Biopolymer-silica hybrid nanoparticles prepared by a non-emulsion method and application in water treatment

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The development of silica hybrid materials containing polysaccharides has experienced remarkable growth owing to the attractive properties of polysaccharides [1]. Nevertheless, due to the poor compatibility between natural biopolymers and common silica precursors the formation of biopolymer–silica hybrid materials is not a trivial task and the polymer hybrids obtained can be heterogeneous and turbid. Moreover, fine control of size and shape of hybrids in the particulate form is still a challenge and requires often the use of surfactants that need to be eliminated from the final particles. Herein, we report a sol-gel non-emulsion method for preparing spherical and uniform polysaccharide–silica hybrid submicrometer sized particles [2]. FTIR and solid state NMR analysis confirmed that polysaccharide is covalently linked to the siliceous network. The method was successfully employed for preparing hybrid particles either from anionic or cationic polysaccharides. The synthetic approach was extended to encapsulate magnetic iron oxide nanoparticles within hybrid shells, in order to obtain bio-hybrid siliceous materials with magnetic features that enable fast magnetic separation from solution. Magnetic bio-hybrid nanoparticles prepared display high affinity towards pollutant molecules owing to functional groups of polysaccharides grafted onto the surface of the particles. The application of these materials as nano-adsorbents for the efficient removal of emerging chemical pollutants (e.g. pharmaceuticals) from water under an external magnetic gradient will be discussed.

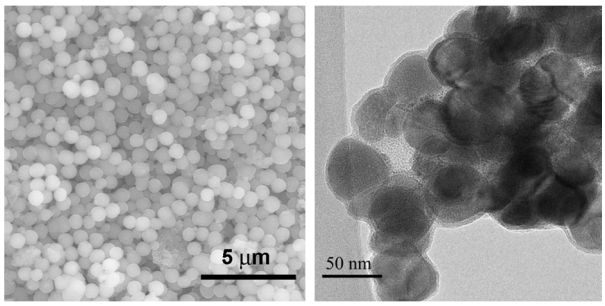

Figure 1 TEM images of carrageenan/silica hybrid particles (left) and Fe_3O_4 nanoparticles coated with carrageenan/silica hybrid thin shells (right).

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