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Corrosion inhibition potential of ethylamine for mild steel corrosion in saline water environment

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ABSTRACT

Corrosion constitutes major set back to the maritime industry, as it effects on ships and port facilities adversely affect their durability, technical efficiency and overall productivity of shipping as an industry. It's therefore imperative to device means to prevent or at least minimize the effects of corrosion on ships and port facilities. Literature reveals that several substances (organic pigments, plant/animal extract, etc) shows high potency in corrosion reduction in several media. The present study is on the effects of ethylamine in the reduction of rate of corrosion of mild steel in saline water environment using weight loss method. Useful parameters like corrosion rate and inhibition efficiency was obtained from data generated experimentally. Fact gathered from analysis of generated data and review of related literature revealed that the corrosion rate of mild steel in saline medium increases significantly ($p<0.05$) with increase in the salinity level of the medium, ethylamine significantly ($p<0.05$) reduces the rate of mild steel corrosion in 0.6M Sodium Chloride solution, percentage inhibition efficiency of ethylamine for mild steel corrosion in saline medium reduces with increase in its concentration administered.

KEYWORDS

Corrosion rate;
Mild steel;
Saline water;
Ethylamine.

INTRODUCTION

Corrosion refers to the oxidation of a metal by its environment, resulting in the destruction of the metal lattice. Corrosion in most cases occur in wet environment by electrochemical process where a cell is setup and the metal oxidized anodically. This phenomenon constitutes major problem facing the maritime industry, as mild steel being the most preferred as ship building material with other vast characteristic applicability, is very susceptible to corrosion. Since the enormous industrial application of mild steel cannot be compromised, measures has to be devised to prevent or atleast reduced the effects of corrosion on mild steel as a construction material[2]. The use of corrosion inhibitors is one of the most practical methods for protection of metals against corrosion[4]. Most well known inhibitors are organic compounds containing Nitrogen, Sulphur, Oxygen and Phosphorus in their functional groups[3,5]. Ethylamine which is the preferred inhibitor for the present study exhibits highest efficiency for the inhibition of mild steel corrosion in various media. Molecules which is suspected to reduce inhibition efficiency for oxygen carrying inhibitors[1]. Weight loss method was considered suitable for this study and necessary parameters like Corrosion Rate (CR) and Inhibition Efficiency (IE) were obtained from experimentally generated data. Corrosion inhibition occurs by adsorption of the inhibitor molecule on the corroding metal surface[3]. The inhibitive action of these molecules has been attributed to the strong adsorption of these molecules on the metal surface, using the lone pairs of electron available on the hetero atoms[1,5]. Sodium chloride was considered suitable for this study because it constitutes 85.6% of salts in sea water which is the environment considered for this study. Other salts include sulfate (7.7%) calcium (1.17%), magnesium (3.65%), potassium (1.13%), others (0.6%)[7].

EXPERIMENTAL PROCEDURE

Preparation of specimen

The mild steel material used for this research work was identified by HYP Engineering Limited, Uyo building materials market, Mbiabong Etoi, Uyo, Akwa Ibom State, Nigeria. The material with thickness, 3.0mm, was mechanically cut into strips of dimension 5.0 cm by 3.5 cm, with holes of diameter 3.0mm drilled at one end for hooking. The mild steel strips obtained were polished to obtain a mirror-like surface using emery paper. The polished steel strips were further treated with acetone to remove grease or any oily substance on it, before washing them with distilled water and finally air dried to get them ready for use as the experimental specimens. 10 of the specimens where selected for the experimented work; 5 immersed in corrodent solutions of different concentrations and 5 immersed in 0.6M sodium chloride solution with various concentrations of ethylamine (inhibitor) i.e total sample size was 10.

Preparation of reagents

All reagents used were AnalaR products of the British Drug House, England. Solutions preparation were by sample dissolution and subsequent dilution using dilution principle, to obtain various concentrations of the respective solutions required.

