Study of the Inhibition Effect of Cymbopogon Extracts on the Corrosion of the X52 Steel in Sulfuric Acid

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Abstract

The effect of Cymbopogon extracts on the corrosion rates of mild steel X52 in 20 % of solution for H2SO4 has been investigated at 25 °C by potentiodynamic polarization method.

The maximum inhibition efficiency (% Pol) was approximately 96.7 %. As far as we know the anticorrosive behavior of this plant has never been undertaken elsewhere.

1. Introduction

The use of chemical inhibitors to decrease the rate of corrosion processes is quite varied. In the processing industries, inhibitors have always been considered as the first line of defense against corrosion. A great number of scientific studies have been devoted to the subject of corrosion inhibitors. However, most of what is known has grown from trial and error experiments; both in the laboratories and in the field. Although many synthetic compounds show good anticorrosive action, most of them are highly toxic to both human beings and environment. These inhibitors may cause temporary or permanent damage to organ system .The toxicity may manifest either during the synthesis of the compound or during its applications. These lead investigations to focus on the use of natural substances in order to find low-cost and non-hazardous inhibitors.

Harnessing naturally occurring substances as corrosion inhibitors is a subject of great practical significance., a Allmad herb which has interesting dyeing properties and used for centuries in the South-East of Algeria (Ouargla) for traditional usages, is readily available, renewable material

source.In this short communication , we present our investigation regarding the corrosion behavior of mild steel X52 in 20 % H2SO4 in the presence of Allmad (figure 1) at ambient temperature.

Material and methods

Allmad was collected in the region of Ouargla. The oil extract was obtained by hydro-distillation using a clevenger. The nominal chemical composition of X52 steel is given in the following table:

Table 1. Nominal Composition of X52 steel

Element	W (%)	Element	W (%)
C	0.1038	Al	0.032
Si	0.1261	Co	<0.05
Mn	0.971	Cu	<0.01
P	<0.0021	Nb	0.0419
S	0.0021	Ti	0.0025
Cr	<0.0021	V	<0.005
Mo	<0.005	W and Si	<0.005
Ni	<0.005	Fe	< 0.98

I - Study theoretical of plant Cymbopogon

Fig-1 Image of the plant Allmad

Classification of plant Allmad

Table 1 - scientific classification for plant Allmad.

Règne	Plantes
Division	Magnoliophyta
Classe	Liliopsida
Sousclasse	Asteridae
Order	Poales

Family	*Poaceae*
Genre	*Cymbopogon*
Especies	*Schoenanthus*

Table 2- active ingredients in Alcrdoovh and Allmad

Cymbopogonschoenanthus	Plants Active substances
+++	Asabonaat
++	Flavonoids
+	Free
++	Sugary
+++	Alkaloids
++	Sterolat tripartite Alterbnat
++	Volatile oils
++	Dragons (Aallsaat)

Study the effectiveness of inhibitory extract (Cy)

•A corrosion-way loss in the cluster

The study was conducted in accordance with the previous method:

$V_{corr} = \Delta m /S.t$ $\qquad$ R%=(V_0- V_{corr})/ V_0 *100$ $\qquad$ $V_0 = \Delta m /S.=33.877$ **mm/an**

V_0: Corrosion speed without inhibitor $\qquad$ t=30 min t : Dipping Time

Tab -3-: the results obtained for the impact of the focus on return on inhibition of the extract of the Mad (Cy) for erosion manner loss in the cluster in the center of sulfuric acid 20% on X52.

