National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Conference Return Seminar on Efficient sulfamethoxazole degradation using Reusable $BiVO_4$ photocatalytic hydrogel (Presented at International Conference on Advanced Materials and Startup Ecosystem on December 13-15, 2024 at Thiruvananthapuram, Kerala, India)
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Venue	: Room. No 303, Chemical Engineering Dept.
Date and Time	: 18 Dec 2024 (2.30 p.m.)
Abstract	: In this study, a reusable $BiVO_4$ photocatalytic hydrogel was developed for the efficient removal of sulfamethoxazole (SMX) using peroxymonosulfate (PMS) activation. The $BiVO_4$ hydrogel was synthesized via hydrothermal synthesis and embedded into a sodium alginate-based hydrogel matrix. Comprehensive XRD, FTIR, FESEM, EDX, PL AND UV-DRS confirmed the successful formation of the $BiVO_4$ hydrogel, exhibiting excellent photocatalytic properties. The $BiVO_4$ hydrogel achieved 85% degradation of SMX (10 mg/L) within 35 minutes under visible light irradiation, with PMS (400 mg/L) as the activator whereas, it showed just 33% degradation under dark(adsorption). Notably, the hydrogel demonstrated exceptional reusability, maintaining its high degradation efficiency over 12 cycles. The $BiVO_4$/PMS/Visible system also showed a mineralization efficiency of 52% after 35 minutes. The enhanced photocatalytic performance of the $BiVO_4$ hydrogel is attributed to its ability to generate stable electron-hole pairs, which facilitate stronger interactions with PMS, accelerating the degradation process. Moreover, the hydrogel's effective utilization of visible light (1.82 eV) contributes to its high catalytic activity. The synergy between the $BiVO_4$ photocatalyst and PMS activation significantly increased the generation of reactive oxygen species (ROS) such as O_2*–, and OH*–, which played a crucial role in the degradation of SMX. These findings highlight the potential of the $BiVO_4$ hydrogel as a sustainable, highly efficient, and reusable photocatalyst for wastewater treatment, offering a promising solution for the remediation of harmful contaminants. Keywords: Photocatalysis, sulfamethoxazole, wastewater treatment, peroxymonosulfate.