# ABSTRACT

In this study, 0.02 and 0.04 wt % of chitosan (CS) were successfully incorporated into a fixed amount of polyvinylpyrrolidone (PVP) -doped $Bi_2O_3$ nanostructures (NSs) via a co-precipitation approach. The purpose of this research was to degrade hazardous methylene blue dye by using prepared CS/PVP-doped $Bi_2O_3$ nanostructures. In view of experimental results, $Bi_2O_3$ exhibits a monoclinic structure and the structure remains the same upon PVP and CS doping. Fourier transform infrared spectra confirmed the presence of dopants and a significant band was observed at 540 $cm^{-1}$ for $Bi_2O_3$ NSs. Quantum dots morphology for $Bi_2O_3$ was observed while the incorporation of PVP forms a layer over there and nanowire formation was explored with an increasing amount of CS, all of which was confirmed with transmission electron microscopy. A significant absorption peak was observed at 295 nm for $Bi_2O_3$, and band gap calculation was undertaken through a UV-Vis spectrophotometer, which showed a decrease in band gap energies. Moreover, the catalytic dye degradation performance was assessed against methylene blue dye in the presence of synthesized nanocatalyst. Generally, the surface area, crystallite size, and shape of nano-catalyst substantially influence catalytic activity. Results showed that CS/PVP-doped $Bi_2O_3$ nanostructures exhibited efficient catalytic activity in the neutral medium (99%), which is attributed to the presence of more active sites provided by catalyst's large surface area.