Filtration of nanoparticles from traffic should become a key criterion of building ventilation

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Air filters that efficiently expel nanoparticles should be adopted in buildings. VTT Technical Research Centre of Finland and Tampere University of Technology (TUT) have developed a comparison technique which has detected marked differences between the nanoparticle-capturing performance of air filters.

Vehicles create harmful emissions which enter indoor air unless they are filtered out. Nanoparticle emissions from traffic have a major effect on the quality of indoor air and human health. Tiny nanoparticles penetrate deep into the lungs, causing damage in the pulmonary alveoli and blood circulation. The latest estimates suggest that nanoparticles cause around 7 million premature deaths around the globe each year. In cold weather, particulate levels in the open air can grow, when vehicle emissions increase and are suspended in the lower atmosphere.

VTT and TUT's research was the first to evaluate the performance of air filters and mechanisms for filtering nanoparticles out of indoor air. The study involved exploring the features of good air filters and the development of comparison techniques. This did not involve tests of different manufacturers' products.

The study included a commonly used F7 class glass-fibre filter, HEPA-class filters, an electret filter and an electrostatic precipitator. The air filters included in the study filter out 50-100% of nanoparticles from traffic. Differences were observed in the filtration performance and energy efficiency of the filters.

"The commonly used F7 class filter removed more than 75% of soot nanoparticles emitted by traffic, which was an acceptable result. The electrostatic precipitator removed 94% and the more expensive HEPA class filters removed 100% of soot nanoparticles. On the other hand, the fibre filter was more efficient than the electric one at removing the very smallest nanoparticles. The type of filter also affects the load endurance and service intervals," says Postdoctoral Researcher Panu Karjalainen of TUT.

The results will open up new opportunities for the development of healthier indoor air. To date, building designers have had to investigate air filters under their own initiative, because the current standards and those taking effect next year take no account of small nanoparticles. That is why issues such as nanoparticles from traffic should be made a key criterion in development work.

"Ventilation designers, in particular, during the design and service and maintenance phase of new buildings, and developers, commissioners and consumers of air filters can now take advantage of the new findings," says Research Scientist Sampo Saari of VTT.

The study was also the first to investigate the filtering of very small nanocluster particles down to 1.3 nanometres in size. These are close to being gas molecules, but their filtration properties are different. All of the air filters that were tested effectively removed nanocluster particles smaller than 3 nanometres, which means that particles of this size are unlikely to enter indoor areas.

More information: Panu Karjalainen et al. Performance of ventilation filtration technologies on characteristic traffic related aerosol down to nanocluster size, *Aerosol Science and Technology* (2017). [DOI: 10.1080/02786826.2017.1356904](https://dx.doi.org/10.1080/02786826.2017.1356904)

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