International Journal of Engineering Research and General Science Volume 3, Issue 3, May-June, 2015
ISSN 2091-2730

Use Reed Leaves as a Natural Inhibitor to Reduce the Corrosion of Low Carbon Steel

Ali Amer A. Hadi

Materials Engineering Department, Faculty of Engineering, University of Kufa, Iraq.

E-mail: alia.alshammary@uokufa.edu.iq

Abstract- Carbon steel, the most widely used engineering material, despite its relatively limited corrosion resistance used in large tonnages in marine applications, nuclear power transportation, chemical processing , petroleum production and refining, pipelines, mining, construction and metal-processing equipment.

The main objective of the present work involved the study of the inhibitive properties of natural product as reed leaves as a safety and an environmentally friendly corrosion inhibitor for low carbon steel in (3.5% NaCl) solution. Results showed when the immersion model in (3.5% NaCl) solution and using (2, 4, 6, 8 and 10%) reed leaves the amount of loss weight decrease with increasing concentration of inhibitor and this shows the damper on his ability to form a protective layer.

Key word: Natural Inhibitor **,** corrosion inhibitor and Low carbon steel.

1. INTRODUCTION

Corrosion is the deterioration of materials by chemical interaction with their environment.The term corrosion is sometimes also applied to the degradation of plastics, concrete andwood, but generally refers to metals. The most widely used metal is iron (usually as steel) and the following discussion is mainly related to its corrosion [1].

The protection of metals or alloys against corrosion can be achieved either by special treatment of the medium to depress its aggressiveness or by introducing into it small amounts of special substances called corrosion inhibitors. Inhibitors are classified according to their action (as anodic, cathodic and mixed inhibitors) and according to their mechanism of action (as hydrogen evolution, scavengers, vapour-phase and adsorption inhibitors) [2].

Carbon steel, the most widely used engineering material, accounts for approximately 85% of the annual steel production worldwide. Despite its relatively limited corrosion resistance. The cost of metallic corrosion to the total economy must be measured in hardness of millions of dollars per year. Because carbon steels represent the largest single class of alloys in use, both in terms of tonnage and total cost, it is easy to understand that the corrosion of carbon steels is a problem of enormous practical importance. This is the reason for the existence of entire industries devoted to providing protective systems for irons and steel.[3, 4]

There are various methods for prevention of corrosion which basically comprises those protective measures providing separation of metal surfaces from corrosive environments or those which cater for adjustment or altering the environment. These various methods of corrosion prevention include cathodic protection, anodic protection , coating and the use of corrosion inhibitor. [5]

The rate of corrosion can also be reduced by using corrosion inhibitors. These inhibitors are chemical compounds that reduce the corrosion rate of metals existing in actively corrosive environments. Using corrosion inhibitors on embedded steel is difficult. There are corrosion inhibitors known to protect bare steel, but some of these compounds have ill effects on the properties of hardened concrete. Setting time, strength, and durability are key elements that can be affected by the corrosion inhibitors [6]

Green corrosion inhibitors are biodegradable and do not contain heavy metals or other toxic compounds. Delonix regia extracts inhibited the corrosion of aluminum in hydrochloric acid solutions [7], rosemary leaves were studied as corrosion inhibitor for the Al + 2.5Mg alloy in a 3% NaCl solution at 25◦C, and El-Etre investigated natural honey as a corrosion inhibitor for copper [8] and investigatedopuntia extract on aluminum [9]. The inhibitive effect of the extract of khillah (Ammi visnaga) seeds on the corrosion of SX 316 steel in HCl solution was determined using weight loss measurements as well as potentiostatic technique. The mechanism of action is attributed to the formation of insoluble complexes as a result of interaction between iron cations, and khellin [10].

In the present work involved the study behavior of natural product as reed leaves extract as a safety and an environmentally friendly corrosion inhibitor for low carbon steel in aqueous media at various concentrations of extract by using simple immersion technique.

2. EXPERIMENTAL WORK

2.1 Chemical Composition of The Alloys

Chemical composition of sample that used in this study shown in Table (1). The analysis has been done in University of Technology /Materials Engineering Department, by using tester " **Portable Metals Analyses**" type(**ARUN Technology**).. The sample was prepared in the form of thick disks (2mm) and diameter (15mm).

