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POTENTIOMETRIC AND THERMODYNAMIC STUDY OF Co(II) COMPLEXES OF THIOGLYCOLIC ACID IN 40% ACETONE MEDIUM

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ABSTRACT

Cobalt complexes of Thioglycolic acid have been investigated by potentiometric technique in 40% V/V acetone. It was found that cobalt forms colourless 1:2 complex. The stability constant of the complexes formed have been determined by applying Calvin and Melchior's extension of Bjerrum's method at three different temperature. The values of log K1, log K2 at 25º, C, 30ºC and 35º C have been found to be 7.85, 6.36, at 298 K, 8.01, 6.50 at 303 K, and 8.10, 6.78 at 308 K, in 40% acetone medium respectively.

Keywords: *Potentiometric Technique, Cobalt Complexes, Thioglycolic Acid, Bjerrum's Method, Thermodynamic Parameters*.

Introduction

The values of overall changes in ∆G, ∆H and ∆S, at three different temperature accompanying the reaction have also been evaluated at 303 K and the values of ΔG_1, ΔG_2, ∆H, ΔS_1, ΔS_2, are found to be -41.82 KJ mol-1 -24.830 KJ mol^{-1} and - 0.098129 J/K + 137.6959 J/K, + 81.6233 J/K in 40% Acetone medium.

There is no reference in the literature regarding the complexing tendency of thioglycolic acid with cobalt ion in 40% aqueous-acetone medium. Hence the present investigation has been initiated. The composition and stability constant of the complexes have been studied by potentiometric method. The value of thermodynamic parameters ∆G, ∆H, and ∆S have also been calculated.

Methodology

Materials

Thioglycolie acid S.D. fine A.R. (B.D.H.) reagents Co $(N_2O_3)_2$ etc. were used and their solutions were prepared in doubly distilled air free water. Freshly prepared solutions of the reagents were always used to avoid the effect of ageing.

Equipments

A Systronics - 335 digital pH meter was used for measurements. A saturated calomel electrode and a wide range glass electrode were used for pH measurements and calibrated by using several buffer solutions of pH 4.0, 7.0 and 9.2. Thus the reading gave immediately concentration and not activities of [H].

Procedure

Potentiometric Studies

The experimental procedure is similar to that described earlier. A series of potentiometric titration of thioglycolic acid with standard NaOH in the absence and presence of Co^{+2} at various ligands

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to metal ratios viz, 1:1, 2:1, 3:1 etc. were performed. Titrations were also carried out at different temperatures in 40% acetone. For calculating the values of ∆G, ∆H, and ∆S accompanying the reaction, all the pH titration were performed in 40% V/V acetone. in 0.1M KNO_3. The results of various titration have been recorded.

The values of $\overline{n}$ and free ligand concentration [A], calculated from the titrations of ligand in the absence and presence of cobalt ion at ratios 5:1 with standard NaOH have also been tabulated together with the other results, obtained.

The experimental observation and the results obtained have been tabulated on the following pages.

Determination of Stoichiometry Potentiometric Titration of TGA in Presence of Co2+ at Ratios (1) 1:0 (2) 1:1 (3) 2:1 (4) 3:1 IN 40% V/V Acetone Medium With 0.1 M NaOH

- **M NaOH V/S 1X10^{-3} M TGA +0.1 M KNO3 (1:0)**

Table –I-(a)-1

S. No.	Mole of NaOH per Mole of Ligand	pH
1	0.00	4.50
2	0.20	4.72
3	0.40	4.90
4	0.60	5.12
5	0.80	5.40
6	0.90	5.64
7	0.95	6.40
8	1.00	7.50
9	1.05	8.52
10	1.10	9.32
11	1.20	10.16
12	1.40	10.70
13	1.60	11.06
14	1.80	11.38
15	2.00	11.66

