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AOP degradation of emerging organic contaminants: ionizing radiations, ultrasounds, UV-TiO₂ hybrid techniques and their scale-up

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General objective of the activity of our group is the comparison of Advanced Oxidation Processes (AOPs) regarding the organic contaminants that are of main concern in Italy. The first objective of this research was the understanding of the degradation kinetic of ofloxacin in neutral water and the mineralization of complex mixtures by using electron beam (EB) or γ -rays. The second one was the investigation on the synergetic effect of ultrasounds on the photo-catalysis under ultraviolet irradiation. The third objective was the scale-up of a photo-catalytic AOP from the lab-scale (~ 1 L) to the scale for the validation in a relevant environmental (~ 10 L) in agreement with the Technical Readiness Level 5 of the Horizon 2020 EU program. Emerging organic contaminants are becoming a concern because they pass through the regular wastewater treatment plants. Ultraviolet disinfection plants could be easily implemented to advanced oxidation processes by adding appropriate photo-

catalysts, enhancing lamp power, and coupling them to ultrasound. Several emerging contaminants (ofloxacin, diclofenac, carbamazepine, benzophenone-3, benzophenone-4, and triton X-100) among the most frequently detected in the environment have been selected on the base of their chemical characteristics. Lab-scale tests with electron-beam, ultraviolet light, ultrasounds, and TiO₂ microparticles have been carried out to evaluate cost-benefit of these synergetic techniques. The processes, initiated both by electron-beam and γ -rays on ofloxacin or on a multi-component solution, show that pollutants are removed according to a first order process vs. dose. A 5 L photo-reactor equipped with ultraviolet lamps (144 W), about 0.25 m² TiO₂, and a recycle pump has been built and tested reaching 38% of mineralization in 6 hours.

M. Saracino; S. Emmi, A. Zanelli "Water remediation 2.0: Advanced oxidation processes"; La Chimica e l'Industria, (2015).

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ISOF 12 – Meeting Room (1st floor)
CNR Research Area
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