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NOTE

Potentiometric Determination of Stability Constants of Rare-Earth Chelates of 1-phenyl-1-hydroxy-3-phenyl-2-thiourea

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Stability constants of the complexes of La(III), Pr(III), Nd(III), Sm(III), Dy(III), Tb(III) and Ho(III) with 1-phenyl-1-hydroxy-3-phenyl-2-thiourea (PHPT) have been determined potentiometrically in 65% (v/v) aqueous dioxane medium. The method of Bjerrum and Calvin, as modified by Irving and Rossotti has been used to find out the values of ñ and pL. The order of the stability constants was found to be:

Ho > Dy > Tb > Sm > Nd > Pr > La

In the present note, chelating ability of 1-phenyl-1-hydroxy-3-phenyl-2-thiourea (PHPT) towards some rare-earth ions have been studied potentiometrically[1] at 0.2 M ionic strength keeping temperature constant at 30°C.

The ligand (PHPT) has been prepared by reported method[2]. PHPT solution was prepared in freshly distilled dioxane. Solutions of metal perchlorates of La(III), Pr(III), Nd(III), Sm(III), Dy(III), Tb(III) and Ho(III) were prepared from their corresponding oxides (99% Johnson Mathey) and were standardised by conventional methods. Tetramethyl ammonium hydroxide (E. Merck) in 65% aqueous dioxane was used as titrant.

From the titration solutions the values of $\tilde{n}_H$ were calculated[2] at various pH-values. On plotting log $(\tilde{n}_H/1 - \tilde{n})$ vs pH, straight lines having intercept equal to pK and slope equal to unity were obtained. From the titration curve of solution (i), (ii) and (iii), ñ values of the metal complexes were determined at various pH values. From pK values and ñ values at different pH values, the corresponding values of pL were calculated.

The order of stability constant of the rare-earth chelates of PHPT is found to be : Ho > Dy > Tb > Sm > Nd > Pr > La. The stabilities from rare-earth chelates with PHPT show an increase in stability from La(III) to Ho(III) in agreement with increasing acidity. In general, $\log K_1 > \log K_2$ for given metal ion. In fact, the maximum ñ values observed in present experiment are $\simeq 2.0$ which support our assumption of 1 : 2 stiochiometry.

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TABLE 1

STABILITY CONSTANTS OF RARE-EARTH CHELATES OF PHPT AT 0.2 M ($NaClO_4$), TEMPERATURE 30° ± 0.5°C (H^+ – 10.30)

Stability Constants	La^{3+}	Pr^{3+}	Nd^{3+}	Sm^{3+}	Tb^{3+}	Dy^{3+}	Ho^{3+}
log K_1	8.20	8.41	8.55	8.61	8.84	9.20	9.31
log K_2	7.60	7.80	8.05	8.14	8.23	8.42	8.61
log β_2	15.90	16.21	16.60	16.75	17.07	17.62	17.25

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