**Improved photodegradation of anionic dyes using a complex graphitic carbon nitride and iron-based metal-organic framework material**

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**Abstract**

Introducing heterostructure to graphitic carbon nitrides (g-C3N4) can improve the activity of visible-light-driven catalysts for efficient treatment of multiple toxic pollutants in water. Here we report for the first time that a complex material can be constructed from oxygen-doped g-C3N4 and MIL-53(Fe) metal-organic framework using a facile hydrothermal synthesis and recycled polyethylene terephthalate from plastic waste. The novel multi-walled nanotube structure with unique interfacial charge transfer at the heterojunction in O-g-C3N4/MIL-53(Fe) composite showed an obvious enhancement in separation efficiency of the photochemical electron-hole pairs, resulting in narrow bandgap energy (2.30 eV compared to 2.55 eV in O-g-C3N4), high photocurrent intensity (0.17 mA cm-2 compared to 0.12 mA cm-2 and 0.09 mA cm-2 in MIL-53(Fe) and O-g-C3N4, respectively), and excellent catalytic performance in the photodegradation of anionic azo dyes (95.1% RR-195 and 99.8% RY-145 degraded after 4 h, and only a minor change in the efficiency observed after four consecutive tests). These results demonstrate the development of new catalysts made from waste feedstocks, high stability and ease of fabrication, which can operate in natural light for environmental remediation.

Key words:MIL-53(Fe) MOF; graphitic carbon nitride; O-g-C3N4; photodegradation; anionic dyes

References

1. Pham, X. N.; Nguyen, B. M.; Ngo, H. S.; Doan, H. V., Highly efficient photocatalytic oxidative desulfurization of dibenzothiophene with sunlight irradiation using green catalyst of Ag@AgBr/Al-SBA-15 derived from natural halloysite. *Journal of Industrial and Engineering Chemistry* 2020, 90 (25), 358-370.
2. Pham, X. N.; Nguyen, T. H.; Pham, T. N.; Nguyen, T.-Thanh-Bao; Nguyen, B. M.; Tran, Van Thi-T.; Doan, H. V., Green synthesis of H–ZSM-5 zeolite-anchored O-doped g–C3N4 for photodegradation of Reactive Red 195 (RR 195) under solar light. *Journal of the Taiwan Institute of Chemical Engineers*, 2020, 114, 91-102.
3. Doan, H. V.; Amer Hamzah, H.; Karikkethu Prabhakaran, P.; Petrillo, C.; Ting, V. P., Hierarchical Metal-Organic Frameworks with Macroporosity: Synthesis, Achievements, and Challenges. *Nano-Micro Letters* 2019, 11 (1), 54.