CORROSION INHIBITION PERFORMANCE OF ROSEMARY OIL ON CARBON STEEL IN ACID AND SALINE ENVIRONMENTS

OLOMUKORO, OBOROGHENE TOPE

(06CF04147)

NOVEMBER, 2020

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(06CF04147)

B.Eng. (Hons) Chemical Engineering, Covenant University, Ota

A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE MASTER OF ENGINEERING DEGREE IN CHEMICAL ENGINEERING IN THE DEPARTMENT OF CHEMICAL ENGINEERING, COLLEGE OF ENGINEERING, COVENANT UNIVERSITY.

NOVEMBER, 2020

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of the degree of Master of Engineering (M.Eng) in Chemical Engineering in the Department of Chemical Engineering, College of Engineering, Covenant University, Ota, Nigeria.

Mr. John A. Philip
(Secretary, School of Postgraduate Studies) Signature and Date

Prof. Akan B. Williams
(Dean, School of Postgraduate Studies) Signature and Date

DECLARATION

I, **OLOMUKORO, OBOROGHENE TOPE (06CF04147)** declares that this research was carried out by me under the supervision of Dr. O. A. Odunlami of the Department of Chemical Engineering, College of Engineering, Covenant University, Ota, Nigeria. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

OLOMUKORO, OBOROGHENE TOPE **Signature and Date**

CERTIFICATION

We certify that this dissertation titled "**THE CORROSION INHIBITION PERFORMANCE OF ROSEMARY OIL ON CARBON STEEL IN ACIDIC AND SALINE ENVIRONMENTS**" is an original research work carried out by **OLOMUKORO, OBOROGHENE TOPE (06CF04147)** in the Department of Chemical Engineering, College of Engineering, Covenant University, Ota, Ogun State, Nigeria under the supervision of Dr. Olayemi A. Odunlami. We have examined and found this work acceptable as part of the requirements for the award of the degree of Master of Engineering (M. Eng) in Chemical Engineering.

Dr. Olayemi A. Odunlami
(Supervisor) Signature and Date

Dr. Augustine O. Ayeni
(Head of Department) Signature and Date

Prof. Oladipupo O. Ogunleye
(External Examiner) Signature and Date

Prof. Akan B. Williams
(Dean, School of Postgraduate Studies) Signature and Date

DEDICATION

‘‘*But there is a spirit in man: and the inspiration of the Almighty giveth them understanding*’’
- Job 32:8 (KJV)

This research work is dedicated to almighty God for wisdom, knowledge and understanding. Also to my ever loving, caring and dependable parents: Prof. & Prof. (Mrs) J. O Olomukoro for their immense support.

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ABSTRACT

The exposure of metals to corrosive fluids have resulted in their deterioration and total collapse, hence, the use of inhibitors to prevent and control corrosion. Inhibitors with weak adsorptive properties and high toxicity are less effective in inhibiting corrosion. This has influenced the use of green organic chemicals from plants as suitable inhibitors for corrosion in metals because they are eco-friendly and possess strong adsoptive properties. Rosemary oil, an extract from rosemary plant is known for its strong adsorption properties on metallic surfaces. Previous studies have reported the inhibition effect of rosemary oil on metals in different corrosive environments. This research aimed to minimise the corrosion in carbon steel using rosemary oil in solutions of citric acid, sulphuric acid and sodium chloride at ambient temperature using weight loss and potentiodynamic polarization techniques. Weight loss technique was carried out for a period of 21 days. The steel samples were immersed in citric acid, sulphuric acid and sodium chloride solutions. After 24 hours, the samples were taken out of the solutions, washed in acetone, rinsed in distilled water and air-dried for about an hour. The samples were re-weighed and re-immersed into the solutions. Potentiodynamic polarisation was carried out through the aid of the potentiostat with potential scans of -1.5 V to +1.75 V at a scan rate of 0.0015 V/s for a duration of 30 minutes. After each scan, the electrodes were polished with silicon carbide paper for easy flow of current. Adsorption of rosemary oil onto the steel surface fitted into the Langmuir model. Inhibition efficiencies of 98 %, 88 % and 78 % were obtained in sodium chloride, citric acid and sulphuric acid solutions which showed that rosemary oil is highly effective. Rosemary oil produced the highest inhibition efficiency in sodium chloride because of its low corrosive nature. Potentiodynamic plots reveal a cathodic-type inhibitor in sulphuric acid because the corrosion potential shifted more towards the negative potential. A mixed- type inhibitor in citric acid and sodium chloride solutions was observed because the corrosion potential shifted towards the positive and negative potentials. The Gibbs energy obtained in citric acid solution, sulphuric acid and sodium chloride solutions were less than -40 $KJmol^{-1}$. This indicates that the inhibition mechanism of rosemary oil were physically adsorbed on carbon steel surface in the three solutions.

Keywords; Rosemary oil, Carbon Steel, Corrosion, Adsorption, Inhibition