# STUDY OF STABILIZATION OF SELENIUM NANOPARTICLES BY POLYSACCHARIDES

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## Abstract

Selenium, being an essential trace element, plays an important role in the human and animal organisms. Selenium compounds are widely used in various fields of science and technology: from feed additives in agriculture and drugs with increased therapeutic activity against malignant neoplasms in medicine to optically active quantum dots in electronics. This paper presents the results of a study of the process of stabilization of selenium nanoparticles with different polysaccharides: hydroxyethyl cellulose, chitosan, maltodextrin, methylcellulose, amylopectin and hyaluronic acid.

Quantum-chemical modeling of the interaction of selenium nanoparticles with various polysaccharide stabilizers was performed in the QChem program using the IQmol molecular editor. Models with electron density distribution are obtained, and molecular orbitals and total energy values of the system are calculated for monomeric polysaccharide units, as well as for "Stabilizer-Se" molecular complexes. At the next stage, laboratory and experimental samples of selenium nanoparticles stabilized with various polysaccharides were obtained. As a precursor nanoselenium used the selenious acid and as a reducing agent - sodium borohydride. The obtained samples were studied by photon-correlation spectroscopy, acoustic and electroacoustic spectroscopy.

It was found that the most stable and energetically advantageous molecular system is the hyaluronic acid-Se system, which has E = - 13752.47 kcal/mol and ΔE = 0.299 a. u. By the results from photon-correlation spectroscopy, acoustic and electroacoustic spectroscopy, it was found that the samples stabilized with amylopectin, hyaluronic acid, and maltodextrin have a monomodal distribution with an average hydrodynamic radius of 191.7, 529.1, and 109.1 nm, respectively. The remaining samples have a bimodal size distribution. It is shown that the smallest hydrodynamic radius has a sample of selenium nanoparticles stabilized with hydroxyethyl cellulose, which contains 2 fractions: 1 - 11.40 nm (10.6%), 2 - 94.05 nm (89.4%). According to acoustic and electroacoustic spectroscopy data, the highest Zeta potential is found in a sample stabilized with maltedextrin (+36.25 mV), and the lowest-with hyaluronic acid (-143.09 mV). The obtained data on the Zeta potential correlate with the charges of functional groups in polysaccharide molecules.

As a result of the conducted research, it is shown that Se nanoparticles stabilized with polysaccharides can be used as a biological active supplement in the food industry.

***Key words:*** *Nanoselenium, Polysaccharides, Computer quantum-chemical modeling, Zeta - potential, Average hydrodynamic radius.*