Nanofiltration (NF) is a pressure driven membrane process employed in water treatment that requires pretreatment for reliable operation of the membranes. In this research, a 0.324 million gallon per day (MGD) NF pilot plant was operated for 3,900 run hours at a flux rate of 15 gallons per square foot day to evaluate the feasibility of eliminating sulfuric acid pretreatment from a 14.5 MGD full scale NF pretreatment process by incrementally decreasing the sulfuric acid feed dose to the pilot unit to sequentially achieve a target feed pH value. The NF pilot unit’s feed, permeate, and concentrate stream water quality, pressures, and flows were monitored while the feed water pH was increased from 6.5 to 7.0 to evaluate process performance, productivity, and cost. NF pilot productivity, as measured by specific flux, was found to decline when the pH was changed by 2.33 percent, 9.61 percent, and 4.08 percent in the first stage, second stage, and total pilot system, respectively, with no noticeable corresponding change in pressure drop. Also, the pH change resulted in a net salt passage increase by 24.0 percent, 47.9 percent, and 24.5 percent in the first stage, second stage, and total system, respectively. Scanning electron microscopy and energy dispersive X-ray spectroscopy with superimposed elemental imaging analysis revealed that after piloting had concluded the tail membrane surface was fouled with FeS2, CaCO3, clay, and natural organic matter. However, the foulant was reversible as flux was recovered to normal operating conditions after a membrane cleaning with deionized water, low pH acid, and high pH base. Results of the pilot study would indicate that sulfuric acid could be eliminated from the full scale NF pretreatment process. Based on the pilot study, elimination of sulfuric acid pretreatment would save over $70,000 per year of chemical costs in the full scale process, assuming acid is $0.63/gallon.

Major: Environmental Engineering

Educational Career:
Bachelor's of Environmental Engineering, BS, 2016, University of Central Florida

Committee in Charge:
Steven Duranceau, Chair, Civil, Environmental, and Construction Engineering
Woo Hyoung Lee, Civil, Environmental, and Construction Engineering
Anwar Sadmani, Civil, Environmental, and Construction Engineering

Approved for distribution by Steven Duranceau, Committee Chair, on October 12, 2017.

The public is welcome to attend.