Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2013, 5(10):272-275

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Role of 2-amino 5-bromo pyridine (ABPY) and its metal ion chelates as corrosion inhibitors

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ABSTRACT

Corrosion inhibition study of 2-Amino 5-Bromo Pyridine(ABPY) & its Metal ion Chelates on mild steel in different acidic media (0.1N HNO_3,0.1N H_2SO_4 and 0.1 N HCl) has been studied by weight loss technique. Certain metal ion chelates act as corrosion inhibitors. Various experiments were conducted to study the inhibition efficiency of 2-Amino 5-Bromo pyridine (ABPY) and its metal ion chelates. The inhibition efficiency was obtained in and 2-Amino 5-Bromo pyridine (ABPY) and its metal ion chelates.

Key words: Corrosion, inhibition, mild steel, Metal ion Chelates.

INTRODUCTION

Corrosion is the process of breaking down or destruction of a material, especially a metal, through chemical reactions. The most common form of corrosion is rusting, which occurs when iron combines with oxygen and water .Iron is used in the form of stainless steel for making cutlery ,hospital and food service equipment .It is the most common chepest and versatile metal used in industry[1]. The use of corrosion inhibitor is one of the most effective measures for protecting metal surfaces against corrosion in acidic environments[2]. The inhibiting action of these compounds is attributed as a first stage, to the adsorption of the additives to the metal/solution interface. The adsorption process depends upon the nature and surface charge of the metal, the type of aggressive media, the structure of the inhibitor and the nature of its interaction with the metal surface[3]. Some heterocyclic compounds as corrosion inhibitors for mild steel in acidic medium[4,5].The use of inhibitors is one of the most practical methods for protection against corrosion[6-7].Amino acids complex with metals like Zn, Cu, CO ,Fe, Cr find wide spread use of corrosion inhibitors because they are non toxic[8-12]. Adsorption of the inhibitor molecules mainly depends on the charge and nature of the metal surface , electronic characteristics of the metal surface, temperature, adsorption of the solvent, ionic species and the electrochemical potential at the solution interface[13]. Corrosion is the slowest process responsible for damage the metallic materials .The process of corrosion is harmful and it is essential to protect metals from corrosion. The inhibitor which are used on metal surface which avoid direct contact between metal and medium .The present investigation is to study corrosion inhibition effect 2-Amino 5-Bromo pyridine (ABPY)and its metal ion chelates on mild steel in 0.1N HNO_3,0.1N H_2SO_4 and 0.1 N HCl .

EXPERIMENTAL SECTION

Mild steel wire were used for weight loss measurements. All weight loss experiments were carried out 72 hours the immersion time. All the solutions were prepared in distilled water. AR grade chemicals were used for this study.

