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"Antifungal Drug's Used As Metal Corrosion Inhibitor in Various Acid Medium"

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Abstract: The weight loss technique has been used to study the corrosion inhibition of mild steel in 0.1N, 0.01N and 0.001N (HCl, HNO_3 and $H_2SO_{4)}$ acidic medium by the antifungal drug's. Thus inhibition efficiency was obtained of various antifungal drugs. 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, Antifungal drugs.

Introduction

Mild steel is used as constructional material in many industries because of its excellent mechanical properties and low cost**.** [1] Chemical industries frequently use concentrated acids for the removal of scale and rust from iron and steel. To prevent corrosion of metal use of inhibitor is a good option. [2,3]. Organic compound are mostly used in industry (for preventing corrosion) which mainly contains oxygen, sulphur, nitrogen atoms, and multiple bonds in the molecule through which they are adsorbed on metal surface [4]. Depending on type of force adsorption can be physorption, chemisorption or a combination of both [5]. The replacement of harmful, inhibitors and ever tightening environmental regulation [6].

Acid solutions are widely used in ore processing, fertilizer manufacturing, oil refining, waste water processing, chemical synthesis and pickling and descaling process [7-10]. Among the various methods to control the destruction of these active metals in acid solutions, the use of inhibitor is quite popular. [11-12].

Many authors generally agree that drugs are inhibitor that can complete favorably with green corrosion inhibitor and that most drugs can be synthesized from natural products. The choice of some drugs used as corrosion inhibitors is based on the following ;**(a)** drug molecule contain oxygen, nitrogen and sulphur as active centers, **(b)** drugs are reportedly environmentally friendly and important in biological reactions and **(c)** drugs can be easily produced and purified.[13-17]. In modern scenario, development of novel biodegradable and less toxic corrosion inhibitors is gaining importance. Biologically active molecules like sulfadimidine, sulfamethoxazole, cefatrexyl, apart from other antibacterial and antifungal drugs have been reported as good corrosion inhibitors. [18-23].The use of drugs as corrosion inhibitors for metals in different aggressive environments is not widely reported. Few reports exist in literature to date. These include the use of sulpha drugs [24-25], antimalerial drugs [26] and analgesic drugs [27] as efficient corrosion inhibitors for metals in various media.

In the present study, we investigate the corrosion inhibition activity of various antifungal drugs, Isoconazole(Comp. A), Itraconazole(Comp. B), Clotrimazole(Comp. C),Fluconazole (Comp. D) and ketoconazole (Comp. E) were evaluated for changes that occurs in mild steel and various acids dilution.

Interface in view of those drugs contains azole, Diazole, triazole, thiozole with active centers like N and aromatic π electrons which can aid adsorption on mild steel surface minimizing the corrosion process in (0.1N, 0.01N, 0.001N) HCl, HNO_3 and H_2SO_4 acid medium.

Experimental Section

Material Preparation

To study, inhibition efficiency of antifungal drugs. The simple experiments were carried out steel binding wire were cleaned first by regmal paper and wash with water and it was dried. After drying it was cut in small 5cm pieces and its weight were determined on analytical balance as initial weight.

In this experiment beakers were labeled from no. 1-54 and in beakers having labeled no.1-6 20ml 0.1N HCl, beakers no. 7-12 20ml 0.01N HCl, beakers no. 13-18 20ml 0.001N HCl and in beakers no. 19-24 20ml 0.1N HNO_3, beakers no. 25-30 20ml 0.01N HNO_3, and in beaker no. 31-36 20ml 0.001N HNO_3 and in beakers no. 37-42 20ml 0.1N H_2SO_4, beaker no. 43-48 20ml 0.01N H_2SO_4, beaker no. 49-54 20ml 0.001N H_2SO_4 were added. After the preparation of the mixture, solution in different labeled beaker dipped binding wire pieces in each beaker for 48 hours. After 48 hours the wire pieces were taken out from the beaker. They were washed with water and dried at room temperature. Its weight was determined on analytical balance as final weight.

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 was calculated by using following formula.

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

Where, I.E = Inhibition efficiency

Wi = Loss is weight in inhibitor solution, Wu = Weight loss in control solution.

