

Synthesis, spectroscopic studies and biological applications of zn(ii), cd(ii) & co(ii) carboxylates



BY

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in partial fulfillment for the award of the degree of

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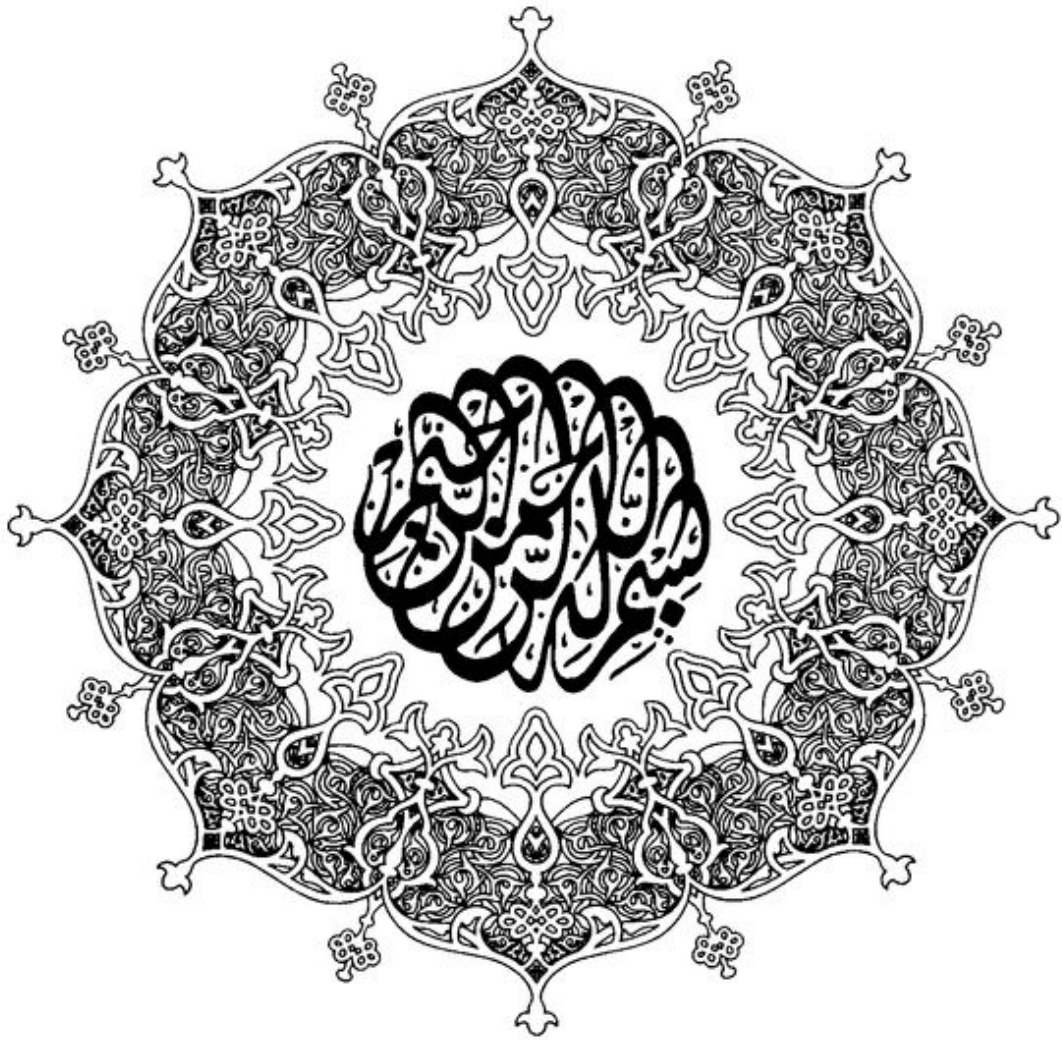
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In the name of

Allah,

The most Compassionate,

The most merciful

“IMAGINATION IS THE
HIGHEST FORM OF
RESEARCH.”

- *Elbert Einstein*

RESEARCH COMPLETION CERTIFICATE

Certified that the research work contained in this thesis titled, “**Synthesis Spectroscopic Studies and Biological Applications of Zn(II), Cd(II) & Co(II) Carboxylates**” has been carried out and completed by **Farhan Butt**, ID: **15004140021**. The quantum and the quality of the work contained in this thesis is adequate for the award of degree of MS.

