V.E. Silant'ev^{*1,2}, L.A. Zemskova², L.A. Fatkullina³, R.A. Shatilov³, V.S. Egorkin², S.V. Gnedenkov², V.V. Kumeiko^{**3,4}



1 Department of Biomedical Chemistry, Far Eastern Federal University, Bldg. M25, FEFU Campus, 10 Ajax Bay, Russky Island, Vladivostok 690922, Russia 2 Institute of Chemistry, Far Eastern Branch of the Russian Academy of Sciences, 159 100-letiya Vladivostoka Pr., Vladivostok 690022, Russia 3 Department of Medical Biology and Biotechnology, Far Eastern Federal University, Bldg. M25, FEFU Campus, 10 Ajax Bay, Russky Island, Vladivostok 4 A.V. Zhirmunsky National Scientific Center of Marine Biology, Far Eastern Branch of the Russian Academy of Sciences, 690041 Vladivostok, Russia E-mail: *vladimir.silantyev@gmail.com, **vkumeiko@yandex.ru



Introduction:

This work describes preparation of hydrophilic drug delivery systems for cancer treatment therapy consisting of biopolymer micro- and nanoparticles. Particles based on chitosan without addition surfactants were obtained by ionic gelation.

Objective:

Formation of nanosized particles based on cationic polyelectrolyte chitosan and its modification for further use in biomedical purposes.

Characterization:

1) Scanning electron microscope, SEM. 2) Transmission electron microscope, TEM. 3) FT-IR spectrometer. 4) Atomic Force Microscope, AFM. 5) UV-spectroscopy.

Particles preparation



Biopolymers are of particular interest among materials for the manufacture of drug delivery devices. Most of them are characterized by biocompatibility and biodegradability. They can be used in various forms - hydrogels, films and coatings, capsule fibrils, micro- and nanoparticles.



Treatment of hard-to-reach human organs and tissues, such as the brain, is possible only with the use of nanosized particles.

The formation of spherical micro- and nanoparticles by ionic gelation without surfactants was established by the SEM and AFM methods.

Mechanical studies have shown that sufficiently soft particles are formed, which is quite suitable for use in drug delivery applications.

Results and discussion

Dependence of chitosan to Na_2SO_4 ratio by volume (TEM images)

Uncharged form of the amino group corresponds to the line at 1596 cm⁻¹. Transition to the charged state is accompanied by a shift of this band by more than 50 cm⁻¹ to the low-frequency region.

Chitosan 1,5 wt.%, Na_2SO_4 20 wt.% Dispersion of particles (100-350 nm)

Large aggregates are formed even with a slight deviation from the optimal ratio





This reflection does not significantly change its position and does not decrease in intensity in cases of nanoparticles. It can indicates that not all amino groups are involved in the formation of the gel structure and stable particles have a positive surface charge.



Well-known cyanogen bromide (CNBr) activation technique [1,2] was modified in a special way for the covalent conjugation of biologically active materials to cation charged polysaccharide particles. White arrows mark standard bovine serum albumin (BSA) associated with chitosan particles on AFM images.



According to the results of UV-spectroscopy (absorbtion at 280 nm) the efficiency of BSA binding to cationic polysaccharide particles was more than 80%.

Abs. (A)



Conclusions:

- Method of ion gelation without the use of surfactants was used to obtain stable particles based on chitosan.
- Their physicochemical properties were studied by SEM, TEM, AFM, FTIR and UV spectroscopy.
- CNBr activation method were modified for cation charged particles. Chitosan particles can be modified with ligands specific to receptors on the surface of particular cancer cell phenotypes for targeted drug delivery.

References:

[1] Journal of Immunological Methods, 122 (1989) 253-258. [2] Biosensors and Bioelectronics 20 (2005) 1380–1387.

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