Closing Gaps of Knowledge with respect to Advanced Chemical Oxidation Processes for the Removal of Contaminants of Emerging Concern

GAPS

ΚΟΥΛΤΟΥΡΑ/ΒΕΝΣ/0412/24

Deliverable 12 (D12) of Work Package 6 (WP6):

A report with the results obtained in WP6

Nicosia, September 2015

Brief summary

The degradation of erythromycin (ERY) and ethylparaben (EtP) in urban wastewater effluents during ozonation was investigated under different experimental conditions. Both substrates were rapidly eliminated within 2 min of contact time at low ozone (O_3) dose of 0.3 mg L^{-1} and the experimental data acquired in the initial reaction phase were well fitted in the pseudo-first-order kinetic model. The ratio of $HO^{\bullet}$- and O_3-exposure (R_{ct}) at the inherent pH was found to be 1.9×10^{-8} using the competition kinetics approach. The degradation of ERY and EtP was considerably pronounced at pH 8 compared to acidic pH conditions. It was also shown that both O_3- and $HO^{\bullet}$-mediated pathway are involved in the degradation of EtP, whereas the saturated-rich structure of ERY renders it O_3-recalcitrant. The degradation rate of both substrates was found to be matrix-depended, with the apparent rate constant (k_{app}) being much higher in ultrapure water (UPW) compared to bottled water (BW), humic acid solution (HA) and wastewater effluents (WW). Under the optimum O_3 dose, BrO_3^- concentration was found to be lower than 10 μg L^{-1} at both pH 5 and 8. Five transformation products (TPs) were tentatively elucidated during ERY oxidation, preserving its characteristic 14-membered lactone ring. In the case of EtP, fifteen TPs were detected, with the structural alterations taking place in the ethyl ester chain mainly via hydrogen abstraction and $HO^{\bullet}$ adduct mechanisms. The inhibition observed in root and shoot growth of the tested plant species can be attributed to the oxidation products formed upon dissolved effluent organic matter (dE_fOM) transformation during the process. *E. coli* harbouring resistance to ERY survived ozonation better than EtP-resistant *E. coli*, however neither ERY- nor EtP-resistant *E. coli* were detected after 15 min of ozonation.

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