Performance of natural sunlight on paracetamol removal from synthetic pharmaceutical wastewater using heterogeneous TiO$_2$ photocatalyst

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Received 17 November 2016; Accepted 30 April 2017

**ABSTRACT**

Paracetamol has been remarked as one of the most heavily used and prescribed drugs nowadays. The presence of paracetamol in the sewage effluent with the average concentration of 0.01 mg/L has been reported in this paper. This study investigated the removal of paracetamol from synthetic pharmaceutical wastewater using titanium dioxide (TiO$_2$) photocatalysis treatment method under natural solar irradiation. Compound parabolic collecting reactor was used as a treatment medium. The effect of each variable (pH, concentration of TiO$_2$ and initial concentration of paracetamol) on the photocatalytic degradation efficiency of paracetamol was investigated by using the single-variable-at-a-time method. Central composite design based on the response surface methodology was used to optimize TiO$_2$ and paracetamol concentrations. Experimental results and analysis of variance analysis showed that the model was significant with the high coefficient of determination ($R^2$) of 0.9885. The optimum conditions of 1.0 g/L of TiO$_2$ concentration and 0.06 g/L of paracetamol initial concentration were predicted for the maximum removal efficiency of 88%. Finally, the performance of UV lamp and natural sunlight in the photocatalytic degradation of paracetamol was compared and discussed in detail. The in situ experimental results in this study have proven the reliability of the solar operation on the photocatalysis treatment process.

**Keywords:** Heterogeneous photocatalyst; Synthetic wastewater; Paracetamol; Titanium dioxide; Solar energy; Compound parabolic collecting reactor