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Photocatalytic treatment of amiodarone and levetiracetam in pharmaceutical industry effluent: process optimization using response surface methodology

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ABSTRACT

In this work, the treatment of synthetic pharmaceutical industry effluent containing two critical pharmaceutical contaminants, viz. amiodarone (AMD) and levetiracetam (LEV) was investigated employing heterogeneous photocatalytic system. Response surface methodology (RSM) was used to model and optimize the process variables. Photoreactor (500 mL), immersion lamp emitting ultraviolet rays at 365 nm (125 W) and TiO_2 as photocatalyst, was employed and four variables, viz. initial concentrations of AMD and LEV, pH, photocatalyst concentration and reaction time, were considered in this study. The influence of the chosen variables on the removal of contaminants was evaluated using RSM. Regression analysis revealed that removal of both AMD and LEV was influenced by all the four variables. It was found that the maximum removal of AMD was 67.6% and LEV was 92.7% under the optimum conditions. Characteristics experiments indicate that the removal by $^{\bullet}OH$ was the major mechanism in the degradation process. Lesser adsorption of AMD and LEV on the surface of TiO_2 and the insignificant removal of these contaminants when acetonitrile was the solvent suggested that heterogeneous photocatalytic effect plays a significant role in the removal process. More than 50% mineralization indicates that the heterogeneous photocatalytic system was capable of oxidizing the synthetic pharmaceutical industrial effluent containing AMD and LEV and could be effectively used to pre-treat the pharmaceutical effluent.

Keywords: Pharmaceutical contaminants; Design of experiment; MINITAB; Titanium dioxide; Adsorption; Optimum condition

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