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Synthesis, Characterization, Optical and Photophysical Properties of Pyrene-Labeled Ruthenium(Ii) Trisbipyridine Complex Cored Dendrimers

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Abstract : Dendritic macromolecules are presenting unique physical and chemical properties. One of them is the faculty of transferring energy from a donor moiety introduced at the periphery to an acceptor moiety at the core, mimicking the antenna effect of the process of photosynthesis. The mechanism of energy transfer is based on the Förster resonance energy exchange and requires some overlap between the emission spectrum of the donor and the absorption spectrum of the acceptor. Since it requires a coupling of transition dipole but no overlap of the physical wavefunctions, the energy transfer by Förster mechanism can occur over quite long distances from 1 to a maximum of 10 nm. However, the efficiency of the transfer depends strongly on distance. The Förster radius is the distance at which 50% of the donor's emission is deactivated by FRET. In this work, we synthesized and characterized a novel series of dendrimers bearing pyrene moieties at the periphery and a Ru (II) complex at the core. The optical and photophysical properties of these compounds were studied by absorption and fluorescence spectroscopy. Pyrene is a well-studied chromophore that has the particularity to present monomer as well as excimer fluorescence emission. The coordination compounds of Ru (II) are red emitters with low quantum yield and long excited lifetime. We observed an efficient singulet to singulet energy transfer in such constructs. Moreover, it is known that the energy of the MLCT emitting state of Ru (II) can be tuned to become almost isoenegetic with respect to the triplet state of pyrene, leading to an extended phosphorescence lifetime. Using dendrimers bearing pyrene moieties as ligands for Ru (II), we could combine the antenna effect of dendrimers as well as its protection effect to the quenching by dioxygen with lifetime increase due to triplet-triplet equilibrium.

Keywords : dendritic molecules, energy transfer, pyrene, ru-trisbipyridine complex
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