Pharmaceutical removal by ozone and electrooxidation: Best treatment option

Francesca Audino*, Sonia Sanchis Pérez, Aleix Conesa, Judith Arboleda Navarro

LEITAT Technological Center, Terrassa, Spain.

Mira Petrovic

Institut Català de Recerca de l'AIGUA (ICRA), Girona, Spain.

Julia Garcia Montaño

LEITAT Technological Center, Terrassa, Spain.

*Corresponding author: C/ de la Innovació, 2 08225 Terrassa,Barcelona, faudino@leitat.org, phone: +34 937882300

Abstract

Hospital wastewaters are complex effluents generally treated together with municipal wastewaters. However, pharmaceuticals are poorly biodegradable and hence are increasingly released to the aquatic environment. This study aims investigating the efficiency of ozone (O3) and electro-oxidation (EO) as post-treatment (following a biological process) of hospital wastewaters. First, the optimization of single O3 and EO was performed using a synthetic hospital wastewater composed by 4 pharmaceuticals (carbamazepine (CBZ), carbamazepine-10,11-epoxide (E-CBZ), lorazepam (LZP), ketoprofen (KTP)) in an initial concentration of 1 mg L-1 each, evaluating the removal of pharmaceuticals individually and in mixture. The pharmaceuticals were selected among the ones that resulted to be the less biodegradable

from a previous study on the effluent of a WWTP serving a local hospital. Then, the sequential (EO»O3; O3»EO) and simultaneous combination of O3 and EO (EO+O3) was studied for the mixture of the 4 pharmaceuticals, under the previously determined optimal conditions for the individual technologies. Finally, the best configuration was validated by treating a real hospital wastewater, previously treated by MBBR. The simultaneous combination of O3 and EO allowed the full degradation of CBZ and LZP in less than 5 min and of KTP and E-CBZ in 90 min, in addition to a significant decrease (80%) of TOC after 120 min. Moreover, it was possible to decrease the operational treatment cost by avoiding the use of electrolytes and by reducing the dose of ozone required for the > 95% degradation of the selected pharmaceuticals (if compared to the dose required when ozone was applied individually).

Keywords: CECs, hospital wastewater, electro-oxidation, ozonation, AOPs, pharmaceuticals.