Preparation of sodium chloride solution

Sodium chloride solution was prepared by dissolving it equivalent weight in water to obtain Idm^3 of solution. The equivalent weight was obtained from the product literature from the manufacturer.

The procedure involve accurate measurement of the equivalent weight using suitable balance and transferring it to a volumetric flask of designated capacity containing water. The volume of the solution was then made up to mark of the volumetric flask by adding more water. Here, the equivalent weight of sodium chloride was 58.44 g and the solution obtained is of IM concentration.

For other concentrations, mass of salt required was evaluated as shown below:

For 0.2M sodium chloride solution, mass of salt required is given by; $\frac{58.44g \times 0.2M}{1.0M} = 11.688g$

For 0.4M sodium chloride solution, we have $\frac{58.44 \times 0.4M}{1.0M} = 23.376g$

For 0.6M sodium chloride solution, we have $\frac{58.44g \times 0.6M}{1.0M} = 35.064g$

For 0.8Mof sodium chloride solution, we have $\frac{58.44g \times 0.8M}{1.0M} = 46.752g$

The respective concentrations were prepared from the respective masses of salt using similar procedure described above for the preparation of 1M solution.

Preparation of standard solution of ethylamine

The molarity of stock was first calculated as shown below:

$$\text{Molarity} = \frac{\%\text{purity} \times \text{Specific gravity} \times 1000\text{cm}}{\text{Molar mass} \times \text{Volume of solution}}$$

Where: % Purity =99%

Specific gravity = 1.077 gcm^{-3}

Molar mass ($C_2H_5NH_2$) = 45.09 gmol^{-1}

Volume of solution =150 ml

$$= \text{Molarity} = \frac{99\% \times 1.017\ \text{gcm}^{-3} \times 1000\text{cm}^3}{45.09\ \text{gmol}^{-1} \times 150\text{cm}^3}$$

= 14.89M

Volume/volume concentrations of 1.5ml, 3.0ml, 4.5ml 6.0ml and 7.5ml respectively of ethylamine each in 150ml of 0.6M solution of Sodium chloride were prepared by accurately measuring the respective volumes of ethylamine and dissolving each in 150ml of 0.6M Sodium chloride in a volumetric flask. The molarities of the respective resulting solutions were obtained by dilution principle as shown below:

$M_1V_1 = M_2V_2$ (dilution principle)

Where, M_1 = Molarity of stock (in this case 14.89M)

V_1 = Volume of stock (1.5ml, 3.0ml, 4.5ml, 6.0ml and 7.5ml)

M_2 = Molarity of diluted solution (to be calculated)

V_2 = Volume of diluted solution (150ml)

$$M_2 = \frac{M_1V_1}{V_2}$$

Then, for 1.5ml, $M_2 = \frac{14.89\text{ M} \times 1.5\text{ml}}{150\text{ml}} = 0.1489\text{M}$

For 3.0ml, $M_2 = \frac{14.89\text{M} \times 3.0\text{ml}}{150\text{ml}} = 0.2978\text{M}$

For 4.5ml, $M_2 \; \frac{14.89\text{M} \times 4.5\text{ml}}{150\text{ml}} = 0.4467\text{M}$

For 6.0ml, $M_2 = \frac{14.89\text{M} \times 6.0\text{ml}}{150\text{ml}} = 0.5956\text{M}$

For 7.5ml, $M_2 = \frac{14.89\text{M} \times 7.5\text{ml}}{150\text{ml}} = 0.7445\text{M}$

Weight loss measurement

The initial weights of the prepared specimens were taken and recorded. The specimens were suspended by means of rubber thread each into 150ml of solution. The solutions were of two sets A and B, where A contained 0.2M, 0.4M, 0.6M, 0.8M and 1.0M of sodium chloride respectively and B contained 0.1489M, 0.2978M, 0.4467M, 0.5956M, and 0.7445M of ethylamine respectively each in 0.6M solution of Sodium chloride.