- **0.1 M NaOH V/S 1x10^{-3} M TGA +0.1 M KNO_3 + 1x10^{-3}M (Co^{2+}) (1:1)**

Table –I-(a)-2

S. No.	Mole of NaOH per Mole of Ligand	pH
1	0.00	3.52
2	0.20	3.55
3	0.40	3.66
4	0.60	3.82
5	0.80	4.02
6	1.00	4.32
7	1.20	4.60
8	1.40	5.06
9	1.60	5.52
10	1.80	7.01
11	2.00	7.70
12	2.20	8.16
13	2.40	8.52
14	2.60	8.78
15	2.80	9.36
16	2.90	9.80
17	2.95	9.96
18	3.00	10.26
19	3.10	10.60
20	3.20	11.00

- **0.1 M NaOH V/S 1x10^{-3} M TGA +0.1 M KNO_3 + 5x10^{-4} M (Co^{2+}) (2:1)**

Table –I-(a)-3

S. No.	Mole of NaOH per mole of ligand	pH
1	0.00	3.68
2	0.20	3.70
3	0.40	3.86
4	0.60	4.08
5	0.80	4.32
6	1.00	4.60
7	1.20	4.86
8	1.40	5.90
9	1.50	6.62
10	1.60	7.00
11	1.80	7.86
12	2.00	8.50
13	2.10	9.52
14	2.20	10.04
15	2.40	10.28
16	2.60	10.60
17	2.80	11.26
18	3.00	11.62

- **0.1 M NaOH V/S 1x10^{-3} M TGA +0.1 M KNO_3 + 3.33x10^{-4} M (Co^{2+}) (3:1)**

Table –I-(a)-4

S. No.	Mole of NaOH per Mole of Ligand	pH
1	0.00	4.10
2	0.20	4.20
3	0.40	4.30
4	0.60	4.44
5	0.80	4.66
6	1.00	4.82
7	1.20	5.12
8	1.40	6.76
9	1.50	7.62
10	1.60	8.02
11	1.65	8.66
12	1.70	8.99
13	1.80	10.02
14	2.00	10.76
15	2.20	11.18
16	2.40	11.52

Determination of Stability Constant Potentiometric Titration of TGA in the Presence of Co^{2+} at Ratios (1) 1:0 (2) 5:1 With 0.2 M NaOH in 40% Acetone

Temperature – 25ºC

- **0.2 M NaOH V/S 01. M KNO_3 + 2x10^{-3} M TGA + 4x10^{-3} M $HClO_4$ (1:0)**
- **0.2 M NaOH V/S 01. M KNO_3 + 2x10^{-3} M TGA + 4x10^{-3} M $HClO_4$ + 4x10^{-4} M (Co^{2+}) (5:0)**

Table –I-(a)-5

S. No.	Mole of NaOH per mole of ligand	pH	
		Curve 1 (1:0)	Curve 2 (5:1)
1	0.00	3.40	3.40
2	0.50	3.58	3.58

3	1.00	3.81	3.81
4	1.50	4.20	4.20
5	2.00	4.52	4.42
6	2.50	5.06	4.74
7	2.70	5.35	4.96
8	2.80	5.48	5.02
9	2.90	6.08	5.17
10	2.95	7.00	5.25
11	3.00	8.42	5.36
12	3.05	8.86	5.50
13	3.10	9.06	5.62
14	3.20	9.36	5.91
15	3.30	9.52	6.46
16	3.35	9.66	8.00
17	3.40	9.74	9.16
18	3.50	9.86	9.52
19	3.80	10.20	10.05
20	4.00	10.42	10.26

Temperature – 30ºC

- **0.2 M NaOH V/S 01. M KNO3 + 4x10–3 M HClO4 + 2x10–3 M TGA (1:0)**
- **0.2 M NaOH V/S 01. M KNO_3 + $4x10^{-3}$ M $HClO_4$ + $2x10^{-3}$ M TGA + $4x10^{-4}$ M (Co^{2+}) (5:1)**

