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Research Article

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Antibiotic 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 antibiotic drug's. Thus inhibition efficiency was obtained of various antibiotic 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, Antibiotic drugs.

INTRODUCTION

Most of the metals tend to corrode easily due to their thermodynamic instability mild steel is very prone to corrosion particularly in acidic medium. As mild steel is prominently used as structural, instrumental & industrial material the prevention of its corrosion is very essential many experimental method are employed to control the corrosion of mild steel. The use of inhibitors is one of the practical methods for preventing corrosion of mild steel especially in acidic media [1].

Corrosion inhibition of mild steel is a matter of theoretical as well as practical importance [2]. Acids are widely used in industries such as pickling cleaning, decaling etc, and because of their aggressiveness, inhibitors are used to reduce the rate off dissolution of metals compounds containing nitrogen, sulphur and oxygen have been reported as inhibitors [3-8]. The efficiency of an organic compound as inhibitors is mainly dependent upon its ability to get absorbed a metal surface, which consists of the replacement of a water molecule at a corroding interface.

The adsorption of these compounds is influenced by the electronic structure of inhibiting molecules, the steric factor aromaticity , and electron density at the donor site, the presence of functional group such as –CHO, -N =N, R-OH, etc molecular area, and molecular weight of inhibitors molecule [9-12].

Recently, the use of antibiotic and other drugs have been investigated [13-14] and their inhibition efficiencies have been linked with their heterocyclic nature (Abdallah, 2004, Eddy and odoemelam, 2008 [15] the unique advantage of using natural product. Most heterocyclic drugs are environmentally friendly and can favorably complete with the natural products. However, studies and the use of drugs of corrosion inhibitors are scanty.

A detailed literature review shows that no data are available in various acids medium regarding the behavior of various antibiotic drugs inhibitors for protection of mild steel against corrosion. In the present study, the inhibitive properties of these antibiotics drugs are reported using weight loss measurement techniques in various acids medium. The inhibition mechanism has been discussed on the basis of these studies. The present study aims to

investigate inhibition efficiency of Dicioxacillin (Comp.A), Cefuroxime(Comp.B) Cefadroxil(Comp.C), Cefixime(Comp.D), Amoxicillin(Comp.E) antibiotic drugs for the corrosion of mild steel.

EXPERIMENTAL SECTION

Material Preparation

To study the inhibition efficiency of antibiotic drugs. The experiments were carried out with steel binding wire was 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 (Initial weight).

In this experiment beakers were labeled from 1-54 and in beakers having labeled beakers no.1-6 20 ml 0.1N HCl , beakers no. 7-12 20 ml 0.01 N HCl, beakers no. 13-18 20ml 0.001 HCl. and in beakers no.19-24 20ml 0.1 HNO_3, 25-30 20ml 0.01 N HNO_3, beakers no. 31-36 20ml 0.001 N HNO_3 and In beakers no. 37-42 20ml 0.1 N H_2SO_4, beakers no.43-48 20ml 0.01 N H_2SO_4, beakers no. 49-54 20ml 0.001 N 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 form the beaker. They were washed with water and dried at room temperature. Their weights were determined on analytical balance (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

Fig: Variation of weight loss of mild steel in 0.1N HCl solution containing various antibiotic drugs

