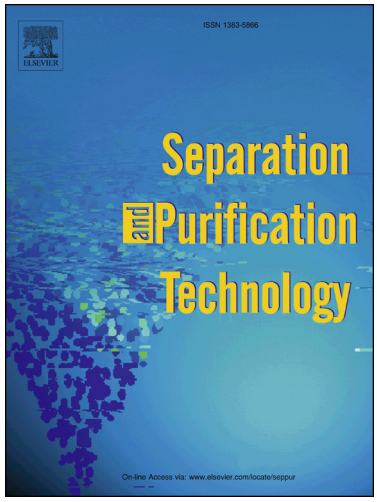

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Modeling of the deep granular bed clogging by nanoparticles

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Abstract

Nanoparticles aerosols are a potential health hazard and are increasingly used in industry today. Effective means for their filtration to avoid occupational exposure are necessary. Granular bed filtration exhibits interesting properties in terms of ultrafine particle collection efficiency or retention capacity, which could make them a good alternative to the fiber filters commonly used in industry today. Being able to predict changes to their collection efficiency and pressure drop during clogging appears essential for the design, optimization and control of the filtration process. To meet these needs, this study presents a predictive model for the different phases of deep-bed clogging. The model developed successfully describes changes to collection efficiency and pressure drop using equivalent collector diameters. Microscopic observations showed these equivalent diameters to be compatible with considering the deposit as a uniform spherical layer all over the collector's surface. The predictions of the model agreed well with data from several clogging experiments for which various operating conditions were used, i.e., different collector's diameters, particulate materials or superficial velocities.

Keywords

Granular Bed Filtration, Aerosol, Nanoparticles, Model, Efficiency, Pressure Drop