

362c Combined Models of Membrane Fouling: Development and Application to Constant Flow Microfiltration of Biological Fluids

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Membrane capacity during the filtration of biotech process streams is typically limited by fouling, which can occur by pore blocking, pore constriction, caking or a combination of the mechanisms. In this study five new fouling models that accounted for the combined effects of the different individual fouling mechanisms were generated. Explicit equations were derived from Darcy's law that related pressure to time during constant flow operation and volume to time during constant pressure operation. The models used two fitted parameters and reduced to the individual models when one mechanism dominated. The applicability of the models to data for constant-flow sterile filtration of plasmid DNA and cell culture media was tested. The combined caking and complete blockage model was the most useful, as it was able to provide good fits of the pressure versus time data and good predictions of filter capacity from limited initial data. The mechanism of fouling was consistent with cross sectional images of fouled membranes obtained with confocal fluorescence microscopy. The cake-complete model will provide good fits of a broad range of curves where the flux declines in a manner between the extremes of cake filtration and complete blocking.