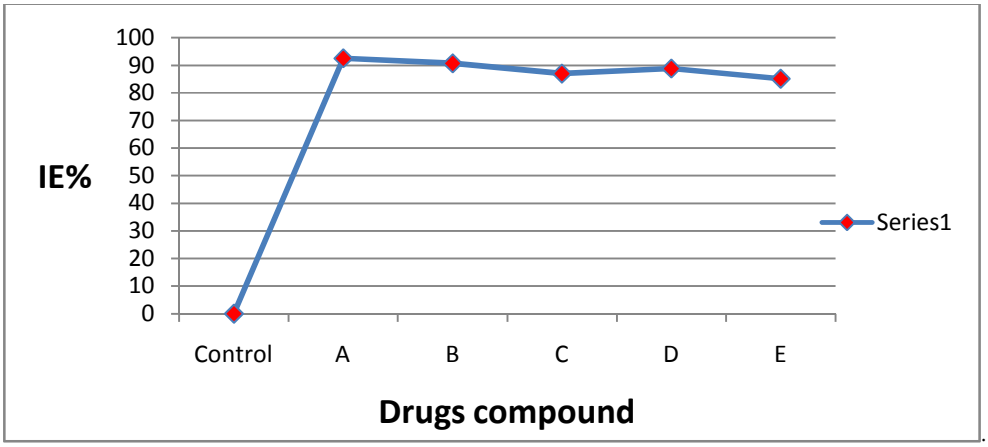

Table No.1 Effect of various Antibiotic drugs on corrosion in 0.1N HCl

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.368	0.314	0.054	14.67	0
A	0.364	0.360	0.004	1.09	92.59
B	0.382	0.377	0.005	1.30	90.74
C	0.369	0.362	0.007	1.89	87.03
D	0.348	0.342	0.006	1.72	88.88
E	0.361	0.353	0.008	2.21	85.18

Table No.2 Effect of various Antibiotic 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	0.396	0.369	0.027	6.81	0
A	0.359	0.357	0.002	0.55	92.59
B	0.393	0.388	0.005	1.27	81.88
C	0.358	0.351	0.007	1.95	74.07
D	0.357	0.353	0.004	1.12	85.18
E	0.375	0.372	0.004	1.06	85.18

Fig: Variation of weight loss of mild steel in 0.01N HCl solution containing various antibiotic drugs

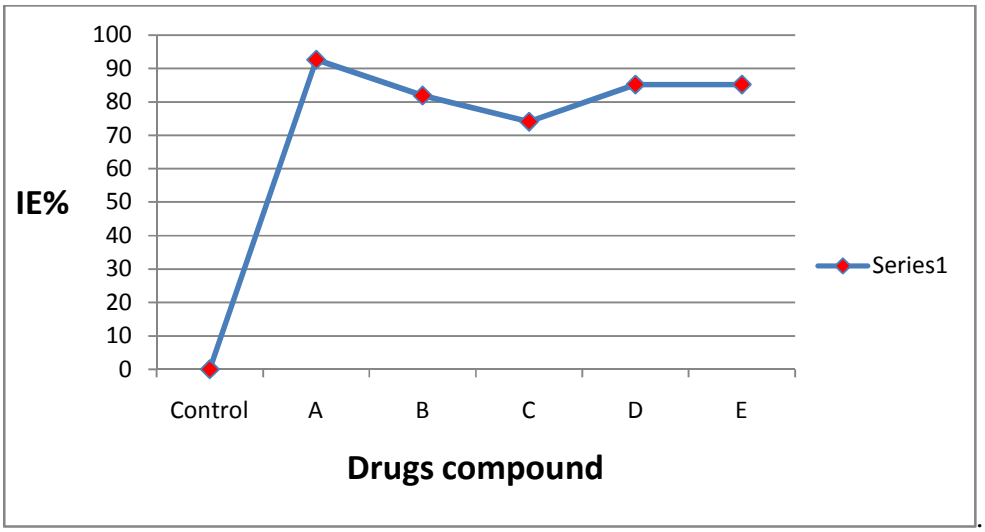

Fig: Variation of weight loss of mild steel in 0.001N HCl solution containing various antibiotic drugs