Iron wire is used to study the inhibition effect of chelating agent and metal ion chelates. Steel binding wire was purchased from local market. All the wires were cleaned by regmal paper and washed with distilled water. After cleaning the wire was dried in an oven at 120^0c for about an one hour .The binding wire was cut into small pieces having length about 6 inch. The standard 0.1N solution of Nitric acid,0.1N solution of Sulphuric acid and 0.1N solution of Hydrochloric acid were prepared in distilled water .In this experiment arrange 24 beakers and labeled from 1-24.In beaker no. 1 to 8 add 20 ml 0.1N HNO_3 solution in each beaker. Beaker no 1.contain 0.1N HNO_3(control) beaker no.2 contains 20 ml HNO_3 along with 20 mg of ligand 2-Amino 5-Bromo pyridine (ABPY) and in beaker no. 3,4,5,6,7&8 contains 20 ml of HNO_3 solution along with 20 mg Cr(III)ABPY Chelate, Mn(II)ABPY Chelate , CO(II)ABPY Chelate, Ni(II)ABPY Chelate , Cu(II)ABPY Chelate were added respectively in each beaker. Beaker no 9.contain 0.1N $H2_SO_4$(control),beaker no.10 contains 20ml H_2SO_4 along with 20 mg of ligand 2-Amino 5-Bromo pyridine (ABPY) and in beaker no. 11,12,13,14,15&16 contains 20ml of H_2SO_4 solution along with 20 mg Cr(III)ABPY Chelate , Mn(II)ABPY Chelate ,Fe(II)ABPY Chelate, CO(II)ABPY Chelate, Ni(II)ABPY Chelate in Cu(II)ABPY Chelate were added in each beaker. Beaker no.17 containing 20 ml 0.1N HCl(control),beaker no.18 contains 20 ml 0.1N HCl along with 20 mg of ligand 2-Amino 5-Bromo pyridine (ABPY) and in beaker no. 19,20,21,22,23&824 contains 20 ml of 0.1N HCl solution along with 20 mg Cr(III)ABPY Chelate ,Mn(II)ABPY Chelate , Fe(II)ABPY Chelate , CO(II)ABPY Chelate ,Ni(II)ABPY Chelate, Cu(II)ABPY Chelate were added were added. The previously weighed binding wire were dipped in each solution for 72 hours. After 72 hours the binding wires were removed from beaker the binding wire were cleaned by reghmal paper and washed with distilled water.The weight of each wire were determined by digital electronic balance. A corrosion inhibitor is a chemical substance that, when added in small concentration to an environment, effectively decreases the corrosion rate. The efficiency of that inhibitor is thus expressed by a measure of this improvement. Relation used to determine I.E.

$$\text{I.E.} = \frac{Wu - Wi}{Wu} \times 100$$

Where,
I.E. = Inhibition efficiency
Wi = Loss in weight in inhibitor solution
Wu = weight loss in control solution

RESULTS AND DISCUSSION

Table No.1 corrosion inhibition effect 2-Amino 5-Bromo pyridine (ABPY) metal ion chelates on mild steel in 0.1N HNO_3 solution

