

## Preparation, characterization, and antimicrobial activities of ZnO nanoparticles/cellulose nanocrystal nanocomposites

### ABSTRACT

Zinc oxide (ZnO) nanoparticles were synthesized within cellulose nanocrystals (CNC) as a new stabilizer by a precipitation method for antimicrobial applications. For fabrication of ZnO/CNC nanocomposites, solutions with different molar ratios of Zn to CNC were prepared in ethanol as the solvent. ZnO/CNC was separated from the suspension and then dried at 120 °C for 1 hour. The nanocomposites were characterized using Fourier transform infrared (FTIR), ultraviolet-visible (UV-vis), X-ray diffraction (XRD), transmission electron microscope (TEM), and thermogravimetric (TG) analyses. According to the XRD and TEM results, the ZnO nanoparticles with a hexagonal wurtzite structure were easily prepared and dispersed in the CNC with an average size of less than 20 nm. The average size of the ZnO nanoparticles increased with increasing molar ratio of ZnO to CNC. The best ratio of Zn:CNC was chosen based on the small size of the ZnO nanoparticles that yielded better antimicrobial and thermal properties. The UV-vis absorption spectra of the ZnO/CNC nanocomposites showed absorption peaks in the UV region that were ascribed to the band gap of the ZnO nanoparticles. The antibacterial effects of ZnO/CNC were stronger compared to ZnO nanoparticles.

**Keyword:** Zinc oxide; Nanocomposite; Cellulose nanocrystal; Antibacterial