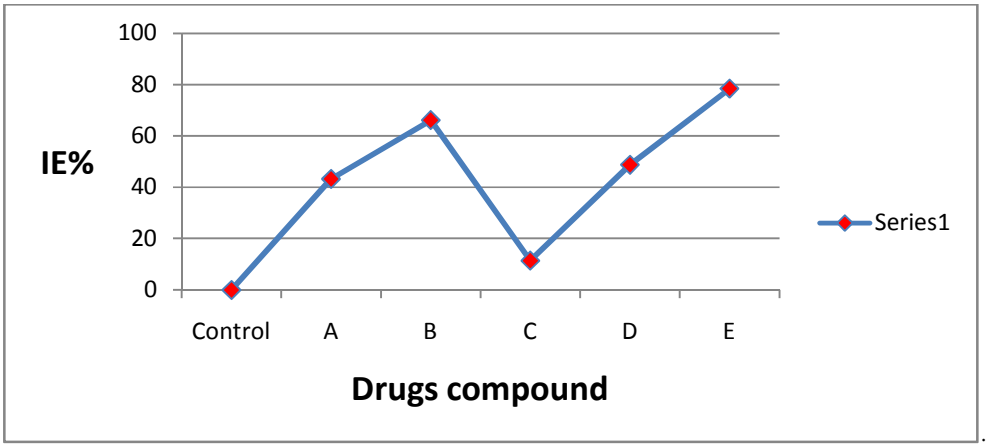

Table No.3 Effect of various Antibiotic drugs on corrosion in 0.001N HCl

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.380	0.371	0.009	2.36	0
A	0.373	0.368	0.005	1.34	43.22
B	0.372	0.369	0.003	0.80	66.10
C	0.334	0.327	0.007	2.09	11.44
D	0.330	0.226	0.004	1.21	48.72
E	0.387	0.385	0.002	0.51	78.38

Table No.4 Effect of various Antibiotic 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	0.371	0.314	0.057	15.36	0
A	0.361	0.337	0.024	6.64	56.77
B	0.348	0.339	0.009	2.58	83.20
C	0.370	0.352	0.018	4.86	68.35
D	0.361	0.342	0.019	5.26	65.75
E	0.351	0.314	0.037	10.54	31.38

Fig: Variation of weight loss of mild steel in 0.1N HNO_3 solution containing various antibiotic drugs

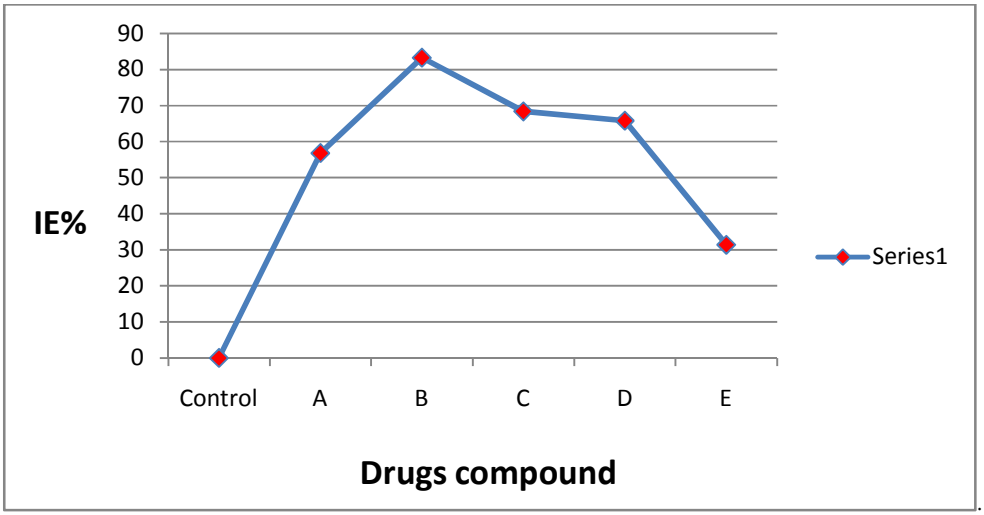

Fig: Variation of weight loss of mild steel in 0.01N HNO_3 solution containing various antibiotic drugs

