ABSTRACT

Water pollution caused by industrial wastewater containing the synthetic dye crystal violet has become a serious environmental concern due to its toxic, stable, and poorly biodegradable nature, necessitating the development of more effective photocatalytic approaches. Oxygen-doped graphitic carbon nitride (O-g-C_3N_4, OGCN) is a promising visible-light-responsive photocatalyst whose performance can be enhanced through heterojunction formation with NH_2-MIL-101(Fe) (MF). This study aimed to synthesize OGCN/MF composites, determine their optimum composition, and evaluate their photocatalytic activity toward crystal violet degradation under visible light irradiation. OGCN was synthesized via hydrothermal and calcination methods, MF via solvothermal method, and both were composited in situ at OGCN:MF mass ratios of 0.01:1 (OMF-50), 0.02:1 (OMF-100), and 0.03:1 (OMF-150). Characterization by ATR-FTIR, UV-DRS, P-XRD, SEM-EDX-Mapping, and GSA confirmed the successful synthesis of all composites, with bandgap energies of OGCN, MF, OMF-50, OMF-100, and OMF-150 measured at 2.50, 2.05, 1.84, 1.76, and 2.23 eV, respectively. In photocatalytic degradation tests of a 10 ppm crystal violet solution analyzed by UV-Vis and LC-MS, the OMF-100 composite exhibited optimum performance with a degradation efficiency of 81.06% within 75 minutes. Radical scavenger tests indicated that h^+ and e^- were the dominant active species in the degradation mechanism, as confirmed by LC-MS through cleavage of the crystal violet chromophore group.

Keywords: *crystal violet, graphitic carbon nitride, heterojunction, oxygen doping, photocatalysis.*