# AIR FILTRATION USING HOLLOW-FIBER MEMBRANES: A COMPARISON OF THEORETICAL MODELS FOR MOST PENETRATING PARTICLE SIZE AND DIMENSIONLESS PERMEABILITY WITH EXPERIMENTAL DATA

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Hollow-fiber membranes (HFMs) have widely been applied to many liquid treatment applications such as wastewater treatment, membrane distillation and membrane contactor/bioreactor applications. However, they have rarely been used for aerosol filtration thus far. In this work, we compared mathematical models developed for prediction of most penetrating particle size (MPPS) and dimensionless permeability applying them on the structural parameters of polypropylene HFMs. MPPS were compared with experimentally measured value using a monodisperse (20, 35, 50, 70, 100, 140, 280 and 400 nm) and a polydisperse aerosol (15–594 nm). Dimensionless permeability was predicted using models based solely on membrane the solid volume fraction (SVF) assuming isotropic 3D pore structure. The results were then compared with air permeability measured using a Quantachrome 3Gzh capillary flow porometer. In the experiments with the monodisperse aerosol, no penetration was observed regardless of particle size. Therefore, face velocity was increased and high concentrations of the polydisperse aerosol were used to increase the penetration. The MPPS was then found to be 333 and 250 nm at a flowrate of 10 and 40 L/min, respectively. The MPPS model derived for diffusion and interception dominant regime by Lee and Liu (1986) was closest to these results. Dimensionless permeability varied depending on the conditions for which the individual models were derived. For example, RUC (representative unit cell) model under-predicts the results while the results predicted using the empirical formula of Davies (1953) differ significantly from the measured values. The model of Davies was, however, derived for filter SVF strictly in the range of 0.01 to 0.3 while HFMs considered in this study have SVF as high as 0.48.