Highly Permeable and Selective Reverse Osmosis Membranes incorporating Artificial Water Channels

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Current commercial reverse osmosis (RO) membranes for desalination comprise an active layer of polyamide (PA) fabricated by interfacial polymerization of m-phenylenediamine with trimesoyl chloride, giving rise to fully aromatic films. However, traditional PA membranes suffer from inherent limitations which reduce their performance. We report the successful development of bio-inspired membranes using an approach to upscale the molecular/supramolecular artificial water channels (AWCs) systems to generate defect-free highly selective membrane materials readily applicable in RO applications. Results demonstrate that our bio-inspired films, embedding densely packed Å-scale bio-mimetic imidazole-quartet water channels, overcome the perm-selectivity trade-off of current commercial desalination PA membranes. They achieve a large improvement of 200% in water permeance (up to 2.8 LMH/bar) while maintaining excellent NaCl rejection (observed rejection > 99.5%) in the desalination of seawater.