ENGINEERING POLYMERS TO STUDY STRUCTURE/PROPERTY RELATIONSHIPS IN DESALINATION MEMBRANES

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Polymer membranes are used in desalination processes that separate ions from water, such as reverse osmosis (RO). State-of-the art RO processes commonly use interfacially polymerized, cross-linked aromatic polyamide membranes. While RO using interfacially polymerized polyamides is a thermodynamically efficient technique for seawater desalination, it is less efficient for ion/water separations performed on non-traditional water sources such as municipal and industrial wastewater, which often have larger concentrations of ions/scalants than seawater. It is desirable to increase the efficiency of desalination processes using non-traditional water sources because seawater desalination is not feasible in many areas. One issue decreasing the efficiency of such desalinations is that amide linkages in state-of-the-art polyamides are susceptible to oxidative degradation via chlorine based compounds. Increasing the efficiency of non-traditional desalinations requires new polymers with different chemistries to address the degradation issues facing polyamides.

To engineer polymers that exhibit both favorable desalination properties and chemical stability, knowledge of how specific polymer structural elements influence membrane transport properties is needed. Thus, being able to synthesize well-defined polymers that can be used to study systematic polymer structure/property relationships would help efforts to engineer desalination polymers for non-traditional ion/water separations. Here, I will discuss an example where polymer reaction engineering plays a role in creating polymer systems to test the influence of specific polymer structural elements on ion and water transport properties. I also will discuss characterization techniques relevant for desalination. Specifically, I will discuss a recent study where we chemically modified a series of chlorine tolerant polysulfone polymers to incorporate methoxy group functionality along the backbone polymer to probe how that modification influenced polymer ion and water transport properties. Overall, this presentation stresses the importance of synthesizing polymer materials with well-defined structure to inform the development next generation desalination materials.