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Oxydation of micropollutants using membrane contactors for the diffusion of ozone

The use of ozone for the disinfection of sewage is becoming increasingly significant, especially when a high degree of treatment is required. Usually, ozone in water treatment is injected in the form of bubbles, with disadvantages such as operational costs, stripping of volatile organic compounds, high footprint of the reactor (column), mass transfer limitations (leading to high energetic costs) and foam generation. By using a bubbleless operation, membrane contactors can overcome these challenges. Indeed, membrane contactors have been pointed out as a good alternative for the transfer of gas to the liquid phase. These devices enable a defined interfacial area and promote non-dispersive mass transfer, reducing gas losses. The advantages of membrane contactors are a high area/volume ratio, a high energetic efficiency and a great modularity, therefore these technologies could be easily scaled up.

The global aim of this project is to evaluate membrane contactors as an alternative to chamber reactors for the treatment of refractive pollutants in wastewater treatments using ozone, in particular the pharmaceutical ones. The specific objectives of this thesis are firstly to characterize the transfer of ozone through membrane contactors, then to evaluate the degradation efficiency of the targeted micropollutants, and finally to model the reaction conditions in the reactor for an optimization purpose. Thus, this project combines experimental work with the development of a numerical model (based on COMSOL Multiphysics) as a tool for a better characterization and understanding of the physical and chemical phenomena which determine the performance of the process.