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Elucidation of filtration performance of hollow-fiber membranes via high-throughput screening platform

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Abstract

Hollow-fiber (HF) membranes are an ideal format for environmental applications and yet the fouling of HF membranes is a complex and ongoing challenge in the field of water and wastewater treatment. There is growing interest in the use of high-throughput (HT) techniques to accelerate the optimization of membrane-based separations. However, all of the previous works in this area have focused on employing HT techniques for flat sheet membranes. In this study, we have developed the first ever high-throughput hollow fiber (HT-HF) membrane device that can run multiple filtration tests in parallel with each test using a single HF membrane to minimize the hold-up volume. The effects of humic acid (HA) type, HA concentration, aqueous solution conditions, filtrate flux, and backwashing conditions on the constant flux filtration performance of polyvinylidene fluoride HF membranes was studied by comparing sieving coefficient results, transmembrane pressure profiles, and changes in hydraulic permeability. In total, over 60 individual filtration experiments and 190 hydraulic permeability measurements, were performed in this comprehensive study. The technique described in this work allows for an efficient way to screen the fouling properties of HF membranes for various applications.