PH DEPENDENT ANTIBACTERIAL EFFECTS OF NANOCERIA

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Cerium oxide nanoparticles (nanoceria) have been used in variety of applications including biomedical applications. The oxygen defect structure on its surface and alternating oxidation state between +3 to +4 gives ceria a unique property of modulating reactive oxygen species (ROS) levels, which allows for their use as a therapeutic agent to fight against cancer and many other ROS associated diseases. Despite the promise of nanoceria as a therapeutic agent for cancer applications, it has not been extensively studied for antibacterial activity. In the current study, the antibacterial activity of dextran-coated nanoceria was examined against Pseudomonas aeruginosa (as a gram-negative bacteria) and Staphylococcus epidermidis (as a gram-positive bacteria) in terms of a dose, time and pH dependent manner. A non-linear growth equation (Gompertz Equation) was fitted to the experimentally collected data and parameters associated with bacteria growth as maximum specific growth rate (?), lag time (?), and the total amount of bacteria (A) were calculated. Findings suggest that dextran-coated nanoceria particles were much more effective at killing P. aeruginosa and S. epidermidis at basic pH (pH=9) compared to acidic pH values (pH=6). Between different bacteria strains at pH 9, P. aeruginosa growth was delayed for few hours between different particle concentrations, whereas S. epidermidis did not grow when treated at 500 ?g/mL nanoceria concentrations for 24 hours. This study provides significant evidence for the use of nanoceria for a wide range of anti-infection applications without resorting to the use of antibiotics.

Keywords: nanoceria, antibacterial properties, inflammation

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