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Title of the Thesis: The study of mechanism, characterization and corrosion inhibition efficiencies of some newly synthesized organic inhibitors on metallic alloys in aqueous mediums.

Abstract

Corrosion is recognized as one of the most serious problems of our modern society and the resulting losses each year are in the hundreds of billion dollars. Cost of corrosion studies have been undertaken by several countries including the United States, the United Kingdom, Japan and India etc. The studies have ranged from formal and extensive efforts to informal and modest efforts. The common finding of these studies was that the annual corrosion costs ranged from approximately 1 to 5 percent of the total Gross National Product (GNP) of each nation.

The aim of the present work undertaken is the study of corrosion inhibition of metallic alloys mainly mild steel in acidic media by using certain organic compound namely N-C2{(2E)-2-[4-(dimethylamino) benzylidene] hydrazinyl} 2-oxo ethyl benzamide, 2[2-oxo-2phenyl hydrazinyl ethyl] benzamide, N-{2-[2,4 Dinitro Phenyl] hydrazinyl} 2-oxo ethyl benzamide, 3-phenyl-2-thioxo-2, 3 dihydro-1H-quinazolin-4-one and 2-ethyl-3-methyl quinazolin-4 (3H)-ones. **Isolated compounds:** Ricinine (C1), N-Demethylricinine (C2) and 4-methoxy pyridine-3-carboxylicacid-2one (C3).these compounds are selected due to their ability to be adsorbed on the metal surface.

This thesis contains mainly eight chapters , **the first and second chapters** describe the introduction and review of literature, classification of corrosion , losses due to corrosion , type of inhibitor and a detailed discussion of the past work from various aspects, including all relevant references for the corrosion inhibition. **In third chapter,** synthesis of organic inhibitor and their characterization using I.R. ^{1}H NMR and T.G.A has been explained briefly. Preparation of alloys coupons, assembly of electrochemical cell, preparation of working electrode and various block diagrams had also been presented. The details of experimental techniques such as Gravimetric and Electrochemical methods and surface analysis techniques such as EDX and SEM are also given The last part in this chapter describes the general aspects of quantum chemical calculation.

The fourth chapter, "Synthesis, characterization and Corrosion inhibition efficiency of N-C2 {(2E)-2-[4-(dimethylamino) benzylidene] hydrazinyl}oxo ethyl benzamide on mild steel in sulphuric acid medium", we have reported the synthesis of N-C2{(2E)-2-[4-(dimethylamino) benzylidene] hydrazinyl} 2-oxo ethyl benzamide (DMB) as a potential inhibitor of mild steel. The study of inhibition effect of DMB on the mild steel in 1.0 N H_2SO_4 solution has been carried out using weight loss, Galvanostatic polarization and EIS techniques. The polarization curves showed that DMB compound behaves as both cathodic and anodic inhibitor, i.e., a mixed type inhibitor. EDX and SEM observations of the mild steel surface confirmed existence of a protective adsorbed film of the inhibitor on the mild steel surface. The temperature dependent studies from 298K to 318K showed that the DMB adsorption follows Langmuir isotherm model. The value of activation energy (E_a) for mild steel corrosion and thermodynamic parameters such as adsorption heat (ΔH_{ads}), K and ΔG^0_{ads} have been calculated and discussed. It has been found that the protection efficiency increases with increasing inhibitor concentration in the range 250 ppm – 1000 ppm, but slightly decreases with increasing temperature. The graphs obtained from TGA indicate relatively good thermal stability of the inhibitor film on the metal surface. The results show that DMB is good corrosion inhibitor for mild steel in acidic medium.

The electronic properties obtained using the two semi-empirical AM1 and PM3 methods.

