Bactericidal activity of argentums nanoparticles against antibioticresistant and susceptible strains

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Aim: To estimate minimal inhibitory concentrations of silver nanoparticles on multiantibioticresistant and sensitive referent strains.

Materials and methods: Argentum nanoparticles (AN) were obtained in active gaseous phase generated by electron beam dispersion of AgNO3 powder under vacuum. AN were applied on polyethylene plate (PEG-115). Nanoparticles size was determined by electron transmissive microscope JEM 2100 (JEOL). Water suspension of AN was achieved by dissolution of plates into distillated water. AN concentration in solution wes determiner under mas-spekrometer Elan 9000 (PerkinElmer). Minimal inhibitory concentrations (MIC) for following bacterial cultures have been tested: Staphylococcus aureus ATCC 25923 (antibiotic-sensitive), S.aureus ATCC 35591 (methicillin resistant), E.coli ATCC 25922 (antibiotic-sensitive), E.coli ESBL CTX M-3 (productive of extended spectrum beta lactamase CTX-M(ESBL CTX-M producing)), Klebsiella pneumoniae ATCC 13883 (antibiotic-sensitive), K.pneumoniae ATCC 700603 (ESBL SHV producing), Pseudomonas aeruginosa ATCC 27853 (antibiotic-sensitive), P.aeruginosa 257 MBL VIM (multi antibiotic-resistant, productive MBL), Salmonella Typhimurium ATCC 13311, Shigella sonnei ATCC 29930 Double serial dilutions of nanoparticles in tripticase-soy broth were made (concentrations range 0.125-8.0 mg/L). Solutions were introduced into alveolar flat-bottomed polystyrene plates in amount of 150 mcL plus 10 mcL of bacterial suspension of tested microorganism, containing 104 cells each flat. As a growth control flats with 150 mcL of broth without nanoparticles were used. Plates were incubated at 37°C for 24 h, growth was checked visually.

Results: Mean nanoparticles value as determined with electron transmissive microscope was 25-30 nm. Marked antimicrobial activity against all tested microorganisms was revealed. MIC of argentums nanoparticles for tested cultures were ranged from 0.5-4 mg/L. Most susceptible to AN (MIC 0,5 mg/L) was ESBL-produsing E.coli. The largest MIC value was determined for polyantibioticresistant MBL-producing P.aeruginosa strain. At concentrations about 1 mg/L AN inhibited growth of antibioticsusceptible E.coli ATCC 25922 and S. aureus ATCC 25923 and antibioticresistant strain K.pneumoniae ATCC 700603. Concentration of AN about 2 mg/L were bactericidal against S.Typhimurium, S.sonnei, MRSA S.aureus, susceptible strains of K. pneumoniae ATCC 13883 and P.aeruginosa ATCC 27853.

Conclusions: Developed technology of forming of argentum nanoparticles has a marked bactericidal activity against all studied bacteria and fungi referent strains. Estimated bactericidal effect is universal and does not depend on antibiotic susceptibility-resistance of tested strains and has a potential usefulness for local antimicrobial treating of infections caused with multiantibioticresistant strains.