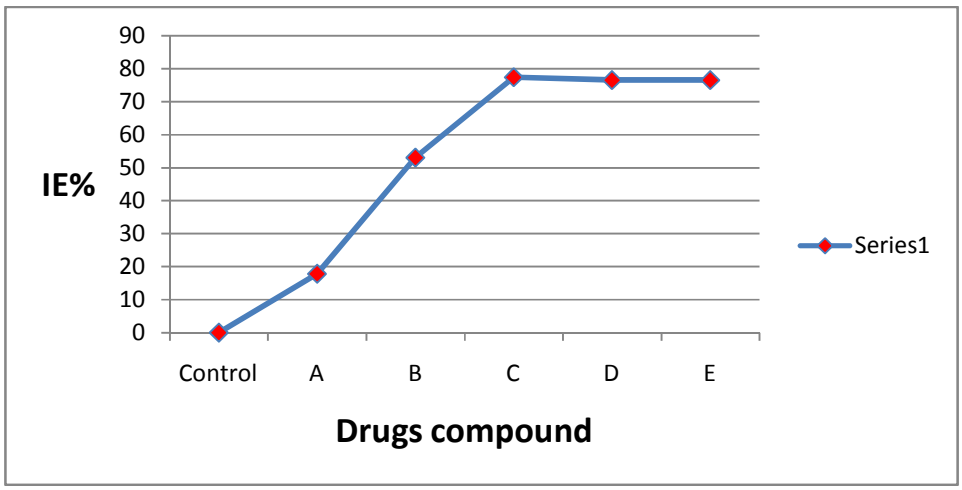

Table No.5 Effect of various Antibiotic drugs on corrosion in 0.01N HNO_3

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.347	0.339	0.008	2.30	0
A	0.357	0.350	0.007	1.89	17.82
B	0.368	0.364	0.004	1.08	53.04
C	0.382	0.380	0.002	0.52	77.39
D	0.364	0.362	0.002	0.54	76.52
E	0.365	0.363	0.002	0.54	76.52

Table No.6 Effect of various Antibiotic drugs on corrosion in 0.001N HNO_3

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.351	0.345	0.006	1.70	0
A	0.341	0.339	0.002	0.58	65.88
B	0.355	0.354	0.001	0.28	83.52
C	0.355	0.353	0.002	0.56	67.05
D	0.366	0.363	0.003	0.81	52.35
E	0.345	0.341	0.004	1.15	93.50

Fig: Variation of weight loss of mild steel in 0.001N HNO_3 solution containing various antibiotic drugs

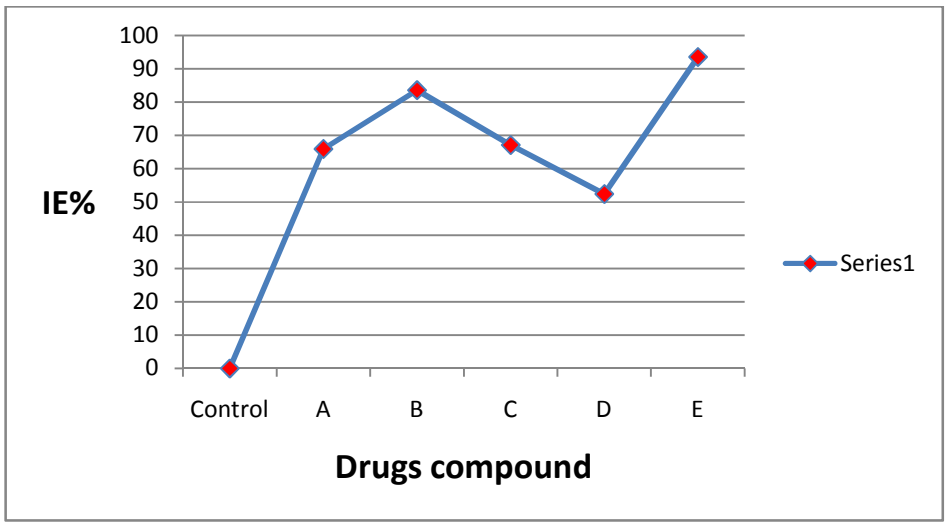

Fig: Variation of weight loss of mild steel in 0.1N H_2SO_4 solution containing various antibiotic drugs

