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REMOVAL OF AN ORGANIC REFRACTORY COMPOUND BY PHOTOCATALYSIS IN BATCH REACTOR – KINETIC STUDIES

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Abstract

The present work systematically investigates the photocatalytic degradation of carbamazepine (CBZ), an organic compound, known as refractory to the conventional wastewater treatment by the titanium dioxide PC 500 catalyst. The effects of some fundamental operating parameters in heterogeneous photocatalysis were investigated in this work in order to determine the main ones affecting the degradation kinetics. The obtained results clearly showed that the removal rate of the target compound is strongly influenced by the initial concentration of the pollutant. The degradation reaction rate increases when the concentration of CBZ decreases due to a lower $OH^{\cdot}$/CBZ ratio. On the other hand, it was shown that during the first 30 minutes the reaction of photocatalytic degradation follows a first order kinetic and also that when the incident light flux increases, the photocatalytic degradation process is accelerated due to the increases of the catalyst excitation probability with sufficient photon energy. A relatively high CBZ removal yield (of about 87%) was obtained for an initial pollutant concentration of 2 mg/L and an irradiation time of 150 min. A total organic carbon (TOC) reduction of about 74% was observed confirming the mineralization of the parent compound under UV light conditions. As expected, it was observed that the effect of TiO_2 concentration on the degradation kinetics was significant confirming the positive influence of the increased number of TiO_2 active sites on the process. Finally, the Langmuir-Hinshelwood (L-H) model was successfully used to fit the experimental results and the L-H model constants were also calculated.

Key words: carbamazepine, kinetics, persistent micropollutant, photocatalytic degradation, TiO_2

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