The specimens were completely immersed in the experimental solution and the setup was allowed to stand for 5 days, after which the specimens were removed, washed with distilled water, polished with emery papar, degreased with acetone, dried and their final weight taken and recorded. The experiment continued until four (4) other readings were generated each at 5 days interval. In each case, the weight loss was obtained from the initial and final weights of the specimens respectively as shown below;

Weight loss = Initial Weight – Final weight.

From the respective weight losses useful parameter like corrosion rate and inhibition efficiency were obtained.

Determination of corrosion rate (cr).

The corrosion rate of mild steel in various concentrations of sodium chloride solution was obtained by mathematical method as shown bellow,

$$CR = \frac{87.6W}{DAT}$$

Where W = Weight loss (in grams)

D = Density of mild steel (7.86 gcm^{-3})

T = Exposure Time (in hours)

A = Area (Total Surface Area of specimen)

In this case, A is obtained from, $A = [LB + (L+B)T]^2$

Where L = Length (5cm),

B = Breath (3.5cm)

T = Tickness (0.3cm)

From A = [LB+(L+B)T]2

A = [5x 3.5+ (5+3.5)0.3]2

A = 40.10cm^2

CR is measured in millimeter penetration per year ($mmpy^{-1}$).

Determination of inhibition efficiency (ie)

The efficiency of various concentrations of the ethylamine in the inhibition of mild steel corrosion in 0.6M solution of sodium chloride was determined by mathematical method as shown below,

$$IE = \frac{W_0 - W_1}{W_O} \times 100\%$$

Where W_0 = Weight Loss without inhibitor,

W_1 = Weight Loss with inhibitor and

% IE = Percentage Inhibition Efficiency.

Alternatively, Inhibition Efficiency can be obtained from corrosion rate as shown below,

$$IE = \frac{CR_0 - CR_1}{CR_0} \times 100\%$$

Where CR_0 = Corrosion Rate Uninhibited

CR_1 = Corrosion Rate Inhibited

IE = Inhibition Efficiency[6].

RESULTS AND DISCUSSION

Weigh loss studies

The corrosion of mild steel in various concentrations of ethylamine were investigated. The results obtained and presented on TABLE 1 shows that; corrosion rate increases with increase in the concentration of sodium chloride solution. Statistical analysis of the data presented on TABLE 3 shows that, the said increase in corrosion rate as concentration of medium increases tested significant (P<0.05) at higher concentrations of sodium chloride solution (e" 0.8M) and non significant (P< 0.05) for lower concentrations (d" 0.6M) of the solution. A summary of the data on TABLE 6 demonstrates corresponding increase in mean rate of corrosion with increase in the concentration of sodium chloride solution. This data was represented in a plot presented on Figure 1 which clearly shows a directly pro-

TABLE 1 : Result of mild steel corrosion in various concentrations of sodium chloride solution without inhibitor.

Concentration of sodium chloride solution (M)	Time(days)	Specimen weights(g)	Weight loss(g)	Corrosion Rate, CR (mmpy^{-1})
0.2	O	44.60	Nil	Nil
	5	42.35	2.25	$5.21X10^{-3}$
	10	40.45	4.15	$4.81 X 10^{-3}$
	15	39.20	5.40	$4.17 X 10^{-3}$
	20	38.35	6.25	$3.62 X 10^{-3}$
	25	37.10	7.50	$3.47 X 10^{-3}$
0.4	0	44.80	Nil	Nil
	5	42.35	2.45	$5.67 X 10^{-3}$
	10	40.10	4.70	$5.44 X 10^{-3}$
	15	38.55	6.25	$4.83 X 10^{-3}$
	20	37.65	7.15	$4.14 X 10^{-3}$
	25	36.35	8.45	$3.91 X 10^{-3}$
0.6		44.80	Nil	Nil
	5	42.15	2.65	$6.14 x10^{-3}$
	10	39.75	5.05	$5.85 x 10^{-3}$
	15	38.35	6.45	$4.98 x 10^{-3}$
	20	37.00	7.80	$4.52 x 10^{-3}$
	25	35.75	9.05	$4.19 x 10^{-3}$
0.8	0	47.35	Nil	Nil
	5	44.65	2.70	$6.25 x 10^{-3}$
	10	42.25	5.10	$5.91 x 10^{-3}$
	15	40.70	6.65	$5.13 x 10^{-3}$
	20	38.60	8.75	$5.07 x 10^{-3}$
	25	37.35	10.05	$4.66 x 10^{-3}$
1.0	0	45.55	Nil	Nil
	5	42.75	2.80	$6.49 x 10^{-3}$
	10	40.00	5.55	$6.43 x 10^{-3}$
	15	38.25	7.30	$5.64 x 10^{-3}$
	20	36.70	8.85	$5.12 x 10^{-3}$
	25	35.30	10.25	$4.75 x 10^{-3}$

