Overview

Forward Osmosis (FO) Membrane Processes
• Osmotic pressure used as driving force across semi-permeable, non-porous membrane
• Favored over hydraulic pressure gradients for wastewater treatment due to increased energy efficiency and economic advantages
• Biofilm is formed due to bacterial adherence and production of extracellular polymer matrix
• Biofouling causes lower water flux, leading to loss in efficiency and higher operating costs

Objectives
• Mitigate biofouling in a FO membrane bioreactor (MBR)
• Observe difference in flux between control and antibiotic (AB) draw solution
• Analyze changes in biofouling on membranes and water flux using sodium metabisulfite (SM) and chloramphenicol (CAM)
• Determine if AB draw is an effective solution for mitigating biofouling and improving water flux

Materials and Methods

Materials
• 3-cell FO-MBR system (Figs. 1 and 2)
• Cellulose triacetate FO membranes
• Control draw solution: 75 g/L NaCl
• SM draw solution: 75 g/L NaCl and 378 mg/L SM
• CAM draw solution: 75 g/L NaCl and 52.5 mg/L CAM
• E. coli JW 3818-1 ΔrfaH in LB broth with 50 mg/L kanamycin

Methods
• Two independent FO loops exposed to same feed conditions
  o Did not use third cell to avoid killing bacteria with AB
• Water flux measurements calculated using mass of liquid in overflow containers
• Draw solutions monitored by conductivity
  o Conductivity kept constant via dosing of 5M NaCl solution and respective concentration of AB (378 mg/L SM or 52.5 mg/L CAM)

Results

Fouling on FO Membranes
• No noticeable biofouling on SM draw membrane at end of the experiment
• Biofouling on CAM draw membrane was present after experiment

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