

NOVEL MEMBRANE FOR RESOURCE RECOVERY FROM SWRO BRINE

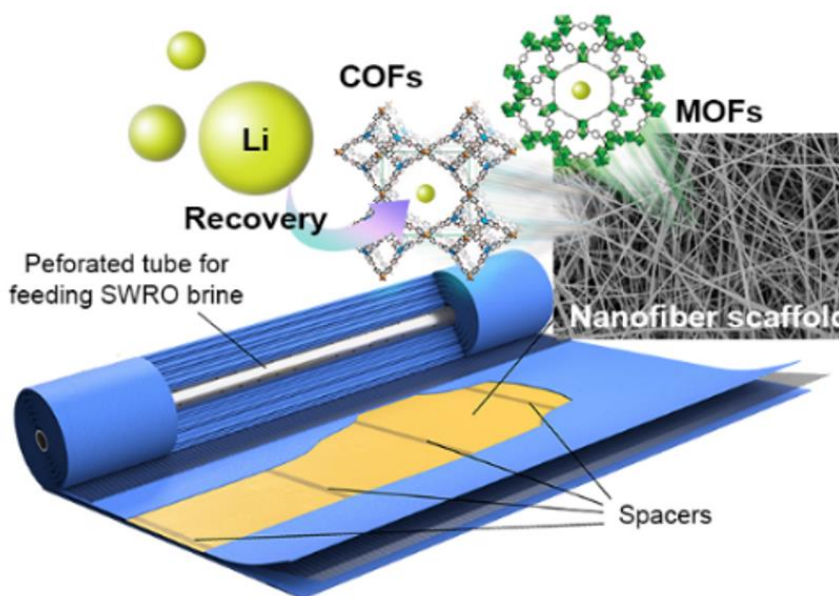
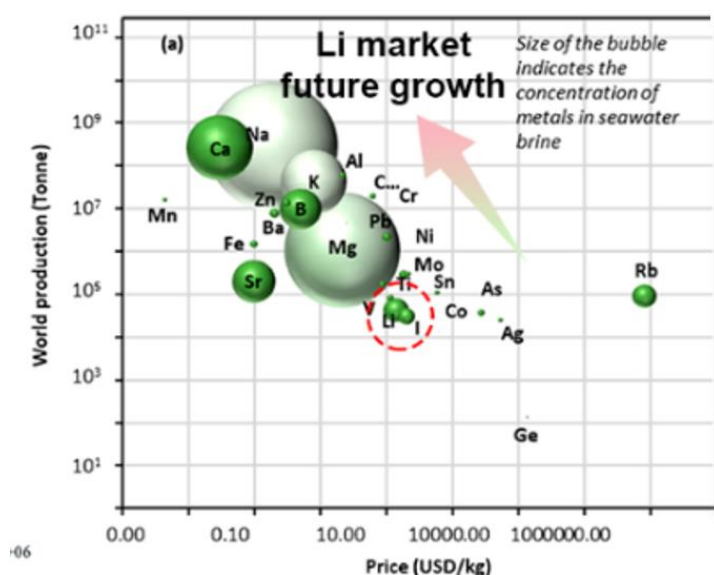
Abstract:

Lithium (Li) is a high-value resource that sees >1000-fold higher amount in seawater than on land. In Singapore, we produce a massive amount of seawater reverse osmosis (SWRO) brine, which puts us in a good position to recovery this resource. However, the challenge is that the Li concentration remains low despite SWRO brine being a concentrated by-product.

Herein, we propose a nano-enabled nanofibrous membrane scaffold as an adsorptive harvesting device to address this pervasive problem. Adsorption is to date the most promising technology for low concentration Li recovery and nanofibrous scaffold can help mitigate the low efficiency due to granulated compaction in a fixed-bed packed column. The amalgamation of both adsorption and nanofibrous membrane technology will be supported by tailored design and synthesis of a new class of porous covalent organic frameworks as high-performance chemically-stable nanoadsorbents with unique pore functionalization for high Li selectivity. Nanofibrous membrane scaffolds will be supported by the electrospinning technique to optimize fiber diameter, porosity and surface area for maximizing loading and mechanical strength. In total, we propose four work packages (WPs) divided into two phases. Phase 1 includes WP1 and WP2 focusing on nanoadsorbents design and synthesis and nanofibrous scaffold fabrication, while Phase 2 includes WP3 on system integration and testing, and WP4 on techno-economic analysis. Unlike other studies, this proposal sees through the entire course of Li recovery from capture right to the conversion to battery-grade lithium carbonate. Our techno-economic analysis will cover every single aspect to give PUB a holistic cost-benefit insight into our technology.

Beyond SWRO brine, we will also demonstrate the potential of our harvesting device for synthetic Salt Lake brine mining. For this reason, our proposal has garnered tremendous support from corporate heavyweights including the chemical industry and an NRF-backed early-stage technology investment company for potential future commercialization.

Nano-Enabled Adsorptive Membrane Scaffolds as Harvesting Devices for Precious Lithium Metal Recovery



Our concept of adsorptive harvesting device



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