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

MS Chemistry

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UNIVERSITY OF MANAGEMENT AND TECHNOLOGY,
LAHORE, PAKISTAN

2017

Synthesis, Spectroscopic Studies and Biological Applications

of Zn(II), Cd(II) & Co(II) Carboxylates

Submitted to University of Management and Technology Lahore

In partial fulfillment of the requirements

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Session: 2015-2017

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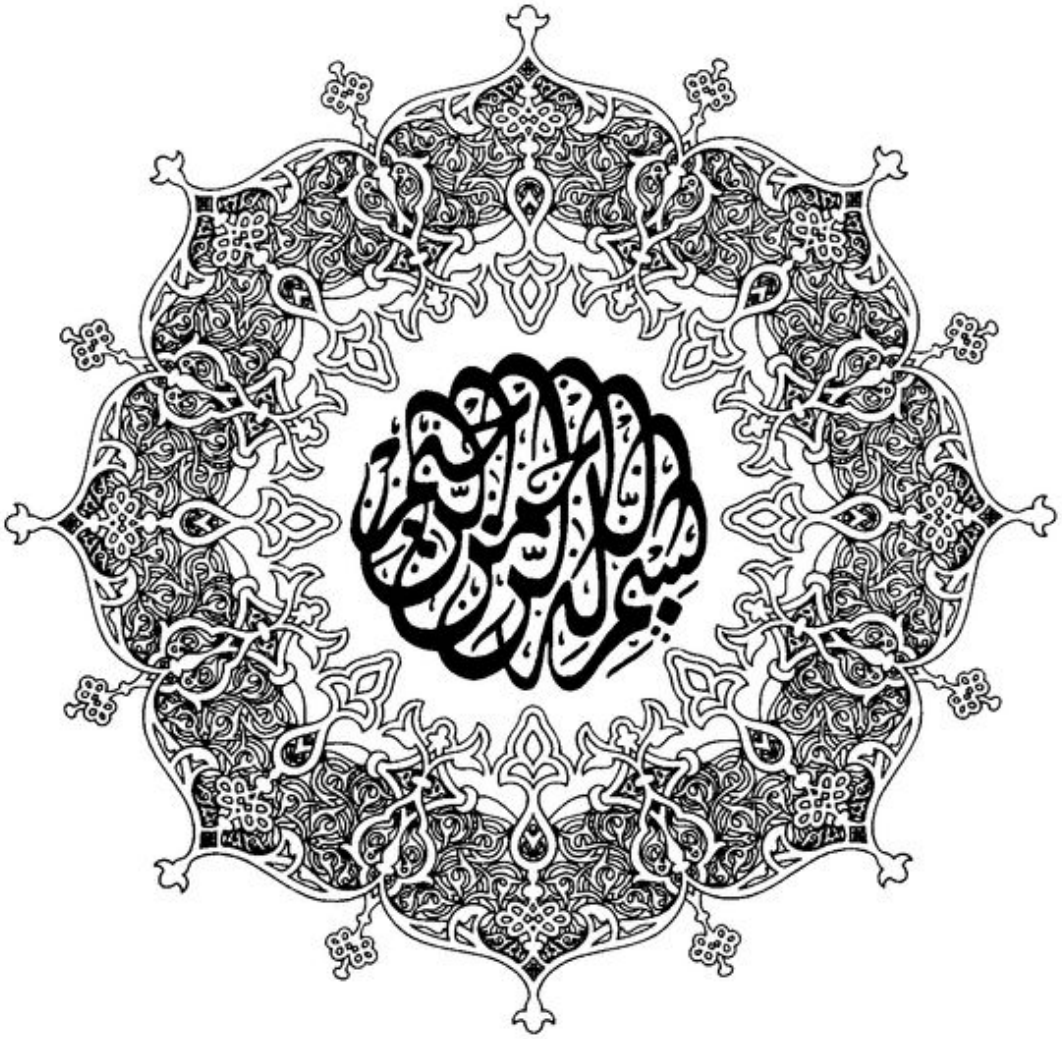

In the name of

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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DECLARATION

I FARHAN BUTT S/O MUHAMMAD SHAFIQ ID: 15004140021 Session 2015-2017 have declared that the matter printed in the thesis dissertation titled "Synthesis, Spectroscopic Studies and Biological Applications of Zn(II), Cd(II) & Co(II) Carboxylates" which isubmit for the research qualification **MS DEGREE IN CHEMISTRY**to the Department of Chemistry, School of Science, University of Management and Technology, Lahore, Pakistan is apart from the recognized assistance of my supervisors, my own work and has not been submitted as research workpreviously, thesis or publication in any form in any University, research institution etc. in Pakistan or abroad to obtain a research diploma or degree.

_____

(Candidate)

Dated: _____

_____

(Supervisor)

DEDICATION

To

The ALMIGHTY ALLAH , perfect symbol of humanity “HazratMuhammad” (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

This thesis owns many thanks to a number of people for their assistance, patience and kindness. Without their support, I could not have achieved my goal.

I would like to express my sincere gratitude to ALLAH ALMIGHTY for His help and blessings. First and foremost, I would like to express my indebtedness to my supervisors, Dr. KhurramShahzadMunawarfor the continuous support of my MS study and related research, for his patience, motivation, and immense knowledge. His guidance helped me in all the time of research and writing of this thesis. I could not have imagined having better advisors for my MS study.

Besides my advisors, I would like to thank Dr. M. Azhar Iqbal (Dean School of Science),Dr. SammiaShahid (Chairperson Department of Chemistry),University of Management and Technology, Lahore for their insightful comments and encouragement and also for the hard question which incented me to widen my research from various perspectives.

I would like to thanks the Muhammad Rizwan (Lab assistantDepartment of Chemistry)and to all my lab fellows, especially FaheemIjaz, for their stimulating discussions, support, encouragement for the sleepless nights we were working together before deadlines, and for all the fun we have had in the last two years.

Finally, I am sincerely grateful to my family: my parents and to my brothers and my sisters for their continuous supporting, assistance, patience and encouraging me spiritually throughout writing this thesis and my life in general.

FARHAN BUTT

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 caracteristics, for example, carboxylate bonding modes, crystal structures, thermal properties and biological applications.Metal carboxylatesplay very important role in various biological reactions.Significance of drugs and their complexes have been desired tosynthesize 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 isolatedhaving 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) Carboxylatesare 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 coligand 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;

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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
H_4PM	Pyromellitic acid
H_3TM	Trimellitic acid.
SD	Standard deviation
TGA	Thermal gravimetry analysis
TG	Thermogravimetry
UV	Ultraviolet
Vis	Visible
$t_{1/2\beta}$	Half-life
λ_{max}	Maximum wavelength
NMR	Nuclear magnetic resonance
Ms	Millisiemens
***p*-NPP** *p*-	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 on 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 lias received considerable recent attention, the most active field has been the chemistry of coordination in metal ions (Rao, 2001).