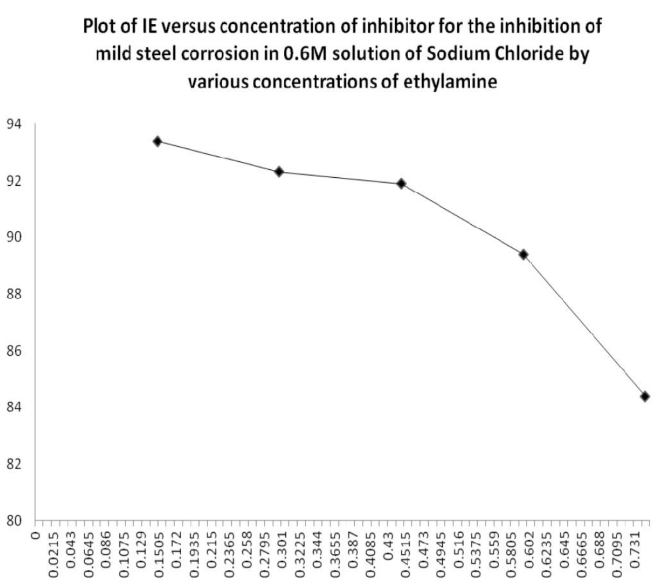

Figure 1 : Plot of CR versus concentration of corrodent for the corrosion of mild steel in various concentrations of sodium chloride solution. Values obtained from TABLE 5

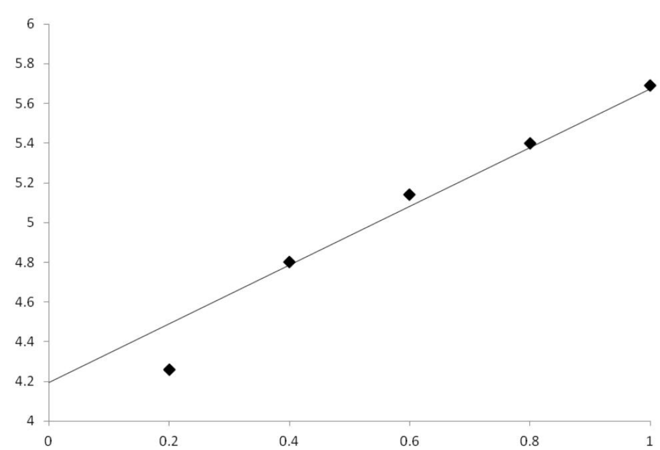

Figure 2 : Plot of IE versus concentration of inhibitor for the inhibition of mild steel corrosion in 0.6M solution of sodium chloride by various concentrations of ethylamine. Value obtained from TABLE 6

portional increase in mean corrosion rate of steel corrosion in saline medium with increase in concentration

TABLE 2 : Results of mild steel corrosion in 0.6M sodium chloride solution with various concentrations of inhibitor

