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 10 (D10) of Work Package 4 (WP4):

A report with the results obtained in WP4

Nicosia, September 2015

Brief Summary

The presence of pathogenic antibiotic-resistant bacteria in aquatic environments has become a health threat in the last few years. Their presence has increased due to the presence of antibiotics in wastewater effluents, which are not efficiently removed by conventional wastewater treatments. As a result there is a need to study the possible ways of removal of the mixtures of antibiotics present in wastewater effluents and the antibiotic-resistant bacteria, which may also spread the antibiotic resistance genes to other bacterial populations. In WP4 the degradation of a mixture of two antibiotics i.e. sulfamethoxazole and clarithromycin, the disinfection of total enterococci and the removal of those resistant to: a) sulfamethoxazole, b) clarithromycin and c) to both antibiotics have been examined, along with the toxicity of the whole effluent mixture after treatment to the luminescent aquatic bacterium *Vibrio fischeri*. Solar Fenton treatment (natural solar-driven oxidation) using Fenton reagent doses of 50 mg L^{-1} of hydrogen peroxide and 5 mg L^{-1} of Fe^{3+} in a pilot-scale compound parabolic collector plant was used to examine the disinfection and antibiotic resistance removal efficiency in different aqueous matrices, namely distilled water, simulated and real wastewater effluents. There was a faster complete removal of enterococci and of antibiotics in all aqueous matrices by applying solar Fenton when compared to photolytic treatment of the matrices. Sulfamethoxazole was more efficiently degraded than clarithromycin in all three aqueous matrices (95% removal of sulfamethoxazole and 70% removal of clarithromycin in real wastewater). The antibiotic resistance of enterococci towards both antibiotics exhibited a 5-log reduction with solar Fenton in real wastewater effluents. Also, after solar Fenton treatment, there were 10 times more antibiotic-resistant enterococci in the presence of sulfamethoxazole than in the presence of clarithromycin. Finally, the toxicity of the treated wastewater to *V. fischeri* remained very low throughout the treatment time.

For more information about the complete Deliverable please send an email to: dfatta@ucy.ac.cy (Dr. Despo Fatta-Kassinos, Director of Nireas-IWRC)