Table (1): Chemical composition of the carbon steel used in research

Fe %	**Mn %**	**V %**	**C %**
96.17	1.35	0.35	Rem.

2.2. Sample Preparation

Specimens were prepared as follows:

1- Sample Preparation.

2- Drying and washing sample .

3- Mechanical preparation of sample (polishing, grinding and cutting).

2.3. Analysis of the Powder Plant

Make detection of active compounds in powder plant extracts using the test of Spectroscope (FTIR) appears in Fig. 1

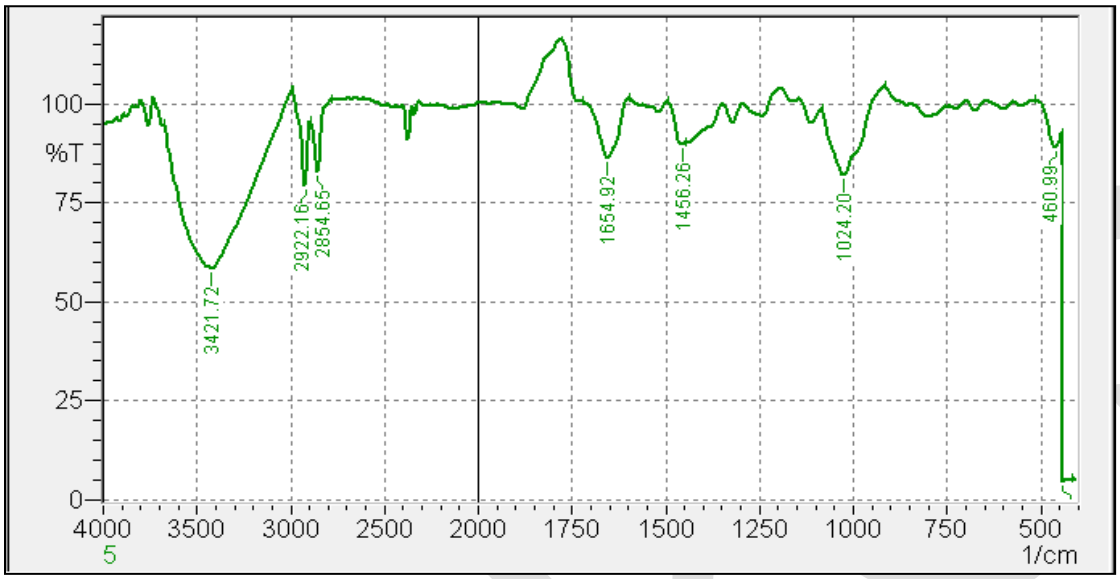

Fig.1 Test of spectroscope (FTIR) for reed fiber.

2.4. Disclosure of Effective Groups in the Powder Plant

Analysis of chemical conducted on the powder plant of the inhibitor the new proved to fit on many of the groups active, which are often vehicles aldehydes, ketone, amines, polyamides and alcohols or compounds of aromatic or phenolic. All of these compounds have properties of inhibition and this is consistent with the findings of other researchers. The presence of bounds double and ties triple and aromatic rings in inhibiting the new system will improve the act inhibitory to this inhibitor and Table (2) identifies the groups and numbers of wavelengths corresponding.

Table (2): The active group and positive number

Positive Number	Active Group
(2854.65-2922.16) cm^{-1}	C – H aromatic
(1654.92) cm^{-1}	C = C

(1024.2) cm^{-1}	Si-O-Si
(460.99) cm^{-1}	Si = H
(3421.72) cm^{-1}	-OH
(1456.26) cm^{-1}	CH_2, CH_3

2.5. Corrosion Testing

This method to expose the samples to the electrolyte solutions [(2, 4, 6, 8 and 10 % reed leaves), , (3%NaCl)] on a regular basis and for periods of time equal about (24 hr.) for each cycle. Where the weight was recorded before and after each cycle, after it washed and dried completely.

3. RESULTS AND DISCUSSION

The results are presented and discussed under various aspects difference between expose the samples to the electrolyte solutions [(2, 4, 6, 8 and 10 % reed leaves), (3%NaCl)] on a regular basis and for periods of time equal about (24 hr.) for each cycle.

3.1. Simple Immersion Test in (3.5%NaCl) Solution Without Inhibitor

The relationship between weight loss and immersion time in (3.5% NaCl) solution without inhibitor appears in Fig. 2 .

