Nanochemistry and biotechnology

Development of new pharmaceutical substance and dosage form based on silver and copper nanoparticles for treatment of multi-drug resistant tuberculosis

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Multi-drug resistant tuberculosis today is a global public health problem, which becomes an increasing threat for control of tuberculosis spread in the world.

The aim of present study was development of new pharmaceutical substance based on metal nanoparticles, estimation *in vitro* of their tuberculocidal activity against multi-drug resistant clinical isolates of *Mycobacterium tuberculosis* and development of liquid dosage form using obtained substance as active pharmaceutical ingredient.

Silver and copper nanoparticles have been synthesized by the method of chemical condensation in water medium. Size, shape and chemical composition of nanoparticles have been characterized using TEM and energy-dispersive X-ray spectroscopy methods. 30 nm spherical silver nanoparticles and 20 nm spherical copper nanoparticles have been synthesized by the reduction of their salts in water medium. Mixture of silver and copper nanoparticles has been prepared with concentration of obtained substance 4.0 mg Ag and 32.0 mg Cu per 1 ml.

Tuberculocidal activity of the substance has been analyzed *in vitro* by Canetti proportion method using Löwenstein–Jensen medium. 10 resistant to isoniazid and 10 resistant to isoniazid and rifampicin clinical isolates of *M. tuberculosis* have been used for estimation of the substance's tuberculocidal activity. Total growth inhibition for all analyzed clinical isolates of *M. tuberculosis* has been observed under presence of the substance in determination medium in concentration 0.08 mg Ag and 0.64 mg Cu per 1 ml.

Metal nanoparticles' biosafety level has been estimated according to the parameters of cytotoxicity, genotoxicity and mutagenicity. Biosafety according to the all analyzed parameters has been specified for the obtained mixture as well as for Ag and Cu nanoparticles.

The composition and technology of oral liquid dosage form has been developed using obtained substance in different concentration.

Obtained results indicate high perspectives of the synthesized pharmaceutical substance in development drugs for treatment of multi-drug resistant tuberculosis.