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Inhibition of Corrosion Carbon Steel in Various Acid Medium by an Expired or Unused Acidity Non Toxic Drugs

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Abstract : The inhibition effect of environmentally friendly and cost-effective drugs, on the corrosion of carbon steel in an acidic medium was studied by the weight loss method at room temperature. The study revealed that the test drug has an inhibitory action on the corrosion of carbon steel in the investigated medium. This paper presents use of expired or unused drugs as corrosion inhibitors for metals in 0.1N, 0.01N and 0.001N (HCl, HNO_3 and H_2SO_4) acidic medium by an expired acidity non toxic drug's. Thus inhibition efficiency was obtained of various acidity non toxic drugs.
Keywords : Corrosion, Inhibition, carbon steel, Weight loss and Expired acidity non toxic drug's.

Introduction

The corrosion of metals remains a worldwide scientific problem as it affects the metallurgical, chemical, construction and oil industries. Most of the metals tend to corrode early due to their thermodynamic instability carbon steel is prominently used as structural, instrumental and industrial material, the prevention of its corrosion is very essential. Many experimental methods are employed to control the corrosion of mild steel. The use of inhibitor is one of the practical methods for preventing corrosion of carbon steel especially in acidic media.[1].

Acid solutions are widely used in many industries, such as acid pickling, industrial acid cleaning, acid descaling and oil well acidizing[2].The inhibitive reactivity of an inhibitor is fundamentally affected by the molecular structure of the inhibiting molecules[3].Most prominent corrosion inhibitors are organic compounds containing nitrogen, sulphur, oxygen and phosphorus in their functional groups[4-5]. A large number of scientific studies have been devoted to the subject of corrosion inhibitors for mild steel in acidic media[6-8]. Few non toxic compounds have been investigated as corrosion inhibitors by some researches[9-10]. The aim of this research work is to investigate the inhibitive effect of carbon steel in different acid medium by various expired acidity non toxic drugs Rentidine, Zantac, Aciloc, Rentac, Omez using weight loss techniques.

Experimental Section

To analysis the corrosion inhibition of mild steel in different acid medium by using various expired or unused acidity non toxic 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 cuted in small 5cm pieces and its weight were determined on analytical balance as initial weight.

In this experiment beakers were labeled from 1-54 and in beakers having labeled 1-6 20ml 0.1N HCl, 7-12 20ml 0.01N HCl, 13-18 20ml 0.001N HCl, in beakers 19-24 20ml 0.1N HNO_3, 25-30 20ml 0.01N HNO_3 and in beaker 31-36 20ml0.001N HNO_3 and in beakers 37-42 20ml 0.1N H_2SO_4, 43-48 20ml 0.01N H_2SO_4, 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 beakers 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.

The loss in mass was determined using the relation.

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

Where,

I.E. = Inhibition efficiency.

W_i= Weight loss of metal in inhibitor solution

W_u = weight loss of metal in control solution

Result and Discussion

Inhibition of corrosion carbon steel in various acidic medium by an expired acidity non toxic drug's in 0.1N HNO_3.(Table-1)

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E. (%)
Control	0.355	0.296	0.059	16.62	-
A	0.318	0.268	0.050	15.73	15.25
B	0.297	0.257	0.040	13.47	32.20
C	0.327	0.290	0.037	11.32	37.28
D	0.319	0.309	0.010	03.14	83.05
E	0.290	0.263	0.027	09.32	54.23

