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Research article

Antimicrobial activity and biocompatibility of alpha-silver tungstate nanoparticles

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Abstract

The growing global threat posed by microorganisms resistant to conventional antimicrobials underscores the urgent need for novel agents to control infections. The aim of this study was to evaluate the antimicrobial activity and biocompatibility of alpha-silver tungstate (α-Ag_2WO_4) nanoparticles (NPs) synthesized by the ultrasonic method. The NPs were characterized, and their antimicrobial activity was assessed against *Candida albicans*, *Staphylococcus aureus*, and *Escherichia coli* using the broth microdilution method, determining the minimum inhibitory concentration (MIC) and minimum bactericidal/fungicidal concentration (MBC/MFC). Intracellular reactive oxygen species (ROS) production was detected by fluorescence using the CM-H2DCFDA probe. Cytotoxicity was evaluated using murine L929 fibroblasts by MTT assay. Cell viability of both microorganisms and L929 fibroblasts was further assessed using Confocal Laser Scanning Fluorescence Microscopy (CLSM). For *C. albicans*, the MIC was 3.90 μg/mL, and the MFC was 7.81 μg/mL. For *S. aureus*, the MIC and MBC were both 62.50 μg/mL, while *E. coli* exhibited MIC and MBC values of 0.48 μg/mL. The biocompatibility assay revealed a significant reduction in cell viability at concentrations starting from 15.62 μg/mL. CLSM images corroborated the results from both microbiological and biocompatibility assays. Additionally, ROS production was detected in all three microorganisms upon exposure to the NPs, confirming their antimicrobial mechanism. In conclusion, α-Ag_2WO_4 NPs effectively inactivated *C. albicans*, *S. aureus*, and *E. coli*. However, a higher concentration was required to inhibit *S. aureus* compared to *E. coli* and *C. albicans*. The biocompatibility assay revealed concentration-dependent cytotoxic effects. These findings highlight the potential of α-Ag_2WO_4 NPs as antimicrobial agents and suggest further research into their efficacy against biofilms, optimization of their biocompatibility, and the application of these nanomaterials in the incorporation and coating of materials used in biomedical and dental devices.

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