Synthesis of Light-Responsive Poly(vinyl alcohol)-C_{60} Nanohybrids for Cancer Photodynamic Therapy

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Among other relevant electronic properties, C_{60} is able to convert molecular oxygen into reactive oxygen species (ROS) upon exposure to light of appropriate wavelength. C_{60} has therefore been suggested as potential medicine for photodynamic therapy (PDT), a cancer treatment involving light-mediated generation of ROS by a photosensitizer that induces tumor cells death. [1]

In order to make C_{60} water-soluble and biocompatible, poly(vinyl acetate) (PVAc) was prepared by cobalt-mediated radical polymerization (CMRP) [2] and next grafted onto C_{60} by radical addition. [3] The structure of the resulting nanohybrids was tentatively tuned by changing the [PVAc]/[C_{60}] ratio for the grafting reaction. Cobalt traces were removed by further reaction with TEMPO, a stable radical, or with 1-propanethiol. Methanolysis of the ester groups of PVAc-C_{60} led to the water-soluble poly(vinyl alcohol)-C_{60} (PVOH-C_{60}) nanohybrid, that turned out to be an interesting candidate for PDT. Indeed, this nanohybrid produced significant amounts of ROS upon red light irradiation, as assessed by the ADPA bleaching test. Moreover, it displayed toxicity towards human monocytic cells when exposed to red light.

Finally, the key characteristic of these light-responsive nanohybrids is the presence of many hydroxyl functions enabling their post-functionalization by targeting agents and/or anti-tumoral compounds that could increase the selectivity and the efficiency of the therapy.

Literature:

[1] Mroz, *Photochem. Photobiol. Sci*., **2007**, *6*, 1139. [2] Debuigne, *Angew. Chem., Int. Ed.,* **2005**, *44*, 1101. [3] Detrembleur, *Macromol. Rapid Commun*., **2006**, *27*, 498.