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Acoustic Mechanisms to Improve Separation of Airborne Contaminants with Fiber Filters

A system utilizing acoustic standing waves dramatically enhances the filtration performance of common HVAC fiber filters for small airborne contaminants, reducing both power consumption and the frequency of filter replacement.

Small (2.5 micrometers) airborne contaminants such as viruses, bacteria, and inhalable solids can be detrimental to health and quality of life. However, traditional fiber filters intended to capture these particles result in high pressure drops, requiring greater power consumption from HVAC systems. To alleviate this issue, researchers at Purdue University have developed a system for using acoustic standing waves to improve the effectiveness of fiber filters for airborne contaminants by as much as 1-2 orders of magnitude. This approach augments the performance of common, low-pressure filters while reducing power consumption and eliminating the creation of hazardous byproducts associated with alternative filtration techniques. This technology offers benefits to organizations designing or maintaining HVAC systems for industrial or residential buildings.

Advantages:

- Capable of superior filtration of particulates 2.5 micrometers diameter

- Compatible with common, low-pressure filters

- Reduces power consumption

- Reduces need for/frequency of filter replacement

Applications:

- Residential and commercial HVAC

- Air filtration

Technology Validation:

This technology has been validated through simulations of the proposed approach, where it was shown that standing acoustic waves improved the

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Category

GreenTech/Environmental Remediation & Pollution Control

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capture efficiency of the fiber filter by 1-2 orders of magnitude.

Related Publications:

Andres Barrio-Zhang, et al. Acoustically enhanced porous media enables dramatic improvements in filtration performance, Separation and Purification Technology, Volume 342, 2024, 126972, https://doi.org/10.1016/j.seppur.2024.126972.

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