

Excited state properties of meso-tetrakis (4-sulfonatophenyl) porphyrin (TPPS4) J aggregate

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Porphyrins are macrocyclic molecules widely known for its interesting optical properties, e.g. linear and nonlinear absorption. Porphyrin aggregates have a huge potential to be employed in a large amount of applications, from photonics to solar cells, mainly due to the possibility of perform molecular engineering aiming at to build supramolecular structures. However, studies regarding the influence of aggregates and its monomers, and how they interact with free molecules, altering their excited state properties are not deeply understood. In this work, we present results concerning about the nonlinear absorption spectrum as well as excited state kinetics of *meso*-tetrakis (4-sulfonatophenyl) porphyrin (TPPS₄) J aggregates in aqueous solution from femto- to nano- and microsecond time scale. We have employed the Z-scan technique with a white light continuum source and also a discrete tunable wavelength source and Laser Flash Photolysis techniques. Our results show that the excited state absorption cross-section exceeds the ground state one in the spectral range from 505 nm up to 625 nm, yielding to a reverse saturable absorption. We also observed that by controlling external solutions parameters such as monomer or salt inducer aggregate concentration, the nonlinear optical behavior can be switched, which is desirable for designing all-optical devices. Finally, the transient absorption data of J-aggregate, when compared with the biprotonated monomer, provided us with good insights about the excited state absorption from 430 nm 620 nm. Our results clearly show that a collective behavior of excitons in J-aggregates from femto- to nanoseconds time scale takes place while an individual kinetics assigned to monomers, in aggregates, is predominant in the order of microseconds. The present work is supported by Brazilian Agencies: CAPES, CNPq and FAPESP.