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Interactions of zinc(II) complexes with 5′-GMP and their cytotoxic activity

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ABSTRACT

The mechanism of substitution from tetrahedral [$ZnCl_2$(en)] and square-pyramidal [$ZnCl_2$(terpy)] complexes (where en = 1,2-diaminoethane or ethylenediamine and terpy = 2,2′:6′,2″-terpyridine) by guanosine-5′-monophosphate (5′-GMP) have been investigated by ^{1}H NMR spectroscopy. The substitution reaction of [$ZnCl_2$(terpy)] complex is faster than the reaction of [$ZnCl_2$(en)], which was finished after 48 h. Information about the structures of the final products in solution were obtained from the DFT calculations (B3LYP/6-31G(d)) and experimental ^{1}H NMR data acquired during the course of the reaction. The cytotoxic activity of zinc(II) complexes was tested on human breast cancer cell line MDA-MB-231, human colon cancer cell line HCT-116 and normal human lung fibroblast cell line MRC-5. Both complexes reduced cell viabilities, while [$ZnCl_2$(terpy)] was significantly cytotoxic on MDA-MB-231 after 72 h, and HCT-116 after 24 h without dose dependence. The differences in reactivity toward 5′-GMP and cytotoxic activity of Zn(II) complexes may be attributed to the very stable square-pyramidal geometry of [$ZnCl_2$(terpy)] in solution, while weak ligand effect of the en compared to the terpy affected slow interaction of tetrahedral [$ZnCl_2$(en)] complex with the target biomolecule.

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