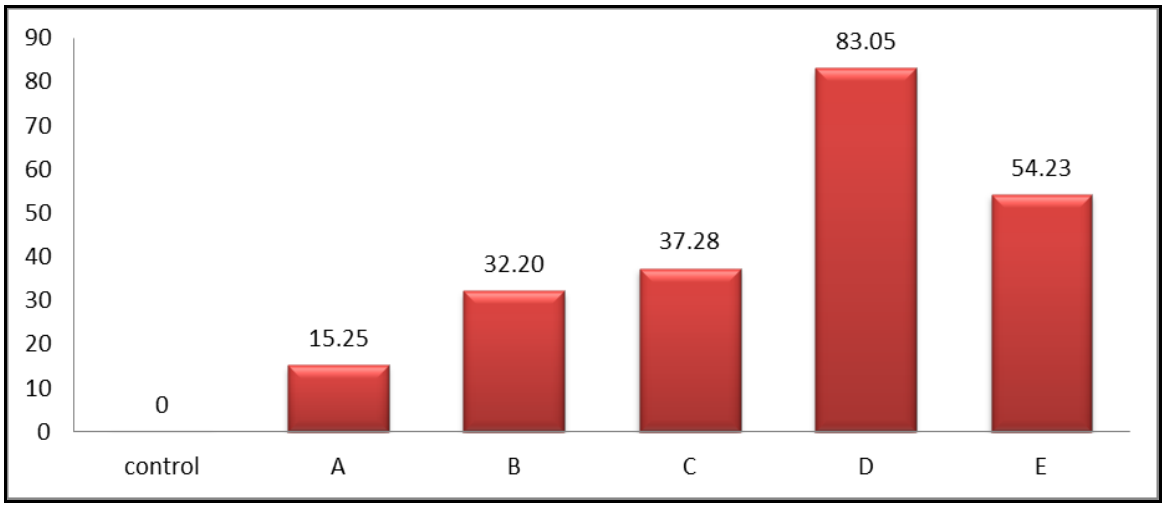

Fig. Variation of weight loss of mild steel in 0.1N HNO_3 solution containing in different acidic medium by an expired acidity non toxic drug.(Graph-1)

Inhibition of corrosion mild steel in different acidic medium by an expired acidity non toxic drugs in 0.01N HNO_3.(Table-2)

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E. (%)
Control	0.293	0.270	0.023	07.85	-
A	0.308	0.295	0.013	04.23	43.47
B	0.316	0.297	0.019	06.02	17.39
C	0.280	0.264	0.016	04.29	30.43
D	0.294	0.285	0.009	03.07	77.77
E	0.300	0.280	0.020	07.67	13.04

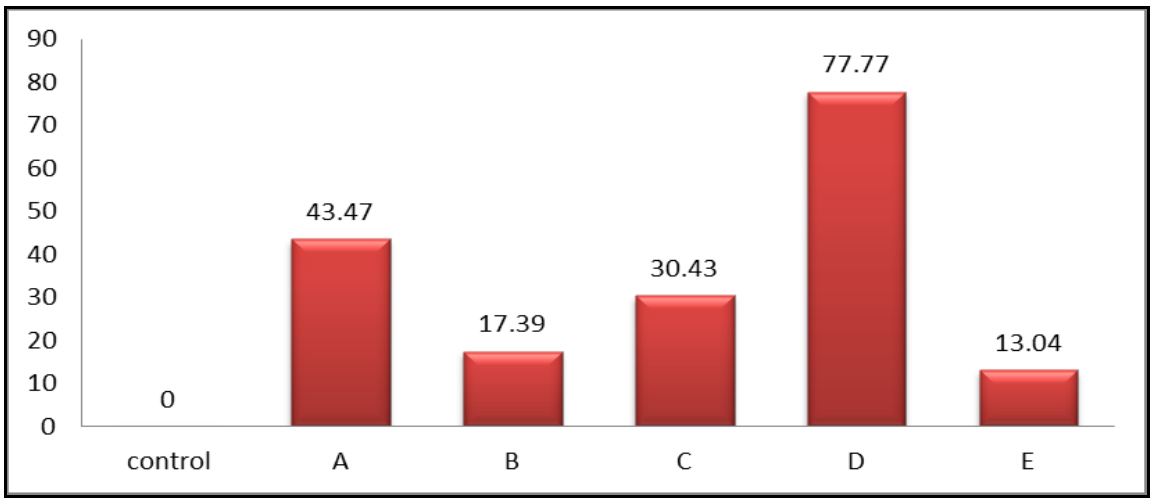

Fig. Variation of weight loss of mild steel in 0.01N HNO_3 solution containing in various acidic medium by an expired acidity non toxic drug.(Graph-2)

Inhibition of corrosion mild steel in various acidic medium by an expired acidity non toxic drugs in 0.001N HNO_3.(Table-3)

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E. (%)
Control	0.356	0.315	0.041	11.52	-
A	0.261	0.248	0.013	04.99	68.29
B	0.304	0.284	0.020	06.57	51.12
C	0.316	0.299	0.017	05.38	58.53
D	0.320	0.310	0.010	03.13	75.60
E	0.289	0.280	0.009	03.12	78.04

