Thermosensitive nanodevices for drug delivery.

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Conventional cancer treatments such as, chemotherapy and radiotherapy, does not distinguish death cells from the healthy cells, which can promote several side effects. In this context, the controlled drug delivery system appears as an alternative to optimize the treatment. In the present work, a nanodevice was synthesized, consisting of a magnetic core – magnetic nanoparticles – functionalized with a biodegradable and thermosensitive copolymer, P(NIPAAm-co-DMAAm). The magnetic core has the aim to direct the drug to the cancer area and promote heating by hyperthermy; the polymer is responsible for drug immobilization and acts as the drug delivery system due to the thermosensitive behavior. The magnetic nanoparticles were obtained by the co-precipitation method and the surface was functionalized with the alkoxysilane 3-(mercaptopropyl)try methoxy silane (MPTS). The thiol groups present in the MPTS allowed the surface polymerization of the magnetic nanoparticles with n-isopropylacrylamide (NIPAAm) and others polymers. The poly(N-isopropylacrylamide) (PNIPAAm) is the most studied thermoresponsive polymer because exhibit a lower critical solution temperature (LCST) around 32°C. Near of LCST polymers possess abruptly changes in the interactions between the polymeric chains and the aqueous media, causing a polymer chain collapse. The LCST could be tuned by PNIPAAm copolymerization with hydrophilic polymers such as dimethylacrylamide (DMAAm), leading to a LCST above body temperature [1].
The Fourier Transform Infrared spectroscopy monitored the surface modification of nanoparticles. FEG-SEM images showed nanoparticles with average size of 10 nm, good stability and size distribution adequate for biomedical applications. The hydrodynamic diameter of the nanosystem as a function of the temperature was measured by dynamic light scattering and the hydrodynamic diameter for the P(NIPAAm-co-DMAAm) surface modified nanoparticles, changes approximately 38°C. Under an alternate magnetic field, the nanosystem showed a high performance for hyperthermia treatment.

[1] M. A. Ward, T. K. Georgiou, Polymers (Basel). **Vol.3, no. 3,** (2011) 1215-1242.