Crystal structure, ferromagnetic coupling and antibacterial activity of a new family of dicopper(II) complexes supported by auxiliary *para*-substituted benzoate linkers

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Streszczenie

In work to investigate the biologically active transition metal complexes, a new family of ferromagnetically coupled dicopper(II) complexes (**1–3**) were synthesized and structurally characterized. Structural analyses of the complexes revealed that the copper centers in **1–3** are doubly bridged by one alkoxide group of the organic scaffold, H_3cpdp (H_3cpdp = *N,N*'-bis[2-carboxybenzomethyl]-*N,N*'-bis[2-pyridylmethyl]-1,3-diaminopropan-2-ol), and one auxiliary *para*-chlorobenzoate/*para*-nitrobenzoate/*para*-methylbenzoate linker. Variable-temperature magnetic susceptibility data disclosed the occurrence of predominant ferromagnetic coupling within the doubly bridged dicopper(II) cores with *J* values of +31.3(1), +29.1(1) and +35.6(1) cm^{-1} for **1, 2** and **3**, respectively. All three complexes were studied for antibacterial activity against the two strains of *Pseudomonas aeruginosa* (PaO1 and Pa27853). The studies revealed an excellent antibacterial activity with minimum inhibitory concentration (MIC) values falling in the range of 300–700 μg/mL with 95 % confidence interval. Our experimental results revealed that **1–3** are far superior antibacterial agents compared to bare H_3cpdp and $CuCl_2$. Complexes **1–3** showed ability to cause lipid peroxidation that disrupts the bacterial cell membrane and causes the leakage of cytoplasmic contents such as DNA and protein as a consequence of accumulation of intracellular reactive oxygen species (ROS) leading to bacterial cell death. The experiment with human embryonic kidney (HeK293) cell line exposure to **1–3** indicated a lack of measurable cytotoxicity at their MIC values. However, a comparative assessment of their biological efficacies specified that the antibacterial activity of **2** is considerably higher than that of **1** and **3**.