

**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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BY

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF
POSTGRADUATE STUDIES IN PARTIAL FULFILMENT OF THE
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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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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 All information cited from published and unpublished literature has been duly referenced.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.

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LIST OF ABBREVIATIONS AND SYMBOLS

1D:	1-Dimensional
3D:	3-Dimensional
CR:	Corrosion Rate
E _{corr} :	Corrosion Potential
EDS:	Energy Dispersive Spectroscopy
i _{corr} :	Corrosion Current
j _{corr} :	Corrosion Current Density
LSV:	Linear Sweep Voltammetry
OCP:	Open Circuit Potential
R _p :	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 sinensis* 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.