

MTBE removal from contaminated water by the UV/H₂O₂ process

Raafat Alnaizy*, Taleb H. Ibrahim

Department of Chemical Engineering, American University of Sharjah, P.O. Box 26666, United Arab Emirates
Tel. +971 (6) 515-2710; Fax +971 (6) 515-2979; email: ralnaizy@aus.edu

Received 2 February 2008; Accepted in revised form 29 June 2009

ABSTRACT

Advanced oxidation process, UV/H₂O₂, was investigated for MTBE degradation in MTBE-contaminated waters. Water solutions of MTBE were prepared in the laboratory with one to five ppm of MTBE. The photochemical oxidation was performed in a completely mixed-batch-photocatalytic reactor with a total volume of 500 mL. Two UV irradiation sources were employed individually; a low-pressure mercury vapor lamp and a high-pressure mercury lamp that is axially centered in the photoreactor. Neither UV nor hydrogen peroxide on its own was very effective for MTBE oxidation. While in combination (UV/H₂O₂), the degradation rate was enhanced by at least one-order of magnitude relative to direct photolysis. A complete MTBE degradation was achieved in less than 15 min. The calculated pseudo-first-order reaction rate constants were strongly dependent on the initial concentration of MTBE and on the hydrogen peroxide concentration. As indicated by the results, the MTBE degradation rate with the high-pressure UV source was highest ($k = 6.0 \times 10^{-3} \text{ s}^{-1}$). After 10 min of irradiation, MTBE was completely degraded when using the 150 W TQ 150 mercury lamp. In addition, results showed that MTBE degradation rate is enhanced at a higher initial concentration of MTBE due to the higher initial H₂O₂ concentration when keeping the MTBE/H₂O₂ molar ratio constant.

Keywords: MTBE; Advanced oxidation processes; UV/H₂O₂; Kinetics

* Corresponding author.