Aerosol Separation Efficiency and Pressure Drop Evolution with Intense Particle Loading of Hollow-fiber Membranes.

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Hollow-fiber membranes (HFMs) have been widely applied to many liquid treatment applications such as wastewater treatment, membrane contactors/bioreactors and membrane distillation. Despite the fact that HFMs are widely used for gas separation from gas mixtures, their use for mechanical filtration of aerosols is very scarce. This work aimed to study filtration performance of polypropylene HFMs of different filtration area challenged with various submicron size aerosols (a monodisperse ammonium sulfate, TiO_2, a nanoaerosol generated from incense stick burning). Size-resolved penetration was measured at different airflow velocities in both outside/in and inside/out arrangement. Pressure drop evolution with long term dust loading was measured until double the value of initial pressure drop with an A2 ASHRAE dust. The results show very high efficiency for submicron particles (Fig. 1). Pressure drops are rather higher due to hollow fiber geometry strongly dependent on inner fiber diameter. Long-term loading by the A2 dust shows very slow pressure drop increase even with very high dust concentrations. HFM reaches the final pressure drop (double the initial value) after 30 hours of loading with 14 g/m^3 of dust. Furthermore, the results have shown very simple regeneration of the membrane using vibrations. After shaking the membrane, the initial pressure drop was obtained with practically no residual resistance.

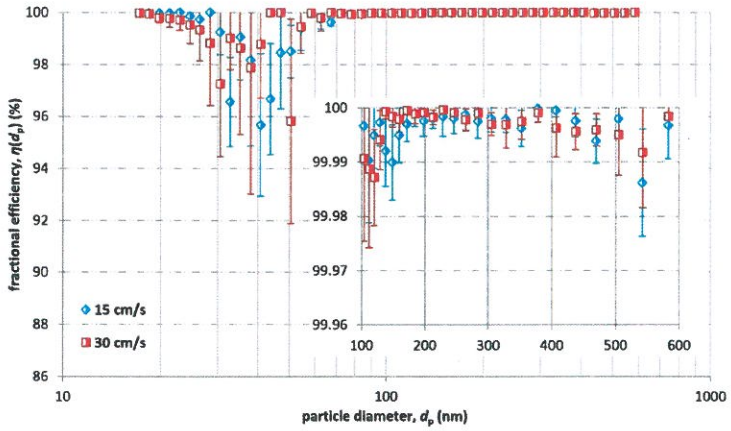

Fig. 1: Filtration efficiency in titanium dioxide particle removal at different permeate velocities