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Removal of anthropogenic pollution markers with a nitrogen-doped reduced graphene oxide-PVDF membrane

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This work presents, for the first time, the efficiency of a continuous flow mode system for water disinfection recruiting the functionalities of a carbon-based catalytic membrane for persulfate activation – an important alternative to the application of conventional powder catalysts in water treatment.

To achieve our goal, nitrogen-doped reduced graphene oxide was obtained using melamine as a doping agent (rGO-M), according to the methodology reported elsewhere [1]. Then, a catalytic poly(vinylidene fluoride) (PVDF) membrane, with a good performance for the degradation of fluoroquinolone antibiotics at ppb level in water, was prepared as previously described [2]. To understand the contribution of each membrane component in the reduction of the microbial abundance, the efficiency of the rGO-M–PVDF membrane was compared to that of a PVDF flat membrane, with and without added persulfate, after 6 hours of operation in continuous flow mode using a suspension of faecal indicator bacteria as the feed.

The obtained results allowed us to conclude that the non-catalytic PVDF membrane does not activate persulfate, but retained 98.5% of the initial abundance of *Escherichia coli* and *Enterococcus faecalis.* The antimicrobial properties of rGO-M contributed to remove 99.9% of these faecal indicators when the system was operated with the rGO-M–PVDF membrane without added persulfate. When the system was operated with the catalytic rGO-M–PVDF membrane and persulfate, the microbial load in the treated water was reduced to values below the detection limit, demonstrating the capacity of the catalytic membrane to activate persulfate. Moreover, the amount of microorganisms retained on the membrane decreased, suggesting that this system has enhanced anti-fouling properties.

Similar results were obtained when the proposed treatment system was used to disinfect river water collected nearby the supply of a drinking water treatment plant located in Northern Portugal, with values below the detection limit being obtained for total heterotrophic bacteria, enterobacteria and enterococci in the treated water (even after 24 h operation in continuous flow mode). Moreover, microorganism reactivation and the effect of disinfection on antibiotic-resistance genes (ARGs) were studied. For that purpose, the regrowth of microorganisms and selected genes (16S rRNA, *intI*1, bla_{TEM} and *sul*1) in the treated water, and after 7 days of storage, was evaluated. The results suggest that the proposed system can be a good alternative to other advanced oxidation technologies used for drinking water production.

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References

[1] Pedrosa, M., Drazic, G., Tavares, P. B., Figueiredo, J. L., & Silva, A. M. T., Chemical Engineering Journal, 369 (2019) 223-232.

[2] Vieira, O., Ribeiro, R. S., Pedrosa, M., Ribeiro, A. R. L., & Silva, A. M. T., Chemical Engineering Journal, 402 (2020) 126117.