Volume of inhibitor in 150ml of 0.6M sodium chloride solution (ml)	Concentration of inhibitor (M)	Exposure time (days)	Weights of specimen (g)	Weight loss (g)	Corrosion rate, CR ($mmpy^{-1}$)	Inhibition Efficiency, IE (%)
1.5	0.1489	0	36.20	Nil	Nil	Nil
		5	36.10	0.10	$2.32x10^{-4}$	95.6
		10	36.00	0.20	$2.32x10^{-4}$	95.2
		15	35.85	0.35	$2.70x10^{-4}$	93.5
		20	35.70	0.50	$2.90x10^{-4}$	92.0
		25	35.50	0.70	$3.24x10^{-4}$	90.7
3.0	0.2978	0	36.60	Nil	Nil	Nil
		5	36.45	0.15	$3.47x10^{-4}$	94.3
		10	36.30	0.30	$3.47x10^{-4}$	94.1
		15	36.15	0.45	$3.47x10^{-4}$	92.8
		20	35.95	0.65	$3.76x10^{-4}$	90.9
		25	35.70	0.90	$4.17x10^{-4}$	89.3
4.5	0.4467	0	36.50	Nil	Nil	Nil
		5	36.35	0.15	$3.47x10^{-4}$	94.1
		10	36.15	0.35	$4.05x10^{-4}$	92.6
		15	36.00	0.50	$3.86x10^{-4}$	92.2
		20	35.80	0.70	$4.05x10^{-4}$	91.0
		25	35.55	0.95	$4.40x10^{-4}$	89.5
6.0	0.5956	0	36.80	Nil	Nil	Nil
		5	36.60	0.20	$4.63x10^{-4}$	91.8
		10	36.35	0.45	$5.21x10^{-4}$	90.4
		15	36.10	0.70	$5.40x10^{-4}$	89.5
		20	35.80	1.00	$5.79x10^{-4}$	88.6
		25	35.45	1.35	$6.25x10^{-4}$	86.6
7.5	0.7445	0	35.80	Nil	Nil	Nil
		5	35.50	0.30	$6.95x10^{-4}$	89.3
		10	35.10	0.70	$8.11x10^{-4}$	87.4
		15	34.65	1.15	$8.88x10^{-4}$	84.2
		20	34.20	1.60	$9.26x10^{-4}$	81.9
		25	33.65	2.15	$9.96x10^{-4}$	79.0

of the medium.

Data presented on TABLE 4, shows that mean rate of corrosion of mild steel in 0.6M sodium chloride is sufficiently reduced by the activities of ethylamine. This reduction was tested significant ($P < 0.05$) for all concentrations of ethylamine administered.

Data on TABLE 2 reveals that percentage inhibition efficiency of ethylamine for mild steel corrosion in 0.6M sodium chloride solution reduced with increase in concentrations of ethylamine administered. Analysed data presented on TABLE 5 revealed that mean percentage inhibition efficiency of ethylamine for mild steel corrosion in 0.6M sodium chloride solution reduced with increase in concentration of ethylamine administered. This reduction tested non significant ($P<0.05$) for lower concentrations (d" 0.4467M) and tested significant ($P<0.05$) for higher concentrations (e" 0.5956M) of ethylamine administered respectively. Summarized data presented on TABLE 7 shows a corresponding reduction in mean percentage inhibition efficiency of ethylamine for mild steel corrosion in 0.6M sodium chloride, with increase in the concentration of ethylamine administered. A plot of the data on TABLE 2 produced a graph demonstrating an irregular reduction in mean percentage inhibition efficiency with increase in concentration of inhibitor administered. This is denoted by line graph sloping at irregularly increasing gradients. The figure showed that the reduction in mean percentage inhibition efficiency was more severe at higher concentrations of the inhibitor.

Method of statistical analysis

Data obtained from experimental work was statistically analyzed and changes in parameters of interest

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TABLE 3 : Statistical analysis of the difference in the corrosion rate of mile steel in various concentrations of sodium chloride unhibited and when inhibited by various concentration of ethylamine (inhibitor).

