

Vol III Issue X April 2014

ISSN No :2231-5063

International Multidisciplinary Research Journal

Golden Research Thoughts

Chief Editor
Dr.Tukaram Narayan Shinde

Publisher
Mrs.Laxmi Ashok Yakkaldevi

Associate Editor
Dr.Rajani Dalvi

Honorary
Mr.Ashok Yakkaldevi

Welcome to GRT

RNI MAHMUL/2011/38595

ISSN No.2231-5063

Golden Research Thoughts Journal is a multidisciplinary research journal, published monthly in English, Hindi & Marathi Language. All research papers submitted to the journal will be double - blind peer reviewed referred by members of the editorial board. Readers will include investigator in universities, research institutes government and industry with research interest in the general subjects.

International Advisory Board

Flávio de São Pedro Filho Federal University of Rondonia, Brazil	Mohammad Hailat Dept. of Mathematical Sciences, University of South Carolina Aiken	Hasan Baktir English Language and Literature Department, Kayseri
Kamani Perera Regional Center For Strategic Studies, Sri Lanka	Abdullah Sabbagh Engineering Studies, Sydney	Ghayoor Abbas Chotana Dept of Chemistry, Lahore University of Management Sciences[PK]
Janaki Sinnasamy Librarian, University of Malaya	Catalina Neculai University of Coventry, UK	Anna Maria Constantinovici AL. I. Cuza University, Romania
Romona Mihaila Spiru Haret University, Romania	Ecaterina Patrascu Spiru Haret University, Bucharest	Horia Patrascu Spiru Haret University, Bucharest,Romania
Delia Serbescu Spiru Haret University, Bucharest, Romania	Loredana Bosca Spiru Haret University, Romania	Ilie Pinteau, Spiru Haret University, Romania
Anurag Misra DBS College, Kanpur	Fabricio Moraes de Almeida Federal University of Rondonia, Brazil	Xiaohua Yang PhD, USA
Titus PopPhD, Partium Christian University, Oradea,Romania	George - Calin SERITAN Faculty of Philosophy and Socio-Political Sciences AL. I. Cuza University, IasiMore

Editorial Board

Pratap Vyamktrao Naikwade ASP College Devrukh,Ratnagiri,MS India	Iresh Swami Ex - VC. Solapur University, Solapur	Rajendra Shendge Director, B.C.U.D. Solapur University, Solapur
R. R. Patil Head Geology Department Solapur University,Solapur	N.S. Dhaygude Ex. Prin. Dayanand College, Solapur	R. R. Yaliker Director Managment Institute, Solapur
Rama Bhosale Prin. and Jt. Director Higher Education, Panvel	Narendra Kadu Jt. Director Higher Education, Pune	Umesh Rajderkar Head Humanities & Social Science YCMOU,Nashik
Salve R. N. Department of Sociology, Shivaji University,Kolhapur	K. M. Bhandarkar Praful Patel College of Education, Gondia	S. R. Pandya Head Education Dept. Mumbai University, Mumbai
Govind P. Shinde Bharati Vidyapeeth School of Distance Education Center, Navi Mumbai	Sonal Singh Vikram University, Ujjain	Alka Darshan Shrivastava Shaskiya Snatkottar Mahavidyalaya, Dhar
Chakane Sanjay Dnyaneshwar Arts, Science & Commerce College, Indapur, Pune	G. P. Patankar S. D. M. Degree College, Honavar, Karnataka	Rahul Shriram Sudke Devi Ahilya Vishwavidyalaya, Indore
Awadhesh Kumar Shirotriya Secretary,Play India Play,Meerut(U.P.)	Maj. S. Bakhtiar Choudhary Director,Hyderabad AP India.	S.KANNAN Annamalai University,TN
	S.Parvathi Devi Ph.D.-University of Allahabad	Satish Kumar Kalhotra Maulana Azad National Urdu University
	Sonal Singh, Vikram University, Ujjain	

Address:-Ashok Yakkaldevi 258/34, Raviwar Peth, Solapur - 413 005 Maharashtra, India
Cell : 9595 359 435, Ph No: 02172372010 Email: ayisrj@yahoo.in Website: www.aygrt.isrj.net



CORROSION INHIBITION EFFECT OF DPDS-LANTHANIDE COMPLEXES ON MILD STEEL IN NITRIC ACID

Kavita Kendre , Girish Pande , Rajewar Vaishali and Pingalkar S. R.

Department of Chemistry, Yeshwant College, N.S.B. College, Science College, NANDED, (M.S.)

Abstract:-Addition of corrosion inhibitors is one of the widely used methods to control corrosion. In this work, an attempt has been made to explore the possibility of using 2,2'-dipyridyl disulphide (DPDS) complex as an inhibitor on mild steel in 0.2 M HNO₃. The inhibition efficiency of DPDS complex has been evaluated by conventional weight loss method and thermodynamic parameter studies. Experimental results are fitted to various adsorption isotherms. The result reveal that DPDS acts as an effective inhibitor around 90% of I.E. in HNO₃ media.