Result And Discussion

Table no. 1 Effect of various Antifungal drugs on corrosion in 0.1N HCl

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E. (%)
Control	0.363	0.315	0.048	12.41	0
A	0.350	0.348	0.002	0.57	95.40
B	0.349	0.346	0.003	0.85	93.08
C	0.470	0.462	0.008	1.70	86.30
D	0.490	0.482	0.008	1.63	86.85
E	0.461	0.457	0.004	0.86	93.01

Fig: Variation of weight loss of mild steel in 0.1N HCl solution containing various antifungal drugs Graph no.1

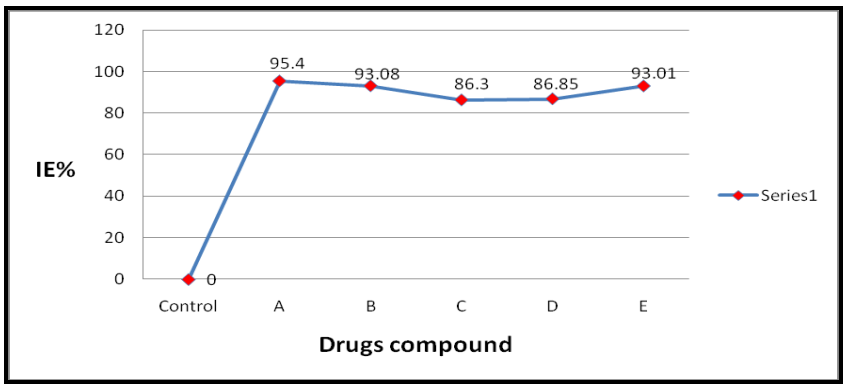


Table no. 2 Effect of various Antifungal drugs on corrosion in 0.01N HCl

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E. (%)
Control	0.448	0.440	0.008	1.78	0
A	0.437	0.433	0.004	0.91	48.74
B	0.477	0.474	0.003	0.62	64.78
C	0.486	0.483	0.003	0.61	65.43
D	0.474	0.470	0.004	0.84	52.74
E	0.378	0.372	0.006	1.58	11.11

Fig: Variation of weight loss of mild steel in 0.01N HCl solution containing various antifungal drugs Graph No. 2

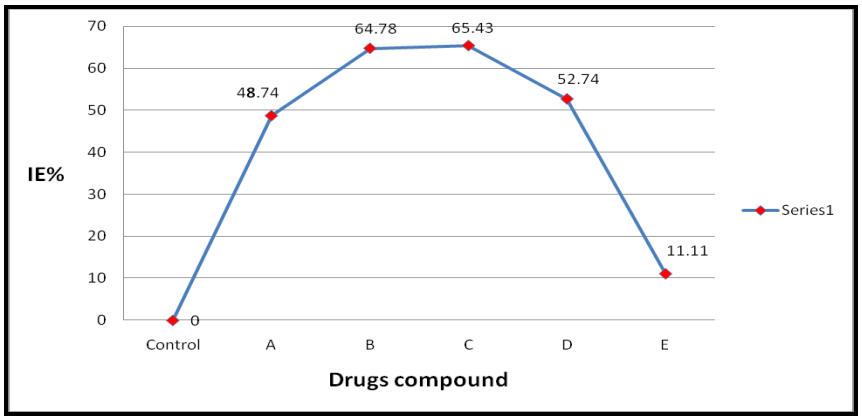


Table no. 3 Effect of various Antifungal drugs on corrosion in 0.001N HCl

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.437	0.416	0.021	4.80	0
A	0.447	0.446	0.001	0.22	95.34
B	0.452	0.450	0.002	0.44	90.79
C	0.470	0.469	0.001	0.21	86.36
D	0.461	0.458	0.003	0.65	86.46
E	0.480	0.468	0.012	2.50	47.98

Fig: Variation of weight loss of mild steel in 0.001N HCl solution containing various antifungal drugs Graph No. 3

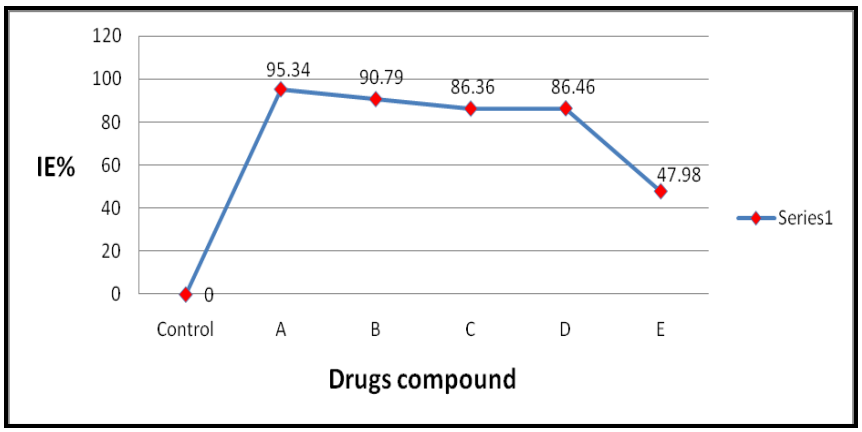


Table no. 4 Effect of various Antifungal drugs on corrosion in 0.1N H_2SO_4

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.467	0.409	0.058	12.41	0
A	0.457	0.453	0.004	0.87	92.95
B	0.351	0.325	0.026	7.40	40.36
C	0.370	0.369	0.001	0.27	97.82
D	0.465	0.461	0.004	0.86	93.07
E	0.448	0.443	0.005	1.11	91.01