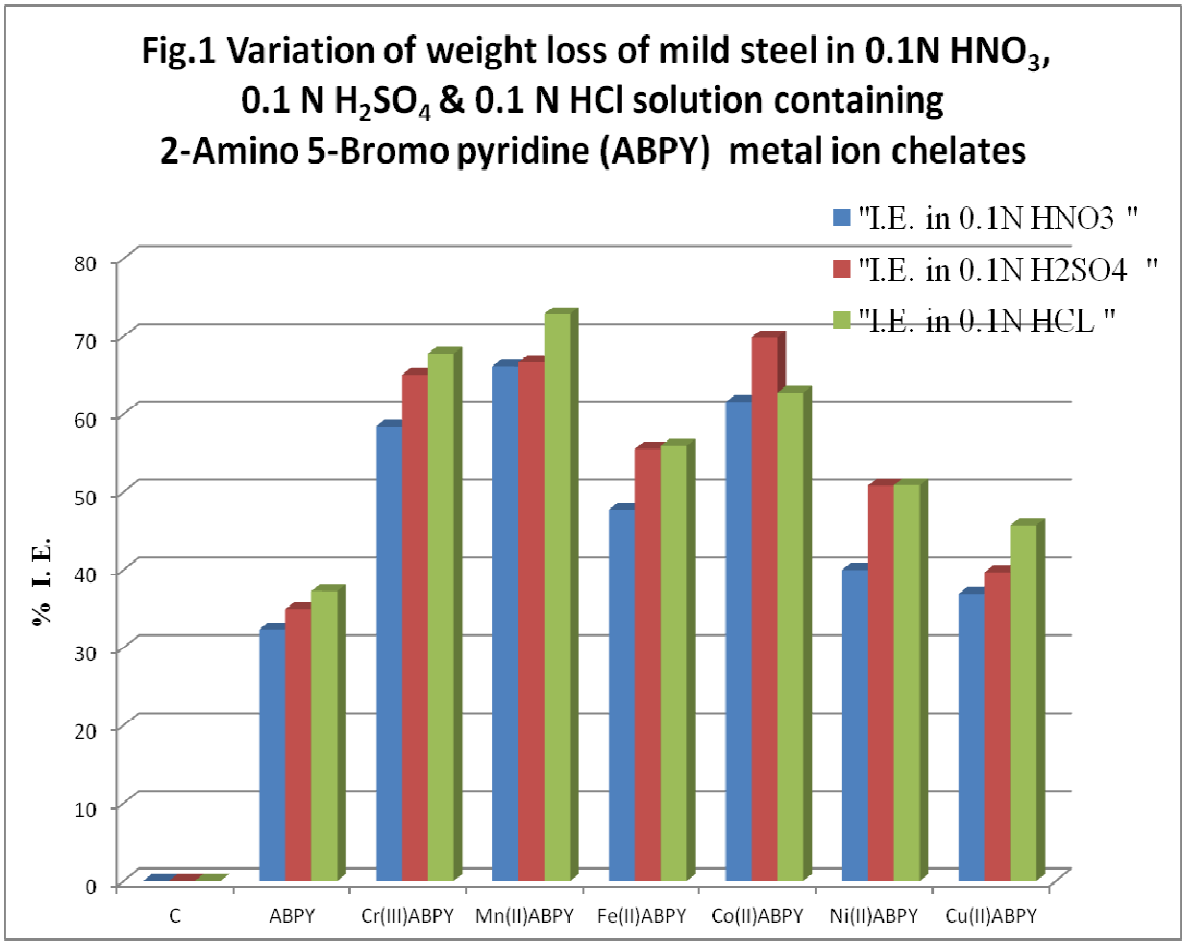
Beaker No.	Compound	Initial weight	Final weight	Loss in weight	%Loss in weight	I.E.
1	Control(HNO_3)	0.760	0.695	0.065	8.55	--
2	HNO_3+ABPY	0.742	0.698	0.044	5.92	32.30
3	HNO_3+Cr(III)ABPY Chelate	0.875	0.848	0.027	3.08	58.46
4	HNO_3+Mn(II)ABPY Chelate	0.728	0.706	0.022	3.02	66.15
5	HNO_3+Fe(II)ABPY Chelate	0.729	0.695	0.034	4.66	47.69
6	HNO_3+Co(II)ABPY Chelate	0.750	0.725	0.025	3.33	61.53
7	HNO_3+Ni(II)ABPY Chelate	0.749	0.710	0.039	5.20	40.00
8	HNO_3+Cu(II)ABPY Chelate	0.843	0.802	0.041	4.86	36.92

Table No.2 corrosion inhibition effect 2-Amino 5-Bromo pyridine (ABPY)metal ion chelates on mild steel,0.1N H_2SO_4solution

Beaker No.	Compound	Initial weight	Final weight	Loss in weight	%Loss in weight	I.E.
9	Control(H_2SO_4)	0.742	0.679	0.063	8.49	-
10	H_2SO_4+ABPY	0.766	0.725	0.041	5.35	34.92
11	H_2SO_4+Cr(III)ABPY Chelate	0.760	0.738	0.022	2.89	65.07
12	H_2SO_4+Mn(III)ABPY Chelate	0.846	0.825	0.021	2.48	66.66
13	H_2SO_4+Fe(III)ABPY Chelate	0.829	0.801	0.028	3.37	55.55
14	H_2SO_4+Co(II)ABPY Chelate	0.732	0.713	0.019	2.59	69.84
15	H_2SO_4+Ni(II)ABPY Chelate	0.705	0.674	0.031	4.39	50.79
16	H_2SO_4+Cu(II)ABPY Chelate	0.762	0.724	0.038	4.98	39.68

Table No. 3 Corrosion inhibition effect 2-Amino 5-Bromo pyridine (ABPY) metal ion chelates on mild steel 0.1N HCl solution

