

## Selective ion transport in graphene oxide membranes and cartridges

Lidia Lancellotti<sup>a</sup>, Antonio Bianchi<sup>a</sup>, Manuela Melucci<sup>a</sup>, Chiara Zanardi<sup>a,b</sup>, Vincenzo Palermo<sup>a,c</sup>

<sup>a</sup>Institute for the Organic Synthesis and Photoreactivity, National Research Council, Bologna, Italy

<sup>b</sup>Dept. of Chemical and Geological Sciences, University of Modena and Reggio Emilia, Modena, Italy

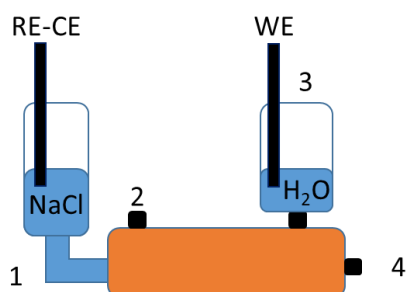
<sup>c</sup>Chalmers University of Technology, Dept. of Industrial and Materials Science, Gothenburg, Sweden

lidia.lancellotti@isof.cnr.it

The growing of the world population and the consequent decrease in drinking water due to pollution requires the development of new technologies capable of desalinating sea water. In the latest years two dimensional materials, like graphene and graphene oxide (GO) are used to produce membrane and new coatings useful to ion storage and filtering applications<sup>1</sup>. We investigated the difference in the transport of monovalent ions ( $\text{Na}^+$ ) and bivalent ions ( $\text{Ca}^{2+}$ ) through graphene oxide membranes (GOM) forced by an electric potential. In view of a future industrial application of this phenomenon, we realized GO coatings on hollow fibers<sup>2</sup> (HF) to realize innovative filtration modules: GO layers were immobilized inside polyethersulfone-polyvinylpyrrolidone (Versatile PES®) hollow fibers to achieve selective transport of  $\text{Na}^+$  inside the cartridge.<sup>3</sup> The transport inside the HF system was activated by applying an electric potential of -0.5V for 120 minutes, continuously measuring the ion transport consequently induced through in-situ impedance measurements. Spectroscopic analysis of the resulting filtered solutions confirmed the amount of ions transported by cartridges possessing a different amount of GO and also containing a cationic polymer, namely polyethylenimine (PEI), covalently linked to the GO coating. These measurements led us to unravel the mechanism of ion transport induced by the GO coating.

### References

- [1] V. Quintano, A. Kovtun, F. Biscarini, F. Liscio, A. Liscio, V. Palermo, *Nanoscale Adv.*, 2021, 3, 353–358.
- [2] A. Kovtun, A. Bianchi, M. Zambianchi, C. Bettini, F. Corticelli, G. P. Ruani, L. Bocchi, F. Stante, M. Gazzano, T. D. Marforio, Matteo Calvaresi, M. Minelli, M. L. Navacchia, V. Palermo, M. Melucci, *Faraday Discuss.*, 2021, 227, 274-290
- [3] S. Mantovani, S. Khaliha, L. Favaretto, C. Bettini, A. Bianchi, A. Kovtun, M. Zambianchi, M. Gazzano, B. Casentini, V. Palermo, M. Melucci, *Chem. Commun.*, 2021, 57, 3765-3768.



**Figure 1:** experimental for the ion transport. WE: working electrode, CE: counter electrode, RE: reference electrode