Corrosion and corrosion control of teel in aqueous solutions contian hetrocyclic comounds

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The corrosion problem is a great problem, which faced the world from the last years until now, we can't hide this problem from our life 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 1M HCl. This work contains three basic chaptersChapter one: "INTRODUCTION"This chapter discusses corrosion theory, causes of corrosion, forms of corrosion, corrosion migration, types of inhibitors, Literature survey of C-steel corrosion and aim of this studyChapter two: " EXPERIMENTAL AND TECHNIQUES"It includes the chemical composition of the investigated material, preparation of the used hydrochloric acid solution, the used cyanoacetamide compounds, 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 in the presence and absence of three compounds in 1M HCl at 25 ± 10 C. This reveled that the inhibitor efficiency increases with the concentration. from these studies the order of inhibition efficiency of investigated compounds in 1M HCl is found to be:A > B > CThese cyanoacetamide derivatives obey Temkin's adsorption isotherm showing that the inhibition is by adsorption. The degree of surface coverage (θ) for the inhibitors on the metal surface increases with increasing the concentration in the corrosive medium. The action of the inhibitors in the aggressive acid was assumed to be due to their adsorption at the metal /solution interface. The effect of temperature on the corrosion inhibition of C-steel in 1M HCl was determined over the temperature range 25-400 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 on C-steel surface. Thermodynamic functions of activation were calculated of cyanoacetamide compounds.Section (B):The effect of cyanoacetamide compounds on the cathodic and anodic polarization of C-steel in 1M HCl was investigated. Corrosion rate decreased with increasing of concentration of the cyanoacetamide compounds together with increase in both cathodic and anodic polarization, but the corrosion inhibition has a great effect on the cathodic polarization. Variation of inhibition efficiency with the structure of cyanoacetamide compounds was interpreted in terms of the number of adsorption sites in the molecule and their electron charge density, molecular size, mode of adsorption and

the polar effect of the substitutent groups. The order of increased inhibition efficiency for C-steel corrosion in 1M HCl at all concentrations in the range 1x10-6 – 2.1x10-5 M by polarization technique isA > B > CThe results obtained from (EIS) show that the corrosion reactions in the absence and presence of cyanoacetamide 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 (Rct) i.e. a decrease of the corrosion rate of C-steel. The double layer capacitance (Cdl) 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.The new technique -electrochemical frequency modulation (EFM) was used as a rapid and non destructive technique for corrosion rate measurements. Corrosion current densities (icorr) obtained with this technique were in good agreement with those obtained from Tafel extrapolation technique. In addition of the causality factors were good internal check for verifying the validity of data obtained by this technique.Section (C):Some quantum – chemical quantities were calculated which is a theoretical analogue to ionization potential that illustrates the electron affinity of the molecule affect the inhibition efficiency of these isoidoline compounds. The inhibition efficiency was found to increase with increasing the energy of HOMO.The influence of the chemical structure of the investigated cyanoacetamide compounds on their inhibition efficiencies was discussed; the order of these inhibition efficiencies depends mainly upon the number of adsorption active centers, skeletal representation of the molecules supported this explanation.In conclusion:The weight loss, polarization, electrochemical impedance spectroscopy (EIS) and EFM measurements support the assumption that corrosion inhibition primarily takes place through adsorption of the inhibitors on the 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.