Beaker No.	Compound	Initial weight	Final weight	Loss in weight	%Loss in weight	I.E.
17	Control(HCl)	0.784	0.725	0.059	7.52	-
18	HCl+ABPY	0.685	0.648	0.037	5.40	37.28
19	HCl +Cr(III)ABPY Chelate	0.789	0.770	0.019	2.40	67.79
20	HCl +Mn(II)ABPY Chelate	0.830	0.814	0.016	1.92	72.88
21	HCl +Fe(II)ABPY Chelate	0.755	0.729	0.026	3.44	55.93
22	HCl +Co(II)ABPY Chelate	0.780	0.758	0.022	2.82	62.71
23	HCl +Ni(II)ABPY Chelate	0.770	0.741	0.029	3.76	50.84
24	HCl +Cu(II)ABPY Chelate	0.765	0.733	0.032	4.18	45.76



The use of inhibitors is one of the most practical methods for protection against corrosion. To study inhibition efficiency the 2-Amino 5-Bromo pyridine (ABPY) and their metal ion chelates are used on mild steel in different acidic solution . Corrosion inhibition effect of 2-Amino 5-Bromo Pyridine(ABPY) metal ion chelates on mild steel in different acidic media 0.1N HNO_3,0.1N H_2SO_4 and 0.1 N HCl solution has been assessed using weight loss technique.

The effect of ligand ABPY and their metal ion chelates are recorded in the above table and represented in graph. The results indicates that the metal ion chelates are good inhibitors .The chelating agent 2-Amino 5-Bromo pyridine (ABPY) inhibit the corrosion action of 0.1N Nitric acid,0.1N Sulphuric acid & 0.1N Hydrochloric acid .It is found that the inhibition efficiency of chelating agent 2-Amino 5-Bromo pyridine (ABPY) is less as compaired to other metal ion chelates. For the study of Inhibition Efficiency the Cr(III), Mn(II), Fe(II), ,Co(II),Ni(II),Cu(II), 2-Amino 5-Bromo pyridine (ABPY) metal ion chelate were used for study. In nitric acid medium the inhibition efficiency of chelating agent 2-Amino 5-Bromo pyridine (ABPY) is less as compaired to other metal ion chelate .It is found

that Mn(II)ABPY metal ion chelate act as inhibitor as compaired to other metal ion chelates .Co(II)ABPY metal ion chelate have slightly less inhibition efficiency than Mn(II)AMPY metal ion chelate but more than Cr(III)ABPY metal ion chelate, Fe(II)ABPY metal ion chelate, Ni(II)ABPY metal ion chelate, Cu(II)ABPY metal ion chelate. The inhibition efficiency were found slightly more in Co(II)ABPY metal ion chelate than Mn(II)AMPY metal ion, Cr(III)ABPY metal ion chelate in Sulphuric acid medium. The 2-Amino 5-Bromo pyridine (ABPY) is an chelating agent it inhibits the corrosion action of Hydrochloric acid. The result shows that the inhibition efficiency of 2-Amino 5-Bromo pyridine (ABPY) is less than the metal ion chelates. The results indicates that Mn(II)ABPY metal ion chelate act as good corrosion inhibitor in Hydrochloric acid medium. The inhibition efficiency of Cr(III)ABPY metal ion chelate is 67.79 which is higher than the remaining metal ion chelates.

CONCLUSION

The results indicates that the inhibition efficiency of chelating agent 2-Amino 5-Bromo pyridine(ABPY) and Cr(III)ABPY metal ion chelate, Mn(II)ABPY metal ion Chelate, Fe(II)ABPY metal ion chelate, Co(II)ABPY metal ion chelate, Ni(II)ABPY metal ion chelate &Cu(II)ABPY metal ion chelate have inhibition property in 0.1N HNO_3,0.1N H_2SO_4 and 0.1 N HCl acidic media. The nitric acid itself is strong oxidizing agent therefore it oxidizes metal. But by the addition of certain organic compounds and the metal ion chelates oxidizing power of nitric acid retards but retardation is not same this way may be due to corrosion inhibition efficiency of organic compound and metal ion chelate. The performance of this organic compound and metal ion chelates as an inhibitor in both the acids is very much encouraging. The efficiency of corrosion inhibition by these chelating agent and metal ion chelates depends on their adsorption behavior of metal surface.

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