EFFECT OF *CASSIA FISTULA* AND *CITRUS SINESIS* ON THE ELECTRO-KINETIC DEPOSITION OF ZINC ON MILD STEEL

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JULY, 2022

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

JULY, 2022

ACCEPTANCE

This is to attest that this dissertation has been accepted in partial fulfillment of the requirements for the award of a degree of Master of Engineering in Mechanical Engineering in the Department of Mechanical Engineering, College of Engineering, Covenant University, Ota, Nigeria.

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(Dean, School of Postgraduate Studies) **Signature and Date**

DECLARATION

I, **NNAMBA, OGECHI JOY (14CM017033)** declare that this dissertation is a representation of my work, and is written and implemented by me under the supervision of Dr. Olugbenga A. Omotosho of the Department of Mechanical Engineering, College of Engineering, Covenant University, Ota, Nigeria. I attest that this dissertation has in no way been submitted either wholly or partially to any other university or institution of higher learning for the award of a masters' degree. All information cited from published and unpublished literature has been duly referenced.

NNAMBA, OGECHI JOY

Signature and Date

CERTIFICATION

This is to certify that the research work titled **"EFFECT OF *CASSIA FISTULA* AND *CITRUS SINESIS* ON THE ELECTROKINETIC DEPOSITION OF ZINC ON MILD STEEL"** is an original research work carried out by **NNAMBA, OGECHI JOY (14CM017033)** meets the requirements and regulations governing the award of Master of Engineering (M.Eng.) degree in Mechanical Engineering from the Department of Mechanical Engineering, College of Engineering, Covenant University, Ota, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This research work is dedicated first and foremost to God Almighty, the custodian of all wisdom, knowledge and understanding for His grace and favor throughout the duration of carrying out this research. Then to my family for their endless support and love.

ACKNOWLEDGEMENTS

My profound gratitude goes firstly to God Almighty for His unspeakable gifts wherewith He has so lavishly poured upon me, and His daily benefits that I enjoy, most pertinent of which is life itself.

My sincere appreciation goes to the Chancellor, Covenant University, Dr. David O. Oyedepo, whose words have always been a constant reminder that anything is possible and achievable. Thank you very much sir, and may your legacy outlive you. Also, to the Vice-Chancellor, Prof. Humphrey Adebayo, the Dean School of Postgraduate Studies, Prof. Akan Williams, Prof. Joshua Okeniyi, the Head of Department of Mechanical Engineering Department, and the Postgraduate Coordinator, Dr. Funmi Joseph for all their tireless pursuits in seeing to the realization of vision 10:2022 for Covenant University being among the top ten Universities in the World. May God Almighty immensely reward all your efforts.

My deep appreciation goes to my amiable supervisor, Dr. Olugbenga Omotosho for his kind-heartedness, support, mentorship and advice he gave to me through the stages of this research work enabling me to complete in time. Many thanks also to the entire Academic and Non-Academic staff in the Department of Mechanical Engineering. May the good Lord reward you all for your investments in my life.

I also want to deeply appreciate my colleagues and friends: Kaki Joy, Shogo Adebanke, Williams Joseph and Ayoola Daniel to name a few, whose contributions were invaluable all through my postgraduate studies. God bless you all and reward you abundantly.

My heartfelt and deep appreciation goes to my parent, Mr. Nnamba who has always been there for me and stood in prayers for my destiny. Words cannot express how indebted I am to you. I pray you will live long enough to reap the benefits of the seeds you have sown in my life and that of my siblings. I love you and God bless you.

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LIST OF ABBREVIATIONS AND SYMBOLS

1D:	1-Dimesional
3D:	3-Dimensional
CR:	Corrosion Rate
Ecorr:	Corrosion Potential
EDS:	Energy Dispersive Spectroscopy
icorr:	Corrosion Current
jcorr:	Corrosion Current Density
LSV:	Linear Sweep Voltammetry
OCP:	Open Circuit Potential
Rp:	Polarization Resistance
SEM:	Scanning Electron Microscope
XRD:	X-ray Diffractometer

ABSTRACT

Mild Steel is a metal that is used in various industries because of its good mechanical properties, however there is a need to improve its physical and tribological properties, hence the reason for introducing coating. This process has proven over time to be an effective method for reducing the corrosion rate of mild steel. This study used zinc as a coating material for mild steel and also used green additives during the electrodeposition process to enhance the physical and mechanical properties of the zinc coating. The plating times used were 15 and 25 minutes. The electrical properties were examined with the aid of a voltage-ammeter device. The Digi-Ivy Potentiostat was used in studying the corrosion properties of the coatings. The microstructural study of the coated samples was carried out using the Scanning Electron Microscope (SEM). It was discovered that the physical, electrical conductivity, corrosion resistance properties and surface morphology of the coated samples improved when *Cassia fistula* and *Citrus sinesis* in certain concentrations were used. COMSOL Multiphysics software was used to validate the experimental data that showed that as plating time increases, the mass deposited on the cathode (mild steel) increased.

Keywords: Electrodeposition, Green Additives, Corrosion, COMSOL Multiphysics.