(Abstract 2)

"A novel α-Fe_2O_3@MoS_2QDs heterostructure for enhanced visible-light photocatalytic performance using ultrasonication approach"

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Abstract:

Constructing excellent heterojunction to improve the photocatalytic performance of materials is critically important. Herein, we report an effective simple, easy preparation method for α-Fe_2O_3@MoS_2QDs nanocomposite via two two-step process, including hydrothermal and ultrasonication approaches. The as-prepared materials were characterized using X-ray diffraction (XRD), Transmission electron microscope (TEM), TGA, X-ray fluorescence (XRF) and photoluminescence spectra (PL). The refined PXRD patterns of α-Fe_2O_3 photocatalyst confirm the formation of a single trigonal phase of Fe_2O_3 without another phase impurities. When the MoS_2 QDs were coupled with α-Fe_2O_3, the phase was changed to a single monoclinic phase with C 2/C space group and no peaks observed for MoS_2 QDs. Morphological analysis reveal the successful formation of Fe_2O_3@MoS_2QDs nanocomposites with uniform distribution of MoS_2 QDs on the Fe_2O_3 surface. The XRF analysis confirmed the presence of Mo, S, and Fe elements indicating the nanocomposite formation. The Uv–vis results revealed the enhancement of absorption capability of the α-Fe_2O_3@MoS_2QDs material, particularly in the white light region. Very noticeably, the as-prepared α-Fe_2O_3@MoS_2QDs exhibit high photocatalytic activity performance (84%) toward methylene blue (MB) in 1 min under visible light irradiation. The superior photocatalytic performance of the prepared material can be attributed to the enhancement of the light absorption and the high separation efficiency of photogenerated electron-hole pair in Fe_2O_3@MoS_2QDs structure, which confirmed by PL analysis. The mechanism of photocatalytic degradation of MB over Fe_2O_3@MoS_2QDs nanocomposite was suggested. This work provides a new, low-cost and straightforward idea for enhancement of the degradation performance of organic pollutants in water.