

## **Comprehensive study on morphological, structural and optical properties of Cr<sub>2</sub>O<sub>3</sub> nanoparticle and its antibacterial activities**

### **ABSTRACT**

Chromium (III) oxide (Cr<sub>2</sub>O<sub>3</sub>) nanoparticles are generated by thermal treatment (calcination) of precursor materials such as chromium nitrate along with a poly (vinyl pyrrolidone) capping agent. The samples produced were characterised by various techniques, including X-ray diffraction (XRD), energy dispersive X-ray spectroscopy (EDX), transmission electron microscopy (TEM) and Fourier transform infrared spectroscopy (FT-IR). Examination results obtained from XRD showed that Cr<sub>2</sub>O<sub>3</sub> nanoparticles exhibit hexagonal crystalline structures, with the presence of Cr and O in these novel materials being confirmed by results of analyses of both EDX and FT-IR. Results of TEM have pointed out that the average nanoparticle size was noticeably increased from 28 to 46 nm in relation to increase of calcination temperature of a range between 500 and 800 °C. The surface composition and valence state of the produced nanoparticles were examined by X-ray photoelectron spectroscopy (XPS), the optical energy gap has been evaluated using UV–visible reflectance spectra with the help of Kubelka–Munk equation. The energy band gap had a reversely proportional relationship with calcination temperature with a reduction in energy band gap from 3.12 to 3.01 eV. Photoluminescence (PL) spectra indicated an increase in photoluminescence with increasing particle size. The antibacterial activity of the Cr<sub>2</sub>O<sub>3</sub> nanoparticles was evaluated in-vitro using gram-negative *Escherichia coli* ATCC 25922 and gram-positive *Bacillus subtilis* UPMC 1175.