Effect of annealing temperature on antimicrobial and structural properties of bio-synthesized zinc oxide nanoparticles using flower extract of Anchusa italica

ABSTRACT

The use of nontoxic biological compounds in the synthesis of nanomaterials is an economic and eco-friendly approach. The present work was undertaken to develop zinc oxide nanoparticles (ZnO-NPs) by a green method using simple precursor from the solution consisting of zinc acetate and the flower extract of Anchusa italica (A. italica). Effect of annealing temperature on structural and antimicrobial properties was investigated. The crystalline structure of ZnO-NPs was shown using X-ray diffraction (XRD) analysis. Transmission electron microscopy (TEM) results showed that ZnO-NPs are hexagonal in shapes with mean particle size of ~8 and ~14nm at 100°C and 200°C annealing temperatures respectively. The optical band gap was increased from 3.27eV to 3.30eV with the decreasing of the particle size. The antimicrobial activity of ZnO-NPs towards Gram positive (Bacillus megaterium and Staphylococcus aureus) and Gram negative (Escherichia coli and Salmonella typhimurium) pathogens decreased with the increasing of the heat treating temperature. In vitro cytotoxicity studies on Vero cells, a dose dependent toxicity with nontoxic effect of concentration below 142μg/mL was shown. The results indicated that A. italica is an appropriate reaction media to prepare ZnO-NPs for cosmetic and bio-medical productions.

Keyword: Anchusa italica; Antimicrobial; Green synthesis; ZnO nanoparticles; Annealing temperature