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Research Article

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Corrosion a universal environmental Problem: a role of Schiff base metal complexes as inhibitors

Suraj B. Ade[1], M. N. Deshpande[2] and D. G. Kolhatkar[2]

[1]Department of Chemistry, Shri Shivaji College, Parbhani, India
[2]P.G.Department of Chemistry, NES, Science College, Nanded, India

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ABSTRACT

The weight loss technique has been used to study the corrosion inhibition of mild steel in 0.1N HNO_3 acidic medium by the Schiff base 4-Chloro-2-(2-oxo-1, 2-dihydro-indol-3-ylidene amino)-benzoic acid (ACBAI) and their Titanium (IV), Zirconium (IV), Cadmium (II) and Mercury (II) metal complexes. Thus, inhibition efficiency was obtained of Schiff base and its metal complexes. The phenomenon of chemical adsorption form thin film on the surface of the material that stops access of the corrosive substance to the metal which increases in its inhibition efficiency.

Keywords: Corrosion, Inhibition, Mild steel, Nitric acid.

INTRODUCTION

Corrosion is the destructive attacks of metals by its environment. The spontaneous destruction of metal due to heterogeneous chemical reaction is the chemical corrosion [1]. Various micro-organisms effects on metal are known as biochemical corrosion [2]. Due to electro chemical corrosion, there affects huge economical loss of metal [3]. The corrosion inhibition is a surface which involves the adsorption of the organic compounds on metal surface [4]. Many organic compounds containing oxygen, nitrogen and sulphur have been studied as corrosion inhibitors for metal. Corrosion inhibitors are of great practical importance, being extensively employed in minimizing metallic waste in engineering material [5].

Hetero atoms such N, O, S and some cases Se and P are capable of forming coordinate-covalent bond with metals owing to their free electron pairs [6]. Compounds with π-bonds also generally exhibit good inhibitive properties due to interaction of π-orbital with the metal surface [4]. Schiff base with –CH=N– linkage (azomethine) have both the above features combined with their structure which make them effective potential corrosion inhibitors [7, 8]. Several Schiff base metal complexes have been investigated as corrosion inhibitors [9, 10].

This present papers deals with the study of the inhibitory action of a Schiff base, 4-Chloro-2-(2-oxo-1, 2-dihydro-indol-3-ylidene amino)-benzoic acid (ACBAI) and their metal complexes on mild steel in 0.1N HNO_3 acid solutions.

EXPERIMENTAL SECTION

Material preparation

Iron wire is used to study the inhibition effect of chelating agent and metal chelate. Steel binding wire was purchased from the local market. First of all wire is cleaned by sand paper, and then it is washed by cleaning solution later on by distilled water. After cleaning the wire it was dried by keeping in oven at 120℃ for one hour. After the preparation of the mixture solution in different labeled beakers.

In the first beaker 0.1N 20ml HNO_3, was labeled as 1 for control system. Beaker number 2 along with 20ml 0.1 HNO_3, 25mg (ACBAI) was added. In labeled beakers number 3, 4, 5 and 6, 0.1N 20ml HNO_3 along with 25mg of [Ti(IV) ACBAI], [Zr(IV) ACBAI], [Cd(II) ACBAI] and [Hg(II) ACBAI] complexes were added respectively. The previously weighed steel wire was dipped for 48 hours.

After 48 hours the wire pieces were taken out from the beaker, pieces were washed with distilled water and dried. The weight of each wire was determined by using electronic balance in gram and they were record in table.

The 4-Chloro-2-(2-oxo-1, 2—dihydro-indol-3-ylidene amino)-benzoic acid (ACBAI) used as inhibitor was newly synthesized.

