

## Down-top nanofabrication of binary (CdO)<sub>x</sub> (ZnO)<sub>1-x</sub> nanoparticles and their antibacterial activity

### ABSTRACT

In the present study, binary oxide (cadmium oxide [CdO]<sub>x</sub> (zinc oxide [ZnO])<sub>1-x</sub>) nanoparticles (NPs) at different concentrations of precursor in calcination temperature were prepared using thermal treatment technique. Cadmium and zinc nitrates (source of cadmium and zinc) with polyvinylpyrrolidone (capping agent) have been used to prepare (CdO)<sub>x</sub> (ZnO)<sub>1-x</sub> NPs samples. The sample was characterized by X-ray diffraction (XRD), scanning electron microscopy, energy-dispersive X-ray (EDX), transmission electron microscopy (TEM), and Fourier transform infrared (FTIR) spectroscopy. XRD patterns analysis revealed that NPs were formed after calcination, which showed a cubic and hexagonal crystalline structure of (CdO)<sub>x</sub> (ZnO)<sub>1-x</sub> NPs. The phase analysis using EDX spectroscopy and FTIR spectroscopy confirmed the presence of Cd and Zn as the original compounds of prepared (CdO)<sub>x</sub> (ZnO)<sub>1-x</sub> NP samples. The average particle size of the samples increased from 14 to 33 nm as the concentration of precursor increased from x=0.20 to x=0.80, as observed by TEM results. The surface composition and valence state of the prepared product NPs were determined by X-ray photoelectron spectroscopy (XPS) analyses. Diffuse UV–visible reflectance spectra were used to determine the optical band gap through the Kubelka–Munk equation; the energy band gap was found to decrease for CdO from 2.92 to 2.82 eV and for ZnO from 3.22 to 3.11 eV with increasing x value. Additionally, photoluminescence (PL) spectra revealed that the intensity in PL increased with an increase in particle size. In addition, the antibacterial activity of binary oxide NP was carried out in vitro against *Escherichia coli* ATCC 25922 Gram (-ve), *Salmonella choleraesuis* ATCC 10708, and *Bacillus subtilis* UPMC 1175 Gram (+ve). This study indicated that the zone of inhibition of 21 mm has good antibacterial activity toward the Gram-positive *B. subtilis* UPMC 1175.

**Keyword:** Binary oxide (CdO)<sub>x</sub> (ZnO)<sub>1-x</sub> NPs; Calcination technique; Antibacterial activity