13TH WORLD FILTRATION CONGRESS
SAN DIEGO CALIFORNIA USA OCTOBER 5-9, 2022

Engineering the Next-Generation of Membrane Materials Needed to Achieve Global Water Sustainability Goals

Prof. Eric Hoek
Department of Civil & Environmental Engineering
UCLA

Today, we have commercially available NF/RO membranes with separation performance ranging from high-divalent/low-monovalent rejecting NF membranes up to seawater RO membranes exhibiting >99.85% TDS rejection, and everywhere between. However, we know of no commercial NF or RO membranes that were specifically developed for removal of uncharged organic solutes from water, which may be present at trace levels in surface and ground waters and higher levels in wastewater effluents. Given the sustainability imperatives driving increasing utilization of impaired, local waters and municipal wastewater as possible potable water sources and the ubiquity of NF/RO membranes in their treatment, it begs the question, "If one were to develop a new NF/RO membrane, specifically for uncharged organic solute rejection, how permeable could it be to water while meeting organic solute rejection goals?" Ultimately, we need to know if NF/RO membranes designed for this purpose would be practically useful and not too expensive or energy intense.

In this talk, I will give a broad overview of our past and present water-energy sustainability research at UCLA and review a few highlights from UCLA NanoMeTeR Lab research over the past two decades, including a few of our attempts to translate our scientific discoveries into commercial innovations. Then, I will present new results--both experimental and theoretical--on uncharged organic transport through NF/RO membranes in the hopes of answering the question posed above, in addition to giving guidance towards the necessary physical-chemical properties of low-pressure NF/RO membranes designed specifically for uncharged organic removal, which may be one of the last unmet challenges in aquatic membrane separations and a key for meeting long term water sustainability goals globally through indirect and direct potable water reuse.