



Methyl red degradation under UV illumination and catalytic action of commercial ZnO: a parametric study

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ABSTRACT

Photocatalytic efficiency of commercially available low-cost ZnO material was evaluated for methyl red (MR) degradation under UV illumination. Photocatalytic reaction system was optimized in terms of dose of catalyst, pH, removal of chemical oxygen demand (COD), intensity/wavelength of UV source. MR degradation followed first-order rate equation, and under optimum conditions 70–99% decolorization was achieved in the concentration range of 10–50 mg/L. About 42% COD removal was achieved for MR solution having concentration 30 mg/L with 1 h illumination and 4.0 g/L ZnO dose. Role of different radical scavengers was also investigated to gain an insight of role of many reactive oxygen species (ROS) in degradation process. These studies revealed that singlet oxygen and the superoxide ions were the main ROS taking part in MR degradation. The present method was compared with other UV-induced photocatalytic processes using other photocatalysts. The recycle ability of the ZnO and the turnover frequency of the process was evaluated. Finally, a comparative account relative to the solar light-induced process of MR degradation using the same ZnO catalyst was revealed.

Keywords: Methyl red degradation; Commercial ZnO; UV light; ROS; Decolorization

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