## ABSTRACT

Pollution of water by poisonous chromate ions can be a serious environmental and health hazard as it is carcinogenic and persistent. This study presents the synthesis and application of a novel hydrogel composite designed for the enhanced removal of chromate ions. Cobalt-doped tin-oxide (Co-$SnO_2$) nanocomposites were incorporated into sodium-alginate hydrogel beads to develop a multifunctional adsorbent in the removal of chromate ions in an aqueous solution. Due to the successful doping, the hydrogel beads and the developed Co-SnO 2 nanocomposite were characterized in detail with Fourier-Transform Infrared Spectroscopy (FTIR), which revealed the presence of the functional groups interacting with the chromate. Scanning Electron Microscopy (SEM) revealed a highly porous morphology of the alginate beads and the uniform dispersion of the nanocomposite, providing an extensive surface area for interaction. Batch adsorption studies, monitored via UV-Visible Spectrophotometry, demonstrated exceptional removal efficiency for chromate ions under optimized conditions of different variables. This work shows a promising direction for the development of hydrogels based on nanocomposite technology in environmental remediation applications. Potential of this cobalt-doped tin oxide-alginate hydrogel composite as a highly effective, stable, and eco-friendly material for the advanced treatment of chromium-laden wastewater.