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Efficient and cost-effective photoelectrochemical degradation of dyes in wastewater over an exfoliated graphite-MoO_3 nanocomposite electrode

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ABSTRACT:

Herein, we prepared hexagonal MoO_3 (h-MoO_3) nanorods by homogenous co-precipitation and utilized them to fabricate a composite h-MoO_3-exfoliated graphite (EG) electrode. The above composite was characterized by scanning electron microscopy, Raman spectroscopy, X-ray diffraction, and UV-Vis spectroscopy, and used for the degradation of cationic (methylene blue, MB) and anionic (methyl red, MR) dyes in synthetic wastewater. The efficiency of this degradation was assessed by UV-Vis spectroscopy and electrochemical techniques. Good dispersion of h-MoO_3 in EG decreased the electron-hole recombination rate and enhanced the photon absorption efficiency of the EG-MoO_3 electrode, which therefore exhibited a higher dye photodegradation efficiency than the bare EG one. Specifically, the efficiencies of 180-min MB photodegradation over EG and EG-MoO_3 electrodes were 66.9 and 88.55%, respectively, whereas the corresponding values for MR were 68.0 and 92.22%, respectively, i.e., MR was degraded more effectively than MB. Furthermore, photoelectrochemical oxidation was shown to be more efficient than purely photolytic and electrochemical oxidation, which, together with the ease of preparation, low cost, and high photoactivity/stability of the fabricated nanocomposite electrode makes it potentially suitable for industrial wastewater treatment.