

NOTE

Cathodic Reduction of Nd(III) *In-Situ* Complexes with Some Organic Acids on DME†

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In this note, we report the *in-situ* reduction of iminodiacetic acid (IDA), nitrilotriacetic acid (NTA) and diethylenetriamine pentaacetic acid (DTPA) complexes with neodymium(III) on mercury drop cathode. These form 1 : 1 complexes in each case with $\log \beta$ values 4.58, 5.01 and 5.39 respectively, which follows the order of $\text{IDA} < \text{NTA} < \text{DTPA}$. At $\text{pH} = 2.6 \pm 0.01$, for mixed system-ligand displacement technique has been revealed, 1 : 1 : 1 mixed complex formation of $[\text{Nd-IDA-NTA}] \log \beta_{11} = 5.23$ was computed. Under various experimental set-ups to search for pure and mixed complexation is in progress.

Key Words: *In-situ*, Nd(III) Complexes, Iminodiacetic acid, Nitrilotriacetic acid, Diethylenetriamine penta-acetic acid.

Amino acids have been extensively used for complex formation with various metals using spectrophotometric, pH-metric and potentiometric methods¹⁻⁵. Polarographic measurements have been successfully utilized for the determination of composition and stability constants of Nd(III) with iminodiacetic acid (IDA), nitrilotriacetic acid (NTA) and diethylenetriamine pentaacetic acid (DTPA). The present paper deals with the electrode behaviour of the complex formation, pure and mixed, along with the stability constant data as evaluated by Linganes⁶, Deford & Humes⁷ and Schaap and McMasters method⁸.

Stock solutions of 0.01 M each of iminodiacetic acid (Loba), nitrilotriacetic acid (BDH) and diethylenetriamine pentaacetic acid (Koch & Light) were prepared in double distilled water. The solution of Nd(III) was prepared by dissolving a calculated quantity of the metal oxide in minimum quantity of dilute HCl (AnalaR). The metal solution was standardized by EDTA method⁹. 0.2 M potassium chloride and 0.1% gelatin solution were prepared in distilled water. For complexation studies ligand concentration was varied from 0.00025 to 0.003 mMol dm³. Dil. HCl/NaOH were used to fix the pH value at 2.60 ± 0.01 . Current-voltage curves were obtained by using Elico pen recording polarograph CL-25 D with recorder-101 P.

Nd(III) gives a well defined reversible reduction wave¹⁰ in 0.1 M KCl plus

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0.01% gelatin at pH 2.6. The reductions of Nd(III) and its complexes with IDA, NTA and DTPA were found to be diffusion controlled with three electron reversible reduction. At pH 2.6 the halfwave potential of Nd(III) shifted to more negative values on increasing the concentration of ligands. A Lingane⁶ treatment of the data revealed 1 : 1 complexes of Nd(III) with each of the three ligands IDA, NTA, DTPA. The metal-ligand ratio and the values of stability constants are reported in following Table-1.

TABLE-1
STABILITY CONSTANTS OF Nd(III) COMPLEXES

1.	Nd(III)-IDA	$\log \beta = 4.58$
2.	Nd(III)-NTA	$\log \beta = 5.01$
3.	Nd(III)-DTPA	$\log \beta = 5.39$
4.	Nd(III)-IDA-NTA	$\log \beta_{11} = 5.23$

It is clear from the data that the metal-ligand stability constant for the three amino acids under examination follows the order of IDA < NTA < DTPA which is in agreement with the results reported by Schwarzenbach and Biedermann¹¹. The increased value of metal-ligand stability constants in the said order may be explained on the basis of the presence of number of acetic acid groups respectively. Attempts are also being made to search for pure and mixed complexes formed *in situ*. McMaster method⁸ revealed 1 : 1 complex in [Nd-IDA-NTA] system with stability constant 5.23.

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