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Polysulfone-Graphene Oxide Hollow Fiber Membranes for Advanced Water Remediation

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Water sources are increasingly affected by chemical contamination by emerging contaminants, e.g. chemicals for industrial uses, pharmaceuticals, personal care products, heavy metals, and perfluoroalkyl substances. Standard water purification technologies are inefficient or ineffective in the removal these pollutants from water, thus they represent a severe risk for the health of humans and the ecosystem. Nanomaterials, in particular graphene related materials, represent a promising source of technologies for the selective and highly efficient removal of such substances and ions from water. Here, we report on composite polysulfone-graphene oxide (PSU-GO) membranes showing synergic ultrafiltration and adsorption capabilities, and on their application for drinking water purification from emerging contaminants. Doping with amount lower than 5% w/w of GO resulted in membranes with porosity lower than 6 nm and related filtration modules with permeability of 300 L/h/bar*m^2 (as the standard PSU ones). These modules showed an adsorption efficiency of up to 14 μg/g toward a mixture of PFAS, to >1000 μg/g toward some heavy metals. These results outperform those of granular activated carbon, the industrial sorbent benchmark, in the same conditions (2 μg/g and 100 μg/g, respectively). No release of GO from the modules was proved by surface enhanced Raman spectroscopy (SERS), at the current state of the art detection limit for GO nanosheets in water (0.1 μg/L). [1-3]

References

[1] Bianchi et al., Faraday Discussions, 227 (2021) 274-290
[2] Bianchi et al., Journal of Membrane Science, 658 (2022) 120707
[3] Khaliha et al., Separation and Purification Technology, 300 (2022) 121826

Figures

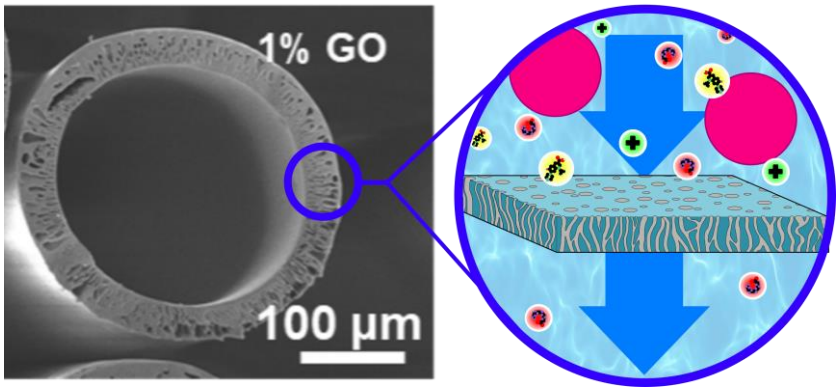

Figure 1: SEM image of a polysulfone-graphene oxide (PSU-GO) hollow fiber, and scheme of its functions.