شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
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Faculty of Science

Chemistry Department

Synthesis and characterization of some novel transition metal complexes and studying their biological efficiency

Thesis Submitted by

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Mina Ezzat

Summary

Details of the studies on the synthesis, spectral characterization and analytical applications of some new transition metal complexes of the Schiff bases derived from 2-hydroxy-1-napthaldehyde are presented in this thesis Schiff-bases are important material for inorganic chemists as these are widely used in medicinal inorganic chemistry due to their diverse biological, pharmacological, antitumor activities. Recently, there has been tremendous interest in studies related to the interaction of transition metal ions with nucleic acid because of their relevance in the development of new reagents for biotechnology and medicine. The thesis is divided to three chapters and pronounced as follows:

Chapter I: Introduction and Literature Review

In chapter I, involves a general introduction to Schiff bases and their transition metal complexes. Brief discussion about the applications of Schiff bases and their metal complexes in various field, importance of Schiff base transition metal complexes, antioxidants and its biological importance are included in this chapter, preparation of Schiff base and its complexes derived from previous studies of some research projects, a literature review on detection and determination Al^{3+} ions by using Schiff base as chemo sensors were discussed.

Chapter II: Experimental Work

In chapter II, is broadly divided into two sections. Part A provides details of the reagents used and various analytical and chemical techniques employed in the characterization and biological studies of

ligands and its complexes. Part B gives the details of the preparation and spectral characterization of new Schiff base. Schiff base have been synthesized by the condensation of 2-hydroxy-1-napthaldehyde with 4,5-dimethyl-1,2-pheneylenediamine.

Chapter III: Results and discussion

This chapter is divided to two parts as follows

Part 1, New complexes of Mn(II), Fe(III), Co(II), Ni(II), Cu(II) and Zn(II) metal ions were prepared from tetradentate Schiff base ligand (H_2L), derived from condensation of 4,5-dimethyl-1,2-phenylenediamine and 2-hydroxy-1-naphthaldehyde. The Schiff base ligand 1,1'-((1E,1'E)-((4,5-dimethyl-1,2-phenylene)bis(azaneylylidene))bis(methaneylylidene))bis(naphthalen-2-ol) (H_2L) and its ligand complexes were characterized by using elemental microanalysis, conductometric measurements, magnetic susceptibility and spectroscopic studies (UV-Vis, mass spectral analysis, FT-IR, ^{1}H-NMR, ^{13}C-NMR, TGA and ESR. To investigate the biological significance of Schiff base ligand and its new complexes. Furthermore, the DNA binding study was performed on Calf-thymus DNA by absorbance, fluorescence, viscosity and thermal denaturation measurement. Notably, the manganese(II) and copper(II) complexes have strong DNA binding interactions compared to other complexes. Further, the newly synthesized ligand and its metal complexes were tested for their *in vitro* anti-proliferative activity against two types of human cancer cell lines (MCF-7 and HepG-2). The complexes displayed moderate activity compared to the reference drug cis-platin.

Part 2, describes fluorescent probe based on the combination of 4,5-dimethyl-1,2-pheneylenediamine and 2-hydroxy-1-naphthaldehyde **(**PAMN**)** for the recognition of Al^{3+} was synthesized and extensively characterized using various elemental analysis, FT-IR, UV–visible, ESI-MS, C,H,N, magnetic moment, Job's plot , ^{1}H-NMR and ^{13}C-NMR spectroscopic studies. It was found to be highly selective and sensitive sensor for Al^{3+} in DMSO-HEPES solution (1:1, v/v, pH= 7.20) in fluorescence spectroscopy. with the gradual addition of Al^{3+} ions, the emission band exhibited a red shift (~539 to ~547 nm). PAMN coordinated with Al^{3+} in [1:1] stoichiometry with an association-constant of 2.18×10^{5} M^{-1} and the detection limit was calculated to be 7.05×10^{-9} M. The binding mode of interaction with Al^{3+} and the chelate complex formation was supported with the help of a ^{1}H-NMR spectroscopy titration, ESI–MS and by theoretical studies. The energies of both HOMO and LUMO for PAMN and PAMN-Al complex were estimated by DFT calculations to elucidate the configuration of the PAMN-Al complex. The live cell imaging study indicated that PAMN is highly efficient in the detection of exogenous Al^{3+} in living cell.

ABSTRACT

New complexes of Mn(II), Fe(II), Co(II), Ni(II), Cu(II) and Zn(II) metal ions were prepared from tetradentate Schiff base ligand (H_2L), derived from condensation of 4,5-dimethyl-1,2-phenylenediamine and 2-hydroxy-1-naphthaldehyde. The Schiff base ligand (H_2L) and its complexes were characterized by using elemental microanalysis, conductometric measurements, magnetic susceptibility and spectroscopic studies (UV-Vis, mass spectral analysis, FT-IR, ^{1}H-NMR, ^{13}C-NMR, TGA and ESR. To investigate the biological significance of Schiff base ligand and its new complexes. Furthermore, the DNA binding study was performed on Calf-thymus DNA by absorbance, fluorescence, viscosity and thermal denaturation measurement. Further, the newly synthesized ligand and its metal complexes were tested for their *in vitro* anti-proliferative activity against two types of human cancer cell lines (MCF-7 and HepG-2).

Schiff base ligand (H_2L) for aluminium recognition has been conveniently synthesized and characterized. H_2L exhibited a weak fluorescence and upon addition of aluminium, it exhibited pronounced enhancement against the background of other metal ions. The recognition mechanism based on excited-state intramolecular proton transfer (ESIPT) and chelation-enhanced fluorescence (CHEF) effect. H_2L coordinates Al^{3+} in 1:1 stoichiometry with association constant of with Al^{3+} is found to be 2.18×10^5 M^{-1}. H_2L displays good linear relationship with Al^{3+} in extremely low concentrations with LOD of 7.05×10^{-9} M. In addition, the living Hela

cell imaging demonstrates that the probe has good cell membrane permeability and shows a great potential for tracing intracellular Al^{3+} ions through fluorescence imaging technology.

KEYWORDS :Schiff-bases; Metal complex; N_2O_2 Schiff base; Chelates; DNA binding; Cytotoxicity ; DNA–binding; Cytotoxicity ; Fluorescent probe ESIPT; CHEF; Aluminum ions; Cell imaging.

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