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Design of nanoparticles (chitosan-hyaluronic acid) for the target delivery of dinitrosy iron-complexes, potential cardiological drugs

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Abstract

Cardiovascular diseases are the leading cause of death worldwide: for no other reason, so many people die each year from cardiovascular diseases. Currently, the available antihypertensive drugs are characterized by a short-term effect and exhibit many side effects such as hypokalemia, hyponatremia, hyperuricemia, impaired glucose tolerance, impaired lipid profile, cardiovascular complications. Therefore, it is necessary to develop cardioselective drugs with prolonged action, with controlled release of the active substance. In this regard, the creation of nanoparticles for targeted delivery of cardiodrugs of prolonged action is very relevant. In this work, nanoparticles from chitosan and hyaluronic acid were prepared by ion gelation. Electron microscopy showed that nanoparticles are homogeneous in shape and have a size of ~100 nm. A mononuclear dinitrosyl iron complex (NO donor), which is a potential cardiac drug, was built into the nanoparticles by the method of physical association. It was found that the encapsulation of the dinitrosyl iron complex in nanoparticles increases the stability of this compound. The amperometric method showed that when the dinitrosyl iron complex is incubated for 10 minutes in an aqueous solution, a sharp decrease in the release of nitrogen monoxide is observed in 4 fold (from 16 nmol to 4 nmol) and after 100 seconds the level of generated NO dropped practically to zero. At the same time, it has been established that the dinitrosyl iron complex in the nanoparticles generates nitric oxide for a long time (>500 sec) and in high yield (13 nmol). The results of the study showed that the encapsulation of the dinitrosyl iron complex in the nanoparticle composition significantly increases the stability of the complex, and also prolongs the generation and yield of nitrogen monoxide. Nanoparticles (chitosan-hyaluronic acid) are water soluble, biocompatible, bio-permeable, capable of carrying out cellular and molecular targeting.

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