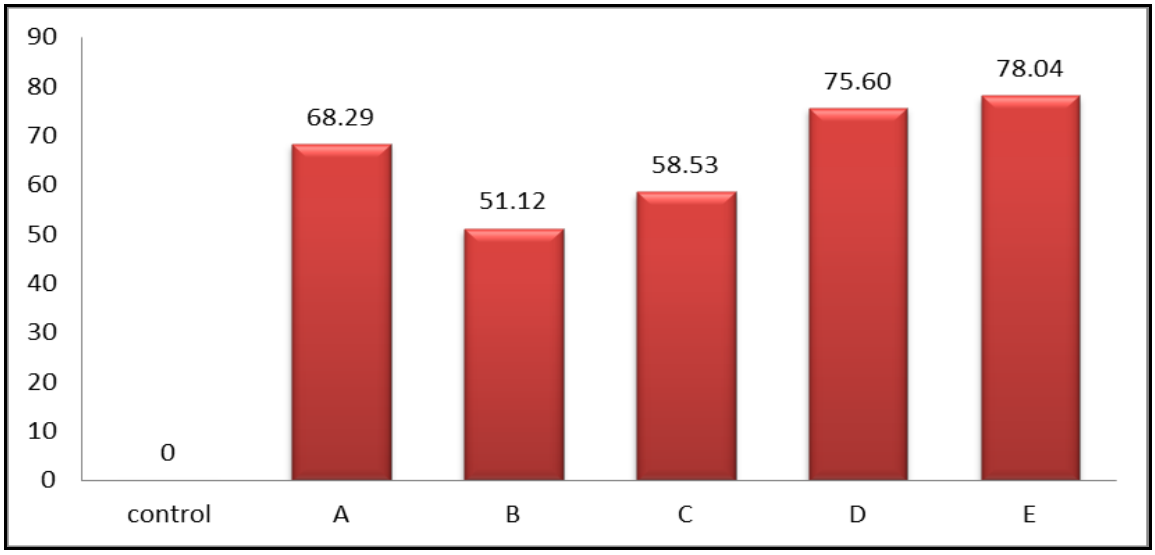

Fig. Variation of weight loss of mild steel in 0.001N HNO_3 solution containing in different acidic medium by an expired acidity non toxic drug.(Graph-3)

Inhibition of corrosion mild steel in various acidic medium by an expired acidity non toxic drugs in 0.1N H_2SO_4.(Table-4)

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.329	0.306	0.023	06.99	-
A	0.295	0.282	0.013	04.41	43.47
B	0.348	0.333	0.015	04.31	34.78
C	0.288	0.272	0.016	05.05	30.43
D	0.298	0.291	0.007	02.35	69.56
E	0.313	0.299	0.014	04.47	39.13

