Contribution ID: **254** Type: **Poster**

Morphological, Physico-Chemical and Mechanical Properties of Radiolytically Synthesized Nano-Ag/poly(N-isopropylacrylamide) Hydrogels

Thursday, 27 April 2017 14:15 (2 hours)

Hydrogels have unique properties and many potential applications, especially in the field of medicine and biotechnology. The gel porosity and swelling properties, stability and strength, biodegradability and biocompatibility are characteristics which are widely variable and easily adjusted. Stimuli responsive or intelligent hydrogels are special class of these materials which shows significant response to small changes in surrounding environment such as temperature, pH, ionic strength, electric field and light. From a biomedical point of view, thermo- and pH-sensitive polymers are the most frequently studied. Poly(N-isopropylacrylamide) (PNiPAAm) is one of the most investigated thermosensitive polymer with a sharp lower critical solution temperature (LCST) at around 32 ℃ which can be adjusted by copolymerization and/or addition of salts or surfactants to the initial polymer solution. On the other hand, silver nanoparticles (AgNPs) have been the subject of intense interest due to their size-dependent optical, catalytic and electronic properties as well as remarkable antimicrobial potential. AgNPs possess capability to release Ag+ ions in a controlled manner which leads a powerful antibacterial activity for large number of bacteria. This controlled release can be provided by incorporation of nanoparticles in crosslinked polymer network. Among many methods for synthesis of nanocomposites, gamma irradiation induced synthesis has been recognized as highly suitable tool.
In this work, synthesis of nanocomposites was conducted as two-step process. In the first step, polymerization and crosslinking of polymer chains occurs and PNiPAAm hydrogels with a large number of pores were obtained. In the second step, these pores serve as nanoreactors for reduction of Ag+ ions and formation of AgNPs.
Absorption spectra of nano-Ag/PNiPAAm hydrogel nanocomposites, with characteristic peaks in the range of 390-415 nm, confirm the successful formation of AgNPs inside PNiPAAm hydrogel matrix. Morphological analyses (SEM and micro-CT) reveal the existence of pores with different size, dependent on PNiPAAm concentration, but independent on incorporation of AgNPs. Structural analysis indicates the presence of spherical AgNPs, with the mean diameter up to 20 nm and face centered cubic crystal structure. Swelling processes of investigated systems show thermoresponse with the volume phase transition temperature (VPTT) between 30.5 and 31.6 ℃. The possibility to apply nanocomposites for controlled release of active silver was investigated by monitoring the release kinetics of Ag+ ions in a buffer solution (pH 7.4) at 25 ℃. The obtained results are modeled by applying five different pharmacokinetic models (Korsmeyer-Peppas, Higuchi, Hixson-Crowel, Kopcha i Makoid-Banakar model). The best fit solution gave Kopcha and Makoid-Banakar models, indicating that the release of Ag+ ions was predominantly controlled by a diffusion process. The results obtained from compression measurements shows that mechanical properties of investigated hydrogels strongly depend on concentration of polymer matrix as well as on concentration of incorporated AgNPs.

Country/Organization invited to participate

Serbia

Primary author: Ms RADOSAVLJEVIĆ, Aleksandra (Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia)

Co-authors: Mr RANKOVIĆ, Dragan (Faculty of Physical Chemistry, University of Belgrade, Serbia); Ms KRSTIĆ, Jelena (Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia); Ms SPASOJEVIĆ, Jelena (Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia); Ms ĐURIĆ, Marija (Laboratory for Anthropology, Institute of Anatomy, Faculty of Medicine, University of Belgrade, Serbia); Mr MILOVANOVIĆ, Petar (Laboratory for Anthropology, Institute of Anatomy, Faculty of Medicine, University of Belgrade, Serbia); Ms KAČAREVIĆ-POPOVIĆ, Zorica (Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia)

Presenter: Ms RADOSAVLJEVIĆ, Aleksandra (Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia)

Session Classification: P-A2

Track Classification: RADIATION SYNTHESIS AND MODIFICATION OF MATERIALS