

Current approaches to elaboration of therapeutic agents incorporating silver nanoparticles

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Prospects for elaboration of new therapeutic agents in medicine suggest relevance of nanotechnology methods for their synthesis. The new direction of development of medicinal substances involves the formation of a complex between the known drugs and nanoparticles (NPs), giving an opportunity to enhance their pharmacological action and provide them with other useful properties [1]. Silver nanoparticles are one of the most actively researched metal NPs for medical purposes with antimicrobial, anti-inflammatory and immunomodulatory pharmacological effects [5].

The use of modern methods to develop NPs can provide orientation of action and increase bioavailability of drugs to solve major goals of pharmacology. Physical methods (intensive heat or force impact on raw material) are considered promising for obtaining nanomaterials as they can be used for elaboration of NPs with increased free energy levels and cleaner chemical composition [2].

New substances have been recently created at E.O. Paton International Centre for Electron Beam Technologies of Electric Welding Institute, NAS, Ukraine with an electron-beam technology (a method of electron beam evaporation and condensation of various substances in vacuum, developed by NASU Academician B.A. Movchan) [4], namely: Substance 1 (contains thiotriazoline with antioxidant and anti-inflammatory action, and silver NPs) and Substance 2 (contains methyluracil with anti-inflammatory, immune stimulating and photoprotective action, and silver NPs) [3]. These substances were used as the basis for elaboration of thiotriazoline and methyluracil ointments containing silver NPs in cooperation with JSC Chemical-pharmaceutical plant “Krasnaya Zvezda” (Kharkov, Ukraine) [3].

Anti-inflammatory and radioprotective activity of thiotriazoline and methyluracil ointments with silver NPs is currently being studied in local ultraviolet irradiation of the skin of guinea pigs. Incorporation of silver NPs to the ointments results in enhanced anti-inflammatory effect of thiotriazoline and methyluracil ointments with silver NPs in ultraviolet irradiation of the skin of laboratory animals (lower intensity and duration of erythema reaction).

The research showed advantages of ointments with silver NPs in comparison to “Methyluracil ointment 10%” and “Thiotriazoline ointment 2%” in their effect on lipid peroxidation activity (inhibition of peroxidation processes) and antioxidant protection system (increased activity of antioxidant enzymes) [6]. At present the authors continue to

investigate the mechanisms of action of thiotriazoline and methyluracil ointments containing silver NPs, determining general regularities of their actions.

Thus, enhancement of pharmacological activity of therapeutic agents can be achieved by incorporation of silver nanoparticles with the ability to increase the action of the drug. Production of NPs for pharmacological purposes requires compliance to the standards of refinement, bioavailability and biosafety; therefore it is necessary to select the most effective methods for their synthesis. The research demonstrated anti-inflammatory and anti-oxidant effect of new ointments with thiotriazoline and methyluracil containing silver NPs.

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