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Cuboidal Zn-MOF Enabled Solar Photocatalysis for Efficient Cr(VI) Reduction and Rhodamine B Degradation

Abstract: In this study, a novel cuboidal Zn-based metal-organic framework (Zn-MOF) was synthesized using a dual-ligand strategy involving succinic acid and terephthalic acid as carboxylate bi-linkers. The incorporation of these two linkers enhanced the structural stability and photocatalytic efficiency of the Zn-MOF. The resulting material exhibited outstanding performance under natural sunlight for the simultaneous reduction of toxic hexavalent chromium (Cr(VI)) and oxidative degradation of the organic dye Rhodamine B (RhB). The dual-functional Zn-MOF achieved an 86.70% reduction of Cr(VI) to the less toxic Cr(III) within just 60 minutes of solar irradiation. In parallel, the oxidative degradation of Rhodamine B reached an efficiency of 93.50% in 80 minutes. This superior activity is attributed to the efficient generation of reactive oxygen species (ROS) facilitated by the Zn-MOF framework under sunlight, driving both reduction and degradation processes. The study demonstrates how the synergistic effect of dual linkers contributes to enhanced light harvesting, structural integrity, and active site availability, making this Zn-MOF a potent photocatalyst for environmental remediation. This solar-driven, sustainable approach offers a green and efficient solution for the detoxification of water contaminants, underlining the significant role of advanced MOFs in promoting eco-friendly chemistry for water purification.

Keywords: Zn-MOF · Bi-Linker · Cr (VI) reduction · Rhodamine B · Sunlight

Biography: Sai P. Katke is a dedicated professional researcher in the field of Chemistry, currently pursuing a Ph.D. from the University of Mumbai under the guidance of Prof. Dr. Suresh D. Pawar. His research focuses on the design, construction, and application of metal-organic frameworks (MOFs) using carboxylate-based ligands, with applications in environmental remediation and energy storage. With several international publications, he explores innovative approaches such as solar-driven catalysis using MOFs. Known for his scientific integrity and creative insight, he remains committed to developing sustainable materials that address real-world environmental and energy challenges.