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ORIGINAL PAPER

Synthesis and characterisation of Cu(II), Ni(II), and Zn(II) complexes of furfural derived from aroylhydrazones bearing aliphatic groups and their interactions with DNA

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Two new Schiff base-hydrazones bearing furan ring, (*Z*)-4-butoxy-*N*′-(furan-2-ylmethylene)benzohydrazide (*IV*) and (*Z*)-*N*′-(furan-2-ylmethylene)-4-(hexyloxy)benzohydrazide (*V*), as well as their Cu(II), Ni(II), and Zn(II) complexes have been synthesised and characterised. The DNA-binding and DNA-cleavage activities of both aroylhydrazone ligands and their transition metal complexes were examined using UV-VIS titration and agarose gel electrophoresis in the presence of an oxidative agent (H_2O_2). The results indicate that the copper complexes bind significantly to calf thymus DNA and effectively cleave pBR322 DNA whereas the nickel and zinc complexes interact slightly with DNA.

Keywords: Schiff base, aroylhydrazone, copper(II) complex, DNA binding and cleavage

Introduction

In recent decades, the interaction of transition-metal complexes with DNA has been studied intensively (Yang et al., 2008; Gama et al., 2011; Banerjee et al., 2009; Garrido et al., 2005; Lahiri et al., 2010). These complexes are suitable candidates for use as DNA secondary structure probes and anti-tumour drugs. In particular, Schiff base complexes have attracted much attention due to their remarkable biological activities and their significance in the development of new therapeutic agents (Wang et al., 2006; Kiranmai et al., 2010). Artificial metallonucleases can have potential uses in gene regulation, mapping of protein and DNA interactions, probing of DNA specific structures and in cancer therapy. For this reason, the development of artificial nucleases is very important in both medicine and biotechnology. Copper is known to play a significant role in biological systems and also as a pharmacological agent. Copper(II) complexes have found possible medical applications in the treatment of many diseases including cancer (Lewis et al., 2001; Grouch et al., 1986). Accordingly, investigations into copper complexes are becoming more prominent in the research area of bio-inorganic chemistry (Silva et al., 2011).

Aroylhydrazone-type ligands have a large number of potential donor atoms; hence they display versatility in metal coordination. The mode of coordination depends on the nature of the central metal atom, the type of ligand as well as on the presence of other species capable of competing for coordination sites. Aroylhydrazones, as well as their metal complexes, have interesting and important biological properties such as anti-bacterial, anti-fungal, anti-oxidant, and anti-cancer properties (Noulsri et al., 2009; Andreani et al., 2008; Rollas & Kücükgüzel, 2007; Vicini et al., 2006; Rodríguez-Argüelles et al., 2004). Furthermore, metal complexes with hydrazones present DNA-binding and cleavage activities (Banerjee et al., 2009; Gama et al., 2011; Garrido et al., 2005). The synthesis and characterisation of new Cu(II), Ni(II), and Zn(II), complexes of 2-formyl furan-derived aroylhydrazones containing aliphatic groups and their DNA binding and cleavage activities are described in this study.

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