Ain Shams University
College for Girls, Arts,
Science and Education
Cairo, Egypt

Effectiveness of Some Novel Surfactants as Corrosion Inhibitors for Carbon Steel in Oil Wells Formation Water

A Thesis Submitted for the Master Degree
In
(Physical Chemistry)
Presented By

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B.Sc. (2006)
To
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(2011)

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/ / 2011

Qualifications

Name: Samar Belal Mahmoud Belal Mahmoud:

Scientific Degree: B.Sc.

Department: Chemistry

College: College of Girls for Arts, Science and Education

University: Ain Shams University

B.Sc. Graduation Year: 2006

NOTE

The candidate has attended courses for one year, covering the following topics:

- Spectroscopy.
- Surface Chemistry
- Electro Chemistry
- Polymer Chemistry
- Nuclear Chemistry
- Advanced Chemical Reactions
- Photochemistry
- Kinetics and Catalysis
- Quantum Chemistry
- Thermodynamics.
- Instrumental analysis.

She has successfully passed a written examination in these courses, in partial fulfillment for the master degree of science.

جامعه عين شمس
كلية البنات للاداب والعلوم والتربية
قسم الكيمياء

فاعلية بعض المركبات ذات النشاط السطحي المبتكرة كمثبطات لتأكل الصلب الكربوني في مياة تكوينات أبار البترول

رسالة مقدمة للحصول علي درجة الماجستير في العلوم

(الكيمياء الفيزيائية)

من

سمر بلال محمود بلال

بكالوريوس علوم- كيمياء (٢٠٠٦)

الي

قسم الكيمياء

كلية البنات للاداب والعلوم والتربية

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جامعه عين شمس
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قسم الكيمياء

رسالة ماجستير

(كيمياء فيزيائية)

اسم الطالبة : سمر بلال محمود بلال

عنوان الرسالة : فاعلية بعض المركبات ذات النشاط السطحي المبتكرة كمثبطات لتأكل الصلب الكربوني في مياة تكوينات أبار البترول

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جامعه عين شمس
كلية البنات للاداب والعلوم والتربية
قسم الكيمياء

اسم الطالبة : سمر بلال محمود بلال

الدرجة العلمية **:** بكالوريوس علوم (كيمياء)

القسم التابع له : الكيمياء

اسم الكلية : كلية البنات للاداب والعلوم والتربية

الجامعة : جامعة عين شمس

سنه التخرج :٢٠٠٦

سنه المنح : ٢٠١١

CONTENTS

CHAPTER 1

Introduction

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

SUMMARY

Pipelines play an extremely important role through the world as a means of transporting gases and liquids over long distances from their sources to ultimate consumers. So that corrosion problems exist in the oil industry at every stage of production from initial extraction to refining and storage prior to use requiring the application of corrosion inhibitors. It has been reported that corrosively is related to the nature of formation water accompanying the oil production process. One of the most economic methods is the application of corrosion inhibitors. The surfactant inhibitors have many advantages such as high inhibition efficiency, low price, low toxicity and easy production. The activity of these surfactants very much depends on their types, compositions and concentrations; in addition to the environmental factors, such as (temperature, pressure, solvents and additives). So, this work aims to synthesis of a new family of nonionic surfactants based on tolyltriazole and evaluation their inhibition efficiency on the carbon steel corrosion in oil wells formation water. This work includes three main parts:

THE FIRST PART:

Synthesis of Compounds Used

Condensation reactions of tolyltriazole with citric acid were carried out. To the formed product poly ethylene glycol (PEG) with different molecular weight (Mol.Wt. 400, 3000, 4000 and 6000) were added to give four nonionic surfactants (I-IV). The purity of the products was checked by FTIR and elemental analysis.

THE SECOND PART:

Study the Surface Activity of the Synthesized Surfactants

Surface activity was studied for the synthesized nonionic surfactants by setting some properties such as surface tension (γ), critical micelle concentration (CMC), maximum surface excess concentration (Γ_{max}) and minimum surface area per molecule (A_{min}).

THE THIRD PART:

Evaluation of the Prepared Surfactants as Corrosion Inhibitors Using Different Techniques

1. Weight Loss Studies

The weight losses of carbon steel in formation water (in mg cm^{-2}) with and without the addition of surfactant inhibitors were determined at different immersion times. It was found that the inhibition efficiency of all these compounds increases with increasing its concentration. The maximum inhibition efficiency for each compound was achieved at 450 ppm and further increase in concentration did not cause any appreciable change in the performance of the inhibitors. The percentage inhibition efficiency was found to be in the following order:

IV > III > II > I

The data obtained from weight loss technique have been tested with several adsorption isotherms. Langmuir adsorption isotherm was found to fit well with our experimental data.

2. Different Electrochemical Measurements

A. Open Circuit Potential Measurements (OCP)

The variation of the OCP of the carbon steel electrode as a function of the period of exposure in the absence and presence of