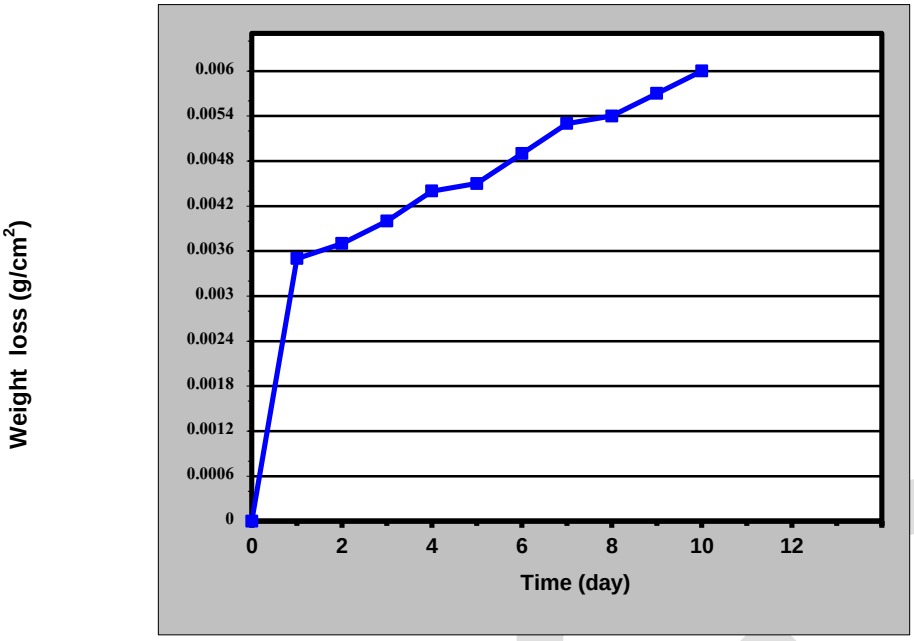

Fig.2. Sample immersion of carbon steel in (3.5%NaCl) solution without inhibitor

Fig .2 appears we note when you immerse the sample in (3.5%NaCl) a continuous decrease weight with increased period of stay in solution, due to the nature of oxides formed as it is porous and weak adhesion (i.e., oxides, non-exhaustive) so they do provide a suitable protection of the metal. Also the large weight loss was due mainly to the presence of ions (Cl).

3.2. Simple Immersion Test in (3.5%NaCl) Solution With Inhibitor

The relationship between weight loss and immersion time in (3.5% NaCl) Solution with inhibitor appears in Figs. (3,4,5,6 and 7).

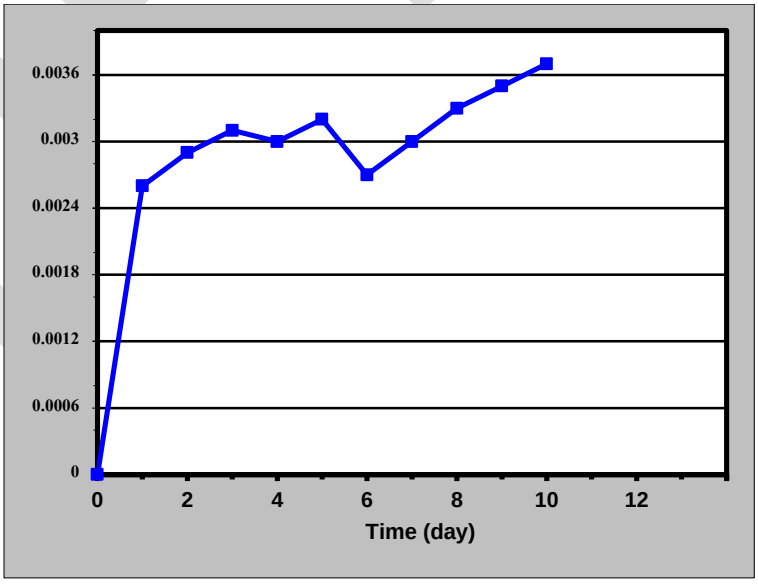

Fig.3. Sample immersion of carbon steel in (3.5%NaCl) solution with (2%) concentration of reed leaves inhibitor

From Figs .3, when you immerse the sample in (3.5%NaCl), which contains the inhibitory concentration of (2%) and a larger weight loss is very small compared with the normal form (without the presence of inhibitor) and the result will be when you use the approach very soaked reed leaves, where a small weight loss.

