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Paper Poster Session
Discovery of more new antibacterial drugs

Antimicrobial and anti-biofilm activities of biologically synthesized selenium nanoparticles

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Background: Tailored nanoparticles (NPs) with desired physico-chemical properties have been proposed as a new line in the battle against antibiotic-resistant microorganisms. In this study, SeNPs generated by two bacterial isolates of environmental origin have been compared with chemically synthesized NPs for their antibacterial, antifungal and cytotoxic activity.

Material/methods: The gram-positive strain *Bacillus mycoides* SeITE01 and the gram-negative strain *Stenotrophomonas maltophilia* SeITE02 were used to produce biogenic SeNPs [(Bm-SeNPs(+) and Sm-SeNPs(-) respectively]. Chemically synthesized SeNPs (Ch-SeNPs) were produced using a standard protocol. SEM analysis and DLS indicated that all the SeNPs produced were spherically shaped and have a size of 170.6 ± 35.12 nm (Sm-SeNPs(-)), 160.6 ±52.24 nm (Bm-SeNPs(+)) and 102.5 ± 29.44 nm (Ch-SeNPs). A number of *Pseudomonas aeruginosa* clinical strains and two reference strains (PAO1 and PYO27853) were used in this study, and grown in TSB medium added with 0.25% glucose. Two yeast clinical strains, *Candida albicans* CVr-21 and *Candida parapsilosis* CPVr-5 and three *Aspergillus* clinical strains (*A. fumigatus* (A), *A. fumigatus* (B) and *A. flavus*) were also included in the study and grown in *Sabouraud* medium. To analyze the effect of SeNPs on biofilm synthesis, *P. aeruginosa* strains and *Candida* species were treated with different concentrations of Bm-SeNPs(+), Sm-SeNPs(-), and Ch-SeNPs, and the biofilm was quantified after methylene blue staining. The biofilm disaggregation effect was evaluated by analyzing the quantity of the biofilm remaining after treatment of the synthesized exopolymer with different concentrations of SeNPs. The antifungal activity was evaluated by analyzing the effect of SeNPs on the mycelia growth and conidial germination.

Results: Se-NPs, especially those produced by *S. maltophilia* SeITE02 in comparison with those synthesized through chemical procedure, demonstrated antibacterial activity with low MIC values (8-16 µg/ml) against a number of clinical *Pseudomonas aeruginosa* isolates but not against the *Candida* clinical isolates. Se-NPs proved also capable of inhibiting the synthesis of biofilm produced by *Pseudomonas* and *Candida* and even of disaggregating the mature polysaccharide matrix produced by these microorganisms at concentrations ranging between 50 and 100 µg/ml. Similarly, Se-NPs at a concentration of 64 µg/ml caused the inhibition of the mycelia growth and the conidial germination of the tested *Aspergillus* strains. At the Se-NP concentrations showing antimicrobial and anti-biofilm activity, no cytotoxic effects were detectable in human dendritic cells or fibroblasts.

Conclusions: Data gained so far suggest that the biogenic SeNPs tested might be considered as biocompatible agents and suitable candidates to be efficiently used, either alone or in combination

with antibiotics, in new therapeutic strategies aimed at inhibiting the growth of some microorganisms or at facilitating the diffusion of drugs within the microbial biofilms.