Fig: Variation of weight loss of mild steel in 0.1N H_2SO_4 solution containing various antifungal drugs Graph No. 4

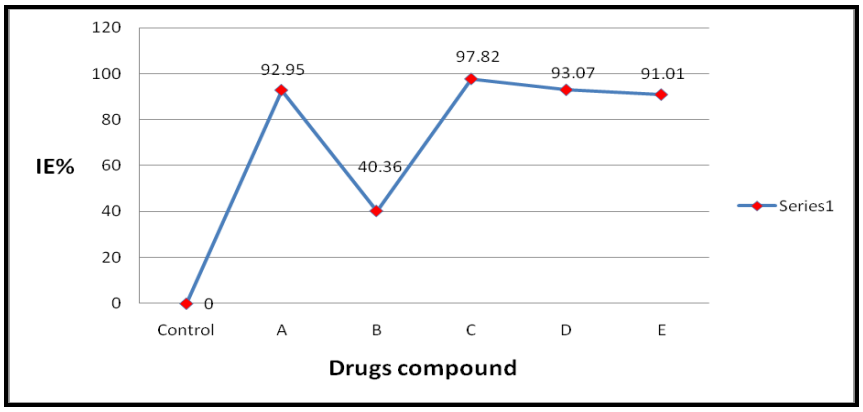


Table no. 5 Effect of various Antifungal drugs on corrosion in 0.01N H_2SO_4

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight(ΔW)	% Loss in weight	I.E.(%)
Control	0.330	0.321	0.009	2.72	0
A	0.328	0.323	0.005	1.52	44.11
B	0.445	0.441	0.004	0.89	67.04
C	0.359	0.352	0.007	2.25	17.47
D	0.311	0.304	0.007	1.94	28.50
E	0.445	0.440	0.005	1.12	58.80

Fig: Variation of weight loss of mild steel in 0.01N H_2SO_4 solution containing various antifungal drugs Graph No. 5

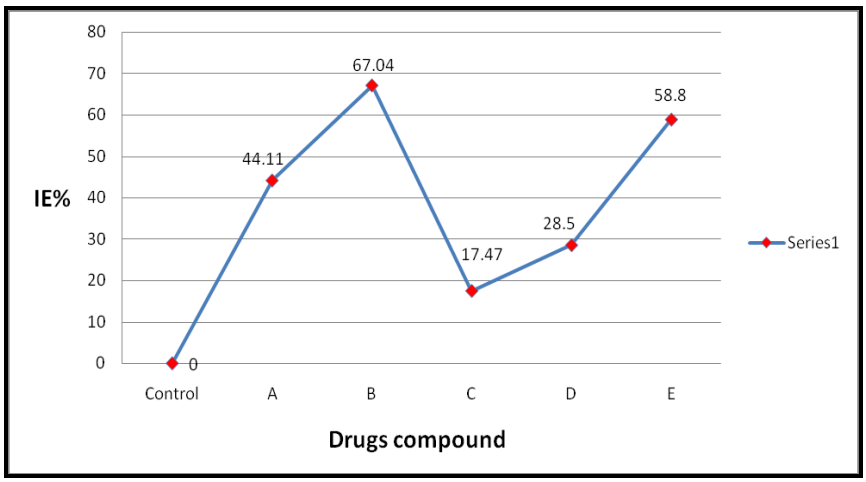


Table no. 6 Effect of various Antifungal drugs on corrosion in 0.001N H_2SO_4

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight(ΔW)	% Loss in weight	I.E.(%)
Control	0.344	0.338	0.006	1.74	0
A	0.449	0.445	0.004	0.89	48.92
B	0.444	0.439	0.005	1.12	35.44
C	0.362	0.357	0.005	1.38	20.81
D	0.425	0.420	0.005	1.17	32.55
E	0.446	0.444	0.002	0.44	74.29

Fig: Variation of weight loss of mild steel in 0.001N H_2SO_4 solution containing various antifungal drugs Graph No. 6

