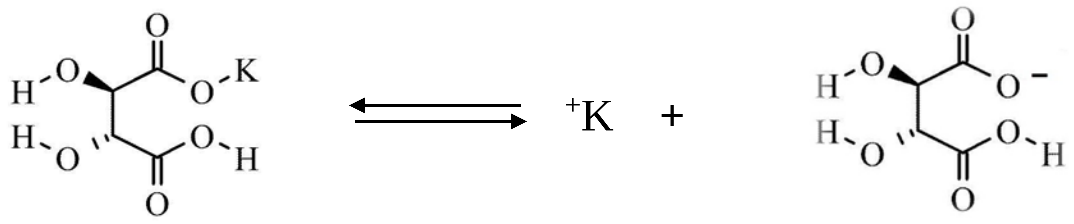

Fig 6-1: The dissociation of potassium acid tartrate

Flask (1):

$KHT \longrightarrow K^{+} + HT^{-}$

$K_{sp} = [HT^{-}]\,[K^{+}]$

In other flasks:

$KHT \longrightarrow K^{+} + HT^{-}$

$KCl \longrightarrow K^{+} + Cl^{-}$

$K_{sp} = [HT^{-}]\,[K^{+} + K^{+}_{\text{from KCl}}]$

In titration:

$HT^{-} + NaOH \longrightarrow NaHT + H_2O$

No. of moles of HT^{-} = No. of moles of NaOH

$[HT^{-}] * V_{HT-} = [NaOH] * V_{NaOH}$

$[HT^{-}] * 10 = 0.025 * E.P_1$

$[K^{+}] = [HT^{-}]$

For flask (1):

$K_{sp} = [HT^{-}]^2$

For other flasks we have $E.P_2$, $E.P_3$, $E.P_4$, and $E.P_5$

$[K^{+}] = [HT^{-}] + [KCl]$

K_{sp} for flask (2) = $[HT^{-}]\,([HT^{-}] + 0.02)$

K_{sp} for flask (3) = $[HT^{-}]\,([HT^{-}] + 0.04)$

K_{sp} for flask (4) = $[HT^{-}]\,([HT^{-}] + 0.06)$

K_{sp} for flask (5) = $[HT^{-}]\,([HT^{-}] + 0.08)$

Group: Subgroup: Date: ***Lab instructor signature:***

Names:

Results

Flask no.	**M KCl**	**E.P**	**[HT]**	**[K^+]**	**K_{sp}**
1					
2					
3					
4					
5					

Homework:

1. What is the effect of increasing the concentration of KCl on the water solubility of KHT?