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Givehchi R, Du B, Razavi M, Tan Z, Siegel JA. 2021. Performance of nanofibrous media in portable air cleaners. *Aerosol Science and Technology*, **55(7)**, 805-816. DOI: 10.1080/02786826.2021.1901846

Abstract

The benefits of nanofibrous media have been extensively explored in laboratory-scale research but are less clear in real filtration applications. Thus, this study investigated the links between the size-resolved filtration efficiency of nanofibrous media mounted in portable air cleaners in a chamber test and results from the media mounted in a cone-shape filter holder in a more conventional duct test. Results showed a similar trend for the filtration efficiency curves for these two experimental tests, despite differences in test type, challenge aerosol, instrumentation, and the calculation of filtration efficiency. Long-term operation, surface area blockage, and isopropyl alcohol treatment adversely impacted the filtration efficiency of the tested nanofibrous media in the chamber test, with a different magnitude of impact for three different media tested. The filtration efficiencies were lower than most of the previously reported data in the literature, which may be due to the differences in medium type, fiber diameter, filter thickness, porosity, face velocity, filter charge, and the number of filter layers. This study suggests the needs for determining the performance of nanofibrous media in terms of filtration efficiency and quality factor in real environmental systems.

Main findings

- This study shows the **feasibility** of nanofibrous media mounted in portable air cleaners to remove airborne nano particles.
- **Similar filtration efficiency trends** vs. particle size observed in nanofibrous media mounted in portable air cleaners in a Chamber Test and a cone-shape filter holder in the Duct Test.
- IPA treatment and particle loading **decreases** the filtration efficiency of nanofibrous filters.
- Long-term operation, blocking surface area, and isopropyl alcohol treatment **negatively impact** the filtration efficiency.

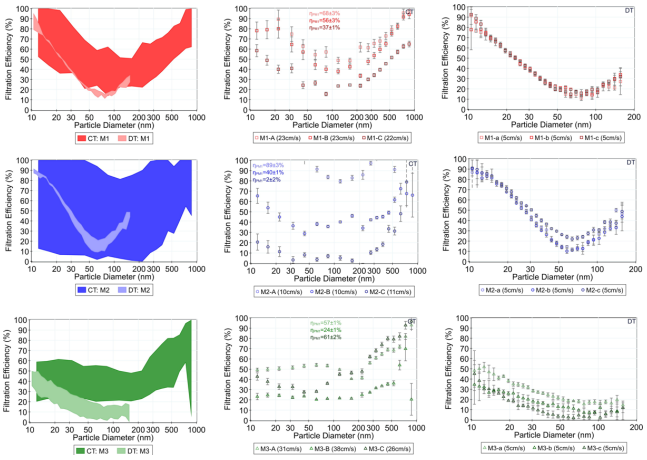

Figure 3. Filtration efficiency of (a) left column: three nanofibrous media in both Chamber Test (CT) and Duct Test (DT), (b) center column: three samples (A, B, C) from each nanofibrous media of M1, M2, M3 in Chamber Test, (c) right column: three samples (a–c) from each nanofibrous media of M1, M2, M3 in Duct Test. η_{PM1} is the filtration efficiency based on the monitor-reported mass concentration of >1-micron particles.

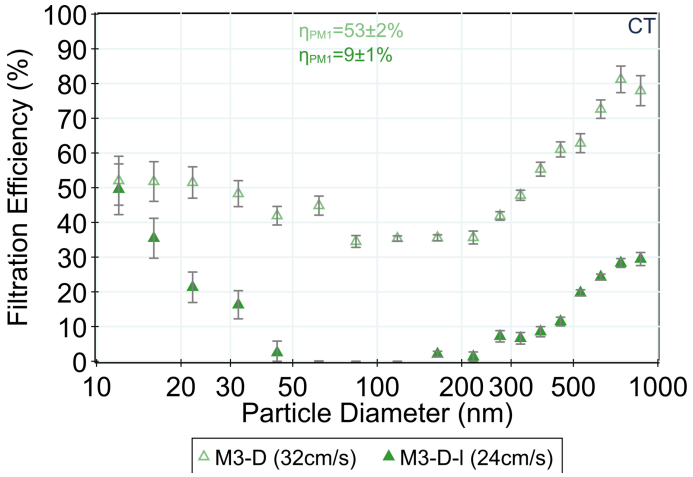

Figure 6. Effects of three months of indoor particle loading (M3-D stands for the initial filter medium and M3-D-l stands for the final medium after long term operation) on filtration efficiency of M3 filter media in Chamber Test (CT).

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