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ORIGINAL ARTICLE

In-situ construction of $BiVO_4$/N-Doped carbon composite for visible-light-driven degradation of methylene blue and Tetracycline hydrochloride

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Abstract

Water pollution from industrial effluents, particularly organic dyes and pharmaceuticals, is a major environmental issue. In this study, $BiVO_4$ based photocatalysts were modified in situ with nitrogen-doped carbon (NC) *via* metal–organic coordination using 2-methylimidazole, yielding $BiVO_4$ and $BiVO_4$@NC under air and nitrogen environment, respectively. These materials were systematically characterized by means of XRD, FTIR, XPS, TEM-EDS, FESEM, PL, and UV–vis spectroscopy. Among the tested samples, $BiVO_4$@NC showed the highest photocatalytic performance, achieving 94% degradation of methylene blue in 120 min and 92% degradation of tetracycline hydrochloride in 60 min under visible light. This marks a significant improvement compared to bare $BiVO_4$, which achieved only 72% and 70% degradation of MB and TC, respectively. Furthermore, $BiVO_4$@NC demonstrated excellent recyclability over five cycles and strong resistance to interfering ions. The enhanced performance is attributed to N-doped carbon, which improved optical absorption, reduced band gap, and facilitated charge carrier separation.

Keywords Metal organic framework-derived · Photocatalysis · Methylene blue · Tetracycline · Hydroxyl radical

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