Nanocontainers based on biocompatible anionic polysaccharide for anticancer drug loading

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Abstract.
Nanocontainers based on hyaluronic acid have some important properties for pharmacology. These are hydrophilicity, a high degree of swelling not only in an aqueous solution, but also under physiological conditions, non-toxicity, biocompatibility, and biodegradability. In addition, the high functionality of hyaluronic acid-based microgels is due to the presence of a large number of hydroxyl and carboxyl groups. Synthesis of polymer nano/microgels as nanocontainers for doxorubicin load was carried out at different molar ratios of monomer units of the anionic polysaccharide (sodium hyaluronate) and Ca^{2+}-ions as a cross-linking agent. Highly water-soluble white fibrous products were prepared. The hydrodynamic characteristics of microgels in dilute aqueous solutions were studied by dynamic light scattering. The values of the effective hydrodynamic diameters of the particles under study were determined. It was shown that the hydrodynamic diameters of microgels change from 180 to 135 nm according to increasing of Ca^{2+}-ions. At the same time diameter of the original sodium hyaluronate macromolecules is about 310 nm. This result is related to the compression of initial polysaccharide macromolecules due to the formation of bridging electrostatic contacts between adjacent segments of macromolecules through Ca^{2+}-ions, accompanied by the formation of a microgel structure. Quantitative binding of doxorubicin by microgels has been demonstrated by UV/vis-spectroscopy and fluorimetry. The static mechanism of quenching the fluorescence of doxorubicin by Ca^{2+}/Hyaluronate microgels has also been established. A significant difference was shown in the quenching of doxorubicin fluorescence by linear polysaccharide and microgels containing different contents of Ca^{2+}-ions as a cross-linking agent.