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Highly efficient visible-light photocatalytic performance of $Ag/AgIn_5S_8$ for degradation of tetracycline hydrochloride and treatment of real pharmaceutical industry wastewater

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Abstract: The deposition of Ag nanoparticles (NPs) on semiconductors has been demonstrated to be an efficient route to improve the separation of photogenerated electrons and holes due to plasma resonance effect, but the photocatalytic efficiency of the available Ag-based photocatalysts is still low and far from practical application. In this study, a novel photocatalyst with Ag NPs deposited on the surface of $AgIn_5S_8$ ($Ag/AgIn_5S_8$) was fabricated via solvothermal method and further photo-reduction approach. The amount of deposited Ag nanoparticles has an obvious effect on the charge separation and visible-light photocatalytic activity of $Ag/AgIn_5S_8$, and 2.5% $Ag/AgIn_5S_8$ nanocomposites exhibit the highest visible-light photocatalytic activity with 95.3% degradation efficiency of tetracycline hydrochloride (TC•HCl) compared with that of the other samples due to the surface plasmon resonance of Ag NPs, proper bandgap of $AgIn_5S_8$ and the synergistic effect between them. The main reactive species in TC•HCl degradation are •OH and $•O_2^-$. The possible degradation pathway of TC•HCl and photocatalytic mechanism of $Ag/AgIn_5S_8$ were proposed according to high performance liquid chromatography-tandem mass spectrometry (HPLC-MS) analysis, main reactive

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