Antimicrobial potential of synthesized zinc oxide nanoparticles against gram positive and gram negative bacteria

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Received 3 August 2012; Accepted 7 May 2013

ABSTRACT

Antimicrobial potential of synthesized zinc oxide (ZnO) nanoparticles against four bacteria strains (Escherichia coli ATCC 25922 and Pseudomonas aeruginosa ATCC 27853, as gram negative bacteria, Staphylococcus epidermidis PTCC 1114 and Staphylococcus aureus ATCC 25923 as gram-positive bacteria) in liquid and solid phases was studied in this work. Firstly, nanoparticle ZnO was prepared by the chemical method with an organic chemical inhibitor. The detail characterization of the nanoparticles was carried out using UV–vis spectroscopy, scanning electron microscopy (SEM), and X-ray diffraction (XRD) analysis. From SEM image analysis, the average particle size was found to be 50 nm. Also, the mean surface area was determined as 90 m$^2$/g by Brauner–Emmet–Teller (BET) analysis. We studied the antibacterial assay, minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), and disk diffusion method as per CLSI recommendations and time–kill studies were performed. Disk diffusion studies revealed greater effectiveness for P. aeruginosa. In vitro time–kill studies were performed for one or two times; the MICs and its results showed that the efficiency of particles increases with rising particle dose in suspension and treatment time. From this work, it is possible to suggest that ZnO nanoparticles are excellent antibacterial agents.

Keywords: Antimicrobial characteristic; ZnO nanoparticle; MIC; MBC; Time–kill