

POLYELECTROLYTE NANOCAPSULES CONTAINING IRON OXIDES AS IMAGINABLE MAGNETICALLY RESPONSIVE DRUG DELIVERY SYSTEM

SZCZEPANOWICZ Krzysztof, PIECHOTA Patrycja, WĘGLARZ Władysław P.,
WARSZYŃSKI Piotr

Jerzy Haber Institute of Catalysis and Surface Chemistry PAS, Cracow, Poland, EU
Henryk Niewodniczanski Institute of Nuclear Physics PAS, Cracow, Poland, EU

Abstract

In the past decades micro- and nanocapsules gained increasing interest in biomedical applications as they can be used as carriers of the lipophilic, poorly water-soluble, or even water-insoluble drugs and protect them from the aggressive biological environment. Such carriers can be specifically developed for achieving intelligent drug delivery system (with targeting and imaging properties). The layer-by-layer adsorption of polyelectrolytes is considered as a convenient method to obtain multilayer nanocapsules' shells on colloidal cores. A polyelectrolyte shell of capsules can be functionalized e.g. by immobilization of targeting ligands or nanoparticles to form theranostic carriers. The aim of this work was to develop the method of preparation of hybrid theranostic nanocapsules containing iron oxide nanoparticles (Fe_3O_4 or Fe_2O_3) embedded in polyelectrolyte shell. The nanocapsules were prepared by sequential adsorption of polyelectrolytes (layer by layer technique) using biocompatible polyelectrolytes (Poly L-lysine as the polycation, Poly-Glutamic acid as the polyanion). Formation of the hybrid multilayer polyelectrolyte shell was evidenced by zeta potential changes with number of layer and UV-Vis spectra of embedded nanoparticles. The PEG corona grafted on the top polyelectrolyte layer assured stability of nanocapsules against aggregation in the media with high ionic strength (FBS solution). To demonstrate the possibility of encapsulation of hydrophobic compounds the β -carotene was enclosed in hybrid carriers of the size of 45 nm. Using T2 and T1 NMR relaxation measurements as well as relaxation time weighted images at 9.4T preclinical MRI scanner we demonstrated that incorporation of magnetic nanoparticles in polyelectrolyte multilayer shell allowed obtaining nanocapsules sensitive to magnetic field, which thus can be detected due to locally altered contrast in the MR image. They may be a promising platform for future targeted therapies (e.g. cancer) or other biomedical applications (e.g. separation systems, diagnostics).

Keywords: Nanocapsules, drug delivery, magnetic, MRI

ACKNOWLEDGEMENTS

This work was supported by IUVENTUS IP2012 058972 and Marian Smoluchowski Krakow Research Consortium - a Leading National Research Centre KNOW supported by the Ministry of Science and Higher Education

Author did not supply full text of the paper/poster.