Electrochemical bihavior of iron in aqueous solutions

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As known that the economic power of any country is determined by its output of iron. So, studies of iron properties in general and electrochemical, especially, have been received a great attention. In such aspect, the corrosion and corrosion inhibition of iron in the different media become very interesting and important owing to its wide applicability in industry and domestic life.The aim of the present work is to study the reactivity of some cephalosporin drugs as corrosion inhibitors for iron in hydrochloric acid and sulphric acid solutions.This thesis contains three main chapters;The first chapter : Deals with the following fields of interest(i) General aspects of corrosion.(ii) Corrosion prevention.(iii) Corrosion inhibitors.(iv) Literature survey of corrosion behavior of iron in HCl&H2SO4 solutions.(v) Aim of the present workThe second chapter: Deals with the experimental part which includes, the chemical composition of the investigated cephalosporin drugs, preparation of HCl&H2SO4 , sodium chloride and investigated cephalosporin drugs solutions.Also the experimental techniques contain the instruments and the procedures used for the corrosion measurements and calculations regarding impedance and galvanostatic polarization.The third chapter: Deals with the results obtained and their discussion under six separated sections, (A) , (B), (C) ,(D) ,(E) , (F) and (G).Section A:Contains the results of galvanostatic polarization, the results obtained are presented in many tables and figures, the effect of inhibitors on the cathodic and anodic polarization of iron in 1 M HCl and 0.5 M H2SO4 solutions was investigated. Corrosion rate (jcorr.) was found to decrease with increase of the concentration in presence of the additives. The polarization curves indicated that these compounds influence both cathodic and anodic processes. The order of increased inhibition efficiency for iron in 1 M HCl and 0.5 M H2SO4 at all concentrations used (10 - 60 ppm) by polarization is :4 > 2 > 3 > 1Also effect of temperature at 35oC indecates the same thing.Section B:Contains the results of adsorption isotherm and indicates that these compounbs obey Langmuir isotherm.Section C:The results obtained from (EIS) show that the corrosion reactions in the absence and presence of HCl and H2SO4 solutions 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 iron. The double layer capacitance (Cdl) of the corroding iron interface decreases with increase in the inhibitor concentration, suggesting an increase of the surface coverage of the inhibitor due to tha adsorption of the

inhibitor species at the iron surface.Section D:In this section potentiodynamic anodic polarization curves of iron in 0.5M NaCl and at different concentrations of the investigated inhibitors was studied. It was found that the addition of these inhibitors compounds cause the destruction of the passivated oxide film and initiate pitting corrosion; the pitting corrosion potential is shifted to more negative values with increasing chloride ion concentrations and to more positive values by increasing concentration of inhibitors.Section E:Some quantum – chemical quantities were calculated and correlated with log jcorr, 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 F:SEM analysis showed that the inhibition of the investigated compounds (1-4) were adsorbed on the metal surface to a thin layer by which metal was protected from corrosion.Section G:Contains the influence of the chemical structure of the used cephalosporin drugs on their inhibition efficiencies was discussed, the order of these inhibition efficiencies depend mainly upon number of absorption sites in the molecule, their electron charge density, molecular size, mode of adsorption, and the polar effect of the substituent groups.In conclusion:The polarization, electrochemical impedance spectroscopy (EIS) measurements support the assumption that corrosion inhibition primarily takes place through adsorption of the inhibitors on iron surface. Agreement among these different independent techniques indicates the validity of the obtained results.This thesis contains also references, Arabic and English summaries.