Silver-modified TiO_2/g-C_3N_4 nanocomposites for photocatalytic degradation of water contaminants

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TiO_2/g-C_3N_4 heterostructures were synthesized by combining sol-gel and hydrothermal techniques. These materials were subsequently modified with Ag nanoparticles and were thoroughly characterized using X-ray Powder Diffraction (XRPD), Raman spectroscopy, Fourier Transform-Infrared spectroscopy (FTIR), N_2 adsorption-desorption isotherms, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), X-ray Photoelectron Spectroscopy (XPS), and electrochemical measurements. The photocatalytic properties of the resulting silver-modified (TiO_2/g-C_3N_4@Ag) nanocomposites were evaluated for the elimination of water contaminants under both UV and artificial solar light illumination. Four characteristic pollutants were selected in order to assess their photocatalytic performance in oxidation [methylene blue (MB), rhodamine B (RhB)] and reduction [4-nitrophenol (4-NP), chromium(VI) (Cr^{+6}] reactions. High efficiencies were obtained during its degradation of MB and RhB under UV illumination (95% and 89%, respectively), as well as under artificial solar light (39% and 52%, respectively). Moreover, the photocatalytic reduction of 4-NP and Cr^{+6} pollutants by the TiO_2/g-C_3N_4@Ag nanocomposites was also effective, as these harmful pollutants were converted to aminophenol (a functional precursor in chemical industry manufacturing) and Cr^{+3} (a considerably less toxic material), respectively.