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 triplet oxygen ($^3O_2$) into reactive oxygen species (ROS) upon irradiation. C_{60} has therefore been suggested as potential medicine for photodynamic therapy (PDT), a cancer treatment involving photoinduced generation of ROS followed by 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] 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 water-soluble poly(vinyl alcohol)-C_{60} (PVOH-C_{60}) nanohybrids, that turned out to be interesting candidates for PDT. Indeed, these nanohybrids produced significant amounts of ROS upon red light irradiation, as assessed by the ADPA bleaching test. Moreover, they displayed marked toxicity towards human monocytic cells when subjected to light. PVOH-C_{60} nanohybrids were also submitted to a protein absorption test (CH50) that revealed a significant activation of the complement system by the nanohybrids. Protein-repellent polymers (e.g. PEG) will be incorporated in the PVOH crown of the nanohybrid to improve its stealthy properties.

Finally, the key characteristic of these 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] P. Mroz, *Photochem. Photobiol. Sci*., **2007**, *6*, 1139. [2] A. Debuigne, *Angew. Chem., Int. Ed.,* **2005**, *44*, 1101. [3] C. Detrembleur, *Macromol. Rapid Commun*., **2006**, *27*, 498.