

TABLE OF CONTENTS

Acknowledgments	I
Table of contents	II
List of figures	V
List of tables	VI
List of schemes	VII
Abbreviations	VIII
Abstract	IX
ملخص بالعربية	X
Introduction.....	1
General principles.....	1
1.2. Zinc.....	3
1.2.1. Zinc as an element.....	3
1.2.2. Importance of zinc in biology.....	3
1.2.3. Stereochemistry of zinc compounds.....	6
1.2.4. Reactivity of Zn.....	6
1.2.5. Zn in medicine.....	7
1.2.6. Zinc as anti-bacterial agent.....	8
1.3. Cobalt	9
1.3.1. Cobalt as an element.....	9
1.3.2. Biological importance of cobalt.....	9
1.3.3. Cobalt complexes with anti-microbial activity.....	10
1.3.4. Cobalt complexes with anti-tumor activity.....	11
1.3.5. Cobalt coordination chemistry.....	13
1.3.5.1. Cobalt(II) complexes.....	13
1.3.5.2. Cobalt(III) complexes.....	13

1.4. Coordination of metal carboxylates.....	14
1.5. Malaria disease.....	17
1.6. BNPP hydrolysis.....	18
1.7 Aim of the project.....	20
2. Experimental.....	21
2.1 Reagents, biological species and chemicals.....	21
2.2 Instrumentation.....	21
2.3 Synthesis and characterization of Zinc(II) compounds.....	21
2.3.1. Zinc sulindac complex, $[\text{Zn}(\text{sul})_2]$ (1).....	21
2.3.2. Zinc sulindac 2-amino pyridine complex, $[\text{Zn}(\text{Sul})_2\text{ 2-ampy}]$ (2).....	22
2.3.3. Zinc sulindac 2-amino methyl pyridine complex, $[\text{Zn}(\text{Sul})_2\text{ 2-ammepy}]$ (3).....	23
2.3.4. Zinc sulindac 1,10-phenanthroline, $[\text{Zn}(\text{sul})_2(1,10\text{ phen})]$ (4).....	23
2.3.5. Zinc sulindac 2,9-dimethyl-1,10-phenanthroline, $[\text{Zn}(\text{sul})_2(2,9\text{-dimephen})]$ (5).....	24
2.4 Synthesis and characterization of cobalt(II) complexes.....	25
2.4.1 Cobalt sulindac, $[\text{Co}(\text{sul})_2(\text{H}_2\text{O})_4]$ (6).....	25
2.4.2 Cobalt sulindac 2-amino pyridine complex, $[\text{Co}(\text{Sul})_2\text{ 2-Ampy}]$ (7).....	25
2.4.3 Cobalt sulindac 1,10-phenanthroline, $[\text{Co}(\text{sul})_2(1,10\text{ phen})]$ (8).....	26
2.4.4 Cobalt sulindac 2,9-dimethyl-1,10-phenanthroline, $[\text{Co}(\text{sul})_2(2,9\text{-dimephen})]$ (9).....	26
2.5 X-ray crystallography.....	27
2.6 Anti-bacterial activity.....	30
2.7 Anti-malarial activity.....	30
2.7.1 Semi-quantitative method	30
2.7.2 Quantitative test.....	31
2.8 BNPP hydrolysis.....	31
3. Results and discussion.....	32
3.1 Synthesis of Co(II) and Zn(II) complexes.....	32
3.2. Magnetic results for cobalt(II) compounds.....	35
3.3. NMR spectroscopy.....	36
3.4. Results of electronic absorption spectroscopy.....	43
3.5. X-ray crystallography.....	45
3.5.1. X-ray crystal structure of $[\text{Zn}(\text{sul})_2(1,10\text{ phen})]$ (4).....	45
3.5.2. X-ray crystal structure of $[\text{Zn}(\text{sul})_2(2,9\text{-dimephen})]$ (5).....	46
3.5.3. X-ray crystal structure of $[\text{Co}(\text{sul})_2(\text{H}_2\text{O})_4]$ (6).....	48

3.5.4. X-ray crystal structure of [Co(sul) ₂ (2,9-dimephen)] (9).....	49
3.6. Results of IR spectroscopy	50
3.7 In-vitro biological activity.....	53
3.7.1 Anti-bacterial activity.....	53
3.7.2 Anti-malarial activity.....	58
3.7.2.1 Semi-quantitative method.....	58
3.7.2.2. Quantitative test.....	60
3.7.3 BNPP hydrolysis.....	62
4. Conclusion.....	64
5. References.....	65
Appendices	72
Appendix A: Crystal structure data of [Zn(sul) ₂ (1,10-phen)] (4)	
Appendix B: Crystal structure data of [Zn(sul) ₂ (2,9-dimephen)] (5)	
Appendix C: Crystal structure data of [Co(sul) ₂ (H ₂ O) ₄] (6)	
Appendix D: Crystal structure data of [Co(sul) ₂ (2,9-dimephen)] (9)	