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Research Article

COMPARISON STUDY OF EXPIRED LIFEBUOY AND DETTOL SOAP ON THE PREVENTION OF MILD STEEL CORROSION IN THE 5 % NaCl ENVIRONMENT

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ABSTRACT

Corrosion inhibitor is the substance when added to the corrosive solution to protect the corrosion rate of the metal. Organic species are preferred when compared to the inorganic compounds. Therefore, hence, in this investigation selected expired Lifebuoy and Dettol soap and analyze its corrosion inhibition property on the mild steel in the 5 % NaCl solution. Weight loss and atomic absorption spectroscopy (AAS) technique was employed to study the corrosion inhibition role of the expired Lifebuoy and Dettol soap. Both weight loss and atomic absorption spectroscopy study reveal that, mild steel corrosion in the NaCl solution decreases with a rise in the concentration of the inhibitors and enhances with a rise in the solution contact time. Expired Lifebuoy soap shows the superior corrosion inhibition property compared to the expired Dettol soap.

INTRODUCTION

Because of good physical and chemical properties, mild steel (MS) is widely used in several industrial sections. Corrosion is a degradation of metal which is caused by the chemical interaction with the environment [1-3]. This process takes when mild steel comes in contact with the corrosive solutions such as HCl, NaOH and NaCl solutions. In the several industrial units, mild steel commonly used for numerous applications. Mild steel comes in contact with a corrosive solution during industrial applications. Mild steel corrosion cannot be fully prevented, but its speed can be successfully controlled by introduction of corrosion inhibitor. Corrosion inhibitor is the chemical substance which is the capable of protecting or reducing the metal corrosion rate [4-7]. The corrosion inhibitor creates a natural thick layer on the metal surface by reaction between the corrosive solution and surface of mild steel. In this case, many researchers focused on the exploration of new corrosion inhibitors. Application of synthetic corrosion inhibitors is banned because of toxic and expensive nature. Hence, natural species are selected as an alternative source because of their easily available, safe, biodegradable, eco environment and cheaper. The presence of N, O, P and S atoms in natural chemicals plays vital role in the inhibition of metal corrosion process [8-10]. Therefore, in current research selected expired Lifebuoy and Dettol soap because of rich sources of electron species in their moieties. The corrosion inhibition property of expired Lifebuoy and Dettol soap in the 5 % NaCl solution was evaluated with the aid of weight loss (gravimetric) and atomic absorption spectroscopy (AAS) techniques.

MATERIALS AND METHODS

Rectangle shape of mild steel of 99.99 % was used for the weight loss (gravimetric) and atomic absorption spectroscopy (AAS) techniques. Before performing weight loss (gravimetric) and atomic absorption spectroscopy (AAS) studies, the mild steel (MS) was polished with 400, 600, 800, 1000 and 1200 grade sand papers. After that, the surface of MS was washed with alcohol and double distilled water. The surface of expired Lifebuoy and Dettol soap wash washed with distilled water in order to remove the dust on the surface of soap. The inhibitor with a concentration range of 0.1 g/L, 0.2 g/L, 0.3 g/L and 0.4 g/L of expired Lifebuoy and Dettol soap was prepared for weight loss (gravimetric) and atomic absorption spectroscopy (AAS) technique studies. The weight loss (gravimetric) and atomic absorption spectroscopy (AAS) experiment was carried out with 100 ml of 5 % NaCl solution without and with

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inhibitors of 0.1 g/L, 0.2 g/L, 0.3 g/L and 0.4 g/L at 303 K with immersion time of 5, 10, 15, 20 and 25 hours.

The protection efficiency can be calculated from the equation below;

Protection (inhibition) efficiency (%) = $\frac{(W_1-W_2)}{W_1} \times 100$, (weight loss technique)

Where, W_1= Weight loss of metal in unprotected system, and W_2= Weight loss of metal in the protected system.

Corrosion efficiency (corrosion inhibition efficiency) can be evaluated from the below relation;

Corrosion protection efficiency = $\frac{B-A}{B} \times 100$,

Where, B= Amount of dissolved iron content in the absence of corrosion inhibitor and A= Amount of dissolved iron content in the presence of corrosion inhibitor.

RESULTS AND DISCUSSION

Weight Loss Results

Based on the results obtained from the weight loss technique (as shown in the **Table 1** and **Figure 1**), it is observed that, both expired Lifebuoy and Dettol soap exhibits the good corrosion behavior on the surface of mild steel in the 5 % NaCl solution. The corrosion inhibition property of inhibitors is due to the adsorption of electron rich elements on the surface of mild steel in the 5 % NaCl solution. The effect of inhibitors concentrations and solution contact time was studied on the surface of mild steel in the 5 % NaCl solution. The expired products show the good corrosion inhibition behavior on the mild steel surface in the 5 % NaCl solution with adsorption mechanism. The electron rich species in the expired Lifebuoy and Dettol soap greatly adsorbed on the mild steel surface in the studied corrosive environment. This leads to the generation of protective thick layer on the mild steel surface in the 5 % NaCl solution. The protective invisible layer on the mild steel surface blocks the attack of 5 % NaCl solution. As a result of this, the mild steel is protected from the aggressive environment. Therefore, the weight loss of mild steel decreases with rise in the concentration of the inhibitor. It is also observed that, the protection efficiency has an inverse relationship with the contact time. As the contact time increases, the protection efficiency decreases. This nature is due to the desorption of inhibitor species (both expired Lifebuoy and Dettol soap) over the mild steel surface in the 5 % NaCl solution. Therefore, metal mild steel metal easily exposed to the mild steel in the 5 % NaCl solution. Hence, weight loss of mild steel enhances with increasing in the contact from 5 hours to 25 hours. Among the two inhibitors (expired Lifebuoy and Dettol soap), expired Lifebuoy soap exhibits superior corrosion inhibition property 97.734 % compared to the expired Dettol soap on the surface of mild steel in the 5 % NaCl solution.

