

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 non-toxic 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