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Preparation of g-C_3N_4/ZnO for Degradation of Ofloxacin under Visible Light Irradiation

Nur Nabihah Mohd Sunhaji[a*], Nor Fadilah Chayed[a*], Nur Syahira Izzati[a],

Structured Abstract

Background: The presence of non-biodegradable antibiotics in wastewater can lead to antibiotic pollution which has negative impacts on the environment and living organisms. Hence, it is important to discover a technique for removing hazardous organic contaminants and antibiotics in water bodies. The use of g-C_3N_4 photocatalyst in heterogeneous photocatalysis for advanced oxidation process (AOP) has gained significant attention in recent years for wastewater treatment. Nevertheless, ZnO and g-C_3N_4 have several limitations such as high recombination rate of electron-hole (e^-/h^+) pairs and limited light absorption within the range of solar spectrum, respectively. These factors can reduce its photocatalytic activity.

Methods: Therefore, our study develops the preparation of a semiconductor heterojunction between g-C_3N_4 and ZnO. The g-C_3N_4/ZnO photocatalyst was characterized using X-ray diffraction (XRD) and Field Emission Scanning Electron Microscope (FESEM) to determine its structural and morphological. The synthesis methodology of materials in obtaining pristine ZnO using a sol-gel method and pristine g-C_3N_4 using thermal polymerization method, whereas for g-C_3N_4/ZnO composite, wet impregnation method was employed. The composite of g-C_3N_4/ZnO was prepared to improve the photocatalytic performance under visible light irradiation to degrade OFL.

Results: This study shows that the g-C_3N_4/ZnO photocatalyst was successfully synthesized by the wet impregnation method. The structural, morphological, and optical properties of g-C_3N_4/ZnO were identified by using XRD, FESEM, and UV-Vis. The g-C_3N_4/ZnO composite appeared crystalline and consisted of nanospherical shapes. The optimal 0.75 g of g-C_3N_4/ZnO composite showed the highest degradation of 78.4% toward photodegradation of 10 mg/L OFL antibiotic under the condition of pH 9 within 240 minutes.

Conclusion: In conclusion, this study's findings indicated a promising potential for antibiotic degradation in wastewater, thereby heading for sustainable development as photocatalysis is an environmentally friendly process. The improved photocatalytic performance of g-C_3N_4/ZnO photocatalyst in this study has a considerable potential to degrade organic pollutants under light effectively, to substitute the conventional method.

Keywords: g-C_3N_4/ZnO photocatalyst, ofloxacin, photocatalysis, visible light, water treatment

*Correspondence: norfadilah6231@uitm.edu.my

[a] School of Chemistry & Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia