ANTIBACTERIAL PROPERTIES OF SILVER NANOPARTICLES WITH VARIOUS MODIFICATIONS OF THEIR SURFACES

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Development and use of nanoscale particles of various materials are one of the most prospective areas of modern nano- and biotechnology. Nanoparticles from nine to fifteen nanometers in size show the best antibacterial and bactericidal activity. This effect is predetermined due to the significant increase of the total particles surface area and the contact area between nanoparticles and bacterial or fungal cells. Only some strains of microorganisms are resistant to metal nanoparticles in contrast to the rapid growth of antibiotic resistance among bacteria. This fact opens a great opportunity to use metal nanoparticles in medical practice. Silver nanoparticles are considered to be effective and promising for the application against pathogenic microorganisms. That is why they have already found applications in various fields of science and daily human life.

The aim of the study was to explore the physicochemical and antibacterial properties of silver nanoparticles (AgNPs) with various composite substances such as polyvinylpyrrolidone (PVP), polyvinyl alcohol (PVA), starch (Starch) and chitosan (Chit). The following microbial strains were used in the study: *Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 25923 and *Candida albicans* ATCC 885-653. Nanoparticles were synthesized by the method of chemical reduction in concentrations of 100 mM with the aforementioned composite substances. Transmission electron microscopy, X-ray analysis, and surface plasmon resonance spectroscopy were used for determination and control of the physicochemical properties of the nanoparticles. Stability of the obtained nanoparticles at different pH values (1-14) after one, two, three and 24 hours from the moment of the pH change were investigated by analyzing the light absorption spectra in the 190-900 nm wavelength range. Standard microbiological tests were used to determine the minimum inhibitory concentration (MIC) and minimum bactericidal (MBC) concentrations. The final concentrations of silver nanoparticles in medium for bacterial growth were 50, 25, 12.5 and 6 mM.

The minimum inhibitory concentration of *E. coli* ATCC 25922 with AgNPs-PVP was 6 mM, with AgNPs-PVA – 12.5 mM, with AgNPs-Starch – 6 mM, and with AgNPs-Chit – 6 mM. The MICs for *S. aureus* ATCC 25923, with AgNPs-Chit was 12.5 mM and with AgNPs-Starch – 50 mM. The complete lack of growth of *C. albicans* ATCC 885-653 was observed at the lowest concentrations of AgNPs by all composite substances.

Thus, the composite substances significantly changed the bactericidal properties of spherical silver nanoparticles with size 9-12 nm. The synthesized nanoparticles showed higher bactericidal activity against Gram-negative bacteria compared to Gram-positive ones.