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REUSE OF PHOTO CATALYTS FOR ADVANCED DEGRADATION OF SOME RECALCITRANT POLLUTANTS FROM AQUEOUS SYSTEMS USING UV-VIS/TiO_2 AND UV-VIS/H_2O_2/TiO_2 SYSTEMS

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Introduction

Advanced Oxidation Processes (AOPs) represents an alternative for degradation of refractory pollutants that are not adequately removed by classical physical-chemical and biological processes used within wastewater treatment plants. AOPs are mainly used for removal of toxic and non-biodegradable pollutants and involves generation of hydroxyl radicals and other oxidizing species that degrades organic pollutants from wastewater. Four emerging pollutants were included in the study, two endocrine disruptors: methyl paraben (MEP) and dimethyl phthalate (DMP) and two pharmaceutical compounds: ciprofloxacin (CIP) and flutamide (FT). The possibility to reuse the photo catalyst in as many treatment cycles as possible was investigated for all target pollutants using a membrane separation process in order to recover and reuse the catalyst (TiO_2).

Materials and methods

UV-VIS/TiO_2 system was used for degradation of MEP and CIP, UV-VIS/H_2O_2/TiO_2 system was used for degradation of DMP, and FT. Photo catalytic experiments were performed using an UV-VIS Heraeus type reactor equipped with a TQ150-Z3 lamp and catalyst separation was performed using a Koch Labell CF 1 CrossFlow membrane module. TiO_2 was purchased from Merck and studied target pollutants were purchased from Sigma. TiO_2 separation was realized using a 10 kDa PES membrane purchased from Sartorius.

Results and conclusions

Degradation of studied compounds was performed in the optimum operating parameters that were defined in previous research works. After UV treatment, the catalyst was separated using the membrane module at a working pressure of 4 bars. The concentration of studied compounds was determined both after UV treatment and after catalyst separation via membrane process. Distilled water flows were also determined in order to monitor membrane clogging. The same membrane was used for TiO_2 separation for all studied compounds and catalyst was reused during four treatment cycles for each studied pollutant. Table 1 is summarizing the main experimental results:

Table 1. Removal of studied pollutants from aqueous system

Pollutant	*CIP*	*FT*	*DMP*	*MEP*
System	UV-VIS/TiO_2	UV-VIS/H_2O_2/TiO_2	UV-VIS/H_2O_2/TiO_2	UV-VIS/TiO_2
$[TiO_2]_0$, mg/L	400	100	300	200
η, % after UV	99.27-99.95	98.47-99.25	99.36-99.49	99.68-99.71
η, % final	99.70-99.97	99.25-99.44	99.74-99.83	99.83-99.88

Experimental results proved that the photo catalyst can be used at least for four treatment cycles for each target compound. Comparison between separation flows and distilled water flows proved that 10 kDa PES membrane can be used for at least 16 treatment cycles as it is presented within Figure 1.

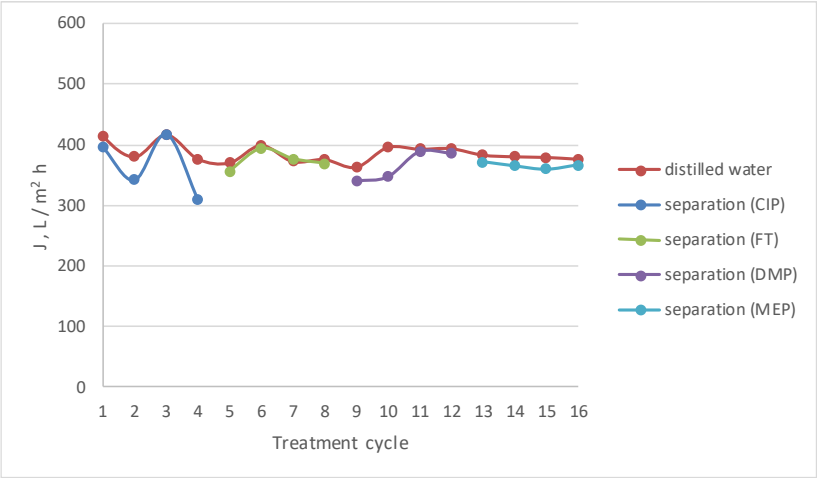

Fig. 1. Catalyst separation and distilled water flows through membrane

The obtained experimental data shows that membrane is playing a double role: on one hand for catalyst separation in order to reuse it and on the other hand for the advanced removal of target compounds.

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