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Development of Anti-Fouling, Anti-Microbial Membranes for Wastewater Treatment

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Introduction

Over 1 billion people lack access to clean drinking water.

Treatment of impaired waters exposes membranes to feed waters containing biological and abiotic species, which leads to fouling and loss of membrane productivity over time.

Fouling is one of the largest costs associated with membrane processes in water treatment.

Hypothesis

Combining chemical coating (Figure 1) and patterning (Figure 2) will yield membrane surfaces that are more effective at fouling control than either method alone.

Surface Modification Fundamentals

Scheme 1 illustrates the surface modification strategy that uses surface-initiated ATRP

Overall Project Objectives

- Prepare and characterize membranes with surfaces that can switch reversibly between passive and active modes
- Evaluate surface chemistry effects on membrane performance
- Evaluate anti-fouling, anti-microbial function of membranes
- Prepare membranes that are patterned uniformly with chemical coatings that are chosen to limit fouling
- Evaluate the effects of patterning on membrane performance
- Evaluate the anti-fouling function of the chemical patterns

Transmission FTIR

CB-OH was synthesized successfully

Polymerization of CB-OH was successful from silicon substrates

FTIR showed successful, reversible switching between CB-OH and CB-Ring

PEGDE test ink was successfully patterned onto membranes

Future Work

- Vary initiator density and measure resultant polymer chain densities and possible effect on switching pH
- Perform polymerization from glass and QCM sensors for bacterial deposition and release studies
- Perform polymerization from NF and RO membranes and test performance.
- Develop polymeric stamp for patterning membranes
- Test fouling performance with colloidal particles and proteins
- Investigate effectiveness of different patterns and chemical coatings

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