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DEDICATION

To

The ALMIGHTY ALLAH , perfect symbol of humanity “Hazrat Muhammad” (Peace be Upon Him), all those who are struggling for the well being of mankind, my teachers who are a symbol of guidance in my life and induced a deep love to struggle, who are a source of strength, inspiration and proud for me, my beloved parents

&

***My son
Abdullah Hussain***

CONTENTS

Acknowledgements	i
Abstract.	ii
List of Tables	iv
List of Figures	v
List of Schemes	vii
List of Acronyms/Abbreviations	viii
1. InIntroduction	12-24
1.1 Metal complexes	2
1.2 Background	3
1.3 Transition elements	4
1.4 Structural properties of metal carboxylates	4
1.4.1 Ionic	5
1.4.2 Monodentate	6
1.4.3 Chelating	6
1.4.4 Carboxylate bridges	7
1.4.5 Trinuclear carboxylate	8
1.4.6 Polymerization of monomers and dimers	8
1.5 Polydentate ligands	9
1.6 Zinc	10
1.6.1 Polyatomic ions of zinc	10
1.6.2 Significance of zinc	11
1.6.3 Role of zinc as a cofactor	11
1.6.4 Biological applications of zinc	12
1.7 Cobalt	13
1.7.1 Polyatomic ions of cobalt	13
1.7.2 Significance of cobalt	14
1.7.3 Biological applications of cobalt	14
1.8 Cadmium	15
1.8.1 Polyatomic ions cadmium	15
1.8.2 Biological applications of cadmium	16
1.8.3 Toxicity of cadmium	17
1.9 Applications of aromatic carboxylates	17
1.10 Synthesis of metal carboxylates	18

1.10.1	Aqueous reactions	21
1.10.2	Electrochemical synthesis	21
1.10.2	Non-aqueous reactions	21
1.11	Crystal growth of aromatic carboxylates	21
1.12	Phosphatases	23
1.12.1	Alkaline phosphatases	24
2.	Literature review	25-36
3.	Experimental Section	37-42
3.1	Chemicals	38
3.2	Instrumentations	38
3.3	Preparation of the ligand (HL)	38
3.4	Synthesis of sodium salt of ligand (NaL)	39
3.5	Procedure for the Synthesis of metal complexes of Zn(II), Cd(II) & Co(II) Carboxylates.	39
3.6	Procedure for the mixed ligand complexes	40
3.7	Conductance measurement	41
3.8	Alkaline phosphatase (ALP) Assay	41
4.	Results and discussion	43-58
4.1	Physical parameters	44
4.2	FT-IR spectra	48
4.3	Conductance measurements	53
4.4	Alkaline phosphatase (ALP) assay	54
4.5	Conclusions	58
	References	59

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ABSTRACT

Background: Metal carboxylates belong to that kind of chemical substances comprising of metal and the long-chain unsaturated and saturated fatty acids. The catalysis of the metal is connected and utilized as a curing promoter and attachment promoter. These metal carboxylates act as accelerator for the chemical reaction and used as inhibitors in the treatment of various diseases like controlling apoptosis, metabolism of genome and proteins, stabilizing macromolecules, controlling bacterial gene expression by blocking the synthesis of proteins. It is an excellent example of prodrug with a specific drug and possesses the high degree bio-activation. At this time, the use of metal carboxylates is greatly popular in the paints, drying and detergents etc. They are especially used in the formation of materials having waterproofing qualities. Hardness of organic substances can also changed by them. Regardless of having long history, the interest for the science of metals and their carboxylates has endured and there is a need of investigating their basic characteristics, for example, carboxylate bonding modes, crystal structures, thermal properties and biological applications. Metal carboxylates play very important role in various biological reactions. Significance of drugs and their complexes have been desired to synthesize and characterize some ternary inner transition metals complexes with carboxylate and their derivative,

Methods: Solid complexes of carboxylates were prepared by the reaction of metal salts containing Zn(II), Cd(II), Co(II) and ligand in the ratio of 1:2. Then ethylenediammine (co-ligand) attached to the Metal-carboxylate complexes with the molar ratio of 2:1 (co-ligand to metal-carboxylate).

Results: Pure complexes have been isolated having sharp and fixed melting point. The complexes were characterized by FT-IR and conductance measurement. FT-IR spectroscopy supported the non involvement of amino nitrogen of the ligand HL with metals because vibrational frequency of NH was not shifted to a considerable extent in complexes **3–8** as compared to the free ligand (HL). The molar conductance data of the synthesized complexes revealed that the ligand is non-electrolyte but Zn(II), Cd(II) & Co(II) Carboxylates are electrolytic in nature. A distorted octahedral geometry was observed around Zn and Co- complexes, where, four oxygen atoms and two water molecules complete the coordination sphere. All Metal-carboxylates co-ligand complexes have the octahedral geometry due to attachment of ethylene diammine.

Conclusion:The effects of these complexes were applied on alkaline phosphatase (ALP) and their activity on the blood serum was also checked.The alkaline phosphatase activities in a control serum sample and active site of the enzyme bind by it.It was also noted that at a concentration of 4mM the inhibition of ALP was 90 % for all the complexes.It has been noted that most of the metal complexes are more active than their respective ligand showing that activity of the ligand enhanced by thecomplexation.