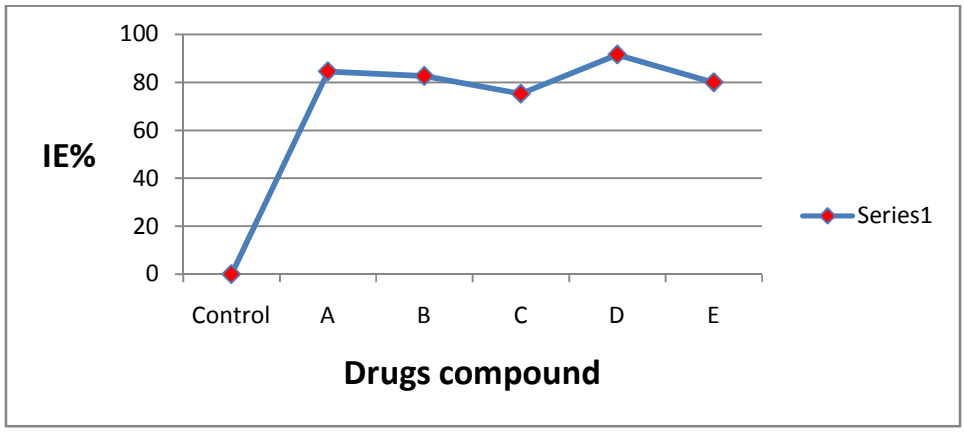

Table No.7 Effect of various Antibiotic drugs on corrosion in 0.1N H_2SO_4

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.355	0.286	0.069	19.43	0
A	0.366	0.355	0.011	3.00	84.55
B	0.356	0.344	0.012	3.37	82.65
C	0.374	0.356	0.018	4.81	75.24
D	0.365	0.359	0.006	1.64	91.55
E	0.360	0.346	0.014	3.88	80.03

Table No.8 Effect of various Antibiotic 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	0.347	0.337	0.010	2.88	0
A	0.357	0.352	0.005	1.40	51.38
B	0.368	0.362	0.006	1.63	43.40
C	0.361	0.353	0.008	2.21	23.26
D	0.354	0.350	0.004	1.12	61.11
E	0.338	0.333	0.005	1.47	48.95

Fig: Variation of weight loss of mild steel in 0.01N H_2SO_4 solution containing various antibiotic drugs

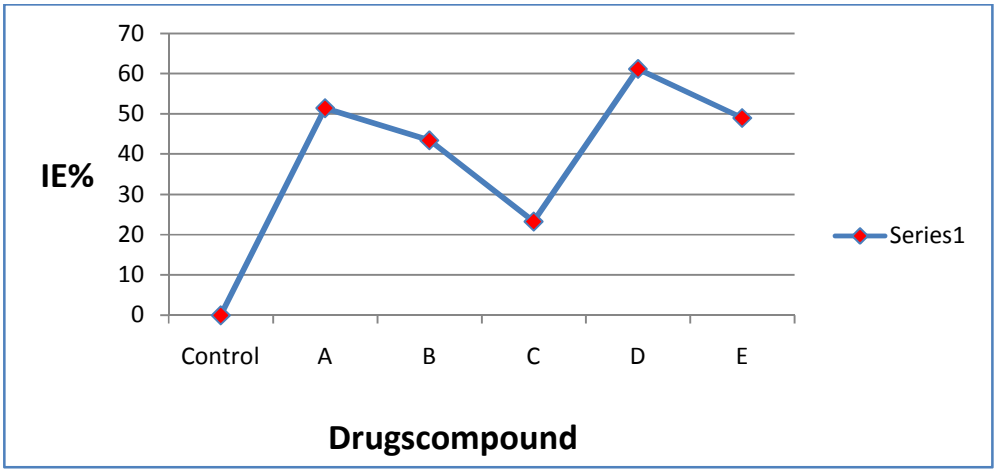

Fig: Variation of weight loss of mild steel in 0.001N H_2SO_4 solution containing various antibiotic drugs

