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# Solar light-induced photocatalytic degradation of methyl red in an aqueous suspension of commercial ZnO: a green approach

Nitin Kumar Singh, Sandip Saha, Anjali Pal*

*Department of Civil Engineering, Indian Institute of Technology Kharagpur, Kharagpur 721302, India*
*Tel. +91 3222 281920; Fax: +91 3222 282254; email: anjalipal@civil.iitkgp.ernet.in*

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ABSTRACT

The potential of commercial ZnO as a heterogeneous photocatalyst for the degradation of methyl red (MR; C. I. Acid Red 2) under solar light irradiation was considered. The effect of initial concentration of MR, catalyst loading, pH, light intensity, radical scavengers, and inorganic salts was studied. The rate of decolorization followed first-order kinetics with respect to dye concentration. Under ambient and neutral pH condition, the catalyst at a dose of 0.5 g/L could decolorize MR (initial conc. 30 mg/L) up to 99% in 1 h. The COD removal under similar situation was ~53%. The mineralization of MR was found to be dependent on catalyst dose and time of solar light irradiation. Thus, mineralization up to 80% was possible for the same solution using catalyst at 1 g/L dose. The method was free from interference due to $Cl^-$, $SO_4^{2-}$, $NO_3^-$, $Ca^{2+}$, $Fe^{2+/3+}$, humic acid, oxalic acid, and citric acid. However, it was strongly interfered by $H_2PO_4^-$, maleic acid, malic acid, and tartaric acid. Studies showed that the reaction was mostly governed by singlet oxygen and superoxide radical. High turnover frequency and recycle ability of the catalyst made the process economical. The recovered ZnO could degrade MR up to 86 and 79% after the first and second cycle under identical experimental conditions. A cost-benefit analysis was made to evaluate the efficacy of the catalyst in relation to the commercial $TiO_2$ and silver-doped $TiO_2$. Further, the efficiency of the present method for MR degradation was compared with those of the other methods involving UV and visible light, and in the presence of nano-ZnO and commercial ZnO.

*Keywords:* Methyl red degradation; Solar light; Commercial ZnO; Color removal; COD removal

*Corresponding author.