English Summary

The thesis comprises six main chapters; **the first one** deals with the following fields of interest :

(i) Corrosion principals, forms and corrosion protection.

(ii) Literature survey of corrosion behavior of carbon steel.

(iii) Aim of the present work.

The second chapter: deals with the experiment part which includes, the chemical composition of the investigated material, also the experimental techniques contain the instruments and the procedures used for the corrosion measurements and calculations such as mass loss, galvanostatic polarization, potentiodynamic anodic polarization, conductometric titration and potentiometric studies.

The third chapter :deals with the results obtained and their discussion under three separated sections, (A), (B), an (C).

Section (A):

Contains the results of mass loss measurements of carbon steel (L-52) in 2M HCl solution containing different concentrations of azo dye compounds derive from 6,7-dihydroxy-4-methyl coumarin. The results revealed that compounds behave similarly and the mass loss in generally decreases with increasing the concentrations of these compounds and also depends upon the nature and type of investigated inhibitors.

The inhibition efficiency of these compounds decreases in the following order:

II > III > I > V > IV

The effect of temperature on the corrosion rate of C-steel (L-52) in 2M HCl solution over the temperature rang 30-60 °C in absence and presence of the selected azo dye compounds have been studied.

Arrhenius plot of logarithm corrosion rate (log R) against reciprocal of absolute temperature (1/T) was found to be linear and obeyed the following equation:

$$\log R_{corr} = \log A - \frac{Ea}{2.303\ RT}$$

where A is a constant depends on the metal type and nature of an electrolyte. The activation energies values are increased in presence of inhibitor. Such increase in activation energies indicates that the azo dye compounds bring about a change in the rate of the corrosion and these compounds bring an inhibition for corrosion of C-steel. Thermodynamic activation parameters ($\Delta H°$,$\Delta S°$ and $\Delta G°$) are also computed and discussed. The percentage inhibition is decrease with increasing temperature, this indicated that, these compounds are physically adsorbed on C-steel surface. The result showed that the adsorption of these compounds obeyed Langmuir adsorption isotherm.

Section (B):

Contains the results of galvanostatic polarization. The effect of inhibitors on the cathodic and anodic polarization of carbon steel in 2M HCl solution was investigated. Corrosion rate (I_{corr}) was found to decrease with increase of the concentration of the additives. The polarization curves indicate that these compounds influence both cathodic and anodic processes (i.e. mixed inhibitors). The order of increased inhibition efficiency for C-steel in 2M HCl solution at all concentration used ($1x10^{-6}$ to $1x10^{-3}$M) by polarization is decreases in the following order :

II > III > I > V > IV

Section (C):

In this section potentiodynamic anodic polarization curves of carbon steel in 0.1M sodium carbonate solution containing different concentration of NaCl solution was studied. It was found that the addition Cl^- ions cause the destruction of the passivation oxide film and initiate pitting corrosion. The pitting corrosion potential is shifted to more negative values with increasing chloride ion concentrations.

Trials were made to inhibit the pitting corrosion of carbon steel using azo dye compounds. These compounds shifted the pitting potential to more positive values, indicating the inhibiting effect of these compounds.

Chapter four : study the possibility of complex formation in solution and its stiochiometry using conductometric titration where it is found that stiochiometric ratios of (metal : ligand) complex (1:1), (2:1) and (1:2).

Chapter five : study acid dissociation constants of the organic ligands and formation constants of the formed complexes using potentiometric techniques.

Chapter six : study the mechanism of interaction between azo dye compounds with steel surface to form stable complex. The stiochiometric ratio of the metal complex between metal and ligand was studied to give the suitable complex formed. The inhibition efficiency increases with increasing the concentration of azo dye compounds and the presence of electro donating group in the substituents. The electro donating group such as $-OCH_3$ and $-OH^-$ is more inhibiting effect than electro withdrowing group such as $-COOH$, NO_2^-. The strong electro donating group facilitates the formation of stable complex because it increase the electron density at the ring and thus, decreases the withdrawing nature of it.