Table 1 Weight loss results

Concentration (g/L)	Contact time (hours)	Protection (corrosion inhibition) efficiency of expired Lifebuoy soap	Protection (corrosion inhibition) efficiency of expired Dettol soap
Bare			
0.1		85.656	83.455
0.2	5	87.546	85.570
0.3		94.634	86.650
0.4		97.734	90.684
Bare			
0.1	10	87.835	80.835
0.2		90.215	83.245
0.3		92.332	85.300
0.4		94.546	88.500
Bare	15		
0.1		88.443	78.430
0.2		89.675	80.673
0.3		90.054	84.065
0.4	20	91.556	86.550
Bare			
0.1		86.003	76.003
0.2		88.045	78.005
0.3	25	89.210	80.201
0.4		90.542	86.004
Bare			
0.1		84.005	73.001
0.2		86.043	75.006
0.3		88.213	78.204
0.4		89.500	83.005

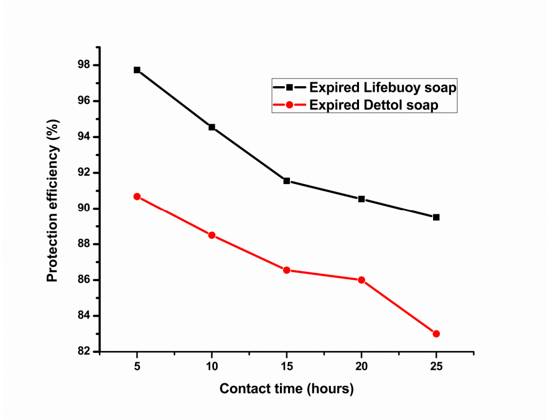

Figure 1 Protection efficiency versus time

Atomic Absorption Spectroscopy (AAS) Studies

Atomic absorption spectroscopy (AAS) was carried out in order to confirm the corrosion inhibition property of expired Lifebuoy and expired Dettol soap. The results of weight loss technique shown in the Table 2 and Figure 2. From this, it is clear that, the weight loss of mild steel in the 5 % NaCl solution decreases with a rise in the concentration of expired Lifebuoy and expired Dettol soap. The decrease in the weight loss of mild steel is due to the adsorption of expired Lifebuoy and expired Dettol soap molecules on the mild steel in the 5 % NaCl solution. The heteroatoms in the expired Lifebuoy and expired Dettol soap strongly adsorb on the mild steel surface in the 5 % NaCl solution. The protective film on the mild steel surface strongly protects the both cathodic and anodic reactions on the mild steel in the 5 % NaCl solution. The AAS results also show that expired Lifebuoy exhibits good corrosion inhibition property compared to the expired Dettol soap. The results obtained from the atomic absorption spectroscopy (AAS) fully support the weight loss results. The electron rich elements in the expired Lifebuoy strongly adsorb on the mild steel surface in the 5 % NaCl solution. As a result of this, high protection efficiency is observed in the presence of expired Lifebuoy on the surface of mild steel in 5 % NaCl solution.

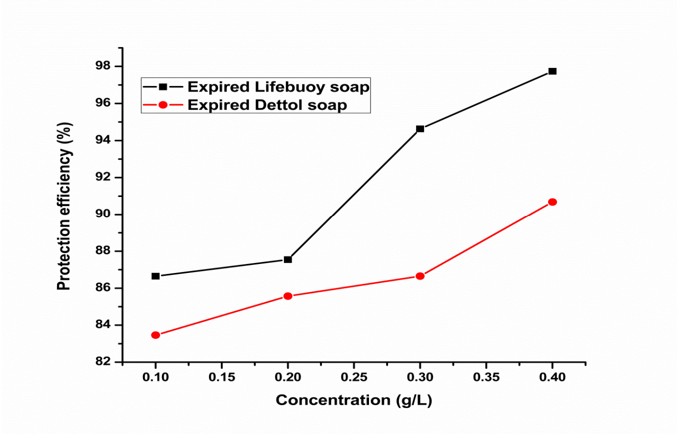

Figure 2 Protection efficiency obtained from the atomic absorption spectroscopy technique

Table 2 Atomic absorption spectroscopy results

Concentration (g/L)	Protection (corrosion inhibition) efficiency of expired Lifebuoy soap	Protection (corrosion inhibition) efficiency of expired Dettol soap
Bare		
0.1	86.650	83.465
0.2	87.544	85.571
0.3	94.630	86.653
0.4	97.735	90.685

CONCLUSION

The effect of expired Lifebuoy and expired Dettol soap on the inhibition of mild steel corrosion in the 5 % NaCl solution was studied by weight loss (gravimetric) and atomic absorption spectroscopy (AAS) techniques. The obtained results show that, both expired Lifebuoy and expired Dettol soap act as effective corrosion inhibitors for mild steel in the 5 % NaCl solution. The inhibitors efficiency enhances with a rise in the concentrations of expired products. However, this ability reduces with increasing in the contact time. The results obtained from the weight loss and atomic absorption spectroscopy (AAS) techniques are in good agreement. Further, expired Lifebuoy shows superior corrosion inhibition property compared to the expired Dettol soap.

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