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

Lidia Favier1,2*, Andrei Ionut Simion3*, Lacramioara Rusu3, Mariana Liliana Pacala4, Cristina Grigoras3, Abdelkrim Bouzaza1,2

1Ecole Nationale Supérieure de Chimie de Rennes, University of Rennes 1, CNRS, UMR 6226, 11, Allée de Beaulieu, CS 50837, 35708 Rennes Cedex 7, France
2Université Européenne de Bretagne
3“Vasile Alecsandri” University of Bacau, Chemical and Food Engineering Departament, 157 Calea Marasesti, 600115 Bacau, Romania
4“Lucian Blaga” University of Sibiu, Faculty of Agricultural Science, Food Industry and Environmental Protection, 7-9 Dr. I. Ratiu St., 550012 Sibiu, Romania

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·/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 TiO₂ concentration on the degradation kinetics was significant confirming the positive influence of the increased number of TiO₂ 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, TiO₂

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* Author to whom all correspondence should be addressed: e-mail: lidia.favier@ensc-rennes.fr, asimion@ub.ro; Phone: +33223238135, +40234524411 ext. 233; Fax: +33223238020, +40234580170