Table –I-(a)-6

S. No.	**Mole of NaOH per mole of ligand**	**pH**	
		Curve 1 (1:0)	**Curve 2 (5:1)**
1	0.00	3.75	3.75
2	0.50	3.90	3.90
3	1.00	4.01	4.01
4	1.50	4.18	4.18
5	2.00	4.45	4.32
6	2.30	4.50	4.48
7	2.50	5.00	4.62
8	2.70	5.28	4.78
9	2.80	5.42	4.87
10	2.90	6.56	4.90
11	2.95	7.52	4.96
12	3.00	8.63	5.00
13	3.05	8.86	5.08
14	3.10	8.98	5.10
15	3.20	9.20	5.26
16	3.30	9.44	5.35
17	3.35	9.50	6.52
18	3.40	9.70	7.20
19	3.45	9.78	8.00
20	3.50	9.82	8.82
21	3.75	10.12	9.60
22	4.00	10.20	10.06

Temperature – 35ºC

- **0.2 M NaOH V/S 01. M KNO3 + 4x10–3 M HClO4 + 2x10–3 M TGA (1:0)**
- **0.2 M NaOH V/S 01. M KNO_3 + $4x10^{-3}$ M $HClO_4$ + $2x10^{-3}$ M TGA + $4x10^{-4}$ M (Co^{2+}) (5:1)**

Table –I-(a)-7

S. No.	Mole of NaOH per Mole of Ligand	pH	
		Curve 1 (1:0)	Curve 2 (5:1)
1	0.00	3.32	3.32
2	0.50	3.50	3.50
3	1.00	3.67	3.67
4	1.50	3.88	3.88
5	2.00	4.35	4.30
6	2.50	4.86	4.78
7	2.70	5.18	4.95
8	2.80	5.36	5.06
9	2.90	5.65	5.26
10	2.95	7.00	5.32
11	3.00	7.80	5.35
12	3.05	8.52	5.50
13	3.10	8.74	5.56
14	3.20	9.00	5.87
15	3.30	9.40	6.30
16	3.35	9.50	7.54
17	3.40	9.65	8.72
18	3.45	9.76	9.30
19	3.50	9.82	9.50
20	3.75	10.18	9.99
21	4.00	10.32	10.22
22	0.00	3.32	3.32
21	0.50	3.50	3.50

Determination of Dissociation Costant pKa$_1$ of TGA in 40 Acetone from First Uffer Region

Temperature – 25ºC

Table –I-(a)-8

S. No.	Mole of NaOH per mole of ligand	Stoichiometric Concentration			$\frac{[HA]}{[A]}$	$\frac{\log[HA]}{[A]}$	$pKa_1 = pH + \log[HA]/[A]$
		pH	[HA]	[A]			
1	0.20	4.60	0.0016	0.0004	4.00	0.6021	5.2021
2	0.40	4.90	0.0012	0.0008	1.50	0.1761	5.0761
3	0.60	5.12	0.0008	0.0012	0.67	-0.1739	4.9461
4	0.80	5.48	0.0004	0.0016	0.25	-0.6021	4.8779

pKa$_1$ = 5.02055

Ka$_1$ = 0.793x10^{-5}

Temperature – 30ºC

Table –I-(a)-9

S. No.	Mole of NaOH per mole of ligand	Stoichiometric Concentration			$\frac{[HA]}{[A]}$	$\frac{\log[HA]}{[A]}$	$pKa_1 = pH + \log[HA]/[A]$
		pH	[HA]	[A]			
1	0.20	4.58	0.0016	0.0004	4.00	0.6021	5.1821
2	0.40	4.86	0.0012	0.0008	1.50	0.1761	5.0261
3	0.60	5.08	0.0008	0.0012	0.67	-0.1739	4.9161
4	0.80	5.42	0.0004	0.0016	0.25	-0.6021	4.8379

