The COHO
Efficient Carbon Capture and Water Reuse
DOE OFE Award DE-FE0024057

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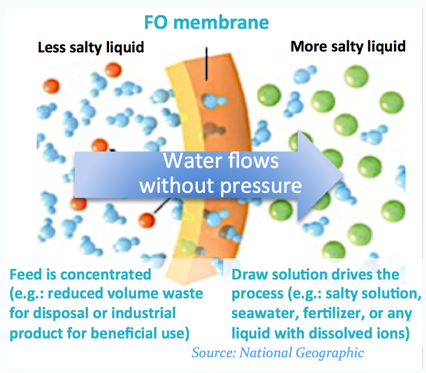
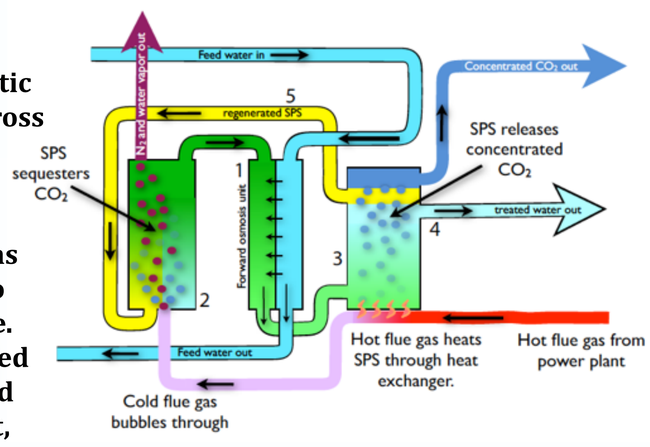
Porifera's Forward Osmosis (PFO) Technology



Forward osmosis is uniquely suited to concentrate high fouling waters that clog up other membranes.

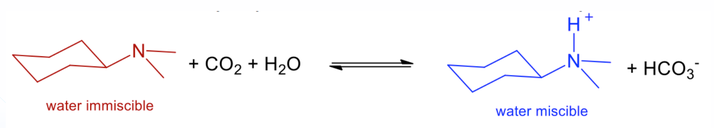
Key Innovations
- **High flux, high selectivity membrane**
- **Most efficient element form factor**
- **Unprecedented reductions in FO system size and cost; highest processing power and smallest footprint.**

How Does COHO Work?

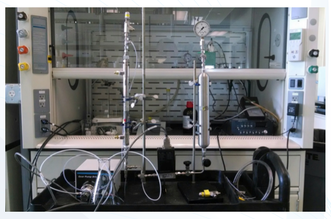


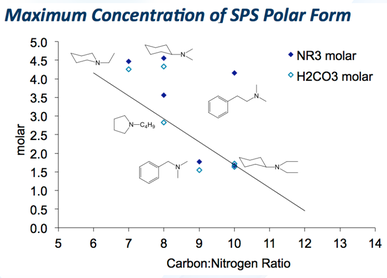
The draw solution purifies wastewater (1) using osmotic potential to drive water across a selective membrane. (2) The draw solution is generated using carbon dioxide from flue gas to switch the draw solute to the miscible aqueous phase. Carbon dioxde (3) is released and clean water is produced (4) by using low-grade heat, switching the drawsolute (5) back to its original immiscible phase for mechanical separation.

About Switchable Polarity Solvents



1) High concentration in water miscible polar form.
2) Can be mechanically seperated when switched to non-polar form.
3) High membrane retention and chemical compatability.



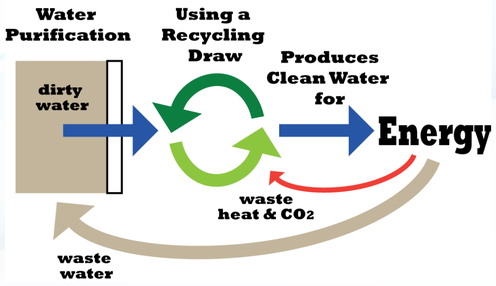


Wilson; Stewart Structure-Function Study of Tertiary Amine Switchable Polarity Solvents, RSC Advances 2014, 4, 11039-11049.

Waste Water Concentration and CO2 Capture Combined

Benefits of COHO:
1) reduce the volume of wastewater
2) expand the capabilities of water treatment
3) facilitate carbon dioxide capture from flue gas
4) use waste heat for draw recovery to reduce the energy costs to treat water

Goals of the Project:
1) Optimize the system process, including: carbon dioxide capture and water processing as well as the draw chemistry.
2) Operate and model the system for installation at a power plant.



Initial Studies

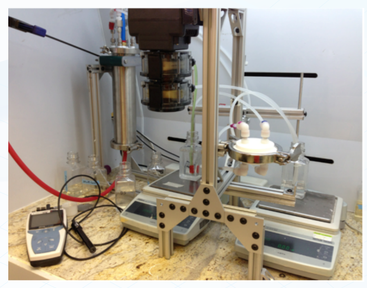
Simulated Power Plant Feeds

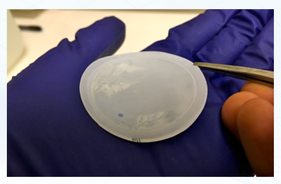
Porifera has developed simulated power plant feeds based off an existing plant that may be ideal for piloting. Target water recoveries ~60 - 80%.

Feed 1: Cooling Tower Feed
TDS = 800 ppm, pH = 9.1
Ca, Na, Ba, Fe, Carbonate, Sulfate, F, Cl

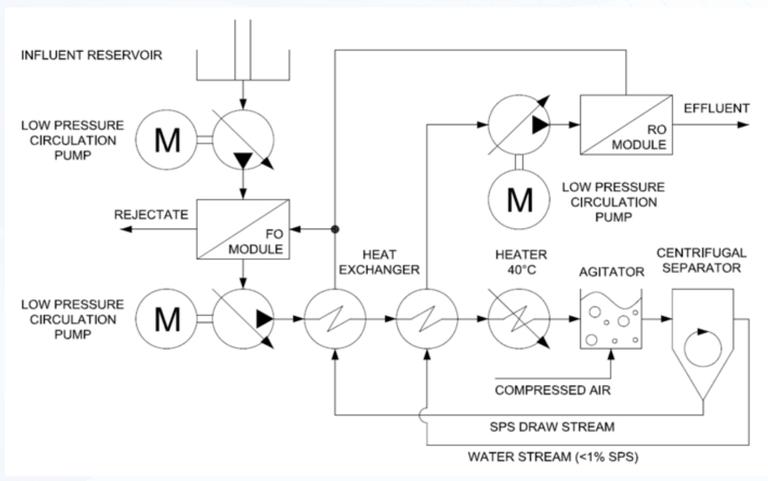
Feed 2: FGD Unit Feed
TDS = 16,000 ppm, pH = 7
Ca, Na, Ba, Fe, Carbonate, Sulfate, F, Cl

Initial studies revealed maximum achievable recoveries, above which membrane scaling occurs. We are developing anti-scalant methods for these challenging feeds.





COHO System Design



Acknowledgements

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