Concentration ppm	m_1 (g)	m_2 (g)	Δm	S (mm²)	(mm/an) V_{corr}	R%

800	21.230.7	21.225.8	0.0049	1.291.209.6	4.2618	87.42
1000	35.9135	35.90626	0.0069	1943.8498	3.9864	88.24
1200	36.5528	36.5473	0.0055	1956.204	3.1569	90.68
1400	.21.1920	21.1897	0.0023	1290.1444	2.002	94.09
1600	36.6800	36.6683	0.0117	1959.3152	6.7063	80.25
1800	35.8736	35.8664	0.0027	1941.20421	1.5619	95.39
2000	21.1602	21.1589	0.0013	1288.56.82	1.1329	96.65
2200	36.0089	36.0019	0.007	1963.7012	4.0033	88.19
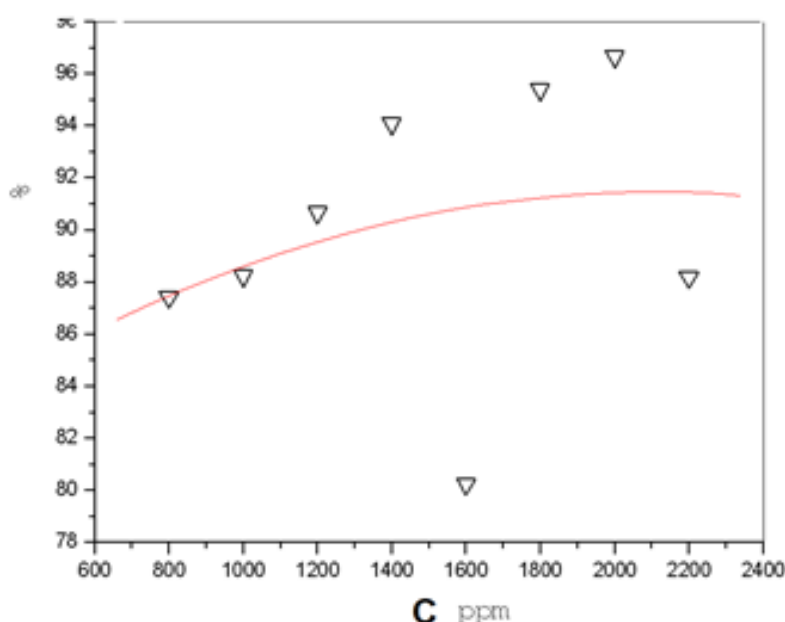
Aggressive solutions were prepared ((H2SO4 20%) by dilution of a stock solution of sulfuric acid (98%, 1.18). A typical three electrodes cell with a working electrode made of carbon steel X52 with an active surface of 1 cm2 was used. The auxiliary electrode was a platinum plate (1cm2) and the reference electrode was represented by a saturated calomel electrode (SCE). Potentiodynamic polarization curves were obtained with the scan rate of 0.5 mV s-1, in the potential range of -750 to -200 mV. The immersion time of the X52 plates in the blank as well as in the presence of different concentrations of essential oil of Allmad was 40 minutes in open circuit at room temperature.

The temperature is thermostatically maintained at 25 ° C. Oxygen is removed from the corrosive medium by bubbling nitrogen for 2 min before each measurement

Under these operating conditions the inhibition efficiency (E%) was calculated according to the following expression

$$E\% = 100 \times (1 - I_{corr}/I^{\circ}_{corr})$$

(1)

I°corr et Icorr are respectively the current densities before and after addition of the in hibitor Fig-2-: change in yield in terms of focus