CR Uninhibited x 10^{-3} (mmy^{-1})	$\bar{X}$ x 10^{-3}	SD x 10^{-3}	CR Inhibited x 10^{-4} ($mmpy^{-1}$)	$\bar{X}$ x 10^{-4}	SD x 10^{-4}	Difference in $\bar{X}$ of CR x 10^{-3}	SEMD x 10^{-3}	Statistical Test: df	Test values: T_{cal}	Test values: T_{tab} (P<0.05)	Significance (P<0.05)
5.21			2.32								
4.81			2.32								
4.17			2.70								
3.62	4.26	0.68	2.90	2.69	0.34	3.99	0.34	8	11.74	2.31	S
3.47			3.20								
5.67			3.47								
5.44			3.47								
4.83			3.47								
4.14	4.80	0.69	3.76	3.67	0.27	4.43	0.33	8	13.42	2.31	S
3.91			4.17								
6.14			3.47								
5.85			4.05								
4.98			3.86								
4.52	5.14	0.75	4.05	3.97	0.30	4.74	0.36	8	13.17	2.31	S
4.19			4.40								
6.25			4.63								
5.91			5.21								
5.13			5.40								
5.07	5.40	0.59	5.79	5.46	0.55	4.85	0.36	8	13.47	2.31	S
4.66			6.25								
6.49			6.95								
6.43			8.11								
5.64			8.88								
5.12	5.69	0.69	9.26	8.63	1.03	4.83	0.55	8	8.78	2.31	S
4.75			9.96								

X : Mean; SD: Standard Deviation; CR: Corrosion Rate; SEMD: Standard Error of Mean Deviation; df: Degree of Freedom; P: Significance Level; $T_{cal:}$ t – calculated; $T_{tab:}$ t – table

was tested using appropriate statistical method (t-test) and their significance measured at appropriate significance level (P < 0.05). The following statistical instruments were used for the entire work:

$$\text{Mean, } \bar{X} = \frac{\sum fx}{\sum f}$$

where $\sum fx$ – Summation f of $\bar{X}$ and

$\sum f$ – Summation f = N

f – Frequency

X – Observation

$$\text{Standard Deviation, S. D} = \sqrt{\frac{\sum f\,\overline{(X-X)}^2}{\sum f}}$$

Where S_1 – Standard Deviation of the first group

S_2 – Standard Deviation of the second group

N_1 – Number of observations of the first group

N_2 – Number of observations of the second group

$$\text{Student's } t\text{–test, } t = \frac{\bar{X}_1 - \bar{X}_2}{SEMD}$$

Where X_1 – Mean of the first group

X_2 – Mean of the second group

SEMD – Standard Error of Mean Deviation

P = Significance Level = 0.05

Occurrence and mechanism of corrosion

Corrosion occurs by electrochemical process involving an electrolyte (where there is ionic transfer), anodic and cathodic reactions respectively and electrical currents to initiate its action. It involves the formation of a chemical cell, in which a potential difference is set up between the points on the surface involved. The

TABLE 4 : Statistical Analysis of Data obtained for the Inhibition Efficiency of various concentrations of Ethylamine for mild steel corrosion in 0.6M sodium chloride solution.

Concentration of Inhibitor (M)	Inhibition Efficiency IE (%)	Mean $\bar{X}$	Standard Deviation (SD)	Difference in $\bar{X}$ % IE	SEMD	Statistical Test: df	Test values: Tcal	Test values: T tab (P<0.05)	Significance (P<0.05): S	Significance (P<0.05): NS
0.1489	95.6 95.2 93.5 92.0 90.7	93.4	1.86	Nil	Nil	Nil	Nil	Nil		
0.2978	94.3 94.1 92.8 90.9 89.3	92.3	1.92	1.1	1.19	8	0.92	2.31		NS
0.4467	94.1 92.6 92.2 91.0 89.5	91.9	1.55	1.5	1.08	8	1.34	2.31		NS
0.5956	91.8 90.4 89.5 88.6 86.6	89.4	1.75	4.0	1.14	8	3.51	2.31	S	
0.7445	89.3 87.4 84.2 81.9 79.0	84.4	3.70	9.0	1.85	8	4.86	2.31	S	

TABLE 5 : Summary of the relationship of mild steel corrosion rate (CR) and concentration of sodium chloride solution (corrodent medium).

