Organic Micropollutant transport in Forward Osmosis: Influence of draw solute

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Introduction

• FO: researched for treatment of heavily polluted water, presence of organic micropollutants
• Compared to pressure-driven membrane systems, additional influence of draw solute on OMP transport

Objectives

• Test influence of draw solutes (DS) on OMP rejection.
  Current hypothesis: high RSD = high OMP rejection
• Compare OMP transport: FO and simple diffusion
• Solution-diffusion model valid?
• FO membrane: CTA membrane by HTI
• Draw solutes: NaCl, Na2SO4, MgCl2, MgSO4; DS membrane permeability determined in FO tests
• OMPs: 30 compounds, common pharmaceuticals and pesticides
• FO: For each DS: 5 OMP rejection tests at different Jw, with draw solution re-concentration
• Diffusion: diffusion across membrane during 7 days, intermittent sampling, no salts nor Jw present

Materials and Methods

• FO membrane: CTA membrane by HTI
• Draw solutes: NaCl, Na2SO4, MgCl2, MgSO4; DS membrane permeability determined in FO tests
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Results

Diffusion:
OMP cations diffuse fast, anions slow: permeability differs on average by factor of 15
Mechanism: Electrostatic repulsion/attraction, CTA membrane has small negative charge

Forward Osmosis:
• Charged OMPs: declining rejection/increasing membrane permeability at higher salt concentrations
  Strong effect of draw solute valence!

FO OMP membrane permeability, function of RSD: lincomycin
• High rejection of both anionic and cationic OMPs, higher rejection for cationic OMPs
  Hypothesis: Donnan potential: in draw solute, higher diffusion coefficient of anions compared to cations