Abstract Submitted
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Optimizing internal structure of membrane filters[1] LINDA CUMMINGS, PEJMAN SANAEI, New Jersey Institute of Technology — Membrane filters are in widespread use, and manufacturers have considerable interest in improving their performance, in terms of particle retention properties, and total throughput over the filter lifetime. In this regard, it has long been known that membrane properties should not be uniform over the membrane depth; rather, membrane permeability should decrease in the direction of flow. While much research effort has been focused on investigating favorable membrane permeability gradients, this work has been largely empirical in nature. We present a simple, first-principles model for flow through and fouling of a membrane filter, accounting for permeability gradients via variable pore size. Our model accounts for two fouling modes: sieving; and particle adsorption within pores. For filtration driven by a fixed pressure drop, flux through the membrane eventually goes to zero, as fouling occurs and pores close. We address issues of filter performance as the internal pore structure is varied, by comparing the total throughput obtained with equal-resistance membranes. Within certain classes of pore profiles we are able to find the optimum pore profile that maximizes total throughput over the filter lifetime, while maintaining acceptable particle removal from the feed.

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