CR x 10^{-3} ($mmpy^{-1}$)	4.26 ± 0.68	4.80 ± 0.69	5.14 ± 0.75	5.40 ± 0.59	5.69 ± 0.69
Concentration of sodium chloride (M)	0.2	0.4	0.6	0.8	1.0

Values for CR are presented in mean ± standard deviation

electrolytic reactions are as presented below:

- Anodic reaction $M_{(s)} \longrightarrow M^{2+}_{(aq)} + 2e^-$
- Cathodic reaction:

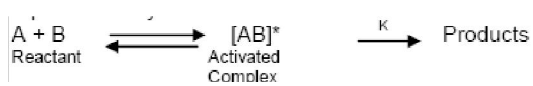
In acidic medium, $2H^+_{(aq)} + 2e^- \longrightarrow H_{2(g)}$

$4H^+_{(aq)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$

In basic medium, $2H_2O_{(l)} + O_{2(g)} + 4e^- \longrightarrow 4OH^-$

The reaction mechanism of corrosion follows the "absolute reaction rates theory" also known as the "transition state theory", which states that; "molecules before undergoing reaction must form an activated complex in equilibrium with the reactants, and that the rate of any reaction is given by the rate of decomposition of the complex to form the reaction products".

Generally, for a reaction between a molecule of A and of B, the postulated steps can be represented by the scheme:



The activated complex has certain properties of an ordinary molecule and possesses temporary stability[1].

Similarly, corrosion of iron in saline medium is by a reaction mechanism presented below:

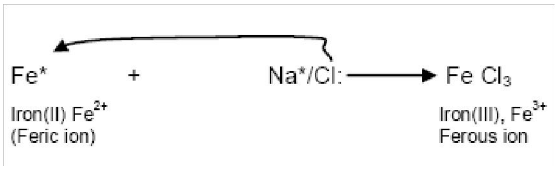
$Fe_{(s)} + NaCl_{(aq)} \overset{K}{\rightleftharpoons} [F_e(H_2O)]Cl_3^{\cdot}{}_{(aq)} \overset{K}{\longrightarrow} Fe_2O_3.xH_2O_{(aq)} + F_eCl_{3(s)}$

By way of further simplification, the reaction above occur by the oxidation of Fe from an oxidation state of +2 to +3 by a lone pair of election from chlorine (Cl^-). The reaction occur by electrophilic addition and its mechanism is as shown below.

TABLE 6 : Summary of relation of inhibition efficiency and concentration of inhibitor (ethylamine) administered.

1E(%)	93.4$\pm$ 1.96	92.3$\pm$1.92	91.9$\pm$1.55	89.4$\pm$1.45	84.4$\pm$3.70
Concentration of inhibitor(M)	0.1489	0.2978	0.4467	0.5956	0.7445

Values for 1E (inhibition efficiency) are presented in mean $\pm$ stand deviation

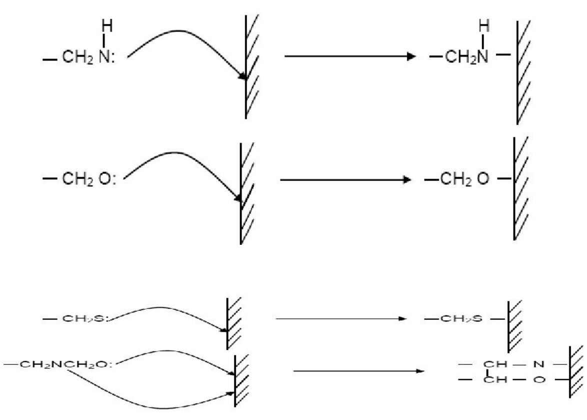


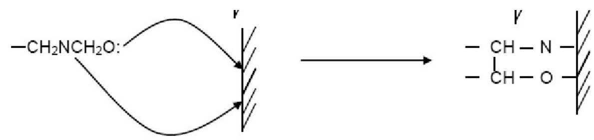
The reaction is characterized by the formation of reddish brown colouration of Fe^{3+} as the corrosion product which is also known as RUST and the process also called RUSTING[1,2].