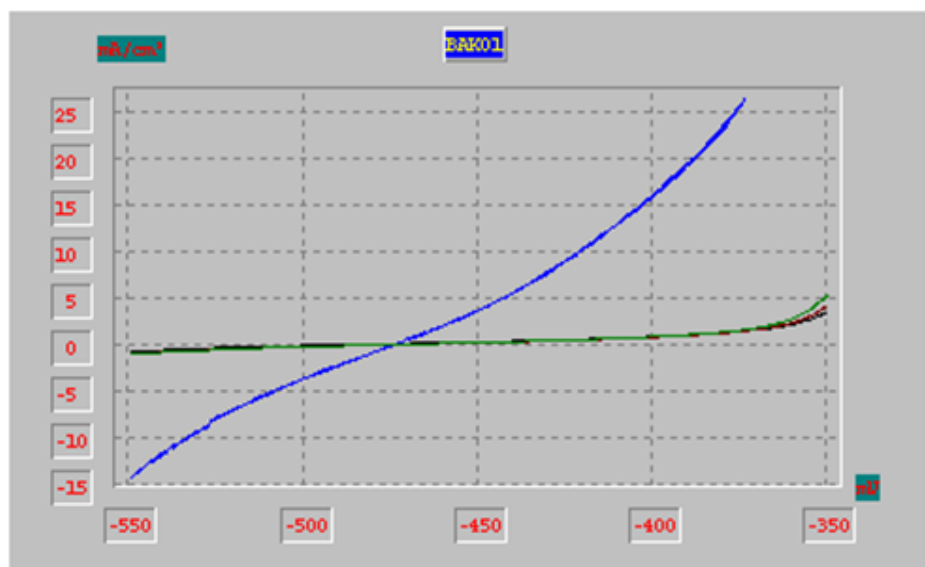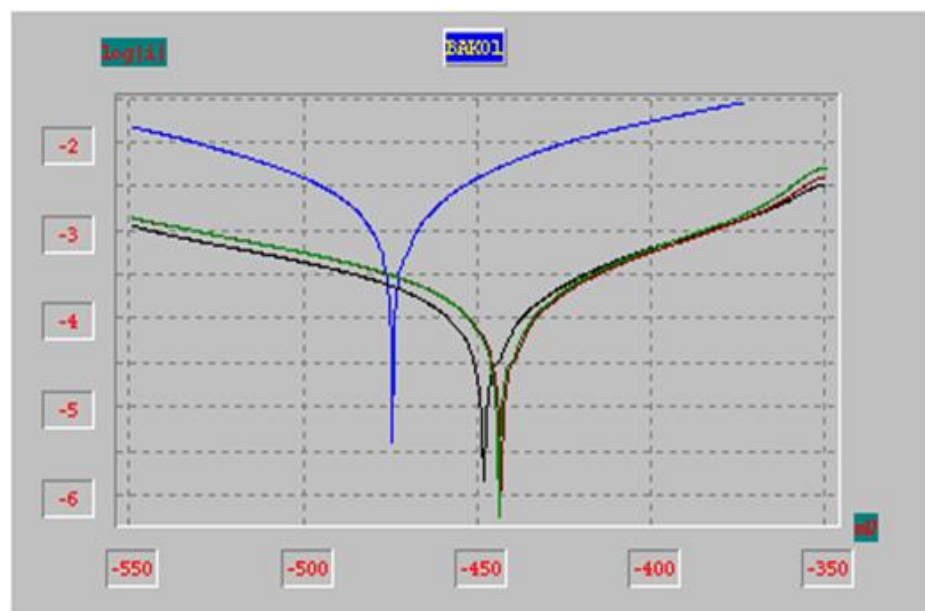Fig- 3-: curves of the polarity of the steel X52 I = f (E) to various concentrations (Cy)

Fig- 4-: Tafel curves of steel X52) logi = f (E for different concentrations (Cy)

Tab- 3: characteristic values of the Tafel curves of different concentrations of the extract (Cy)

Concentration Ppm	Ecorr (mV)	Icorr (m A/cm²)	Ba (mV)	Bc (mV)	Rp oh.cm²	Vcorr (mm/an)	R %
0000	-473.6	2.8963	99.1	-89.0	7.34	2.8963	00.00
1800	-447.3	0.1324	74.2	-108.4	119.18	1.567	95.37
2000	-442.3	0.0944	55.0	-64.6	109.02	1.118	96.70
2200	-442.6	0,0620	37.2	-40.2	105.89	1.442	95.74

The objective of this work is to study the inhibitory plant extract on carbon steel X52 impact in the center of sulfuric acid 20% and study the effect of the nature center, where facilities for what the impact of acid ion, and all of that in normal temperature.

By the way Alaketrrukemaaúah and the results were comparable manner loss in the cluster, in most cases, and to study the phenomenon of erosion in the middle of sulfuric acid was chosen to focus 20% of that the more acid concentration increased solubility extracts studied, was also identified corrosion speed

The behavior of this extract wire damper anode, and achieved an equal degree equation of Angmar.

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