pKa$_1$ = 4.98555

Ka$_1$ = 1.03x10^{-5}

Temperature – 35ºC

Table –I-(a)-10

S. No.	Mole of NaOH per mole of ligand	Stoichiometric Concentration			$\frac{[HA]}{[A]}$	$\frac{\log[HA]}{[A]}$	$pKa_1 = pH + \log[HA]/[A]$
		pH	[HA]	[A]			
1	0.20	4.58	0.0016	0.0004	4.00	0.6021	5.1621
2	0.40	4.80	0.0012	0.0008	1.50	0.1761	5.9761
3	0.60	5.04	0.0008	0.0012	0.67	-0.1739	4.8661
4	0.80	5.36	0.0004	0.0016	0.25	-0.6021	4.7579

$pKa_1 = 4.93805$

$Ka_1 = 1.153 \times 10^{-5}$

Determination of pKa₂ from Second Uffer Region in 40% Acetone

Temperature – 25ºC

Table –I-(a)-11

S. No.	Mole of NaOH per mole of Ligand	Stoichiometric Concentration			$\frac{[HA]}{[A]}$	$\frac{\log[HA]}{[A]}$	$pKa_1 = pH + \log[HA]/[A]$
		pH	[HA]	[A]			
1	0.20	9.36	0.0016	0.0004	4.00	0.6021	9.9621
2	0.40	9.74	0.0012	0.0008	1.50	0.1761	10.9161
3	0.60	10.04	0.0008	0.0012	0.67	-0.1739	9.8661
4	0.80	10.20	0.0004	0.0016	0.25	-0.6021	9.5979

$pKa_2 = 9.8555$

$Ka_2 = 1.460 \times 10^{-10}$

Temperature – 30ºC

Table –I-(a)-12

S. No.	Mole of NaOH per mole of ligand	Stoichiometric Concentration			$\frac{[HA]}{[A]}$	$\frac{\log[HA]}{[A]}$	$pKa_1 = pH + \log[HA]/[A]$
		pH	[HA]	[A]			
1	0.20	9.20	0.0016	0.0004	4.00	0.6021	9.8021
2	0.40	9.70	0.0012	0.0008	1.50	0.1761	9.8761
3	0.60	10.03	0.0008	0.0012	0.67	-0.1739	9.8561
4	0.80	10.18	0.0004	0.0016	0.25	-0.6021	9.5779

$pKa_2 = 9.77805$

$Ka_2 = 1.667 \times 10^{-10}$

Temperature – 35ºC

Table –I-(a)-13

S. No.	Mole of NaOH per mole of ligand	Stoichiometric Concentration			$\frac{[HA]}{[A]}$	$\frac{\log[HA]}{[A]}$	$pKa_1 = pH + \log[HA]/[A]$
		pH	[HA]	[A]			
1	0.20	9.00	0.0016	0.0004	4.00	0.6021	9.6021
2	0.40	9.65	0.0012	0.0008	1.50	0.1761	10.8261
3	0.60	10.02	0.0008	0.0012	0.67	-0.1739	9.8461
4	0.80	10.16	0.0004	0.0016	0.25	-0.6021	9.5579

$pKa_2 = 9.70805$

$Ka_2 = 1.958 \times 10^{-10}$

Summary of Dissociation Costant of TGA in 40% Acetone at Different Temperature

Table –I-(a)-14

Temperature – 25ºC

S. No.	Temperature	Dissociation Constants of TGA	
		Ka_1	Ka_2
1	25º C	$0.793x10^{-5}$	$1.460x10^{-10}$
2	30º C	$1.03x10^{-5}$	$1.667x10^{-10}$
3	35º C	$1.153x10^{-5}$	$1.958x10^{-10}$

