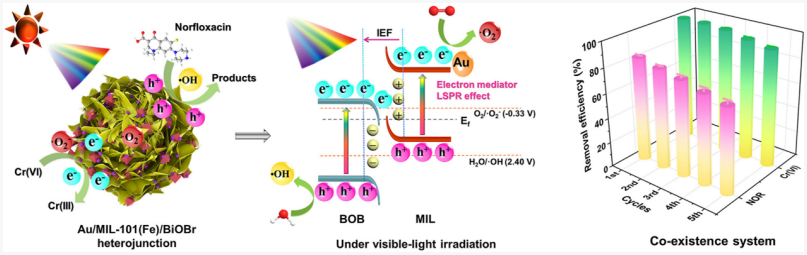
Synchronous removal of Cr(VI) and antibiotics using a novel photocatalyst

USA, August 31, 2024 /EINPresswire.com/ -- In a landmark development for environmental conservation, a pioneering plasmonic photocatalyst has been engineered to synergistically degrade the potent pollutants hexavalent chromium (Cr(VI)) and norfloxacin from aquatic environments. This dual-action photocatalyst, leveraging the plasmonic effect and metal-organic framework (MOF) integration, marks a significant leap forward in the quest for efficient and sustainable water purification solutions.



Graphic abstract

Water contamination by pharmaceuticals and heavy metals poses severe environmental and health risks. Traditional methods like biodegradation and filtration often lack efficiency and sustainability. Photocatalysis, using solar energy to degrade pollutants, offers a promising alternative but faces challenges such as weak redox capacity and low catalytic performance. Due to these challenges, there is a need for innovative materials that can efficiently and concurrently clean up diverse contaminants, driving the development of advanced photocatalysts for comprehensive water purification solutions.

Scientists at Zhejiang Ocean University (China), in collaboration with the University of Missouri (USA), have made a groundbreaking advancement. Their research (DOI: 10.1016/j.esci.2023.100208), published in the journal eScience on Issue 2, Volume 4, introduces an innovative Au/MIL-101(Fe)/BiOBr photocatalyst designed to address the synchronous decontamination of water pollutants.

The Au/MIL-101(Fe)/BiOBr photocatalyst is designed to enhance photocatalytic activity through the integration of a metal-organic framework (MIL-101(Fe)) and the plasmonic effects of gold nanoparticles. This unique combination increases light absorption, provides more active sites, and improves the separation and transport of photo-induced carriers. Under visible light, the photocatalyst achieved a Cr(VI) reduction rate up to 53.3 times higher and a norfloxacin degradation rate 2 times greater than traditional BiOBr. The system's efficiency is further enhanced in the presence of both Cr(VI) and norfloxacin, demonstrating superior performance in

mixed-contaminant environments. The research highlights the potential of Au/MIL-101(Fe)/BiOBr as a multifunctional solution for wastewater treatment, addressing the need for effective and simultaneous removal of heavy metals and pharmaceuticals.

Dr. Xiaobo Chen, a leading researcher from the University of Missouri, commented, "This research marks a significant advancement in photocatalytic technology. The Au/MIL-101(Fe)/BiOBr photocatalyst not only achieves high efficiency in pollutant removal but also opens new avenues for developing multifunctional materials for environmental remediation."

The successful development of the Au/MIL-101(Fe)/BiOBr photocatalyst paves the way for its application in real-world wastewater treatment. Its ability to simultaneously remove heavy metals and pharmaceuticals addresses a critical need in environmental cleanup, potentially improving water quality and reducing ecological and health risks associated with contaminated water sources.

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