

# Chemical Engineering Doctoral Defense

Synthesis of polymeric membranes and their applications  
in desalination and water purification


School for Engineering of Matter, Transport and Energy

**Yusi Li**

Advisor: Mary Laura Lind

## Abstract

Freshwater as the resource for the survival of human and all lives on earth is very precious but scarce. The shortage of the original freshwater resources and the interfering activities by human and other natural factors form this issue together. To reduce the water supply pressure and deterioration of freshwater systems (for example, river, wetland, and groundwater), the quantity-increase and the quality-increase strategies should be implemented at the same time. Therefore, corresponding membrane technologies have been developed to achieve water purification with high efficiency and low cost. For desalinating seawater and other types of saline water, pervaporation has been proved that has the potential to complete desalination with salt rejection rate over 99% when dealing with high salinity water that reverse osmosis (RO) cannot handle. In this dissertation, two types of pervaporation desalination membranes (nanophotonic-enhanced membrane and free-standing sulfonated membrane) have been presented and discussed, to evaluate the potential of pervaporation to desalinate seawater and saline water with more complex ion composition, and the possibility of achieving zero liquid discharge in the desalination field when having pervaporation as the assistance. For mitigating polluted water that caused by human activities, especially agricultural activities, electrodialysis is an effective method to remove specific ions from water, and it does not require extra chemical cost or regeneration. A type of anion exchange membrane inspired by ion exchange resins was synthesized and tested, and the performance on nitrate removal has been evaluated in this dissertation.



April 10, 2023; 2:30 PM; ECG G335;

Zoom Link: <https://asu.zoom.us/j/6385107911>