Value of $\bar{n}$ and –log[A] at Different pH Value in 40% Acetone

Temperature – 25ºC

Table –I-(a)-15

S. No.	pH	Concentration of Ligand Bound x 10^{-3}	$\bar{n}$	–log[A]
1	4.8	0.10	0.250	8.23
2	5.0	0.20	0.500	7.93
3	5.4	0.30	0.750	7.38
4	5.5	0.35	0.875	7.26
5	5.7	0.40	1.000	7.02
6	5.8	0.45	1.125	6.92
7	6.0	0.50	1.250	6.71
8	6.2	0.55	1.375	6.50
9	6.4	0.60	1.500	6.31
10	6.5	0.70	1.750	6.23
11	6.8	0.75	1.875	5.94
12	7.2	0.80	2.000	5.56
13	7.5	0.90	2.250	5.29
14	8.0	0.95	2.375	4.82

Value of $\bar{n}$ and –log[A] at Different pH Value in 40% Acetone

Temperature – 30ºC

Table –I-(a)-16

S. No.	pH	Concentration of Ligand Bound x 10^{-3}	$\bar{n}$	–log[A]
1	4.8	0.20	0.500	8.12
2	5.0	0.25	0.625	7.82
3	5.2	0.30	0.750	7.55
4	5.4	0.35	0.875	7.30
5	5.5	0.40	1.000	7.19
6	5.6	0.45	1.125	7.08
7	5.7	0.50	1.250	6.97
8	6.0	0.55	1.375	6.65
9	6.2	0.60	1.500	6.45
10	6.5	0.70	1.750	6.17
11	6.7	0.75	1.875	5.98
12	7.0	0.80	2.000	5.70
13	7.2	0.90	2.250	5.54

Value of $\bar{n}$ and –log[A] at Different pH Value in 40% Acetone

Temperature – 35ºC

Table –I-(a)-17

S. No.	pH	Concentration of Ligand Bound x 10^{-3}	$\bar{n}$	–log[A]
1	4.40	0.10	0.250	8.67
2	4.50	0.15	0.375	8.51
3	4.60	0.20	0.500	8.35
4	4.70	0.25	0.625	8.20
5	5.90	0.30	0.750	7.74
6	5.20	0.35	0.875	7.48
7	5.40	0.40	1.000	7.23
8	5.50	0.45	1.125	7.12
9	5.70	0.50	1.250	6.90
10	5.80	0.55	1.375	6.80
11	6.00	0.60	1.500	6.59
12	6.20	0.70	1.750	6.41
13	6.70	0.75	1.875	5.91
14	7.00	0.80	2.000	5.61

Summary of log K_1, log K_2, K_1, K_2& $[A]_{\bar{n}-1/2}$ $[A]_{\bar{n}-3/2}$ in 40% Acetone Different Temperature

Table –I-(a)-18

S. No.	Temp.	log K_1	log K_2	K_1	K_2	$[A]_{\bar{n}-1/2}$	$[A]_{\bar{n}-3/2}$
1	25ºC	7.93	6.31	8.511×10^{7}	2.041×10^{6}	1.162×10^{-8}	0.488×10^{-6}
2	30ºC	8.12	6.45	1.318×10^{8}	2.818×10^{6}	0.745×10^{-8}	0.348×10^{-6}
3	35ºC	8.35	6.59	2.238×10^{8}	2.890×10^{6}	0.442×10^{-8}	2.52×10^{-7}

Determination of Stability Constant by Least Square Method in 40% Acetone at Different Temperature

