Self-assembled nanoparticles for photoinduced and photothermal therapies

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Abstract

Nanoparticles obtained by self-assembly of organic chromophores have significant potential for designing functional materials for nanomedicine, optoelectronics and solar light harvesting.
In the biomedical field, self-assembled nanoparticles have recently emerged as highly versatile systems, functioning as photosensitizers in photodynamic or photothermal therapies for cancer treatment, because of their ability to generate reactive oxygen species or localized temperature increases, determining cellular death.
In this contribution I will illustrate examples of systems that we have recently extensively analyzed, by means of both steady state and ultrafast time resolved spectroscopic techniques, to understand the molecular mechanisms of their photoinduced behavior. More specifically, I will present new photosensitizers based on the functionalization of bodipy dyes with triarylphosphonium rotaxanes, which self-assemble in water, forming spherical nanoparticles employed as antimicrobial photothermal agents.[1] Furthermore, I will consider nanovesicles obtained by supramolecular self-assembly of aggregation-induced emission luminogens (AIEgens) linked to metal centers, used in live cells as drug carriers or as anticancer drugs in photodynamic therapy.[2]

References

[1] Sambucari, G. et al, Advanced Optical Materials, 13 (2025), [2403076].
[2] Hernando-Muñoz C., et al, ACS Applied Materials & Interfaces, 17 (2025), [10097–10107].

Figures

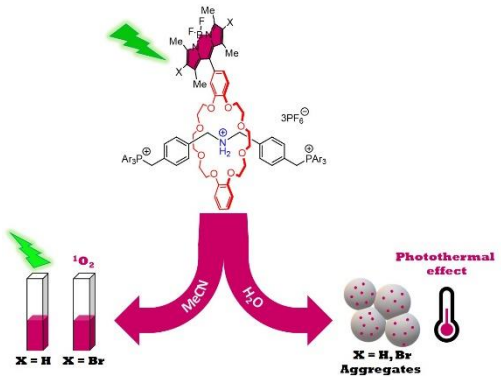

Figure 1: Bodipy nanoparticles for photothermal therapy (Calibri 11)