Keywords:Corrosion, inhibitor, DPDS complexes mild steel.

INTRODUCTION

Most large structures in industries are made by steel owing to its cheapness, availability and strength. In corrosive environments mild steel is susceptible to corrosion attack and the losses incurred due to corrosion.

Most of the acid inhibitors are organic compounds nitrogen, sulphur and oxygen atoms. It has been reported that many heterocyclic compounds containing heteroatoms like N, O, S have been proved to be effective inhibitor for the corrosion of steel in acidic solution has been investigated by several authors. The inhibition property of these compounds is attributed to their molecular structure. The planarity and lone pairs of electron on the heteroatoms are important features that determine the adsorption of these molecules on the metallic surface. They can adsorb on the metal surface, block the active sites on the surface and there by reduce the corrosion rate.

The aim of this work is to investigate the role played by newly synthesized 2,2'-dipyridyl disulphide (DPDS) complexes with lanthanide on the corrosion of mild steel in 0.2 M nitric acid. Using DPDS complexes various study using DPDS complexes is a new methodology though its synthesis already exists. Since the work on the corrosion inhibition of mild steel is not expensive, an attempt was made to examine the inhibitive action of mild steel in acidic solutions.

RESULT AND DISCUSSION :

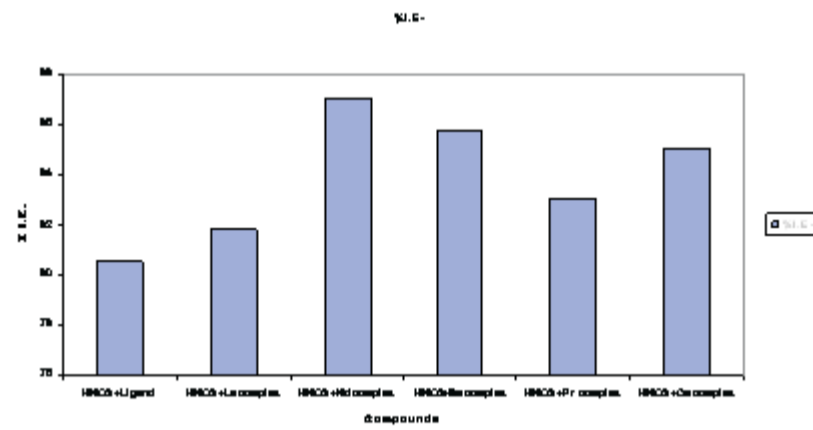
Weight loss measurement :

Weight of metal wire pieces before and after dipping in corrosion solution, loss in weight, % of I.E. was calculated by usual method. The % of I.E. were calculated by following formula

$$P = \left(\frac{w_u - w_i}{w_u} \right) \times 100$$

Table No. 1 : % Inhibition Efficiency of metal complexes

Beaker No.	compound	Initial wt. gm.	Final wt. gm.	Loss in wt gm	% IE
1.	Control	0.830	0.676	0.154	-
2.	HNO ₃ + Ligand	0.791	0.761	0.030	80.51
3.	HNO ₃ + La complex	0.845	0.817	0.028	81.81
4.	HNO ₃ + Nd complex	0.847	0.823	0.024	87.01
5.	HNO ₃ + Sm complex	0.834	0.812	0.222	85.77
6.	HNO ₃ + Pr complex	0.847	0.821	0.226	83.11
7.	HNO ₃ + Ce complex	0.831	0.808	0.023	85.06



From data it can be seen that, the Nd, Sm, Ce, and Pr have maximum inhibition efficiencies than La complex and free ligand. The ligand shows the least inhibitor efficiency.

2.Free energy of Adsorption :

The values of free energies of adsorption (ΔG_a) were calculated with the help of following equation as¹.

$$\log C = \log \left(\frac{\theta}{1-\theta} \right) - \text{Log} B$$

Where, $\log B = -1.74 \times (\Delta G_a / 2.303RT)$, C = Inhibitor concentration and $\theta = \left(\frac{w_u - w_i}{w_i} \right) \times 100$ is the fraction of metal surface covered by the inhibitors.

Table No. 2 : Calculation of ΔG_a values

Sr. No.	Concentration	θ	$\log\left(\frac{\theta}{1-\theta}\right)$	Log B	ΔG_a
1	-	-	-	-	-
2	0.0002723	4.13	-0.05667	2.50828	-8335.43
3	0.0009725	4.50	-0.1091	2.9029	-9647.03
4	0.0009673	5.40	-0.09691	2.9174	-9695.20
5	0.0009580	6.10	-0.07918	2.9394	-9768.31
6	0.0009725	4.90	-0.09912	2.9129	-9680.25
7	0.0009738	5.60	-0.08539	2.9261	-9724.11

The free energy of adsorption of Ce complex is maximum compared to free energy of adsorption of Pr, Nd, and La and free ligand.