In fifth chapter, "**Synthesis, characterization and Corrosion protective efficiency of 2[2-oxo-phenyl hydrazinyl ethyl] benzamide on mild steel in sulphuric acid medium",** 2[2-oxo-phenyl

hydrazinyl ether] benzamide was synthesized, characterized and tested effective for corrosion inhibition of mild steel in 1N H_2SO_4 solution using galvanodynamic polarization and EIS techniques. Polarization resistances calculated from the EIS measurements are in good agreement with those obtained from alternating current polarization measurements. The mild steel samples were also analyzed by SEM. The result showed that 2BA is an excellent inhibitor for mild steel in acid medium. The inhibition was assumed to occur via adsorption of the inhibitor molecule on the metal surface. In 303K- 323K temperature range, the 2BA adsorption follows Langmuir isotherm model. The protection efficiency increases with increasing the inhibitor concentration in the range of 250-1000 ppm but slightly decreases with increasing temperature. The electronic properties obtained using the two semi-empirical AM1 and PM3 methods.

In the sixth chapter, "Corrosion Inhibition of mild steel in HCl by isolated compounds of Riccinus Communis(L)", we have isolated three pyridine base alkaloids namely Ricinine (C1), N-Demethylricinine (C2) and 4-methoxy pyridine-3-carboxylic acid (C3) from methanolic extract of Riccinus Communis leaves and investigated corrosion inhibition effect on mild steel in 0.5 HCl solution using the Weight loss and Electrochemical techniques. Polarization resistances calculated from the EIS measurements are in good agreement with those obtained from alternating current polarization measurements. The mild steel samples were also analyzed by SEM. The results show that C1 is an excellent inhibitor for mild steel in acid medium. The inhibition was assumed to occur via adsorption of the inhibitor molecule on the metal surface. In 298K- 308K temperature range, the C1, C2 and C3 adsorption follows Langmuir isotherm model. The protection efficiency increases with increasing the inhibitor concentration in the range of 250-1000 ppm but slightly decreases with increasing temperature. The electronic properties obtained using the two semi-empirical AM1 and PM3 methods.

In the seventh chapter, "**Synthesis characterization and Corrosion protective efficiency of N-{2-[2,4 dinitro Phenyl] hydrazinyl} 2-oxo ethyl benzamide on",** N-{2-[2,4 dinitro Phenyl] hydrazinyl} 2-oxo ethyl benzamide was synthesized, characterized and tested effective for corrosion inhibition of mild steel in 1N H_2SO_4 solution using Galvanostatic polarization and EIS. Polarization resistance calculated from the EIS measurements were in good agreement with those obtained from alternating current polarization measurements. The mild steel samples were also analyzed by SEM. The results showed that AB' is an excellent inhibitor for mild steel in acid medium. The inhibition was assumed to occur via adsorption of the inhibitor molecule on the metal surface. In 25°C- 45°C temperature range, the AB' adsorption follows Langmuir isotherm model. The protection efficiency increases with increasing inhibitor concentration in the range 250-1000 ppm but slightly decreased with increased temperature. The electronic properties obtained using the two semi-empirical AM1 and PM3 methods.

In the eighth chapter, "**Quinazolin-4-one derivatives as corrosion inhibitor for mild steel in acid medium",** The inhibitive action of some 2-thioquinazolin-4-one derivatives, namely , 3-phenyl-2-thioxo-2, 3 dihydro-1H-quinazolin-4-one and 3-allyl-2-thioxo-2, 3 dihydro-1H-quinazolin-4-one against the corrosion of mild steel in 0.5 M H_2SO_4 solution has been investigated using Tafel polarization and Electrochemical Impedance Spectroscopy techniques. The obtained experimental results revealed that these compounds inhibited the steel corrosion in acid solution. The protection efficiency increased with increasing inhibitors concentration. Polarization studies clearly showed that both inhibitors acted as mixed inhibitors. Adsorption of these inhibitors on steel surface obeyed to Langmuir adsorption isotherm. SEM and the thermodynamic data of adsorption showed that inhibition of steel corrosion in normal sulphuric solution by 2-thioquinazolin-4-one derivatives is due to the formation of a chemisorbed film on the steel surface. Molecular modelling was used to gain some insight, about structural and electronic effects in relation to the inhibiting efficiencies.