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Visible light-excitable ZnO/2D graphitic-C_3N_4 heterostructure for the photodegradation of naphthalene

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ABSTRACT

In this study, ZnO/g-C_3N_4 heterostructure was synthesized with enhanced photodegradation potential for polycyclic aromatic hydrocarbons (PAHs) (viz. naphthalene) in water using visible light. The as-prepared catalysts were characterized via different techniques such as scanning electron microscopy, high-resolution transmission electron microscopy, fourier transform infrared, ultraviolet visible (UV-Vis), photoluminescence, and X-ray diffractometry to elucidate their physicochemical and structural properties. The identified properties of the newly synthesized heterostructure catalyst indicated a successful integration of physicochemical characteristics suitable for effective photocatalytic degradation activities. The kinetics study and mechanism of photodegradation of naphthalene using ZnO/g-C_3N_4 heterostructure have been discussed in detail. The photodegradation outcomes demonstrated that the synthesized heterostructure of semiconductors was more effective than the parent catalyst ZnO nanoparticles because of better light absorption for higher photogeneration of electrons and holes, suppressed recombination rate, and consequently prolonged availability of active species for degradation. The ZnO/g-C_3N_4 heterostructure has exhibited a photocatalytic efficiency of 84.5% in 4 h, which was relatively higher than the photocatalytic efficiency of individual photocatalysts. Thus, this report highlights the potential of as-prepared heterostructure for the photodegradation of naphthalene under visible light, therefore suggesting an avenue for the treatment of wastewater contaminated with PAHs.

Keywords: Zinc oxide; g-C_3N_4; Photocatalysts; Water pollution; PAHs; Naphthalene

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