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MONASH University

Faculty of Engineering
Summer Research Program 2022-2023

Project Title: Interfacial Photopolymerisation

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Objective

The objective of this project is to perform interfacial, radical-mediated photopolymerisations using vinyl and ring-opening monomers to yield untra-thin films and assess the influence of reactants and reaction conditions on the polymerization rate, reaction extent, and porosity of the generated films.

Project Details

Although the separation selectivity of a membrane is determined by its chemical make-up and structure, the flux through a membrane scales inversely with its thickness; thus, increasing the flux of a membrane can be readily achieved by simply decreasing its thickness. Moreover, for particularly expensive materials, decreasing the film thickness can yield significant fabrication cost reductions. Owing to the mechanical fragility of ultrathin films, membranes that utilize such films as the selective layer are often layered, thin film composite (TFC) structures consisting of an ultrathin separating barrier supported by a much thicker and highly porous layer.

This project involves a TFC fabrication approach known as interfacial polymerization, an approach that has served has as the favored method for making commercial reverse osmosis and nanofiltration TFC membranes for over 30 years. The hallmark of interfacial polymerizations is that polymerization occurs exclusively at the interface of two immiscible phases. Whereas conventional interfacial polymerisation proceeds *via* a spontaneous polycondensation co-reaction at the interface of the two immiscible solutions, yielding a sub-micron thick film with a characteristic surface roughness, the spatial and temporal control afforded by interfacial photopolymerisation developed here will enable the fabrication of much thinner films that can incorporate relief patterns. The development of this approach will allow the separation properties of the membrane to be decoupled from its macroscopic mechanical properties, and the molecular discrimination of the membrane to be increased while maintaining economically useful fluxes.

Prerequisites

Completion of coursework units in organic or polymer chemistry would be advantageous.