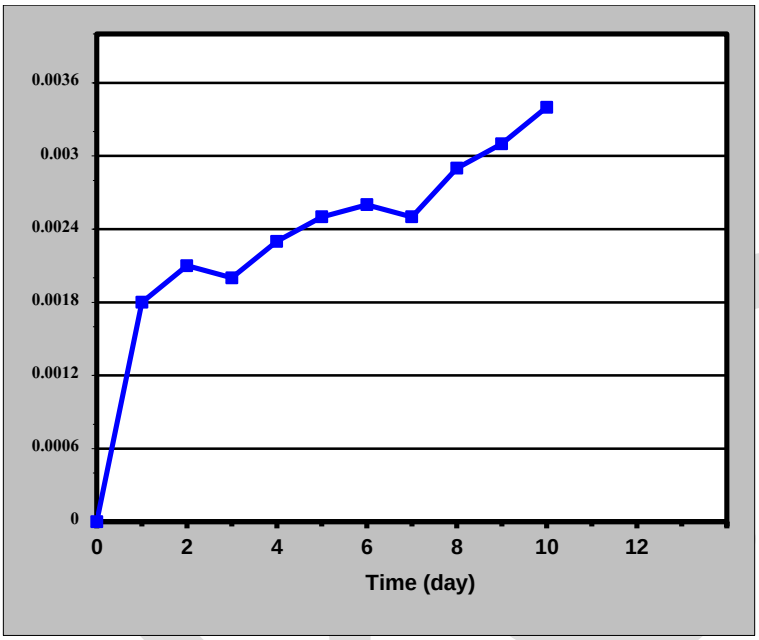

Fig.4. Sample immersion of carbon steel in (3.5%NaCl) solution with (4%) concentration of reed leaves inhibitor

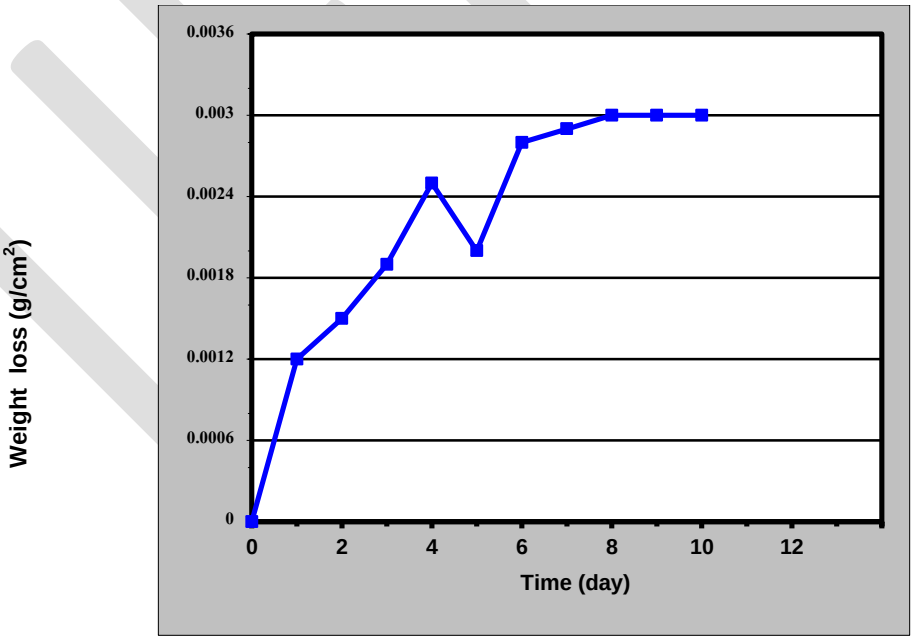

Fig.5. Sample immersion of carbon steel in (3.5%NaCl) solution with (6%) concentration of reed leaves inhibitor

