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Disrupting Desalination: Novel Energy Efficient Technologies for Hypersaline Brines

Ngai Yin Yip
Columbia University

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The Doctoral Program in Environmental Management and
MSU Sustainability Seminar Series Present:

Disrupting desalination: novel energy-efficient technologies for hypersaline brines

WHEN: December 11, 4:00 pm WHERE: CELS 120 lecture hall

Ngai Yin Yip
Columbia University



Bio. Ngai Yin Yip is an Assistant Professor of Earth and Environmental Engineering at Columbia University. He received his doctoral degree in Chemical and Environmental Engineering from Yale University, where his dissertation work on novel membrane technologies for the sustainable production of energy and water earned the CH2M Hill/AEESP Outstanding Doctoral Dissertation Award in 2014. Prior to Columbia, he pursued postdoctoral research at the Singapore Centre for Environmental Life Sciences Engineering. He completed his Civil and Environmental Engineering BEng degree in Nanyang Technological University of Singapore. His current research is focused on advancing highly energy-efficient desalination technologies, pioneering sustainable resource recovery from waste streams, and developing novel membrane materials for water purification.

Abstract. Management and treatment of hypersaline brines, e.g., produced water from oil and gas extraction, zero liquid discharge effluent, and flue gas desulfurization wastewater, are of growing environmental importance. Prevailing practice of distilling brines is highly energy-intensive and costly because the evaporation of water is enthalpically unfavorable. Here, we present two novel technologies for hypersaline desalination: cascading osmotically mediated reverse osmosis (COMRO) and temperature swing solvent extraction (TSSE). The first technology, COMRO, utilizes the novel design of bilateral countercurrent reverse osmosis stages to lessening the osmotic pressure difference across the membrane, thereby simultaneously depressing the hydraulic pressure needed and reducing energy demand. The second technology, TSSE, is membrane-less, not based on evaporative phase-change, and utilizes low-grade waste heat to drive the separation. Working principles of the technologies are presented, the desalination performance are examined, and implications for the treatment of hypersaline brines are discussed.

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