Field testing of PolyCera®, PES, and PVDF ultrafiltration membranes in municipal tertiary filtration: Impacts of membrane polymer chemistry on fouling, cleaning, energy, and cost

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ABSTRACT

A 6-month pilot-scale field study was conducted to investigate the performance of three polymeric ultra filtration membranes for tertiary filtration within a Southern California municipal water recycling plant. Commercial hydrophilic polyvinylidene fluoride, polyether sulfone, and PolyCera® flat-sheet membranes were packaged identically into Spiral Monolith cross-flow back washable modules. The overall objective of the study was to evaluate the filtrate recovery, energy demand, and operating cost of the three membrane materials in achieving California Title 22 product water quality filtering secondary-treated sewage. All three membranes met California Title 22 filtered water quality criteria throughout the entire testing period due to their small characteristic pore size. The PolyCera membrane was the least fouling prone and, as a result, produced significant benefits in filtrate recovery, energy consumption, and operating cost due to less frequent and intense backwashing requirements. Filtration was maintained for over 5 weeks when operating the PolyCera membrane with an average flux of 33 LMH and filtrate backwashing every 25 min. During this long-term operation, the PolyCera system consumed, on average, 0.035 kWh at an operating cost of $0.016 for every cubic meter filtrate water produced, which is a net savings up to 46% compared to standard systems reported in literature.

Keywords: Water reuse; Advanced polymers; Fouling; Tertiary filtration; Sustainability