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Light-Responsive UiO-66-NH₂/Ag₃PO₄ MOF-Nanoparticle Composites for the Capture and Release of Sulfamethoxazole

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Abstract: Light-responsive materials are attracting increasing amount of attention and have great potential in many research fields in environmental chemistry, materials science, biology, and nanotechnology. In this work, UiO-66-NH₂/Ag₃PO₄ (UAP-X) Metal-organic framework (MOF)-nanoparticle composites with remarkable adsorption performance toward sulfamethoxazole (SMX) were reported. In addition, visible light-triggered release of SMX in the UAP-X composites was reported for the first time. It is believed that the light-triggered desorption of SMX is due to the transformation from Ag⁺ to Ag⁰ in the light-sensitive Ag₃PO₄ nanoparticles (NPs) of the composites. The SMX release performance of UAP-X can be tuned by the size of Ag₃PO₄ NPs distributed on the UiO-66-NH₂. Specifically, the smaller crystal size of Ag₃PO₄ NPs, which can facilitate the reduction of Ag⁺ to Ag⁰, can be achieved with an increase in relative UiO-66-NH₂ content in the composites. In addition, the higher UiO-66-NH₂ content of the composite could provide more deposition area to minimize the aggregation of Ag₃PO₄, which could further enhance the reduction of Ag⁺. The light triggered desorption provides new possibility to achieve pollution-free and low-cost recyclability of adsorbents.

Key words: light-response, MOF-nanoparticle composites, desorption, UiO-66-NH₂, PPCPs, mechanism

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