Cationic Zinc(II) Porphyrins as photosensitizers in photodynamic therapy: synthesis, characterization and interaction tests with biomolecules

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Cancer is a group of diseases that significantly reduces the life expectancy of thousands of people around the world, characterized by disordered cell growth, which can invade other tissues and spread throughout the body.[1] Porphyrins, which are macrocyclic molecules formed by four pyrrole rings linked by methylidenic carbon atoms (meso positions), have potential as drugs for the treatment of cancer.[2] In this work, the objective was to synthesize and characterize two porphyrins and their complexes with zinc(II), in addition to carrying out interaction tests of these compounds with biomolecules, with the aim of investigating the affinity of these macrocycles with biological targets. Cationic zinc(II) porphyrins with the substituents 3-ethylpyridyl and 3-hexylpyridyl were synthesized. The purpose of synthesizing these molecules with different carbon chains is based on trying to modulate the amphiphilicity of the compounds and analyze its effect on the efficiency of interaction with the targets.

The zinc(II) porphyrins were synthesized and characterized by hydrogen nuclear magnetic resonance (1H NMR), absorption spectroscopy in the ultraviolet and visible region, elemental and thermogravimetric analysis. From the 1H NMR data, it was possible to observe that the pyridyl groups of the macrocycles were completely alkylated, and that the tosylate formed during the synthesis was completely removed. From the UV-VIS measurements it was also verified that these compounds have great solubility in water, showing intense absorption bands in the red and blue regions. Based on elemental and thermal analyses, these compounds exhibited, respectively, between 12 and 20 and between 6 and 18 waters of hydration in their structure, which were considered for the calculation of molar absorptivity values.

It was found that porphyrins with the hexyl group are more lipophilic when compared to the ethylated ones. The solubility of these macrocycles increased in less polar organic solvents, causing the amphiphilicity to increase, which can facilitate the interaction with biomolecules. Therefore, due to this high solubility of cationic zinc(II) porphyrins both in water and in non-polar organic solvents, experiments are also being carried out on the interaction of these compounds with DNA and albumin, in order to better understand the possible targets of these compounds in tumor cells.[3]

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