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SURFACE FUNCTIONALIZATION OF INORGANIC OXIDE NANOPARTICLES

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In recent years, nanosized inorganic particles have been introduced in different medical areas as new tools in diagnostics and as potential therapeutic agents. The unique physical properties of titania and silica have been exploited in our lab to develop inorganic oxide nanoparticles for *in vivo* administration [1,2]. The fate of nanoparticles *in vivo*, however, mainly depends on their surface properties, which should provide free circulation in body fluid by avoiding recognition and clearance by phagocytic cells. This "stealth" character can be achieved by covering the nanoparticle with a layer of a water soluble, protein-repellent polymers, such as poly(ethylene glycol) (PEG). Two different methods of surface functionalization of inorganic oxide nanoparticles will be presented.

"PEGylation" of TiO_2 nanoparticles was obtained with a graft-onto approach, by using PEG-based polymers conjugated with terminal dopamine groups. The presence of these chelating enediol ligands allows the polymers to bind on the titania surface[2], providing an irreversible surface functionalization.

Alternatively, a surface initiated polymerization technique was developed for the functionalization of SiO_2 nanoparticles. A synthetic polycation, which contains initiators of Atom Transfer Radical Polymerization (ATRP), was adsorbed onto the anionic surface of colloidal silica. The initiators offered the possibility to decorate the nanoparticles with polymer layers composed of PEG or poly(HEMA), which could provide, respectively, stealth character and chemical functionality.

1) Cellesi, F.; Tirelli, N. Colloids and Surfaces A, 2006, 288, 52-61.
2) Kotsokechagia, T. et al., submitted to Adv. Funct. Mater.