

Carbon@NiCoFeS Nanoparticles for Photocatalytic Degradation of Organic Pollutants via Peroxymonosulfate Activation

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Abstract : This study presents the synthesis and application of Carbon@NiCoFeS nanoparticles as a photocatalyst for the degradation of organic pollutants through peroxymonosulfate (PMS) activation. The Carbon@NiCoFeS nanoparticles, synthesized via a hydrothermal method, exhibit a highly crystalline and uniformly distributed nanostructure, as confirmed by XRD, SEM, TEM, and FTIR analyses. The photocatalytic performance was tested using ibuprofen (IBU) as a model pollutant under visible light, demonstrating remarkable efficiency across various conditions, including different concentrations of photocatalyst and PMS and a range of pH values. The enhanced activity is attributed to the synergistic effects of Ni, Co, and Fe, promoting effective electron-hole separation and reactive radical generation, primarily $\text{SO}_4^{\bullet-}$ and $\bullet\text{OH}$. Quenching experiments highlighted sulfate radicals' predominant role in the degradation process. The Carbon@NiCoFeS photocatalyst also showed excellent reusability and stability over multiple cycles, and its versatility in degrading various organic pollutants underscores its potential for practical wastewater treatment applications. This research offers significant insights into multi-metal sulfide photocatalyst design, showcasing Carbon@NiCoFeS nanoparticles' promising role in environmental remediation via efficient PMS activation.

Keywords : NiCoFeS nanoparticles, photocatalytic degradation, peroxymonosulfate activation, organic pollutant removal, wastewater treatment

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