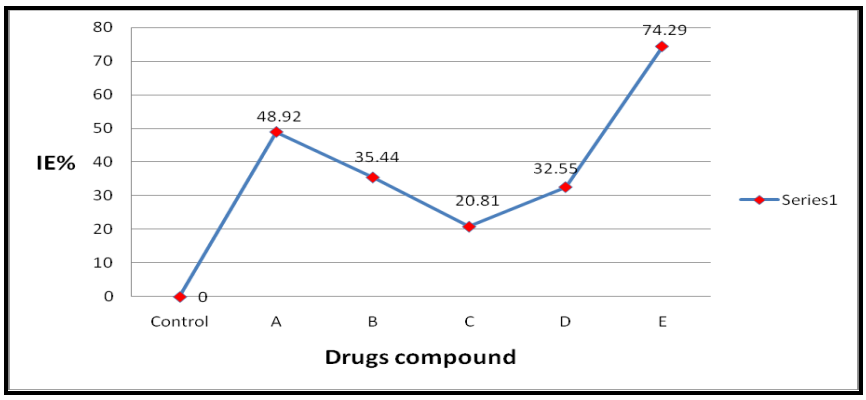


Table no. 7 Effect of various Antifungal drugs on corrosion in 0.1N HNO_3

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E. (%)
Control	0.431	0.390	0.041	9.51	0
A	0.338	0.330	0.008	2.36	75.11
B	0.323	0.295	0.028	8.66	8.87
C	0.457	0.427	0.030	6.56	30.99
D	0.339	0.330	0.009	2.65	72.09
E	0.459	0.430	0.029	6.31	33.58

Fig: Variation of weight loss of mild steel in 0.1N HNO_3 Solution containing various antifungal drugs Graph No. 7

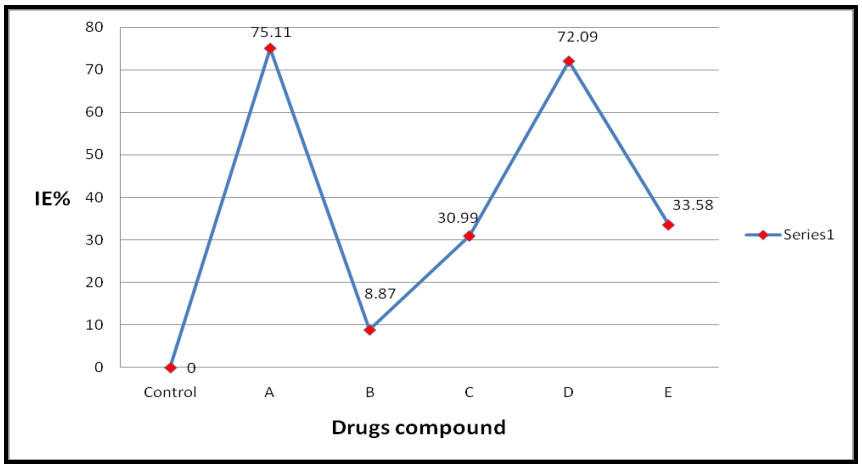


Table no. 8 Effect of various Antifungal drugs on corrosion in 0.01N HNO_3

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.442	0.437	0.005	1.13	0
A	0.443	0.442	0.001	0.22	80.05
B	0.340	0.338	0.002	0.58	48.00
C	0.345	0.342	0.003	0.86	23.13
D	0.338	0.336	0.002	0.59	47.69
E	0.339	0.337	0.002	0.58	47.85

Fig: Variation of weight loss of mild steel in 0.01N HNO_3 solution containing various antifungal drugs Graph No. 8