3. CORROSION RATE AND ENERGY OF ACTIVATION :

The corrosion rate in $\text{gm cm}^{-2} \text{h}^{-1}$ was calculated from the following formula as³.

$$\rho = \frac{\Delta W}{At}$$

Where ΔW is the weight loss, A is the total area of the wire and t is the immersion time. The relationship between the corrosion rate (ρ) and temperature (T) in acid medium is given by Arrhenius equation as.

$$\log \rho = \log A - \frac{E_a}{2.303RT}$$

Or

$$E_a = 2.303RT \log \frac{A}{\rho}$$

Where E_a is the apparent activation energy, R is the molar gas constant and T is the absolute temperature.

Table No. 3 : Values of corrosion rate and Energy of activation

Sr. No.	ρ	E_a (KJ mol ⁻¹)
1	-	-
2	0.000317	32497.25
3	0.000296	31827.43
4	0.000250	32251.45
5	0.000230	32460.85
6	0.000279	32012.65
7	0.000243	32322.77

Results of corrosion rate and energy of activation also show similar trends as that for % I.E.

4. ENTHALPY OF ADSORPTION AND ENTROPY OF ADSORPTION :

The enthalpy of adsorption (ΔH^0_{ads}) and entropy of adsorption (ΔS^0_{ads}) were calculated using the following equation as.

$$\Delta H^0_{ads} = E_a - RT, \quad \Delta S^0_{ads} = \frac{\Delta H_{ads} - \Delta G_{ads}}{T}$$

Table No. 4 : ΔH^0_{ads} and ΔS^0_{ads}

Sr. No.	ΔH^0_{ads} (kJ mol ⁻¹)	ΔS^0_{ads} (J mol ⁻¹ k-1)
1	-	-
2	29144.340	124.1050
3	29316.602	129.01860
4	29470.627	130.5822
5	29950.022	132.3940
6	29501.390	129.7420
7	29811.942	130.9140

Complexes shows maximum enthalpy of adsorption as compared to Pr, La and Free ligand. While Sm, Ce, Nd have maximum entropy of adsorption as compared to Pr, La and free ligand.

CONCLUSION :

2,2'-dipyridyl disulphide (DPDS) complexes exhibits maximum efficiency towards corrosion inhibition of mild steel in 0.2 M HNO₃ media even at a very low concentration. The inhibition of corrosion by DPDS complexes is due to the physical adsorption on the metal surface. It is apparent from the molecular structures that these compounds are able to get adsorbed on the metal surface through π electrons of aromatic ring and lone pair of electrons of N, O and S atoms.

REFERENCES :

1. P.S. Desai, R.T. Vashi: Efficiency of Xylenol Orange as corrosion inhibitor for Aluminium in trichloroacetic acid: Indian Journal of Chemical Technology Vol.17, January 2010 : 50-55.
2. B.Zerga, B.Hammouti, M.Ebn Touhami, R.Touir, M.Taleb, M.Sfaira, M.Bennajeh, I.Forssal : Comparative inhibition study of new synthesized pyridazine derivatives towards mild steel corrosion in hydrochloric acid. Part II: Thermodynamic Properties. Int. J. Electrochemical Sci, 7 (2012) 471-483.
3. I.B.Obot, E.E.Ebenso, I.A.Akpan, Z.M.Gasem, Ayo S.Afolabi: Thermodynamic and density functional theory investigation of sulphathiazole as green corrosion inhibitor at mild steel/ HCl interface. Int. J. Electrochem. Acta Vol. 7, (2012) 1978-1996.

Publish Research Article International Level Multidisciplinary Research Journal For All Subjects

Dear Sir/Mam,

We invite unpublished Research Paper, Summary of Research Project, Theses, Books and Book Review for publication, you will be pleased to know that our journals are

Associated and Indexed, India

- * International Scientific Journal Consortium
- * OPEN J-GATE

Associated and Indexed, USA

- EBSCO
- Index Copernicus
- Publication Index
- Academic Journal Database
- Contemporary Research Index
- Academic Paper Database
- Digital Journals Database
- Current Index to Scholarly Journals
- Elite Scientific Journal Archive
- Directory Of Academic Resources
- Scholar Journal Index
- Recent Science Index
- Scientific Resources Database
- Directory Of Research Journal Indexing

Golden Research Thoughts
258/34 Raviwar Peth Solapur-413005, Maharashtra
Contact-9595359435
E-Mail-ayisrj@yahoo.in/ayisrj2011@gmail.com
Website : www.aygrt.isrj.net