Comparative study on photocatalytic treatment of diclofenac: slurry vs. immobilized processes

Daria Juretic Perisic a, Alexandre Belet a,b, Hrvoje Kusic a,*, Urska Lavrencic Stangar c, Ana Loncaric Bozic a, *

a Faculty of Chemical Engineering and Technology, University of Zagreb, Marulicev trg 19, Zagreb 10000, Croatia, Tel. +385 1 4597 160; Fax: +385 1 4597 143; email: hkusic@fkit.hr (H. Kusic), Tel. +385 1 4597 123; Fax: +385 1 4597 143; email: abozic@fkit.hr (A.L. Bozic)
b National Polytechnic Institute of Industrial and Chemical Engineering, Toulouse, France

Laboratory for Environmental Research, University of Nova Gorica, Vipavska 13, SI-5000 Nova Gorica, Slovenia

Received 21 February 2017; Accepted 17 June 2017

A B S T R A C T

The applicability of different photocatalytic systems for the treatment of pharmaceuticals in water was investigated. Slurry (UV-A/TiO 2(s) and UV-A/TiO 2(s)/H 2O 2) and immobilized (UV-A/TiO 2(i)/H 2O 2) processes were compared regarding the removal of diclofenac (DCF) and total organic content, as well as the improvements in biodegradability and toxicity. The applied response surface modeling revealed the significance of TiO 2 dosage and concentration of H 2O 2, while pH was less influential within the studied range. Although UV-A/TiO 2(i)/H 2O 2 was somewhat less effective in comparison with UV-A/TiO 2(s)/H 2O 2 process (88.8% and 99.1% of DCF removal, respectively), the immobilized system enabled photocatalyst reuse. In comparison with air dried and thermally reactivated, chemically reactivated photocatalyst provided better performance through four consecutive runs.

Keywords: TiO 2 photocatalysis; Pharmaceuticals; Slurry process; Immobilized photocatalyst; Reactivation

* Corresponding author.