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Modeling of photocatalytic mineralization of phthalic acid in TiO_2 suspension using response surface methodology (RSM)

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ABSTRACT

The optimization of operational parameters for enhanced phthalic acid photocatalytic mineralization by TiO_2/UV system was conducted using factorial experimental design and analysis. Response surface methodology (RSM) was adopted to investigate the optimum value of the selected factors for achieving maximum photocatalytic mineralization. The main factors studied were the initial concentration of phthalic acid, TiO_2 dosage, volume of the solution, and agitation speed. The parameters coded as X_1, X_2, X_3, and X_4, consecutively, and were investigated at two levels (−1 and +1). The effects of individual variables and their interaction effects for dependent variables, namely, the quantity of CO_2 formed after 60 min of irradiation were determined. Experimental results showed that TiO_2 dosage had significant influence on the photocatalytic mineralization. The optimum quantity of CO_2 formed after 60 min of irradiation was 0.08513 mmol, when the operational parameters were phthalic acid concentration of 1 mmol/L, TiO_2 dosage of 2,000 mg, volume of the solution of 1 L, and agitation speed of 1,100 rpm. The excellent correlation between predicted and measured values further confirmed the validity and practicability of adopted model.

Keywords: Experimental design; Response surface methodology; Optimization; Photocatalytic mineralization; Phthalic acid

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