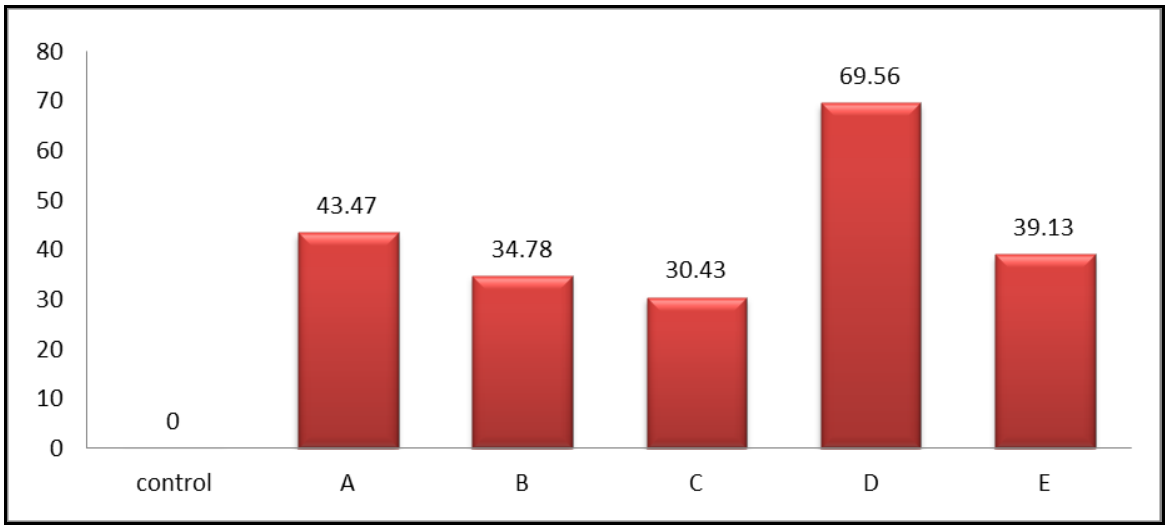

Fig. Variation of weight loss of mild steel in 0.1N H_2SO_4 solution containing in different acidic medium by an expired acidity non toxic drug.(Graph-4)

Inhibition of corrosion mild steel in various acidic medium by an expired acidity non toxic drugs in 0.01N H_2SO_4.(Table-5)

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.324	0.294	0.030	09.25	-
A	0.297	0.287	0.010	03.36	66.66
B	0.298	0.285	0.013	04.36	56.66
C	0.312	0.300	0.012	03.85	60.00
D	0.388	0.375	0.015	03.85	50.00
E	0.298	0.278	0.020	06.71	33.33

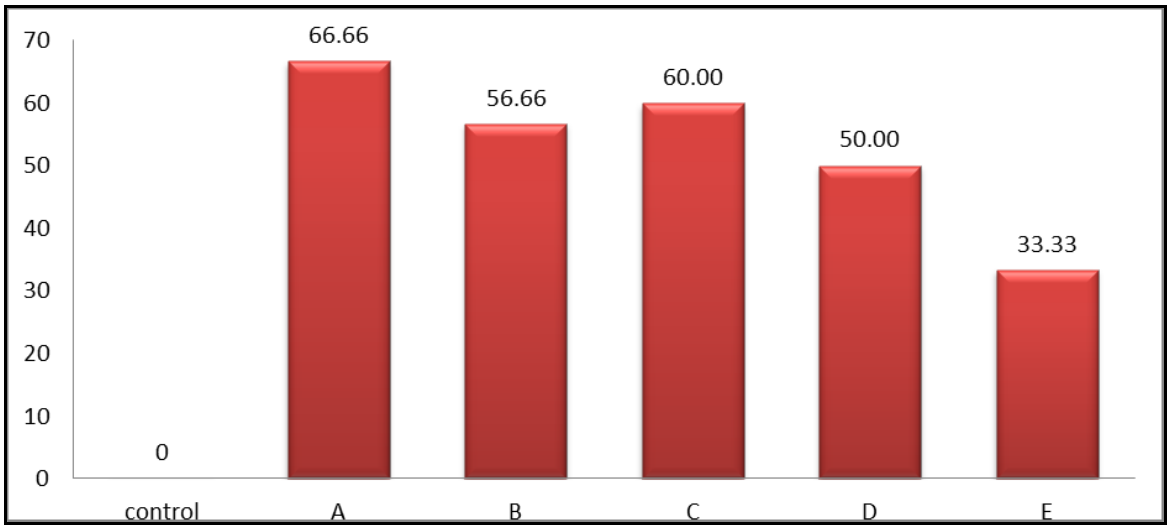

Fig. Variation of weight loss of mild steel in 0.01N H_2SO_4 solution containing in different acidic medium by an expired acidity non toxic drug.(Graph-5)

Inhibition of corrosion mild steel in various acidic medium by an expired acidity non toxic drugs in 0.001N H_2SO_4. (Table-6)

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.314	0.291	0.023	07.32	-
A	0.337	0.325	0.012	03.56	47.82
B	0.303	0.296	0.009	02.30	60.86
C	0.328	0.315	0.013	03.96	43.47
D	0.295	0.281	0.014	04.75	39.13
E	0.315	0.304	0.011	03.49	52.17

