

**Synthesis and characterization of Zn(II) and Cd(II) complexes of S-benzyl- $\beta$ -N-(2-pyridyl)methylenedithiocarbazate (HNNS): bioactivity of the HNNS Schiff base and its Zn(II), Cu(II) and Cd(II) complexes and the X-ray structure of the [Zn(NNS)<sub>2</sub>] complex**

ABSTRACT

A tridentate Schiff base having HNNS donor sequence was prepared by condensing S-benzylthiocarbazate (NH<sub>2</sub>NHCSSCH<sub>2</sub>Ph) with pyridine-2-carboxaldehyde. Complexes of this ligand, pyCHNNHCSSCH<sub>2</sub>Ph(HNNS), with Cu(II), Cd(II) and Zn(II) were synthesized and characterized by elemental analyses and various physico-chemical techniques. X-ray crystallographic analysis shows that the Zn(II) complex, [Zn(NNS)<sub>2</sub>], is six-coordinate and has a distorted octahedral structure with the ligand coordinated to the Zn(II) ion as a uninegatively charged tridentate chelating agent via the pyridine nitrogen, the azomethine nitrogen and the mercaptide sulfur atoms. Distortions from the regular octahedral geometry are attributed to the restricted bite angles of the planar NNS tridentate ligand. The Cu(II) complex, [Cu(NNS)Cl], was paramagnetic with a square-planar stereochemistry while the Cd(II) complex, [Cd(NNS)Br], was diamagnetic and is suggested to have a tetrahedral structure. The Schiff base and its complexes were screened for antimicrobial, cytotoxic and antioxidant activities. Disc diffusion methods were employed for antimicrobial assays against eight pathogenic microorganisms. The Schiff base and the complexes do not display activities against any of the microorganisms. The Schiff base was cytotoxic with a CD<sub>50</sub> value of 5.90  $\mu$ g ml<sup>-1</sup> against the T-lymphoblastic leukemic cells while the Cu(II) and Cd(II) complexes were strongly cytotoxic with CD<sub>50</sub> values of 2.20 and 2.30  $\mu$ g ml<sup>-1</sup>, respectively. The Cu(II) and Cd(II) complexes were also effective against colon cancer cells with CD<sub>50</sub> values of 2.60 and 3.10  $\mu$ g ml<sup>-1</sup>, respectively. SBDTC showed a higher antioxidant activity than the  $\alpha$ -tocopherol (vitamin E) and was comparable with butylated hydroxytoluene (BHT), a commercially used synthetic antioxidant.

**Keyword:** Zn(II) complexes; Cu(II) complexes; Cd(II) complexes; S-Benzyl- $\beta$ -N-(2-pyridyl)methylenedithiocarbazate; Bioactivity of metal complexes; Bioactivity of NNS Schiff base; Crystal structure of Zn(II) complex