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Synthesis, Characterization and Photochemistry of 5,10,15,20-tetra-4-(N-pentylpyridyl)porphyrins

There has been a growing interest in the chemistry of porphyrins in view of their versatility as Photosensitizers in photodynamic therapy, detoxification of toxic organic pollutants, photochemical systems for solar-energy conversion etc. Water-soluble porphyrins are much concerned in this respect.

5,10,15,20-tetra-4-(N-pentylpyridyl)porphyrin(TpePyP) and its Zn(II) derivative [(TpePyP)ZnII] have been prepared and characterized by 1H NMR, UV-Visible and fluorescence spectroscopic methods. The synthesis of TpePyP involves refluxing a mixture of 5,10,15,20-(4-pyridyl)porphyrin(H2TpyP) and a 40-fold excess of bromopentane for four hours in DMF. The solvent was evaporated under reduced pressure and the residue was washed with ether followed by dichloromethane. 1H NMR (200MHz, in D2O)δ 9.02(8H,s,βH), 9.23(8H,d,o-pyridylH),8.85(8H,d,mpyridylH),4.74(8H,t,C1pentyl),2.23(8H,m,C2pentyl),1.44(16H,m,C3C4pentyl), 0.89(12-H,t,C5-pentyl);UV-Vis(CH3OH) λmax(logε) 425(5.30), 516(4.11), 552(3.10), 591(3.66), 648(3.04)nm. Metallation of the H2TpyP in CH3OH-CHCl3 was accomplished by refluxing with Zinc acetate at 600C for two hours and the reaction was monitored by absorption spectroscopy. After evaporation of the solvent, the residue was washed with distilled water and air dried. The alkylation of this compound yielded zinc derivative of TpePyP. UV-Vis(CH3OH) λmax(logε) 439(4.90), 522(3.30), 564(3.86)606(3.42).

Fluorescence intensities and Soret band peak positions were found to be dependent on the pH and the type of surfactants present in the medium. Photobleaching studies carried out in solutions of different pH show that, in the presence of O2, TpePyP undergoes photodegradation much faster in aqueous medium at high pH, when the solution is irradiated at 560 nm. Singlet Oxygen quantum yield was also measured for TpePyP in DMF and found to be as high as with other photosensitizers such as hematoporphyrinIXdimethylester (HPDME), hematoporphyrinIX dihydrochloride (HPDHC) and protoporphyrinIXdimethylester (PPDME).