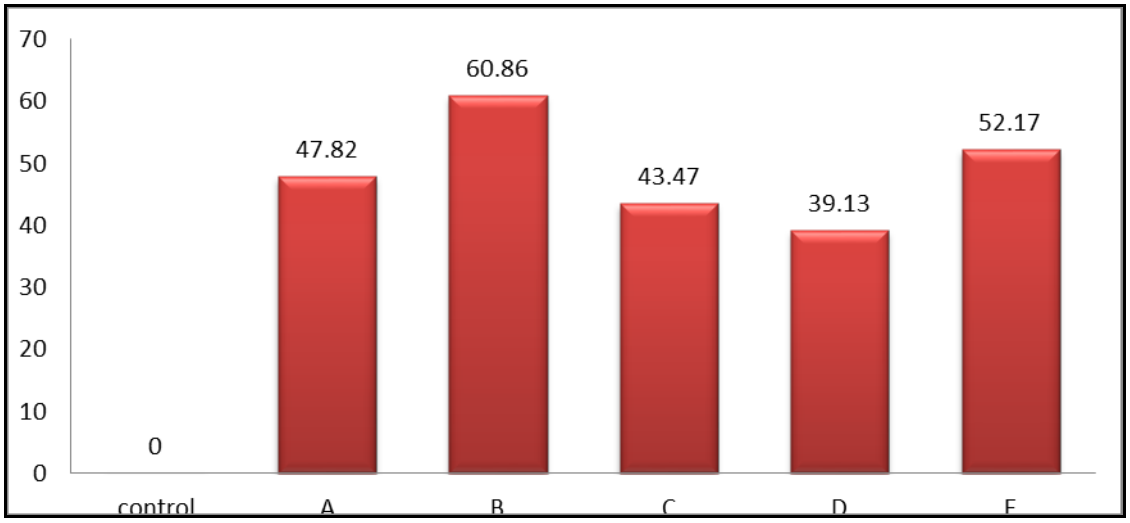

Fig. Variation of weight loss of mild steel in 0.001N H_2SO_4 solution containing in different acidic medium by an expired acidity non toxic drug.(Graph-6)

Inhibition of corrosion mild steel in various acidic medium by an expired acidity non toxic drugs in 0.1N HCl. (Table-7)

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E. (%)
Control	0.280	0.175	0.105	37.50	-
A	0.297	0.281	0.016	05.39	84.76
B	0.299	0.285	0.014	04.68	86.66
C	0.303	0.291	0.012	03.96	88.57
D	0.353	0.342	0.011	03.11	89.52
E	0.306	0.272	0.034	11.12	67.61

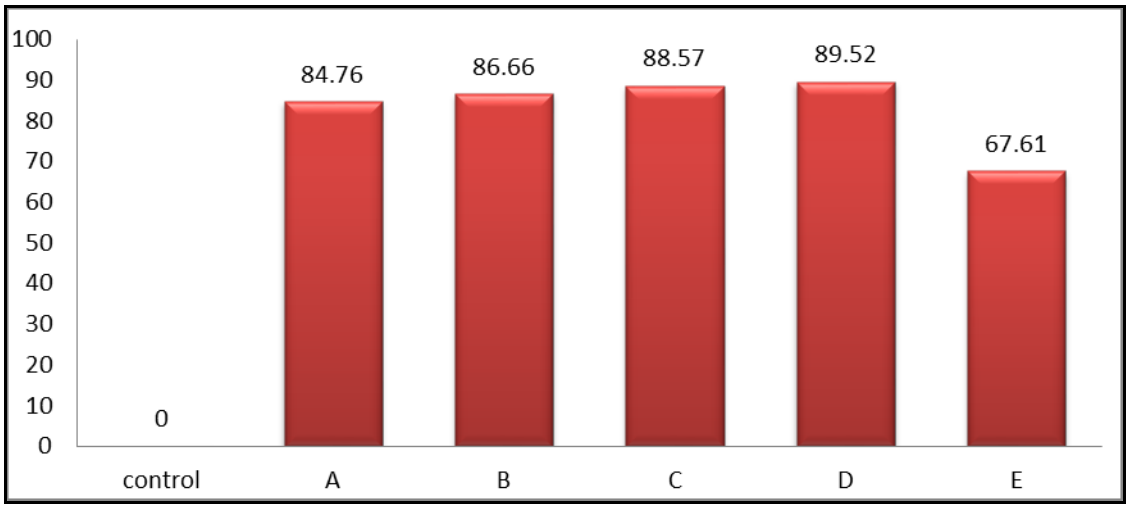

Fig. Variation of weight loss of mild steel in 0.1N HCl solution containing in different acidic medium by an expired acidity non toxic drug. (Graph-7)