Keywords: Metal-carboxylates; ALP assay;FT-IR spectra;

Lists of Table

Table 1.1: Types of phosphatases	23
Table 4.1: Physical parameters of ligand and metal complexes	45
Table 4.2: Conductivity measurement of ligand and metal complexes	49
Table 4.3: Alkaline phosphatase(ALP) assay of ligand and metal complexes	54
Table 4.4: FT-IR spectra of the lignd and synthesized complexes	55

List of Figures

Figure 1.1: Resonance stabilized carboxylate anion and a hydrated proton	3
Figure 1.2: Structural arrangements of the derivatives of titanium alkoxide	5
Figure 1.3: Simple ionic carboxylate	5
Figure 1.4: Tinmonodentate carboxylate	6
Figure 1.5: A chelating carboxylate of basic zinc acetate	6
Figure 1.6: Possible bridging of carboxylates	7
Figure 1.7: Common structure for carboxylate-bridged metal dimers	7
Figure 1.8: (a) The ORTEP view of the asymmetric unit of the complex (b) the coordination environment around the cobalt atoms in the trinuclear moiety in the repeating unit of the polymer	8
Figure 1.9: Polymerization of dimmers and monomers	9
Figure 1.10: Crystal structure of a hexagonal wurtzite ZnO	10
Figure 1.11: Five-coordinate salicylaldehyde and ethylenediamine tertiary butyl (Salen- ^t Bu) complexes of zinc	11
Figure 1.12: Crystal structure of tris-(2,3-pyridine dicarboxylato) zinc anion	12
Figure 1.13: Complex of Co(II) ion with the orotate ligand	13
Figure 1.14: Crystal structure of $[\text{Co}(\text{L}_4)_2(\text{H}_2\text{O})_2]_n \cdot 2\text{NO}_3$	14
Figure 1.15: Cadmium-oxide-unit-cell-3D-balls	15
Figure 1.16: Paddlewheel (left), trinuclear basic carboxylate (middle) and tetranuclear butterfly carboxylate (right) complexes	16
Figure 1.17: Coordination environment of the central cadmium ion	16

Figure 1.18: Ribbon diagram of human carbonic anhydrase II with cadmium ion is visible in cente	17
Figure 1.19: Structure of aspirinate of Cu(II)	20
Figure 1.20: Four variations of the gel method for the growth of single crystal	22
Figure 1.21: Ribbon diagram of human placental alkaline phosphatase	40
Figure 3.1: General structure of complex	40
Figure 3.2: Structure of metal coligand complex	41
Figure 4.1: FT-IR spectra of HL	50
Figure 4.2: FT-IR spectra of ZnL_2	50
Figure 4.3: FT-IR spectra of $ZnL_2(en)_2$	51
Figure 4.4: FT-IR spectra of $CdL_2 \cdot 2H_2O$	51
Figure 4.5: FT-IR spectra of $CdL_2(en)_2$	52
Figure 4.6: FT-IR spectra of CoL_2	52
Figure 4.7: FT-IR spectra of $CoL_2(en)_2$	53
Figure 4.8: Graphical representation of % age inhibition of ALP against HL, NaL, ZnL_2 and $ZnL_2(en)_2$	56
Figure 4.9: Column representation of % age inhibition of ALP against HL, NaL, ZnL_2 and $ZnL_2(en)_2$	56
Figure 4.10: Graphical representation of % age inhibition of ALP against CdL_2 , $CdL_2(en)_2$, CoL_2 and $CoL_2(en)_2$	57
Figure 4.11: Column representation of % age inhibition of ALP against CdL_2 , $CdL_2(en)_2$, CoL_2 and $CoL_2(en)_2$	57

List of schemes

Scheme 1.1: Preparation of the dye fluorescein by Friedel-Crafts acylation	11
Scheme 1.2: Synthesis of metal carboxylates	19
Scheme 1.3: Transformation of a zero-dimensional compound	19
Scheme 1.4: Representation of various reactions of Cu(II) acetate with 2- nitrobenzoic acid	20
Scheme 3.1: Synthesis of ligand	39
Scheme 3.2: Synthesis of sodium salt of ligand	39
Scheme 3.3: General procedure for the ALP assay	42

List of Acronyms/Abbreviation

HL	Ligand
ATP	Adenosine triphosphate
ALP	Alkaline phosphatase
en	Ethylene diamine
DMSO	Dimethyl sulfoxide
FT-IR	Fourier transforms infrared spectroscopy
IUPAC	International Union of Pure and Applied Chemistry
RCOONa	Sodium salt of ligand
H₄PM	Pyromellitic acid
H₃TM	Trimellitic acid.
SD	Standard deviation
TGA	Thermal gravimetry analysis
TG	Thermogravimetry
UV	Ultraviolet
Vis	Visible
t_{1/2β}	Half-life
λ_{max}	Maximum wavelength
NMR	Nuclear magnetic resonance
Ms	Millisiemens
<i>p</i>-NPP	Nitrophenyl phosphate



INTRODUCTION



Chapter 1

1. Introduction

1.1 Metal complexes

During the last few decades, the interests of scientists are increasing in the synthesis and applications of carboxylates. Institutions of government, some research centers of public, different type of government and private universities and some firms have investigated these significant resources throughout the world. The technique of carboxylate synthesis and its application is still at an early stage of progress (Ackermann, 2011).

The development in the synthesis of carboxylates was made possible by the availability of large quantities of pure metallic compounds. The ion-exchange process for separating the metal elements from each other is primarily responsible for increasing the availability of spectroscopically pure rare earths and transition metals. Although every aspect of metal complex chemistry has received considerable recent attention, the most active field has been the chemistry of coordination in metal ions (Rao, 2001).