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Magnesium and platinum doped hydroxyapatite nanoparticles as multifunctional biocompatible-bactericidal composites

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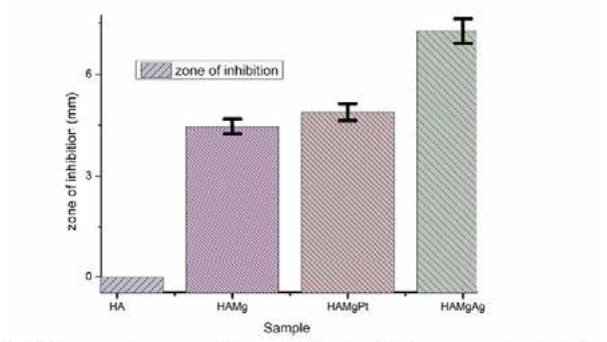
Nanotechnology and materials science can be combined to develop new devices with intrinsic antimicrobial properties. For bactericidal effects, alternatives such as the use of metal nanoparticles (MNPs), metal oxides and metal phosphates have been studied. Hydroxyapatite nanoparticles and magnesium oxide nanoparticles (MgO NPs) have received much recent scientific attention however to reach antibacterial effects similar to that observed for silver oxide nanoparticles (Ag_2O) NPs. The purpose of this research is to produce multifunctional biocompatible-antimicrobial nanocomposites made of hydroxyapatite doped with magnesium and platinum (HA/Mg/PtNPs) by using a solvothermal method. For synthesis of targeted nanocomposites $Ca(NO_3)_2.4H_2O$(0.5 M); $(NH_4)_2HPO_4$ (0.3 M); $MgCl_2.6H_2O$ (0.05 M) and $PtCl_4$ (0.025 M) were used in solutions adjusted to pH 11. Next, mixtures were added slowly into water in oil emulsion of cyclohexane with a suitable stoichiometric ratio (surfactant/cosurfactant) of cetyltrimethylammonium bromide and polyethylene glycol 600. The milk suspension was heated in a hydrothermal reactor for 12 h at 170°C (16 bar). After that, the obtained precipitate was dried at 60°C for 14 h and the resultant material was calcined at 600°C for 2 h. Antibacterial activity of the as-synthesized nanopowders was tested by the standard agar disk-diffusion method. Solutions of nanopowders were tested against bacterial suspensions (*E.coli – S. aureus*) with a turbidity of 0.5. It was found that hydroxyapatite doped was successful synthetized by solvothermal method. FTIR analysis of HA/Mg nanoparticles showed broader spectra compared to pure HA. The crystallite size of HA/Mg nanoparticles was also lower than that to pure HA. Further, results of antibacterial activity test showed that HA/Mg/Pt nanoparticles are resistant material against Gram negative bacteria. Interestingly, it was found that the stoichiometric surfactant/cosurfactant ratio used affects the size and morphology of HA/Mg/Pt nanoparticles as well as the corresponding antibacterial activity. These results point to HA/Mg/Pt nanoparticles can be used as antimicrobial agent.



Inhibition zone of nanoparticles synthesized against gram-negative bacteria

Biography

Carlos García-Negrete obtained a BS in Chemistry from Universidad de Córdoba in 2004, an MSc from Universidad Nacional de Colombia in 2009 and a PhD from University of Seville in 2016. He received Colombian Young investigator research award and Junta de Andalucía Pre-doctoral fellowship. He was a Graduate Student Visitor at Cambridge University. He received STEEM2 Award for transnational access to Graz University of Technology. He is working as an Assistant Professor of Chemistry in the Universidad del Sinú from 2016 to present.

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