Copper(II) complexes with 2-ethylpyridine and related hydroxyl pyridine derivatives: structural, spectroscopic, magnetic and anticancer *in vitro* studies

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Streszczenie

Copper(II) complexes with 2-ethylpyridine (**1** and **2**), 2-(hydroxyethyl)pyridine (**3**) and 2-(hydroxymethyl)pyridine (**4**) have been synthesized and characterized. All inorganic compounds have been studied by X-ray diffraction, thermogravimetry, vibrational and EPR spectroscopy as well as theoretical methods. The geometry of the complexes **1**, **3** and **4** adopts nearly perfect geometry close to square planar (**1**, **4**) or square pyramid (**3**) stereochemistry, respectively. The distortion of five coordinated copper(II) ions in complex **2** indicates intermediate geometry between square pyramidal and trigonal pyramidal geometry. Further, the magnetic measurements have shown antiferromagnetic behaviour of the prepared complexes in a wide range of temperatures. The antiferromagnetic behaviour of **2** should originate from the superexchange interactions between each copper(II) ion by the mixed chloride and μ_4-O ion pathways. Besides, the weak antiferromagnetic character of **2** can be also attributed to the presence of intrachain exchange between dimeric units through double oxide ion. In complex **3**, strong antiferromagnetic coupling between Cu(II) centres in the $Cu_2O_2Cl_2$ moiety is found. The cytotoxicity of all compounds was tested *in vitro* against various cancer cell lines: human lung adenocarcinoma (A549), human breast adenocarcinoma (MCF7), human prostate carcinoma; derived from metastatic site: brain (DU-145) and two normal cell lines: human embryonic kidney (HEK293T) and human keratinocyte (HaCat). Furthermore, Pluronic P-123 micelles loaded with selected complexes (**1** and **3**) were proposed to overcome low solubility and to minimize systemic side effects. More detailed study revealed that complex **3** loaded inside micelles causes DU-145 cells' death with simultaneous decrease of mitochondrial membrane potential and a high level of reactive oxygen species generation. The stability of the compounds **1–4** in DMSO was confirmed by UV-Vis and FT-IR spectra studies.