WEIGHT LOSS MEASUREMENT

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

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

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

The corrosion rates in mmpy (milli meter per year) are expressed as in [11, 12].

$$\text{Corrosion rate (mmpy)} = \frac{\Delta M \times 87.6}{A \times D \times T}$$

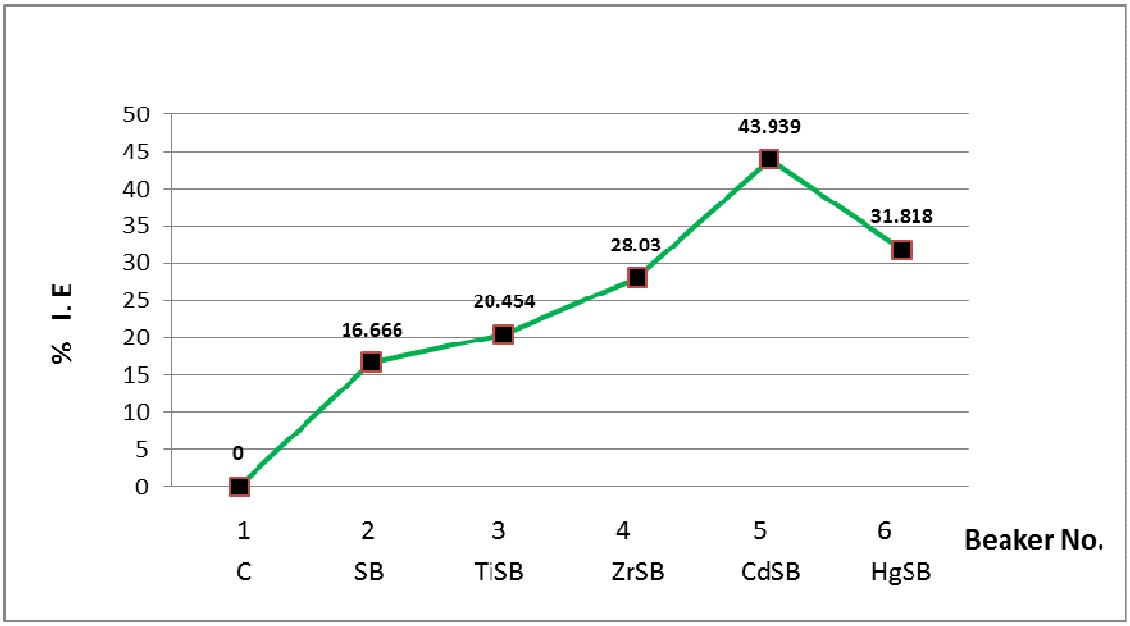
Where,
ΔM is the weight loss of specimen in mg,
A is the area of exposure of specimen in square cm
T is the time in hours
D is the density of specimen in gm/cm^3

RESULTS AND DISCUSSION

Effect of 4-Chloro-2-(2-oxo-1, 2-dihydro-indol-3-ylidene amino)-benzoic acid (ACBAI) and their metal complexes on corrosion.

Beaker No.	Compound	Initial Weight	Final Weight	Loss in Weight	% Loss in Weight	I.E.
1	Control (HNO_3)	0.417	0.285	0.132	31.654	-
2	HNO_3 + ACBAI	0.423	0.313	0.110	26.004	16.666
3	HNO_3 + [Ti(IV) ACBAI]	0.409	0.304	0.105	25.672	20.454
4	HNO_3 + [Zr(IV) ACBAI]	0.428	0.333	0.095	22.196	28.030
5	HNO_3 + [Cd(II) ACBAI]	0.415	0.341	0.074	17.831	43.939
6	HNO_3 + [Hg(II) ACBAI]	0.418	0.328	0.090	21.531	31.818

Figure 1: Variation of weight loss of mild steel in 0.1N HNO_3 solution containing Schiff base (ACBAI) and their Ti(IV), Zr(IV), Cd(II) and Hg(II) complexes



0.1N HNO_3 is used as oxidizing agent for metal corrosion. The Schiff base (ACBAI) and their Ti(IV), Zr(IV), Cd(II) and Hg(II) metal complexes used to study inhibition efficiency. Effect of ligand and their metal ion complexes are recorded in table and also represented in graph. The results of percentage inhibition efficiency indicate that [Cd(II) ACBAI] complex is good inhibitors. [Ti(IV) ACBAI], [Zr(IV) ACBAI], and [Hg(II) ACBAI] complexes have less inhibition efficiency.

The inhibitive property of (ACBAI) Schiff base metal complexes accounts for blanket preventing mild steel from coming in contact with acidic and the corrosive environment.

CONCLUSION

The experimental results regarding I.E. of the Schiff base ligand and their metal complexes under study reveals that, the compounds have inhibition property. They inhibit the oxidation of metal in acid medium. The inhibition of metal corrosion may be due to adsorption of added the ligand and metal chelates.

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