

Abstract

Green synthesis of nanostructures is an alternative method to physical and conventional chemical methods, which is cost-effective and environmentally friendly. This study focuses on the synthesis of nanostructured multilayer graphene and zinc oxide nanocomposites from natural extracts and their utilization for photodegradation of brilliant black (BB) under solar light irradiation. The fabricated ZnO and graphene nanostructures were used to fabricate multilayer graphene/zinc oxide (MLG/ZnO) nanocomposites, with different ratios of MLG to ZnO (1:1, 1:2, 1:3) through ex-situ casting of the two materials. Various characterization techniques such as XRD, SEM, HR-TEM, EDS, BET, UV-Vis, and Raman were used to study the physico-chemical properties of the synthesized materials. The XRD profiles and Raman spectra exhibited predominant features of MLG and the characteristic wurtzite structure of ZnO in the nanocomposites. The UV-Vis absorbance spectra analysis revealed that combining MLG and ZnO reduced the energy band gap of ZnO nanoparticles, consequently improving the light absorption of the ZnO in the visible range. The overall percentage photodegradation of BB under sunlight by MLG, ZnO, MLG/ZnO_1, MLG/ZnO_2 and MLG/ZnO_3 were found to be 7%, 63%, 39%, 81% and 93%, respectively. Scavenger experiments confirmed that holes played a significant role in the photodegradation of BB followed by superoxide radicals and hydroxyl radicals being the least. The results of this study showed that MLG/ZnO nanocomposite can be adopted for beneficial application in the removal of pollutants from water using natural solar light irradiation.