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Novel synthesis of hydroxyapatite-Ag composite

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Novel and better antimicrobial agents are still being developed to control associated microorganisms. Nanoparticles of metals can be toxic to bacteria, showing biocidal activities at low concentrations. Metal, oxide or compounds based on silver was applied like antimicrobial agents. The capacity of integration of metallic nanoparticles in ceramic matrices has improved the antimicrobial behavior, resulting in the search for composites with increased bactericidal properties. The aim of this study was to prepare and characterize hydroxyapatite nanopowders containing silver nanoparticles and evaluate its antimicrobial properties against various Gram-positive and negative microorganisms associated to drug-resistance infections. Hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$, HA) powders were synthesized by sol-gel and silver nanoparticles (AgNPs) were prepared by reduction in situ method of Ag+ ions with the simple addition of gallic acid. Hydroxyapatite-silver composite (HA-AgNPs) was prepared by adsorption of AgNPs at several concentrations. The results of dynamic light scattering, transmission scanning electron microscopy and UV–visible spectroscopy showed the presence of silver nanoparticles with diameters around 5.6 ± 2.9 nm. STEM and energy dispersive X-ray spectroscopy confirmed the presence of silver agglomerates distributed over the surface of hydroxiapite nanopowders. All HA-AgNPs samples showed good and specific antibacterial effect despite of low silver concentration; therefore, this activity might depend on microbiological and cell structure characteristics as well as concentration of silver. HA-AgNPs composites might have a high potential for medical applications focused to the control of drug-resistance infections.