Inhibition of corrosion mild steel in different acidic medium by an expired acidity non toxic drugs in 0.01N HCl.(Table-8)

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E.(%)
Control	0.326	0.278	0.048	14.72	-
A	0.317	0.307	0.01	03.15	79.16
B	0.328	0.321	0.007	02.13	85.41
C	0.314	0.310	0.004	01.27	91.66
D	0.364	0.355	0.009	02.47	81.25
E	0.320	0.303	0.017	05.31	64.58

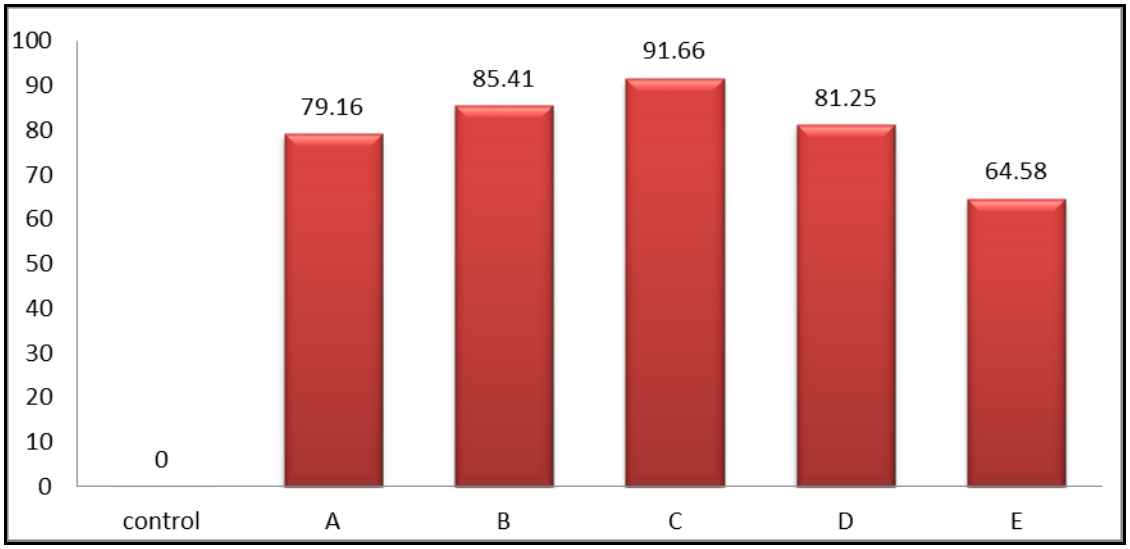

Fig. Variation of weight loss of mild steel in 0.01N HCl solution containing in various acidic medium by an expired acidity non toxic drug.(Graph-8)

Inhibition of corrosion mild steel in different acidic medium by an expired acidity non toxic drugs in 0.001N HCl.(Table-9)

Compound	Initial weight (W_1)	Final Weight (W_2)	Loss in weight (ΔW)	% Loss in weight	I.E. (%)
Control	0.326	0.277	0.049	15.03	-
A	0.282	0.265	0.017	06.03	65.30
B	0.311	0.306	0.005	01.61	89.79
C	0.363	0.352	0.011	03.03	77.25
D	0.338	0.330	0.008	02.36	83.67
E	0.294	0.284	0.01	03.40	79.59

