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Antibacterial Activity of "Green" Silver Nanoparticles (AgNPs) in Combination with Benzylpenicillin and Kanamycin

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Abstract

Due to the lack of progress in the development of antibiotics, there is a pressing need for innovative approaches to treat bacterial infections. Nanotechnology and repurposing existing drugs are innovative approaches that can potentially replace traditional antimicrobials. Silver nanoparticles (AgNPs) have the potential to not only exhibit antibacterial and antibiofilm properties but also serve as carriers for antibiotics and natural antimicrobial compounds. Our study involved testing the antibacterial activity of biogenic AgNPs and their complexes with the antibiotics benzylpenicillin (BP) and kanamycin (KM) against the growth of the gram-negative bacteria Escherichia coli K-12. The antibacterial activity of preparations studied with the disk diffusion method, determined the colony-forming activity by serial dilutions, and calculated the minimum inhibitory concentrations (MIC) of the preparations. Additionally, we determined the growth phases of Escherichia coli K-12. Our findings indicate that the AgNPs at the studied concentrations do not possess cyto- and genotoxicity. The results showed that the action of AgNPs in combination with BP against the growth of the bacterium Escherichia coli K-12 has a synergistic effect at concentration 0.5 mg/ml and higher, which can reduce the antibiotic dose up to 8 times, while in the complex with KM has additive activity, in this case, AgNPs reduce the active dose of KM by 30 times. The tested complexes have potential antivirulence effects that inhibiting the development of biofilm formation at concentrations below the MIC. These findings suggest that the complexes could be used as safe alternatives to antibiotics.

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Keywords: green silver nanoparticles, escherichia coli K-12, benzylpenicillin, kanamycin, antibacterial biocompatible complexes

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