
ENGLISH
SUMMARY

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The aim of the present work is to study the reactivity of some compounds as corrosion inhibitors for aluminum and aluminum –silicon alloy in 1M hydrochloric acid solution. The thesis comprises three main chapters.

The first chapter:

Deals with the Introduction, which includes corrosion theories, types of corrosion, corrosion protection, literature survey on corrosion behavior of aluminum and aluminum -silicon alloy in acidic solutions and aim of the present work.

The second chapter:

Deals with the experimental techniques, which includes the chemical composition of the investigated materials and preparation of the used solutions.Also the experimental techniques contain the instmments and the procedures used for the corrosion measurements such as weight loss and poteniodynamic polarization and AC impedance techniques.

The third chapter:

Deals with the results obtained and their discussion under three separated sections; (A), (B) and (C).

Section A:

Contains the results of weight loss measurements for aluminum pure in 1M HCl containing different concentrations of investigated compounds. These results revealed that these compounds behave similarly and the weight loss is generally decreases with increasing the concentration of

these compounds and also depends upon the nature and type of the investigated compounds. The order of increasing inhibition efficiency of these compounds is:

Compound (I) **>** Compound (II)

The synergistic effect of potassium iodide, potassium thiocynate and potassium bromide was examined by addition of $1x10^{-2}$M of KI, KSCN and KBr, individually with different concentrations of the selected compounds to enhance the inhibitive effect of these compounds. The values of synergism parameters, S_θ, was also calculated and discussed.

Section B:

Contains the results of electrochemical techniques

1- Potentiodynamic polarization measurements for aluminum and aluminum -silicon alloy in 1M HCl in the absence and presence of different concentrations of the investigated compounds. The polarization curves indicated that these compounds influence both cathodic and anodic processes. The order of increasing inhibition efficiency for the additives is:

Compound (I) >Compound (II)

This is also in agreement with the observed order of corrosion inhibition determined by the weight loss technique.

The results obtained from this technique give further support to that obtained from the previously mentioned weight loss measurements.

A number of mathematical relationships for the adsorption isotherms have been suggested to fit the experiment data of the present work. The

simplest equation that fit our results from aluminum and aluminum- silicon alloy is that due to Temkin and adsorption isotherm is given by the general equation:

$$\text{Ln } KC = a\theta$$

Thermodynamic parameters for the adsorption of the investigated compounds in 1M HCl on aluminum surface were also calculated.

The effect of temperature on the corrosion rate of aluminum and aluminum-silicon alloy in 1M HCl over the temperature range (25-40°C) in absence and presence of different concentrations of the investigated compounds has been studied.

The % inhibition efficiency is found to decrease with increasing the temperature; this indicated that, these compounds are physically adsorbed on the aluminum surface. Arrhenius plots of logarithm corrosion rate (log k) against reciprocal of absolute temperature (1/T) were found to be linear and obeyed the following equation:

$$\text{Log } k = \log A - (E_a^* / 2.303\ RT)$$

The values of the activation energy are calculated in the absence and presence of different concentrations of the investigated compounds and are found to decrease with increasing the concentration of these compounds.and have higher in aluminum than aluminum silicon alloy.

Plots of logarithm corrosion rate divided by absolute temperature (log k/T) against reciprocal ofabsolute temperature (1/T) were found to be linear and obeyed the following transition state equation:

$$\text{Rate} = RT/Nh \exp(\Delta S^*/R) \exp(-\Delta H^*/RT)$$

Thermodynamic activation parameters (ΔH^* and ΔS^*) are also computed and discussed. The values of the activation energy, E_a^*, and the activation enthalpy, ΔH^*, are increased with increasing inhibitor concentration while the value ofthe activation entropy, ΔS^*, is decreased at the same time.

2- Ac impedance spectroscopy measurements for aluminum and aluminum-silicon in IM HCl in the absence and presence of different concentrations of the investigated compounds.From the impedance data, we conclude that:

i-The value of R_{ct} increases with increase in the concentration of the inhibitors and this indicates an increase in the corrosion inhibition efficiency in acidic solution and increasing from aluminum than aluminum -silicon alloy.

ii-The value of double layer capacitance decreases by increasing the inhibitor concentration. This is due to the adsorption of these compounds on the electrode surface leading to a film formation on the Al and Al-Si surfaces.

iii -The %IE obtained from EIS measurements are close to those deduced from polarization and weight loss methods.

The order of decreasing inhibition efficiency for the additives is:

Compound (I) > compound (II)

Section C:

The influence of the chemical structure of the used compounds on their % inhibition efflciencies was discussed. The order of these % inhibition efficiencies depends mainly upon the type and kind of the substituent

groups,skeletal representation of the molecules supported this examination.

In conclusion the polarization and weight loss measurements support the assumption that corrosion inhibition primarily takes place through adsorption of the inhibitors on aluminium and Al-Si alloy surface. Agreement among these different independent techniques indicates the validity of the obtained results.

This thesis contains also references, arabic and english summaries.