

## SUPPLEMENTARY INFORMATION

### Enhanced desalination performance in compacted carbon-based reverse osmosis membranes

*Hiroki Kitano,<sup>†</sup> Kenji Takeuchi,<sup>‡,||</sup> \* Josue Ortiz-Medina,<sup>||,¶</sup> \* Isamu Ito,<sup>‡</sup> Aaron Morelos-Gomez, <sup>‡,||</sup> Rodolfo Cruz-Silva,<sup>‡,||</sup> Taiki Yokokawa,<sup>‡</sup> Mauricio Terrones,<sup>‡,||</sup> Akio Yamaguchi,<sup>†</sup> Takuya Hayashi,<sup>‡,||</sup> and Morinobu Endo,<sup>‡,||</sup>*

<sup>†</sup> *Kitagawa Industries Co., Kasugai City, Aichi Prefecture 480-0303, Japan.*

<sup>‡</sup> *Global Aqua Innovation Center, Shinshu University, Nagano City, Nagano Prefecture 380-8553, Japan.*

<sup>||</sup> *Research Initiative for Supra-Materials, Shinshu University, Nagano City, Nagano Prefecture 380-8553, Japan.*

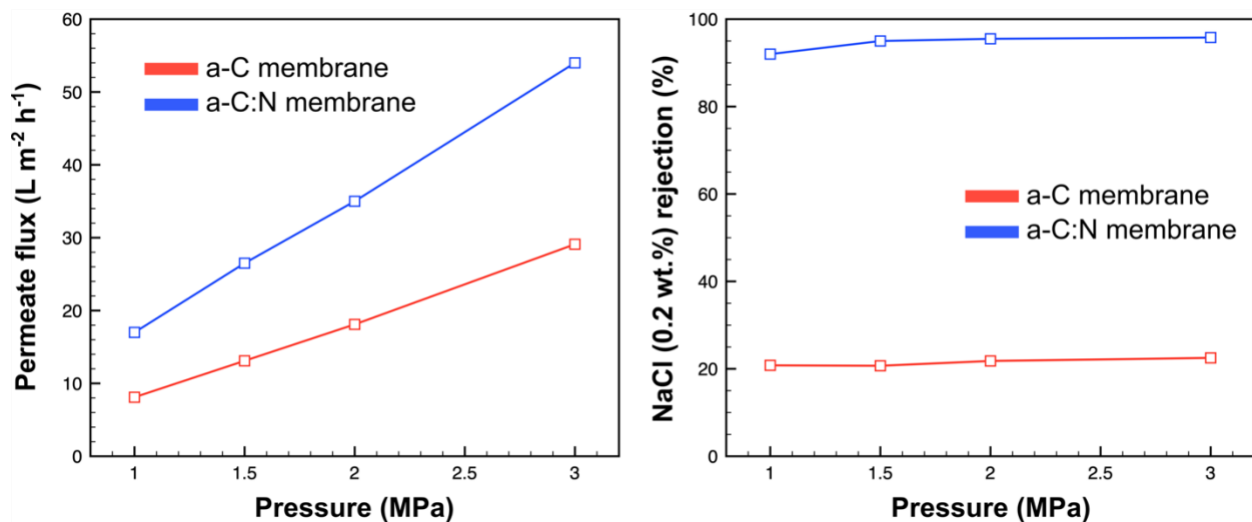
<sup>||,¶</sup> *Universidad Panamericana, Facultad de Ingeniería, Josemaría Escrivá de Balaguer 101, Aguascalientes, Ags 20290, México.*

<sup>‡,||</sup> *Department of Physics, Department of Chemistry, Department of Materials Science and Engineering, and Center for 2-Dimensional and Layered Materials, The Pennsylvania State University, University Park, PA 16802, USA.*

\* Corresponding authors emails: [takeuchi@endomoribu.shinshu-u.ac.jp](mailto:takeuchi@endomoribu.shinshu-u.ac.jp), [jortizm@up.edu.mx](mailto:jortizm@up.edu.mx)

#### Low-pressure effects on a-C and a-C:N based membranes

Ultrathin (30 nm) pure amorphous carbon (a-C) and nitrogenated a-C (a-C:N) membranes were previously evaluated for NaCl rejection and water permeability performance.<sup>1</sup> The results (including the ones for a-C) are reproduced in figure S1 for reference. These results show the membranes performance for low intermembrane pressure range (1.0 up to 3.0 MPa), where the a-C:N outperforms both NaCl rejection and water permeability. Salt rejection is not a function of the applied pressure, at least in this low-pressure range.



**Figure S1.** Water permeability (left) and NaCl rejection (right) performance for a-C and a-C:N based membranes, for intermembrane pressure values of 1.0, 1.5, 2.0 and 3.0 MPa, which are below the high-pressure operating conditions analyzed in the main manuscript (5.5 MPa).

## References

- 1 J. Ortiz-Medina, H. Kitano, A. Morelos-Gomez, Z. Wang, T. Araki, C.-S. Kang, T. Hayashi, K. Takeuchi, T. Kawaguchi, A. Tanioka, R. Cruz-Silva, M. Terrones and M. Endo, *NPG Asia Mater.*, 2016, **8**, e258–e258.