

Synthesis, Characterization and Biological Properties of Half-Sandwich Complexes of Ruthenium(II), Rhodium(II) and Iridium(III)

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Abstract : Platinum-based drugs are now widely used as chemotherapeutic agents. However the platinum complexes show the toxic side-effects: i) the development of platinum resistance; ii) the occurrence of severe side effects, such as nephro-, neuro- and ototoxicity; iii) the high toxicity towards human fibroblast. Therefore the development of new anticancer drugs containing different transition-metal ions, for example, ruthenium, rhodium, iridium is a valid strategy in cancer treatment. In this paper, we reported the synthesis, spectroscopic, structural and biological properties of complexes of ruthenium, rhodium, and iridium containing N,N-chelating ligand (2,2'-bisimidazole). These complexes were characterized by elemental analysis, UV-Vis and IR spectroscopy, X-ray diffraction analysis. These complexes exhibit a typical pseudotetrahedral three-legged piano-stool geometry, in which the aromatic arene ring forms the seat of the piano-stool, while the bidentate 2,2'-bisimidazole (ligand) and the one chlorido ligand form the three legs of the stool. The spectroscopy data (IR, UV-Vis) and elemental analysis correlate very well with molecular structures. Moreover, the cytotoxic activity of the complexes was carried out on human cancer cell lines: LoVo (colorectal adenoma), MV-4-11 (myelomonocytic leukaemia), MCF-7 (breast adenocarcinoma) and normal healthy mouse fibroblast BALB/3T3 cell lines. To predict a binding mode, a potential interaction of metal complexes with calf thymus DNA (CT-DNA) and protein (BSA) has been explored using UV absorption and circular dichroism (CD). It is interesting to note that the investigated complexes show no cytotoxic effect towards the normal BALB/3T3 cell line, compared to cisplatin, which IC₅₀ values was determined as 2.20 μM. Importantly, Ru(II) displayed the highest activity against HL-60 (IC₅₀ 4.35 μM). The biological studies (UV-Vis and circular dichroism) suggest that arene-complexes could interact with calf thymus DNA probably via an outside binding mode and interact with protein (BSA).

Keywords : ruthenium(II) complex, rhodium(III) complex, iridium(III) complex, biological activity

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