

**COMPLEXATION OF SCHIFF BASE LIGANDS: SYNTHESIS,
CHARACTERIZATION AND ANTIMICROBIAL STUDIES**

RUZY BINTI MOHAMMAD

**Final Year Project Report Submitted in
Partial Fulfilment of the Requirements for the
Degree of Bachelor of Science (Hons.) Chemistry
in the Faculty of Applied Sciences
Universiti Teknologi MARA**

NOVEMBER 2007

ACKNOWLEDGEMENTS

Alhamdulillah.

Upon completion of this project, I would like to express my gratitude to many parties. First of all my heartfelt thanks go to my supervisor, Puan Sharifah Rohaiza bt. Syed Omar for her continuous guidance, valuable advice and comments during this project. I also would like acknowledge my co-supervisor, Prof. Madya Dr. Hadariah bt. Bahron for her suggestions, guidance and assistance in helping me to complete this project.

I would like to thank my second examiner, Dr. Karimah bt. Kassim for her comments and guidance in using the instruments for analysis. I wish to express sincere gratitude to Encik Adnan Ismail, Encik Khairul, Puan Zaleha, Encik Mohd Kadim Sarmean, Encik Rahimi Mat Noor, Encik Tuan Haji Rozali Meat and Encik Johari Saffar for their kind assistance in using laboratory facilities during this project.

I would like to express my appreciation to my family, my project partner, Suhaili Bt Zainal Abidin, my antimicrobial partner, Nurhidayu Jamaludin, my classmates, my housemates, roommates, coursemates and all my friends for their guidance, opinion, support and patience during the completion of my project.

Last but not least, I wish to thank everyone who has helped me directly or indirectly throughout this project.

ABSTRACT

COMPLEXATION OF SCHIFF BASE LIGANDS: SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL STUDIES

Two Schiff base ligands are prepared by condensation reaction of ethylenediamine with benzaldehyde or 4-chlorobenzaldehyde in the ratio of 1:2. The metal complexes are prepared by the template method in the ratio of 1:2:1 (ethylenediamine: 4-chlorobenzaldehyde: Zn(II) acetate dehydrate or Ni(II) acetate tetrahydrate). The complexes of the Schiff base N,N'-bis-(4-chlorobenzylidene)ethylenediamine with Zn(II) is successfully prepared. Complexes and ligands are then characterized by elemental analysis, IR spectroscopy, ¹H NMR spectroscopy and magnetic susceptibility. The results suggested that the structure of Schiff base metal complexes is a polymeric coordination compound of the [Zn(cbaen)₂]. A new type of Schiff base Ni(II) complex is successfully prepared with the suggested formula of [Ni(cba)₂(en)(H₂O)₂].H₂O. The antimicrobial studies are successfully conducted. Both the Schiff base ligands N,N'-bis-(4-chlorobenzylidene)ethylenediamine and N,N'-bis-(dibenzylidene)ethylenediamine have inhibiting properties while the Zn(II) complex show higher antimicrobial compared to the Ni(II) complex.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vi
LIST OF FIGURES	vii
LIST OF ABBREVIATIONS	ix
ABSTRACT	xi
ABSTRAK	xii
CHAPTER 1 INTRODUCTION	
1.1 Background	1
1.2 Significance of study	3
1.3 Objectives of study	4
CHAPTER 2 LITERATURE REVIEW	
2.1 Introduction	5
2.2 Preparation of ligands and complexes	5
2.2.1 Synthesis of Schiff base ligands	5
2.2.2 Synthesis of metal complexes	6
2.3 Characterization techniques	7
2.3.1 Elemental analysis	8
2.3.2 FTIR Spectroscopy	10
2.3.3 ¹ H NMR Spectroscopy	13
2.3.4 Magnetic Susceptibility	14
2.3.5 Single X-ray Crystallography	15
2.4 Biological Studies	18
CHAPTER 3 METHODOLOGY	
3.1 Materials	21
3.2 Methods	21
3.2.1 Synthesis of baen Schiff base ligands	22
3.2.2 Synthesis of cbaen Schiff base ligands	24
3.2.3 Synthesis of Schiff base complexes	24
3.3 Characterization	24
3.5 Antimicrobial activity	25
CHAPTER 4 RESULTS AND DISCUSSION	
4.1 Elemental analysis	26
4.2 FTIR Spectroscopy	28
4.3 NMR Spectroscopy	29

CHAPTER 1

INTRODUCTION

1.1 Background

A Schiff base is an organic compound synthesized by the condensation of ketones or aldehydes with primary amines. The azomethine group ($>C=N$), also known as the imine group is a functional group that consists of a carbon-nitrogen double bond with the nitrogen atom connected to an aryl or alkyl group (McMurry et al., 2004). It has a general formula of $R_1R_2C=NR_3$ as shown in Figure 1.1 in which R_3 is an aryl or alkyl group that can contribute to the stability of the Schiff base.

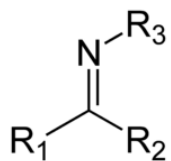


Figure 1.1 The general structure of an imine.

A ligand is a molecule or ion that donates or shares one or more of its lone pair(s) of electrons through a coordinate covalent bond with one or more central atoms or ions. In coordination compounds, the central atom is a metal and ligand molecules can bind to the metal through various types of binding sites by coordinate bonds (dative covalent bonds). A ligand binding through one site is called monodentate or unidentate and a bidentate ligand binds through two donor