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Structural, spectral and biological investigations on Cu(II) and Zn(II) complexes derived from NNO donor tridentate Schiff base: Crystal structure of a 1D Cu(II) coordination polymer

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ABSTRACT

Copper(II) and zinc(II) complexes of an NNO donor tridentate Schiff base, 4-bromo-2-(((3-(methylamino) propyl)imino)methyl)phenol (HL), were synthesised and characterized by different physicochemical methods including single crystal XRD, elemental analysis, IR, electronic and EPR spectral analysis. Copper(II) complex is a 1D coordination polymer in which chlorine acts as a bridging ligand and zinc(II) complex is a bis-ligated one. Hirshfeld surface analysis of the complexes has been carried out which provided better understanding of intermolecular interactions. Effects of solvents on charge transfer bands and *d-d* bands were investigated and the former shows a negative solvatochromic behaviour and latter a positive behaviour upon increasing solvent polarity. Luminescent properties were analysed and found that copper(II) and zinc(II) complexes exhibit quenching and enhancement of fluorescence respectively which is backed by quantum yield values. Cytotoxic activity of both complexes has been screened *in vitro* against lymphoma ascites cell lines. In addition, antibacterial activity of complexes has been screened against bacterial species *Bacillus cereus, Staphylococcus aureus, Klebsiella pneumonia* and *Escherichia coli.*

1. Introduction

Application of metal complexes of Schiff bases in diverse fields is of current research interest to coordination chemists all over the world. By recognizing the significance of metal complexes incorporating Schiff bases from their application perspective, a lot of efforts are being invested to develop inexpensive synthetic routes for these compounds. Several studies have been reported illustrating the biological activity of Schiff base complexes including their anticancer [1], antimicrobial [2], antioxidant [3] *etc.* activities.

Cytotoxic activities of metal complexes derived from Schiff bases against various malignant tumors have also been extensively studied and the metal which is incorporated in the complex has a great impact on the effectiveness of the compound [4]. Several attempts are being made to find suitable alternatives to platinum based metal complexes in order to broaden the spectrum of activity, to enhance clinical effectiveness and to reduce general toxicity leading to undesirable side-effects [5]. Compared to organic agents, metal complexes offer better ways of drug action due to their wide range of coordination numbers and flexible geometries as well as kinetic properties [6]. The determination of cytotoxicity and cell viability of coordination compounds can be considered as an initial step in the development of anti-cancer drugs. Transition metal complexes have been found to possess extensive antimicrobial activity which depend on the nature of metal ion as well as ligands, presence of certain functional groups, geometry of the complex *etc.* Schiff base ligands serve as better candidates for the synthesis of such complexes since they are characterized by the presence of biologically important azomethine functionality [7]. Copper and zinc are bioessential metal ions, involved in several biological processes and their complexes have been largely explored for their significant cytotoxic and antimicrobial activities [8].

Herein we report the synthesis and characterization of an NNO donor tridentate Schiff base, formed by the facile condensation of *N*-methyl-1,3-diaminopropane and 5-bromosalicylaldehyde and its copper(II) and zinc(II) complexes. Molecular structures of the

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