HYBRID MAGNETIC HYDROGELS FROM NATURAL AND SYNTHETIC POLYANIONS

Kriukova D.[1], Spiridonov V.[2], Alekhina Yu.[3], Perov N.[3], Teplonogova M.[1,4], Knotko A.[1], Yaroslavov A.[2]

[1] Lomonosov Moscow State University, Faculty of Materials Science, Leninskie Gory 1-73, 119991, Moscow, Russia;
[2] Lomonosov Moscow State University, Department of Chemistry, Leninskie Gory 1-3, 119991, Moscow, Russia;
[3] Lomonosov Moscow State University, Department of Physics, Leninskie Gory 1-2, 119991, Moscow, Russia;
[4] Kurnakov Institute of General and Inorganic Chemistry of the Russian Academy of Sciences, Leninskiy Prospect 31, 119071, Moscow, Russia

Hydrophilic magnetically sensitive hydrogels are promising systems for biomedical applications as containers for targeted delivery of biologically active substances. Magnetically controlled hydrophilic nanocomposites have proven to be an effective anti-tumor tool. With an external magnetic field, the composites loaded with drugs can be delivered to a specific area of the body, thus providing a targeted therapeutic effect. However, the introduction of magnetic nanoparticles into hydrogel particles is accompanied by a decrease in the solubility and loading capacity of nanocontainers, which necessitates additional functionalization of hydrogels. To solve this problem, the modification of magnetic hydrogel based on sodium hyaluronate with linear sodium polyacrylates (PA) was carried out.

A sample of a magnetic hydrogel (MHG) based on sodium hyaluronate as a matrix stabilizing maghemite magnetic nanoparticles was synthesized. The content of iron in the MHG, determined via dissolution of the hydrogel in water followed by spectrophotometric titration with sulfosalicylic acid, was of 12.5 wt%. Aqueous solutions of linear PA with molecular weights ranging from 2.1 to 15 kDa were added to the resulting hydrogel.

The obtained systems were studied with dynamic light scattering, laser microelectrophoresis, IR spectroscopy, turbidimetric titration, XRD, scanning and transmission electron microscopy and magnetometry. It was established that all added PA's have been incorporated into samples of initial MHG resulting hybrid MHG's. The carboxylate groups quantity on the surface of particles of each sample was determined. It was shown that the incorporation of PA into the MHG leads to a significant additional functionalization of MHG particles. It was established that the effective size of magnetic nanoparticles in the modified systems also increases in comparison with the initial hydrogel, indicating the clustering of maghemite nanoparticles due to their interaction with PA. It was found that the magnetic characteristics change significantly when the MHG is modified with PA. The features of hybrid MHG enzymatic decomposition under the action of hyaluronidase were demonstrated. It was found that the addition of PA to the MHG leads to increase in the rate of enzymatic decomposition of the resulting hybrid MHG particles. The effect of molecular weight of added PA on the time of enzymatic decomposition of MGHs was shown. It was established that the increase of PA molecular weight leads to decrease in time of enzymatic decomposition of the modified MHG's.

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