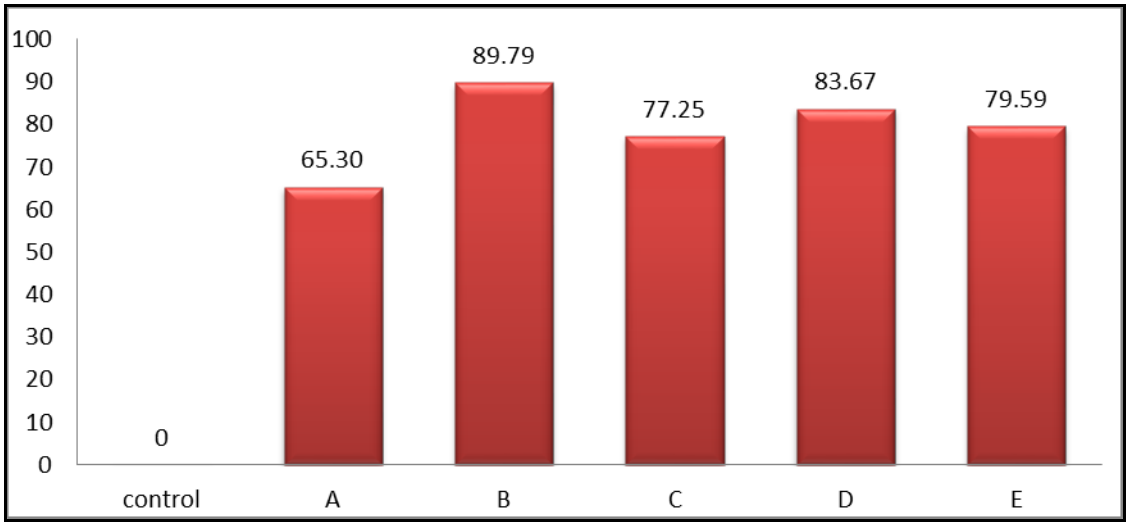

Fig. Variation of weight loss of mild steel in 0.001N HCl solution containing in various acidic medium by an expired acidity non toxic drug.(Graph-9)

In this research work the inhibition of corrosion of carbon steel binding wire in various minerals acid medium by an expired acidity non-toxic drug's were studied.

The inhibition effectiveness of Rentidine, Zantac, Rentac, Aciloc and Omez have been studied in regarding corrosion of mild steel in 0.1N, 0.01N 0.001N, HCl, HNO_3 and H_2SO_4 acidic medium.

Comp.B. Rentac shows I.E 83.05, 77.7 and 75.60 in 0.1, 0.01, and 0.001 N HNO_3 acid medium. The comp. (E) Omez also shows higher I.E of Rentidine, Zantac & Aciloc compounds is having less I.E in 0.1, and 0.1, and 0.001N, HNO_3 acid medium.

The I.E of Rentidine, Zantac & Aciloc drug's compound is less in the dilution of 0.1N and 0.01N Nitric acid solution.

In the analysis of expired acidity non-toxic drug's in sulphuric acid medium. The interesting results come out from the observation comp. D (Rentac) were shows 69.56% I.E in 0.1N H_2SO_4 acid medium.

Comp. A (Rentidine) has good result 66.66% I.E but shows less I.E below 50% in 0.1 N and 0.01N H_2SO_4 acid solution.

In certain comp. (B) Zantac and Comp. (C) - Aciloc exhibits I.E value 60.86% in 0.001 N H_2SO_4 and also 60% in 0.01N sulphuric acid medium.

The most effective corrosion inhibition for the steel binding wire were observed with an expired acidity non-toxic drug's comp. C- (Aciloc) I.E factor up to 91.66% in 0.01N HCl solution similarly other conc. of acid shows 88.57 in 0.1N HCl and 77.25 in 0.001 N HCl acid medium from the given observation from the given observation. The study of different acidity non-toxic drugs has been found good inhibitor for the mild steel in various HCl acid solutions. The I.E should follow the sequence i.e. HCl> HNO_3> H_2SO_4.

The I.E increases with increase in conc. of acids. The corrosion process in inhibited by the adsorption these molecules on the steel binding wire. The various expired acidity non- toxic drug's comp. containing active group which is responsible to inhibits corrosion of mild steel in different acidic medium. The inhibition performance of various expired acidity non- toxic drugs depends on the adsorption of its molecules on the metallic surface. The results determined by weight loss experimental techniques unconvincingly good agreements. The adsorption model obeys.

Conclusion

In the study of inhibition effect of an expired acidity non-toxic drug's on the corrosion of mild steel in various acidic medium by weight loss technique at room temperature.Result obtained from experimental data shows that expired acidity non- toxic drugs Aciloc is good inhibitor for the corrosion of mild steel in 0.01 N HCl also comp.(D)- Rentac exhibits 83.05% I.E in 0.1N HNO_3 comp. (E)- Omez shows 78.04% I.E in 0.001N HNO_3 acidic medium comp. Zantac exhibits 66.66% efficiencies in 0.01N H_2SO_4 .The different expired acidity non-toxic drug's exhibits good I.E at 65 to 91% in all dilution of HCl, acidic medium solution. The results obtained from the observations table graphical methods & weight loss measurements are in good agreements with each other.

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