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Keynote Lecture: Biomimetic membranes incorporating artificial water channels for highperformance water reverse osmosis desalination

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Biomimetic membranes incorporating artificial water channels for high-performance water reverse osmosis desalination

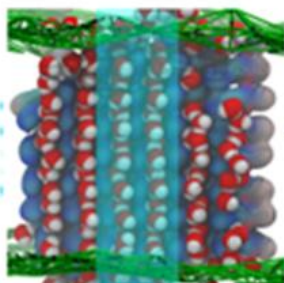
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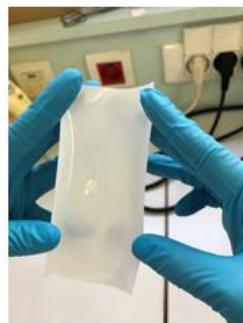
Inspired by biological models, artificial water channels can be used to overcome the permeability/selectivity trade-off of traditional desalination membranes. We demonstrate that rational incorporation of I-quartet artificial water channels in composite polyamide membranes synthesized *via* interfacial polymerization, provide defect free biomimetic membranes with intrinsic water-to-salt permeability on the operational SWRO-BWRO/TWRO desalination pressure and high/medium/low salinity conditions. The best biomimetic composite membranes, which can be easily scaled for industrial standards ($> \text{m}^2$), provide remarkable 99.5% rejection of NaCl and 91.2% boron rejection with water flux of $75 \text{ L m}^{-2} \text{ h}^{-1}$ at 65 bar applied pressure with a 35000 ppm NaCl feed solution at pH 8, representative of seawater desalination. This flux is more than 75% higher than that observed with current state-of-the-art membranes with equivalent solute rejection, translating into an equivalent reduction of the membrane effective area for the same water output and a $\sim 12\%$ reduction of the required energy for desalination.

« Towards the ultimate reverse osmosis desalination membranes »

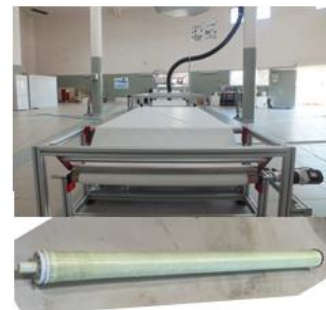
Fundamental science
Artificial Water Channels



Lab scale Membranes



Industrial Modules



Acknowledgments



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References

1. M. Di Vincenzo, A. Tiraferri, V.-E. Musteata, S.Chisca, R.Sougrat, L.-B. Huang, S. P. Nunes, M. Barboiu, Nature Nanotechnol. 2021, 16, 190-196
2. L.-B. Huang, M. Di Vincenzo, M. Göktuğ Ahunbay, A. van der Lee, D. Cot, S. Cerneaux, G. Maurin*, M. Barboiu, J. Am. Chem. Soc. 2021, 143, 14386-14393.
3. M. Di Vincenzo, A. Tiraferri, V.-E. Musteata, S. Chisca, M. Deleanu, F. Ricceri, D. Cot, S. P. Nunes, M. Barboiu, Proc. Natl. Acad. Sci., 2021, 118(37), e2022200118.

