SYNTHESIS, CHARACTERIZATION AND ANTIBACTERIAL ACTIVITY OF SELECTED SCHIFF BASE LIGANDS AND THEIR COPPER COMPLEXES

FREDRICH KIBET TONUI

A Thesis Submitted to the Graduate School in Partial Fulfillment of the Requirements for the Award of the Degree of Master in Chemistry of Chuka University

CHUKA UNIVERSITY OCTOBER

2025

DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and has not been presented for an award of diploma or conferment of degree any degree in any other university.

Signature .....Date....26/10/2025.

Fredrich Kibet Tonui.
SM11/57596/22

Recommendation

This thesis has been examined, passed and submitted with our approval as University supervisors

Signature .....Date....27/10/2025.

Prof. Eric Njagi, Ph.D.
Chuka University

Signature .....Date....27/10/2025.....

Dr. Zipporah Wanjiku, Ph.D.
Chuka University

COPYRIGHT

DEDICATION

This research work is dedicated to my parents, Mr. Gabriel Korir and Mrs. Grace Korir, my brothers, and my sisters. Thank you for everything.

ACKNOWLEDGEMENTS

I sincerely appreciate the Almighty for the gift of life, favor and grace for making it possible to start and complete this MSc. Program. I wish to specially thank my supervisors Prof. Eric Chomba and Dr. Zipporah Wanjiku for their tremendous guidance and assistance, loan of knowledge and sharing noble ideas with me throughout the course of this research. Your simplicity, encouragement, unwavering affection and efforts are sincerely appreciated. Special thanks to laboratory technicians Mr. Eric Lihanda, Mr. Martin Mutembei and Madam Juliet for their unwavering assistance in the laboratory. May God bless you abundantly.To my fellow postgraduate students, I thank you very much for the knowledge shared, endless days in the laboratory and the fun all the way. I extend special thanks to the academic and non-academic staff members of the department of chemistry for their contribution towards this master program. I am greatly indebted to my parents Mr. Gabriel Korir and Mrs. Grace Korir for their full commitment to see me through this academic journey, I thank members of my family, my brothers, my sisters and all people who encouraged, counseled and supported me financially during the entire period of this research and study. Thank you very much.

ABSTRACT

Resistant strains of bacteria have emerged because of improper use of antibiotics and insufficient infection management, posing a serious danger to both public health and the global economy. Therefore, it has become essential to produce a new generation of antimicrobials to slow the spread of antibiotic resistance. This is by advancement of antimicrobial drugs that can specifically interact with a target site of a particular pathogen. The work described in this paper entails the synthesis, characterization and antibacterial evaluation of schiff base ligands and their Cu (II) complexes. The ligands, Ligand 1 (*(E)-N,N-dimethyl1-4-((p-tolyimino)methyl)aniline*) and Ligand 2 (*(E)4(((2,4-dinitrophenyl)imino)methyl)-n-n-dimethylaniline*), were obtained by microwave assisted condensation and then refluxed for 3 hours, the solid was filtered and rinsed with ethanol and left to dry. The copper complexes were prepared by treating a hot (40°C) solution of the ligands dissolved in ethanol with an aqueous solution of Cu (II) chloride followed by refluxing for 3 hours. Ultraviolet Visible spectroscopy and Fourier Transform Infrared Spectroscopy characterized each of the synthesized compounds. The percentage yield was at 78% for ligand 1, 62% for ligand 2, 76% for complex 1 and 81% for complex 2. The UV-Visible spectra showed two major absorption bands for the ligands, which shifted to higher and lower wavelengths for the complexes. The FTIR spectra show that the azomethine (-C=N-) stretch shifts from 1640.0 cm^{-1} in the ligands to 1635.64 cm^{-1} in complex 1 and 1614.42 cm^{-1} in complex 2. Similarly, the carbonyl (-C-O-) stretch shifts from 1238.00 cm^{-1} (Ligand 1) and 1160.00 cm^{1} (Ligand 2) to lower values in complex 1 (1027.00 cm^{1}) and complex 2 (1141.00 cm^{1}), confirming metal-ligand interaction. The antibacterial sensitivity levels of the synthesized Schiff bases and the Cu (II) complexes was evaluated using disk diffusion method. The bacterial strains employed included; GramPositive *staphylococcus aureus* and Gram-negative *Escherichia coli*. The filter paper discs were deepen into concentration ranging from 10ug/ml-40ug/ml for every compound synthesized and then laid onto the surface of the discs. The average inhibition zone for the ligands was at 7.0 mm (ligand 1) and 6 mm (ligand 2) for gram negative bacteria and 10.5 mm (ligand 1) and 10.75 (ligand 2) for Gram positive bacteria. For the complexes 6.0 mm (complex 1) and 6.75 mm (complex 2) for gram negative bacteria and 9.5mm (Complex 1) and 8.75 mm (complex 2) for gram positive bacteria relative to standard gentamycin which showed activity at 24 mm for gram negative and 26 mm for gram positive bacteria. These results were relative to the literature work done, however the zones were slightly lower. From these results, it is concluded that the ligands and complexes were successfully synthesized and all these compounds showed promising activity against bacteria. To explore further potential of these compounds, further studies on other antimicrobial properties as antiviral, antifungal among others should be performed to evaluate similar performance.