Photocatalytic treatment of pharmaceutical industry wastewater over TiO$_2$ using immersion well reactor: synergistic effect coupling with ultrasound

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ABSTRACT

The sonophotocatalytic degradation of pharmaceutical industry wastewater was studied with a TiO$_2$ slurry mode process with UV 125 W medium-pressure mercury lamp coupled with ultrasound (100 W, 33 ± 3 kHz). The degradation of wastewater was investigated in terms of reduction in COD that confirmed the apparent first-order degradation kinetics. The rate constant was greatly affected by catalyst dose, variation in pH, and concentration of oxidant (H$_2$O$_2$). The catalyst concentration was optimized at 1.0 g L$^{-1}$, pH at 4, and the oxidant concentration at 0.075 g L$^{-1}$. The first-order rate constants obtained from coupled sonophotocatalysis were two-folds than those obtained from photocatalysis and approximately ten-folds than sonolysis. The COD reduction follows the trend, sonophotocatalysis > photocatalysis > sonocatalytic > sonolysis. The study demonstrates better efficiency of coupled sonophotocatalysis over independent treatment processes.

Keywords: Sonophotocatalysis; Pharmaceutical industry wastewater; Photocatalysis; TiO$_2$; Sonolysis

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