Abstract

This study investigated the synthesis of zinc oxide nanoparticles (ZnO NPs) using marula leaf extract. Boiling water was used to extract the active marula ingredients, which were then processed hydrothermally with zinc precursor to synthesize ZnO NPs. Under UV light irradiation, the produced ZnO NPs were used to simultaneously degrade two dyes: methylene blue (MB) and rhodamine 6 G (R6G) in a binary dye mixture. The XRD analysis showed that pure and crystalline structures of ZnO NPs were fully formed after calcination at 350 ℃. Raman spectroscopy was employed to determine the materials' molecular functional groups using the fingerprint regions on the spectra. The distinctive peaks at 318, 429, and 566 cm^{-1} were used to identify ZnO NPs. SEM showed that ZnO NPs had both sphere-like and agglomerated nanorod structures and BET analysis showed that the ZnO materials had a an average pore size of 2818.35 (Å) with a pore volume of 0.008846 cm^3/g and a surface area of 21.29 ± 0.07 m^2/g. CT350-ZnO NPs afforded simultaneous MB and R6G degradation efficiencies of 99 and 98 %, respectively, after a time interval of 75 min. The degradation efficiency increased with the catalyst amount, contact time, and reaction temperature and decreased as the original concentration was raised. This study shows that ZnO NPs have a great deal of promise for environmental and public health protection because of their high effectiveness in degrading binary dye combinations when exposed to UV light.