

**Synthesis, characterization and bioactivity of mixed-ligand Cu(II) complexes containing Schiff bases derived from S-benzylthiocarbamate and saccharinate ligand and the X-ray crystal structure of the copper-saccharinate complex containing S-benzyl- $\beta$ -N-(acetylpyrid-2-yl)methylenedithiocarbamate**

ABSTRACT

Mixed-ligand complexes of general formula,  $[\text{Cu}(\text{NNS})(\text{sac})]$  ( $\text{NNS}' = \text{S-benzyl-}\beta\text{-N-(2-acetylpyrid-2-yl)methylenedithiocarbamate}$ ,  $\text{NNS}'' = \text{S-benzyl-}\beta\text{-N-(2-benzoylpyrid-2-yl)methylenedithiocarbamate}$  and  $\text{NNS} = \text{S-benzyl-}\beta\text{-N-(6-methylpyrid-2-yl)methylenedithiocarbamate}$ ,  $\text{sac} = \text{the saccharinate anion}$ ) have been synthesized by reacting  $[\text{Cu}(\text{sac})_2(\text{H}_2\text{O})_4] \cdot 2\text{H}_2\text{O}$  with the appropriate ligands in ethanol and characterized by various physico-chemical techniques. Magnetic and spectral evidence indicate that the complexes are four-coordinate in which the Schiff bases coordinate as NNS ligands and the sac- anion coordinates as a unidentate N-donor ligand. An X-ray crystallographic structural analysis of  $[\text{Cu}(\text{NNS}')(\text{sac})]$  shows that the complex has a distorted square-planar geometry with the Schiff base coordinated to the copper (II) ion as a uninegatively charged tridentate chelating agent via the pyridine nitrogen atom, the azomethine nitrogen atom and the thiolate sulphur atom while the fourth coordination position is occupied by the N-bonded saccharinate anion. The complexes have been evaluated for their biological activities against selected pathogens and cancer cell lines. They display weak activity against the pathogenic bacteria and fungi. The complexes were highly active against the leukemic cell line (HL-60) but only  $[\text{Cu}(\text{NNS}')(\text{sac})]$  was found to exhibit strong cytotoxicity against the ovarian cancer cell line (Caov-3). All complexes were inactive against the breast cancer cell line (MCF-7).

**Keyword:** Copper (II) complexes, Dithiocarbamate Schiff base, Saccharin complexes, S-benzylthiocarbamate, Tridentate NNS Schiff bases