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In situ fabrication of $BiVO_4$-$CeVO_4$ heterojunction for excellent visible light photocatalytic degradation of levofloxacin

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Abstract: $BiVO_4$-$CeVO_4$ heterojunction was in situ prepared with hydrothermal method employing bismuth nitrate, cerium nitrate and ammonium vanadate as precursors. The microstructural and crystalline structure of the as-prepared materials were comparatively characterized by XRD, SEM, TEM, EDS, XPS, DRS, PL spectroscopy and photoelectrochemical measurement. Compared with bare photocatalysts, the $BiVO_4$-$CeVO_4$ heterojunction showed more efficient visible light photocatalytic activity of levofloxacin degradation, resulting from the enhancement of separation and transfer efficiency of photogenerated electron-hole pairs. The trapping experiments and ESR tests identified that the contribution of active species was in descending order of $\cdot OH > h^+ > \cdot O_2^-$ in photocatalytic degradation of levofloxacin, and a possible degradation mechanism was also proposed.

Keyword: $BiVO_4$-$CeVO_4$ heterojunction; Levofloxacin; Visible light; Photocatalysis

1. Introduction

Levofloxacin is a third generation fluoroquinolone antibiotic and shows a specific activity against Gram-negative bacteria, Gram-positive organisms and intracellular pathogens [1, 2]. Therefore, it is used widely for the treatment of bacterial infections and even HIV diseases [3]. However, it is poorly metabolized in human body and 65–80% is released into the environment through urine as parent compound, leading to the improvement of antibiotic-resistant bacteria and severe harm to the ecosystem [4]. Therefore, the potential impact and effective treatment of levofloxacin has been a very important issue in modern society.

Heterogeneous photocatalysis is widely used in the removal of organic compounds [5-10]. Over the past few years, nano-scaled TiO_2 has been extensively studied as a catalyst for photocatalytic degradation of antibiotic under UV light due to its outstanding activity and stability [11, 12]. Nevertheless, TiO_2 can only be excited up to 420 nm wavelength, which hinders its practical application under visible light.

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