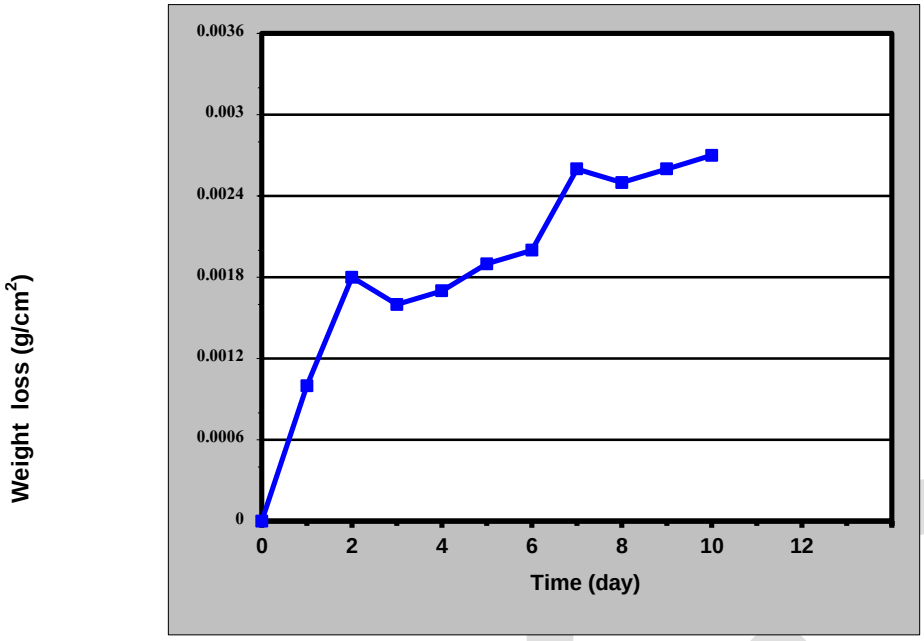

Fig.6. Sample immersion of carbon steel in (3.5%NaCl) solution with (8%) concentration of reed leaves inhibitor

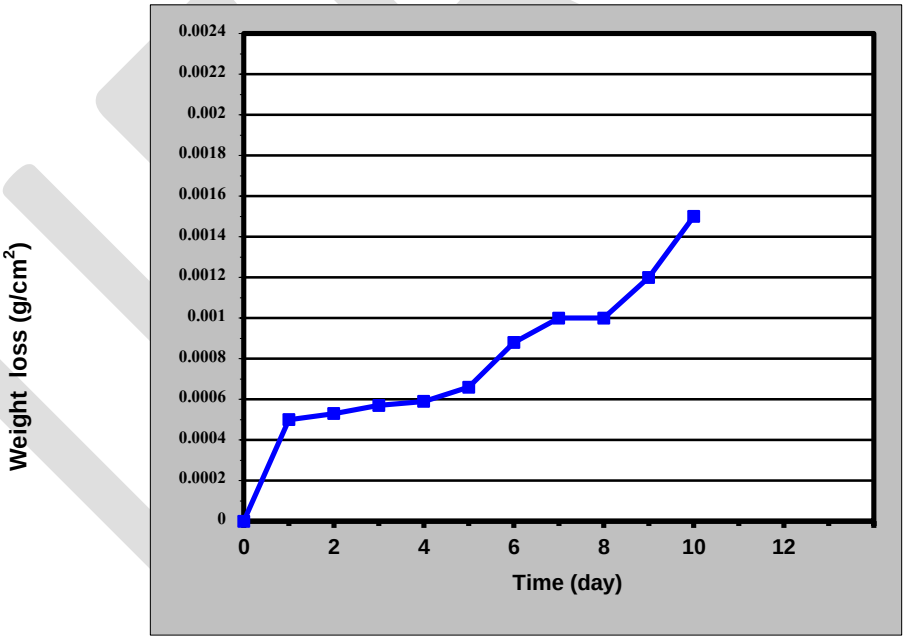

Fig.7. Sample immersion of carbon steel in (3.5%NaCl) solution with (10%) concentration of reed leaves inhibitor

From Figs (4, 5, 6 and 7) appears when the immersion the sample in (3.5%NaCl) that contains the inhibitor with concentration of (4, 6, 8 and 10 %), the amount of loss weight decrease with increasing concentration of inhibitor and this shows the damper on his ability to form a protective layer.

Also not getting lost weight high only after (6 days), indicating a layer of adequate oxide on the surface of steel,

4. CONCLUSION

According to results of present work, the following can be concluded :

1- Natural product as peel of reed leaves as a safety and an environmentally friendly corrosion inhibitor for low carbon steel in aqueous media.

2- The weight loss of low carbon steel in (3.5%NaCl) decreases with the inhibitor concentration increases.

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