

Slurry photocatalytic membrane reactor technology for anti-cancer drugs removal from wastewater

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The potential of slurry photocatalytic membrane reactors (PMR) to degrade anti-cancer drugs is presented in this work as an emerging technology for wastewater treatment. Such compounds and their metabolites, as well as their degradation products have genotoxic and mutagenic effects. Therefore safe strategies should be developed in order to collect and degrade the micro-pollutants using appropriate treatment technologies. In this study, a lab scale slurry PMR has been used to degrade 4 cytostatic drugs commonly delivered in Belgium: cyclophosphamide, 5-fluorouracil, gemcitabine and ifosfamide. The slurry photoreactor and tubular membrane module were studied in batch modes. Firstly pCBA was used as a probe for hydroxyl radical production and optimization of suspended catalyst load. Based on these results, anti-cancer drugs were spiked (500 µg/L) in real wastewater treatment plant effluents and drugs removals were measured using liquid chromatography (UPLC-MS). In addition, the energy required to decrease pollutant concentration of one order of magnitude was calculated by atrazine actinometry. The electrical energy order of the pollutants was classified as 5-fluorouracil < capecitabine < cyclophosphamide < ifosfamide which is in agreement with literature data. Beside photocatalytic degradation, successful separation of catalyst particles was performed by ceramic membranes operating in a cross-flow mode. This last results open doors towards micro-pollutants removal by continuous operation of photocatalytic membrane reactor.

Submission to an oral presentation or poster

The first authors is a PhD student with 3 years of research experience.