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Advanced treatment of membrane concentrate with pulsed corona discharge

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ABSTRACT

The aim of this study was to examine the feasibility of pulsed corona discharge (PCD) oxidation for treatment of the nanofiltration concentrate from a municipal wastewater treatment plant. The concentrate studied contained high concentrations of micropollutants, since it was produced in the two stage nanofiltration process and filtered to a very high volume reduction factor of 300. The goal of the PCD treatment was to decrease the amount of micropollutants and to increase biodegradability of the concentrate. The energy dose (10 kWh/m³) used in the PCD treatment was sufficient to reduce 21% of organic carbon present in the concentrate. However, the PCD treatment degraded efficiently some of the target micropollutants: higher than 92% degradation of diclofenac, carbamazepine, citalopram and furosemide was reached. Degradation rate of the beta-blockers (bisoprolol, sotalol, metoprolol) as well as ketoprofen and N,N-diethyl-meta-toluamide (DEET) was lower: 82, 51, 33, 44 and 50% respectively. The BOD₇/COD ratio of the NF concentrate was also increased 3.7 times due to the oxidation.

Based on a linear regression analysis, molecular weight of the micropollutants, the amount of double bonds in their structure and the hydroxyl radical degradation constant were identified as the determining parameters for the degradation rate of the micropollutant in the PCD oxidation. This lead to a conclusion that presence of hydroxyl radicals was more critical for the degradation of the micropollutants than the presence of ozone under the examined conditions.

Keywords:

Advanced oxidation

Micropollutant

Nanofiltration

Pharmaceuticals

Regression analysis

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