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Development of a high mass-transfer dielectric barrier discharge reactor dedicated to the degradation of persistent organic pollutants in water OLIVIER LESAGE, Laboratoire de genie des procedes plasma et traitement de surface, France / Laboratoire de biomateriaux et bioingenierie, Canada, JEAN-MARC COMMENGES, Laboratoire des Reactions et Genie des Procedes, France, WILLY MORSCHEIDT, Laboratoire de genie des procedes plasma et traitement de surface, France, XAVIER DUTEN, Laboratoire des Sciences des Procedes et Materiaux, France, MICHAEL TATOULIAN, SIMEON CAVADIAS, STEPHANIE OGNIER, Laboratoire de genie des procedes plasma et traitement de surface, France
— Some organic compounds such as pCBA are refractory to ozone oxidation. In that context, an AOP based on the use of a dielectric barrier discharge (DBD) working in air at atmospheric pressure has been developed. The process consists in a Thin Falling Film Plasma Reactor (TFFPR) where a discharge is created in the gaseous gap between a high voltage electrode and the surface of the water to treat. To improve radical species transfer, a microstructured plate was used to obtain a thin water film flow. Solution of pCBA was treated in the TFFPR with two different plates (SS316L and Brass). The concentrations of pCBA, NO3- and NO2- were measured using liquid chromatography. To understand the influence of the surface of the material, the NOx concentration on the gas phase and to quantify the flux of HO, we made a simulation with a CFD code. Our results indicated that the DBD directly in contact with liquid can be efficient to oxidize persistent molecules (80% after 30 min) and are brought out the production of HO in the liquid phase. Indeed, the simulation showed that 50% of HO are trapped by NO2-. The efficiency can be increasing by avoiding NOx formation. For brass, the efficiency is reduced to 50% due to corrosion reactions of the material.

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