Occurrence and mechanism of corrosion inhibition

Most inhibitors are organic compound and Thiourea derivatives containing Nitrogen (N), Oxygen (O) and Sulphour (S) in their molecule which are all electron rich atoms[3]. The compounds are hydrolysable and can easily get adsorbed on the metal surface via the lone pair of electrons carried by their respective N,O or S atoms by process of electrophilic addition. The bulky group that carries the functional groups containing the reacting atoms, covers the surface of the metal preventing further interaction of the metal with the corrosion environment and perhaps subsequent characteristic ionic transfer, as such preventing corrosion occurrence. The thin layer coverage formed essentially blocks the discharge of H^+ and dissolution of metal ions, producing an electrostatic system where the protonated constituents molecule are adsorbed by process of physisorption producing inhibition effect of very high efficiency[6].

The schematic representation of the mechanism is as shown below:

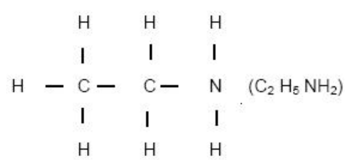




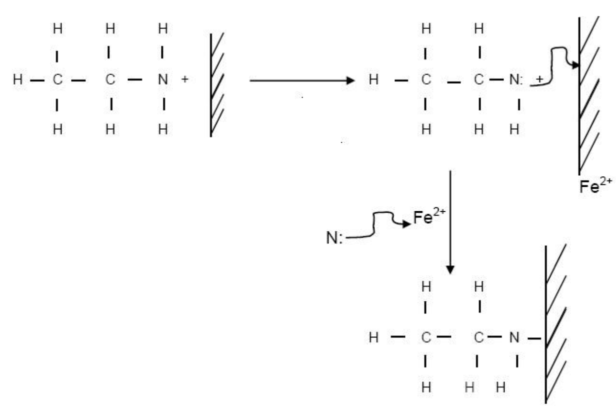
From the mechanism presented above, corrosion inhibition can be explained on the basis of the concept of adsorption of inhibitors on the corroding metal surface. The inhibitive action of these compounds has been attributed to the strong adsorption of these molecules on the positive metal surface, using the lone pairs of electron available on their hetero atoms[1].

Ethylamine as a corrosion inhibitor

Ethylmmine is an organic compound and belongs to the family of Alkylamine. It is liquid at room temperature and readily dissolved in water. It is a clear colourless liquid with characteristic irritating smell. It has specific gravity of 1.017g cm^{-3}, 45.09 $gmol^{-1}$ relative molecular mass and 99% purity assays. It molecular formular is $CH_3\,CH_2\,NH_2$ and structural configuration is



As a corrosion inhibitor which is the contention of the present study, ethylamine operate with the mechanism presented below;



Ethylamine and other nitrogenous inhibitors have been reported to show higher inhibition efficiency than every other inhibitors. This may be because the molecule has less interaction with the medium, as nitrogen lone pairs of electron anchors on the positive metal surface with it heteroatom. While other inhibitors especially those carrying OH group have been suspected to be responsible for the gradual deterioration of the metal with time[1].

CONCLUSION

1 Corrosion rate of mild steel in saline medium increased significantly ($P< 0.05$) with increase in concentration of the medium.
2 Ethylamine significantly ($P< 0.05$) reduced the mean rate of corrosion of mild steel in 0.6M sodium chloride solution at all concentrations of ethylamine administered.
3 Inhibition efficiency of ethylamine for mild steel corrosion in 0.6M sodium chloride solution reduced with corresponding increase in the concentration of ethylamine administered.
4 Ethylamine works better in the inhibition of mild steel corrosion in saline medium at its lower (d" 0.45M) concentrations.
5 The effectiveness of the inhibitor clearly signifies the actions of its molecular structure.

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