Temperature – 25ºC

Table –I-(a)-19

S. No.	pH	$\bar{n}$	[A]	$Y = \frac{\bar{n}}{(\bar{n}-1)[A]}$	$X = \frac{(2-\bar{n})[A]}{(\bar{n}-1)}$	X2x10^{-16}	XY
1	4.8	0.250	0.583×10^{-8}	-0.5718×108^{8}	-1.36×10^{-8}	1.849	0.7776
2	5.0	0.500	1.162×10^{-8}	-0.8605×10^{8}	-3.486×10^{-8}	12.15	2.999
3	5.4	0.750	0.4157×10^{-7}	-7.218×10^{7}	-2.078×10^{-7}	431.8	14.99
4	5.5	0.875	0.547×10^{-7}	-12.81×10^{7}	-4.922×10^{-7}	2422	63.05
5	5.8	1.125	1.190×10^{-7}	7.563×10^{7}	8.328×10^{-7}	6935	62.98
6	6.0	1.250	1.94×10^{-7}	2.577×10^{7}	5.82×10^{-7}	3387	14.99
7	6.2	1.375	0.310×10^{-6}	11.82×10^{6}	0.5166×10^{-6}	2668	6.106
8	6.4	1.500	0.488×10^{-6}	6.147×10^{6}	0.488×10^{-6}	2381	2.999
9	6.5	1.750	0.577×10^{-6}	4.044×10^{6}	0.1922×10^{-6}	369	0.7772
10	6.8	1.875	1.129×10^{-6}	1.898×10^{6}	0.112×10^{-6}	259	0.3059

Σxy	=	169.97	a	=	5.1167×10^{7}
Σx	=	20.24×10^{-7}	b	=	1.4498×10^{14}
Σy	=	-21.82×10^{-7}	log K_1	=	7.70
Σx^2	=	$18866.799 \times 10^{-16}$	log K_2	=	6.46
n	=	10	log β	=	14.16

Determination of Stability Constant by Least Square Method in 40% Acetone at Different Temperature

Temperature – 30ºC

Table –I-(a)-20

S. No.	pH	$\bar{n}$	[A]	$Y = \frac{\bar{n}}{(\bar{n}-1)[A]}$	$X = \frac{(2-\bar{n})[A]}{(\bar{n}-1)}$	$X^2 x10^{-16}$	XY
1	4.8	0.500	$0.745x10^{-8}$	$-1.344x10^{8}$	$-2.35x10^{-8}$	5.52	3.1564
2	5.0	0.625	$1.48x10^{-8}$	$-1.126x10^{8}$	$-5.426x10^{-8}$	29.44	6.1090
3	5.2	0.750	$0.278x10^{-7}$	$-10.86x10^{7}$	$-1.39x10^{-7}$	193.20	15.0950
4	5.4	0.875	$0.499x10^{-7}$	$-14.04x10^{7}$	$-4.490x10^{-7}$	2016.00	63.0000
5	5.6	1.125	$0.827x10^{-7}$	$10.89x10^{7}$	$3.788x10^{-7}$	3350.00	63.0000
6	5.7	1.250	$1.050x10^{-7}$	$4.76x10^{7}$	$3.13x10^{-7}$	992.20	14.9900
7	6.0	1.375	$2.20x10^{-7}$	$1.666x10^{7}$	$3.666x10^{-7}$	1343.00	0.1000
8	6.2	1.500	$0.348x10^{-6}$	$8.620x10^{6}$	$0.3448x10^{-6}$	1211.00	2.9990
9	6.5	1.750	$0.664x10^{-6}$	$3.514x10^{6}$	$0.2213x10^{-6}$	489.00	0.7776
10	6.7	1.875	$1.024x10^{-6}$	$2.09x10^{6}$	$0.1462x10^{-6}$	213.00	0.3055

Σxy	=	175.534	a	=	6.567×10^{7}
Σx	=	13.1014×10^{-7}	b	=	2.6578×10^{14}
Σy	=	-30.861×10^{-7}	log K_1	=	7.81
Σx^2	=	9842.36×10^{-16}	log K_2	=	6.61
n	=	10	log β	=	14.42

Determination of Stability Constant by Least Square Method in 40% Acetone at Different Temperature

