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Cerium oxide and iron oxide nanoparticles abolish the antibacterial activity of ciprofloxacin against gram positive and gram negative biofilm bacteria

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Abstract: Metal oxide nanoparticles have been suggested as good candidates for the development of antibacterial agents. Cerium oxide (CeO2) and iron oxide (Fe2O3) nanoparticles have been utilized in a number of biomedical applications. Here, the antibacterial activity of CeO2 and Fe2O3 nanoparticles were evaluated on a panel of gram positive and gram negative bacteria in both the planktonic and biofilm cultures. Additionally, the effect of combining CeO2 and Fe2O3 nanoparticles with the broad spectrum antibiotic ciprofloxacin on tested bacteria was investigated. Thus, minimum inhibitory concentrations (MICs) of CeO2 and Fe2O3 nanoparticles that are required to inhibit bacterial planktonic growth and bacterial biofilm, were evaluated, and were compared to the MICs of the broad spectrum antibiotic ciprofloxacin alone or in the presence of CeO2 and Fe2O3 nanoparticles. Results of this study show that both CeO2 and Fe2O3 nanoparticles fail to inhibit bacterial growth and biofilm biomass for all the bacterial strains tested. Moreover, adding CeO2 or Fe2O3 nanoparticles to the broad spectrum antibiotic ciprofloxacin almost abolished its antibacterial activity. Results of this study suggest that CeO2 and Fe2O3 nanoparticles are not good candidates as antibacterial agents, and they could interfere with the activity of important antibiotics.