Nanomaterials for Imaging and Therapy

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Nanoparticles, porous materials and capsules are interesting nano/micro system able to entrap desired molecules and act as delivery or imaging species. They can be created using soft species such as gels or polymers or inorganic precursor to obtain microporous and mesoporous silica based nanoparticles. In this talk I will focus on the use of ultrasmall (<5 nm) silicon nanoparticles, SiNPs, for *in vitro* and *in vivo* imaging and on breakable silica materials for an easy and rapid clearance after therapy. Indeed, the concern about the elimination of any type of artificial material from the body of animals can be solved using both approach: small size particles or fragments after destruction allows the elimination via renal patway. Indeed, the issue related to the use of materials for therapy in living organism, is their accumulation in vital organs that often prevent their use in clinical applications. The SiNPS can be decorated with different imaging labels allowing a multiple detection and even a recognition when sugars are covalently anchored on their surfaces.[1,2]

However the small particles cannot be efficiently employed for therapy and therefore we have recently developed a new generation of breakable hybrid nanoparticles, able to response and degrade upon external stimuli (*e.g.* reductive agents, pH, *etc.*).[3,4] The insertion of responsive linkers in the framework of these particles, results not only in the destruction and safe excretion of the nanoparticles from the cells, but also in a faster and better delivery of the payloads. Moreover, to expand the breakability properties of this material for other purpose, the possibility to entrap proteins into a breakable silica shell has also been realized in our laboratory.[5]

Experiments *in vivo* on the use of these materials for the treatment of hepatocarcinoma will be discussed.

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