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Thermally Insulating Support Layer Membranes for Efficient Drying Applications

Technology ID
2025-WARS-70979

Category
GreenTech/Water & Resource Management
Buildings, Infrastructure, & Construction/HVAC & Building Energy Efficiency

Authors
Md Ashiqur Rahman
David Elan Martin Warsinger

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Researchers at Purdue University have developed an energy-saving dehumidification method for commercial and residential buildings. Conventional dehumidification systems, such as vapor compression refrigeration (VCR) and desiccant-based dehumidification, require significant energy input and incur high capital costs, respectively. A membrane energy recovery ventilator (MERV) is considered one of the most promising technologies in this space as the method requires no active components such as vacuum pump or compressor and provides significant cost savings. However, current MERV systems cannot efficiently reject humidity without losing heat. Purdue researchers have tackled these pitfalls by developing a highly thermal insulating support layer for MERV. This technology developed at Purdue ensures the efficient operation of MERV systems by incorporating membranes with low thermal conductivity, thus significantly reducing heat loss.

Technology Validation:

Purdue's thermal insulating membrane was compared with a control membrane under the effect of relative humidity change, temperature, and mass flow variation. The thermally insulating membrane outperformed the control membrane at a temperature higher than 34oC. Furthermore, at 35 L/min feed flow rate, the latent effectiveness of the thermally insulating membrane was 6.67% higher than the membrane with no rGO filler.

Advantages:

-Higher energy efficiency than conventional VCR systems

-Inexpensive

-Useable in hot and humid climates, like those in many parts of the developing world

Applications:

-Dehumidification in commercial and residential buildings

-Food and agricultural product drying

-High temperature industrial drying applications

-Green/sustainable building standards

TRL: 2

Intellectual Property:

Provisional-Gov. Funding, 2024-12-03, United States

Keywords: Energy-saving dehumidification,Membrane energy recovery ventilator,MERV efficiency enhancement,Thermal insulating membrane,Low thermal conductivity support,Heat loss reduction,Latent heat recovery,High-humidity climate suitability,Energy-efficient HVAC,Green building technology