Abstract

Nanostructures of carbon nitride (C_3N_4)-doped into iron (Fe)-doped cobaltosic oxide (Co_3O_4) were prepared with chemical precipitation technique where various concentrations of C_3N_4 (1, 2 & 3%) were doped into fixed amount of Fe/Co_3O_4 lattice. Iron was selected as a dopant material due to very small difference in the ionic radii of Co^{+2} (0.125 nm) and Fe^{+2} (0.126 nm) which can generate desirable defects. Additionally, comparable band gap energies of Co_3O_4 (~2.5 eV) and C_3N_4 (~2.7 eV) would result in a suitable band alignment to form type-II heterojunction. Phase constitution, presence of functional groups, optical properties and surface morphology of C_3N_4-Fe/Co_3O_4 were evaluated using X-ray diffractometer (XRD), Fourier transform infrared spectroscopy (FTIR), UV-Vis spectrophotometer and High-resolution transmission electron microscope (HR-TEM), respectively. Co_3O_4 consisted of cubic FCC structure and crystallinity of the sample was observed to increase with increasing doping concentration as verified by XRD results. HR-TEM images revealed the novel prism-like geometry of prepared nanostructures which offered larger surface area and abundant active sites. FTIR spectra confirmed the presence of various functional groups and molecules such as Co-O and O-Co-O, in the prepared composites. UV-vis spectroscopy depicted a slight redshift in the absorption windows upon addition of C_3N_4 in the prepared nanostructures. Samples were tested for photocatalytic potential against methylene blue ciprofloxacin (MB-CF) dye under visible light. Furthermore, bactericidal activity against gram positive and gram negative bacteriae have been evaluated.