## ABSTRACT

Industrial wastewater contains horrendous dye effluents, progressively discharged by industries, significantly jeopardizing the effectiveness of water. To sustain an environmental restoration, contaminated water must be remediated. A facile co-precipitation method was adopted to synthesize varying concentrations (2 and 4 wt. %) of chitosan (CS) and fixed concentration (3 wt. %) of cetyltrimethylammonium bromide (CTAB) doped tin selenide (SnSe) nanostructures (NSs) work as a remedy. The current study explores the addition of CS and CTAB in SnSe to decompose Rhodamine B (RhB) dye. It examines the antibacterial action against a gram-positive bacteria *staphylococcus aureus (S. aureus)*. The XRD patterns revealed the orthorhombic structure of SnSe, augmentation of CS, and CTAB resulted in reduced crystallite size. UV-Vis spectroscopy unveiled that CS/CTAB-SnSe exhibits an increased bandgap. The highest CS content in CTAB-SnSe elevated the catalytic breakdown of RhB to 80 % in acidic settings and a significant inhibition zone value of 5.45 mm was attained against *S. aureus*. The docking investigations were undertaken to investigate the microbicidal prohibitive mechanism of CTAB-SnSe and CS/CTAB-SnSe on DNA gyrase enzymes in *S. aureus*.