SUMMARY

The corrosion problem is of a great importance, which faced the world from the last years until now, we can't hide this problem from our live but we can reduce "inhibit" it in the metals by several methods as the environment need. This work discusses the corrosion of C- steel in 1 M HCl.

This work consists of three basic chapters

Chapter one: "INTRODUCTION "

This chapter discusses: corrosion theory, causes of corrosion, forms of corrosion, corrosion migration, types of inhibitors, Literature survey of corrosion of C- steel and aim of this study.

Chapter two: "EXPERIMENTAL AND TECHNIQUES"

It includes the chemical composition of the investigated material, preparation of the used HCl solution, the used derivatives, solutions and procedures used for the corrosion measurements such as a weight loss and electrochemical techniques.

Chapter three: "RESULTS AND DISCUSSION"

It deals with the results obtained and their discussion and this chapter is divided into five sections:

Section (A):

Evaluation of the inhibitor efficiency by weight loss method for all the derivatives in 1 M HCl at 30±1 °C reveled that the inhibitor efficiency increases with the concentration. From these studies the order of inhibition efficiency of increase in the compounds 1-4 in 1 M HCl is found to be:

$$1 > 2 > 3 > 4$$

These organic additives obey Freundlich adsorption isotherm showing that the inhibition is by adsorption. The degree of surface coverage (θ) of the inhibitors was found to increase with increasing the concentration of the additives in the corrosive medium. The effect of temperature on the corrosion inhibition of C- steel in 1 M HCl was determined over the temperature range 30-50 °C using weight loss measurements. The rate of corrosion increases with increasing the temperature together with decrease in inhibition efficiency indicating that the inhibition occurs through physical adsorption of the additives.

Thermodynamic functions of activation were calculated in presence of different concentrations of additives.

Section (B):

Contains the results of galvanostatic polarization. The results obtained are presented in many Tables and Figures, also the effect of inhibitors on the cathodic and anodic polarization of C- steel in 1 M HCl solution was investigated.

Corrosion rate (j_{corr}) was found to decrease with increase in the concentration of the additives. The polarization curves indicated that these compounds influence both cathodic and anodic reactions.

The order of decreasing inhibition efficiency for C- steel in 1 M HCl at all concentrations used (1×10^{-4} to 11×10^{-4} M) by polarization is: 1 > 2 > 3 > 4

Section (C):

The results obtained from (EIS) show that the corrosion reactions in the absence and presence of the derivatives proceed under charge transfer control. The increase in concentration of the inhibitors leads to an increase in the value of the charge transfer resistance (R_{ct}) i.e. a decrease of the corrosion rate of C-steel. The double layer capacitance (C_{dl}) of the corroding C- steel interface decreases with increase in the inhibitor concentration, suggesting an increase of the surface coverage of the inhibitor due to the adsorption of the inhibitor species at the C- steel surface.

Section (D):

Some quantum – chemical quantities were calculated and correlated with log i_{corr}, HOMO which is a theoretical analogue to ionization potential that illustrates the electron affinity of the molecule affect the inhibition efficiency of these additives used. The inhibition efficiency was found to increase with increasing the energy of HOMO.

Section (E):

Case study in new Mansoura plant for drinking water treatment using water containing chlorine solution (which used as disinfection and killing microorganisms) as corrosive medium for pipes which carry out the water. By increasing the concentration of the compound (1), the corrosion rate of pipes is decreased. This means that the presence of this compound retards the corrosion of pipes in chlorine solution or in other words, this compound acts as inhibitor.

In conclusion:

The weight loss, polarization and electrochemical impedance spectroscopy (EIS) support the assumption that corrosion inhibition primarily takes place through adsorption of the inhibitors on C- steel surface. Agreement among these different independent techniques indicates the validity of the obtained results.

This thesis contains also references, Arabic and English summaries.