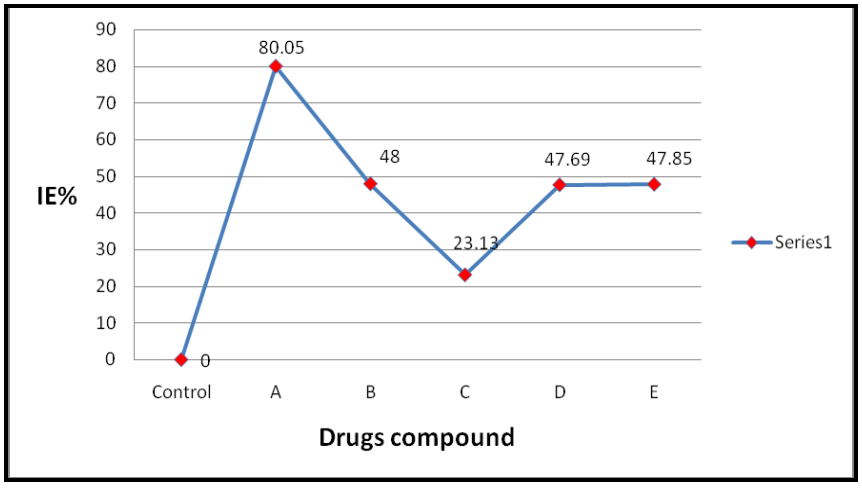
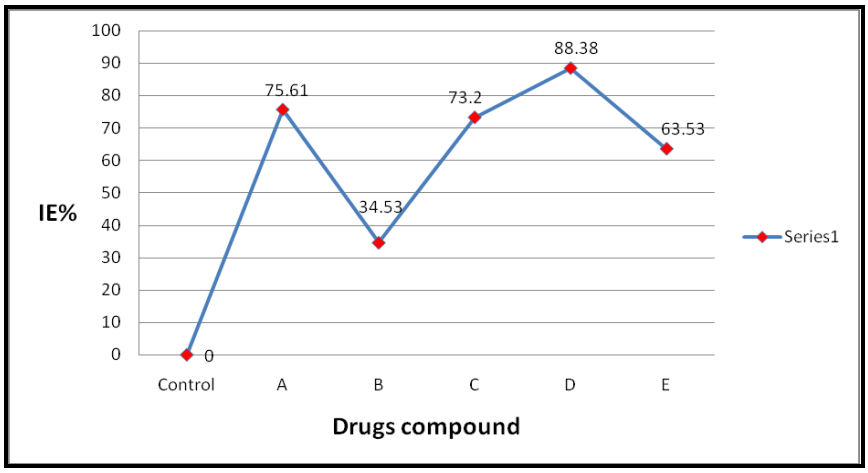


Table no. 9 Effect of various Antifungal drugs on corrosion in 0.001NHNO$_3$

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight(ΔW)	% Loss in weight	I.E. (%)
Control	0.318	0.310	0.008	2.51	0
A	0.326	0.324	0.002	0.61	75.61
B	0.425	0.418	0.007	1.61	34.53
C	0.445	0.442	0.003	0.67	73.20
D	0.342	0.341	0.001	0.29	88.38
E	0.436	0.432	0.004	0.91	63.53

Fig: Variation of weight loss of mild steel in 0.001N HNO_3 Solution containing various antifungal drugs Graph No. 9



From observation table we conclude that the drugs compound (A) has higher IE in 0.1N and 0.001N HCl solution having IE is 95.00 but in 0.01N HCl solution having inhibition efficiency is 48.74 which is much less than 0.1N and 0.001N solution.

In 0.1N HCl solution compound (B) and (E) has IE value 93.08 and 93.01 which is less than compound (C) and (D) are less corrosion inhibitor due to its low IE.

In 0.01N HCl solution compound (C) shows higher IE is 65.43, compound (C) and (D) has IE value 45.43 and 52.74 which is very less compound (C) in this medium. Overall antifungal drugs in this medium acts as less corrosion inhibitor due to its low IE.

In 0.001N HCl solution compound (A) shows higher IE 95.34, compound (E) has IE value 47.98 which is less than compound (B), (C) and (D) they acts as less corrosion inhibitors due to its lower IE.

By graphical representation compound (A) has IE value is 75.11 in 0.1N HNO3 and compound (B) has inhibition efficiency value is 8.87 in 0.1N HNO_3 in observed data. Compound (A) in 0.1N and 0.01N HNO_3 acid medium has greater IE value. While in 0.001N HNO_3 solution compound (A) acts as less corrosion inhibitor. In 0.001N HNO_3 compound (D) acts as good corrosion inhibitor.

In 0.1N H_2SO_4 compound (C) shows IE value 97.82 and in 0.01N H_2SO_4 compound (B) shows IE value 67.04 also in 0.001N H_2SO_4 compound (E) shows IE 74.29 hence in H_2SO_4 solution compound (B) and (C) and (E) acts as good corrosion inhibitor because of higher IE. While compound (A) and (D) acts as less corrosion inhibitor. The inhibitive property of various antibiotic drugs 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 various antifungal drugs under study reveals that, the compounds have inhibition property. They inhibit the oxidation of metal in various acid medium. The inhibition of metal corrosion may be due to adsorption of added antifungal drugs.

Interesting results come out from the experiments that in HCl acid, drugs show good inhibition efficiency than HNO_3 and H_2SO_4 acid.

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