Temperature – 35ºC

Table –I-(a)-21

S. No.	pH	$\bar{n}$	[A]	$Y = \frac{\bar{n}}{(\bar{n}-1)[A]}$	$X = \frac{(2-\bar{n})[A]}{(\bar{n}-1)}$	$X^2 x10^{-16}$	XY
1	4.4	0.250	$0.209x10^{-8}$	$-1.595x10^{8}$	$-0.4876x10^{-8}$	0.2377	0.7777
2	4.5	0.375	$0.306x10^{-8}$	$-1.961x10^{8}$	$-0.7955x10^{-8}$	0.6328	1.5599
3	4.6	0.500	$0.442x10^{-8}$	$-2.262x10^{8}$	$-1.326x10^{-8}$	1.758	2.999
4	4.7	0.625	$0.629x10^{-8}$	$-2.650x10^{8}$	$-2.306x10^{-8}$	5.317	6.11
5	5.0	0.750	$1.78x10^{-8}$	$-1.685x10^{8}$	$-9.022x10^{-8}$	79.21	14.99
6	5.2	0.875	$3.30x10^{-7}$	$-2.121x10^{7}$	$-29.69x10^{-7}$	88140	62.97
7	5.5	1.125	$0.753x10^{-7}$	$11.95x10^{7}$	$5.270x10^{-7}$	2771	62.97
8	5.7	1.250	$1.25x10^{-7}$	$4.0x10^{7}$	$3.75x10^{-7}$	1400	15
9	5.8	1.375	$1.57x10^{-7}$	$2.335x10^{7}$	$2.616x10^{-7}$	684	6.1
10	6.0	1.500	$2.52x10^{-7}$	$1.190x10^{7}$	$2.52x10^{-7}$	635	2.99
11	6.2	1.750	$0.382x10^{-6}$	$6.108x10^{6}$	$0.1213x10^{-6}$	162	0.7775
12	6.7	1.875	$1.20x10^{-6}$	$1.785x10^{6}$	$0.1714x10^{-6}$	293	0.3059

Σxy	=	177.55	a	=	8.1283×10^{7}
Σx	=	13.928×10^{-7}	b	=	0.08727×10^{14}
Σy	=	-83.38×10^{-7}	log K_1	=	7.91
Σx^2	=	$94172.155 \times 10^{-16}$	log K_2	=	7.14
n	=	12	log β	=	15.05

Summary of Stability Constant Calculated by Least Square Method in 40% Acetone Medium at Different Temperature

Table –I-(a)-22

S. No.	Temp.	log K_1	log K_2	Log β
1	25º C	7.70	6.46	14.16
2	30º C	7.81	6.61	14.42
3	35º C	7.91	7.14	15.05

Summary of Stability Constant Calculated by Schroder's Covergence Formulas Method in 40% Acetone Medium at Different Temperature

Table –I-(a)-23

S. No.	Temp.	log K_1	log K_2	Log β
1	25º C	7.92	6.32	14.24
2	30º C	8.10	6.46	14.56
3	35º C	8.34	6.61	14.95

Summary of Stability Constant Calculated by Schroder's Convergence Formulas Method in 40% Acetone Medium at Different Temperature

Table –I-(a)-24

S. No.	Method	25º C			30º C			35º C		
		log K_1	log K_2	log β	log K_1	log K_2	log β	log K_1	log K_2	log β
1	Extension of Bjerrum's	7.93	6.31	14.24	8.12	6.45	14.57	8.35	6.59	14.94
2	Least Square	7.701	6.46	14.16	7.81	6.61	14.42	7.91	7.14	15.05
3	Schroder's Convergence formula	7.92	6.32	14.24	8.10	6.46	14.56	8.34	6.61	14.95
	Mean Value	7.85	6.36	14.21	8.01	6.50	14.51	8.20	6.78	14.88

Conclusion

The present investigation clearly reveals the formation of two complex species CoSA and $[Co(SA)_2]^{-2}$. The logarithms value of successive stability constant were found to be 7.90, 6.36 (at 25ºC), 8.01, 6.50 (at 30º C), 8.20, 6.78 (at 35º C) in 40% V/V Acetone medium. The value of ΔG_1, ΔG_2, ΔH, ΔS_1, ΔS_2, evaluated at 30º C is found to be -46.78 KJ mol^{-1}, -37.71 KJ mol^{-1}, -0.1029 KJ, +153.03 J/K, 124.12 in 40% V/V acetone medium.

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