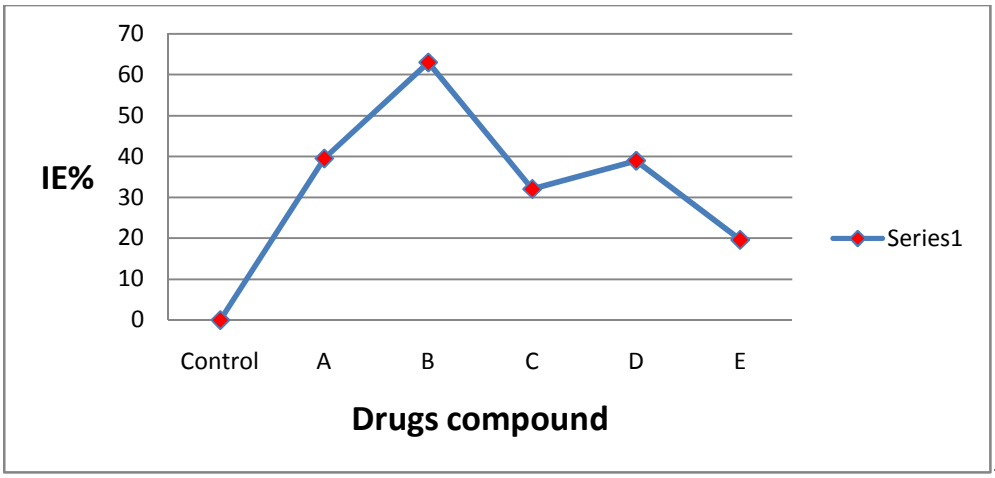

Table No.9Effect of various Antibiotic drugs on corrosion in 0.001N H_2SO_4

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.359	0.346	0.013	3.62	0
A	0.364	0.356	0.008	2.19	39.50
B	0.372	0.367	0.005	1.34	62.98
C	0.365	0.356	0.009	2.46	32.04
D	0.361	0.353	0.008	2.21	38.95
E	0.378	0.367	0.011	2.91	19.61

From observation table we conclude that the drugs compound (A) has higher IE in 0.1N and 0.01N HCl solution having IE is 92.59 but in 0.001N HCl solution having inhibition efficiency is 43.22 which is much less than 0.01N and 0.001N solution.

In 0.1N HCl solution compound (A) shows higher IE value 92.59 compound (b) has IE value 90.74 which is less than compound (A) in this compound (C), (D) and (E) are less corrosion inhibitor due to its low IE.

In 0.01N HCl solution compound (A) shows higher IE is 92.59, compound (E) and (D) has IE value 85.18 which is less compound (A) in this medium. Compound (B), (C) less corrosion inhibitor due its lower IE.

In 0.001N HCl solution compound (E) shows higher IE 78.38, compound (B) has IE value 66.10 which is less than compound (A), (C) and (D) they acts as less corrosion inhibitors due to its lower IE.

By graphical representation compound (B) has IE value is 83.20 in 0.1N HNO_3 and compound (E) has inhibition efficiency value is 93.50 in 0.001N HNO_3.This value higher than compound (B) and (C) IE value is 77.39 in 0.01N HNO_3 other compound shows lower IE value. Hence compound (A) and (D) are having less corrosion inhibitor due to lower IE.

In 0.1N H_2SO_4 compound (D) shows IE value 91.55 and in 0.01N H_2SO_4 compound (D) shows IE value 61.11 also in 0.001N H_2SO_4 compound (B) shows IE 62.98 hence in H_2SO_4 solution compound (D) and (B) acts as good corrosion inhibitor because of higher IE. While, compound (A), (C) and (E) acts as less corrosion inhibitor.

The inhibitor used in this study is acts as effective inhibitor for mild steel in HCl, H_2SO_4 and HNO_3 but stands slightly better in HCl which is related to the synergistic adsorption of inhibitor molecule through acid anion Cl^- on metal surface.

Corrosion is two deterioration of metal the acidic medium is kept study the corrosion the inhibition arises due to surface adsorption oxidizing agent also helps to adsorption. Adsorption thin layer are made on surface of metal and which to anti-corrosion effect [16].

CONCLUSION

The experimental results regarding I.E. of the various antibiotic drugs in different acidic medium under study reveals that, antibiotics compound 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 the antibiotic drugs.

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