Organic and Hybrid Photosensitizers for Photodynamic Therapy and Imaging

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Extensive efforts have been devoted to the development of near-infrared (NIR) dyes for biological applications, especially for photodynamic therapy (PDT) and imaging. [1,2] Polymethine dyes (i.e. squaraines and cyanines) deserve to be counted among innovative potential photosensitizers (PSs) because they offer numerous advantages such as their easiness in designing NIR molecules simply by elongating the central bridge and/or tuning the lateral functional groups [3], providing NIR compounds with absorption that perfectly match the phototherapeutic window (650-850 nm). Moreover, they possess high absorption coefficients, bright fluorescence and photostability in organic media. However, in physiological conditions, their chemical instability and self-aggregation properties limit their widely applications. In this context, the incorporation of these dyes in nanoparticles (NPs) is extremely important in order to prevent the formation of dye aggregates in aqueous environment and protect the photophysical characteristics from nucleophilic attacks.

The present contribution deals with the design and synthesis of a new series of NIR absorbing polymethine dyes with different substitution groups to implement a structure-activity study and to determine the substitutions influence on the reactive oxygen species (ROS) production, cellular uptake and photodynamic activity. [4, 5] These dyes were then encapsulated in solid lipid nanoparticles (SLN) to promote their use in physiological conditions. SLN-dye complexes exhibit excellent optical properties, remarkable photostability, biocompatibility and efficient cellular internalization.

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