Faculty of Education
Chemistry Department

An Electrochemical Study for Corrosion Inhibition of Iron by Some Organic Compounds in Acidic Media

Thesis Submitted

By

Nashwa Saad Abd El-Shafy Mohamed

M.Sc., Education (٢٠٠٣)

For

The Degree of

Ph. D. for Teacher's Preparation in Science (Physical Chemistry)

To

Chemistry Department
Faculty of Education
Ain Shams University
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Faculty of Education
Chemistry Department

Approval Sheet

Name of candidate: Nashwa Saad Abd El-Shafy Mohamed

Degree: Ph. D. for Teacher's Preparation in Science
(Physical Chemistry)

Thesis Title: An Electrochemical Study for Corrosion Inhibition of Iron by Some Organic Compounds in Acidic Media

This Thesis has been approved by:

Approved

Prof. Dr. Sayed Sabet Abdel-Rehim(D.Sc.) ……

Prof. of Physical Chemistry, Faculty of Science, Chemistry Department, Ain Shams University.

Prof. Dr. Reda Mohamadi Abdel Rahman(D.Sc.) ……

Prof. of Organic Chemistry, Faculty of Education, Chemistry Department ,Ain Shams University.

Dr. Khaled Fouad Khaled Mahmoud……

Ass. Prof. of Physical Chemistry, Faculty of Education, Chemistry Department, Ain Shams University.

Dr. Fawzya Fouad Abdullah……

Lecturer of Physical Chemistry, Faculty of Education, Chemistry Department, Ain Shams University.

Prof. Dr. E. A. Mohamed
Head of the Chemistry Department
Faculty of Education
Ain Shams University

٢٠٠٧

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Under the Supervision of

Prof.Dr. Sayed Sabet Abdel-Rehim

Prof. of Physical Chemistry, Faculty of Science, Chemistry Department. Ain Shams University (D.Sc.)

Prof. Dr. Reda Mohamadi Abdel Rahman

Prof. of Organic Chemistry, Faculty of Education, Chemistry Department. Ain Shams University (D.Sc.)

Dr. Khaled Fouad Khaled Mahmoud

Ass. Prof. of Physical Chemistry, Faculty of Education, Chemistry Department. Ain Shams University .

Dr. Fawzya Fouad Abdullah

Lecturer of Physical Chemistry, Faculty of Education, Chemistry Department. Ain Shams University .

Faculty of Education
Chemistry Department

Title Sheet

Name of researcher : Nashwa Saad Abd El-Shafy Mohamed

Date of Birth : ٢٩/٩/١٩٧٣

Place of Birth : Elmansora

First University Degree: B.Sc. & Ed., May ١٩٩٦

Name of University : Ain Shams

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Chemistry Department

ABSTRACT

An Electrochemical Study for Corrosion Inhibition of Iron by Some Organic Compounds in Acidic Media.

By

Nashwa Saad Abd El-Shafy Mohamed

Department of Chemistry, Faculty of Education Ain-Shams University, Roxy, Cairo,Egypt

Electrochemical frequency modulation (EFM) can be used as a rapid and non-destructive technique for corrosion rate measurements without prior knowledge of Tafel constants. Corrosion rates obtained with this technique were in good agreement with other traditional techniques as Tafel extrapolation and EIS. Causality factors used by EFM are good internal check for verifying the validity of data obtained by this technique.

The corrosion inhibition of iron in ١ M hydrochloric acid solution by some new thiourea derivatives, ٩-(٤-fluorophenxyl aminothioxo)carbazole **(FPAC)**, ١-octayl-٣-phenyl- thiourea **(OPT)**, ١, ٣-diarylidenethiourea **(DAT)**, ١-(٢-hydroxyphenyl)-٣-phenylthiourea **(HPP)**, and ١-(anthraquinon) thiosemicarbazone

Abstract

(ATC) was studied using the following techniques: Tafel extrapolation method, electrochemical impedance spectroscopy (EIS), and electrochemical frequency modulation (EFM). These measurements show that the inhibition efficiency increased by increasing the inhibitor concentration. The inhibition efficiency follows the order: FPAC > OPT > HPP > DAT > ATC.

Polarization studies show that these compounds act as mixed type inhibitors in ١ M HCl solution. The effect of temperature on corrosion inhibition was studied using polarization technique. The fundamental thermodynamic parameters for dissolution and adsorption were determined and discussed. These inhibitors function through adsorption following Flory-Huggins and kinetic-thermodynamic model isotherm. Equivalent circuits of the investigated system are suggested.

The electronic properties of these inhibitors, obtained using MNDO semi-empirical self-consistence field method, have been correlated with their experimental efficiencies using non-linear regression method.

Keywords: iron; corrosion; EFM; EIS; Tafel; MNDO; acid inhibition

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