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Wet Inertial Impactor for Collection of Airborne Particles into Liquid Media

Nebulizer-assisted wet inertial impactor captures ≥70 nm airborne particles directly into liquid at high flow, preserving viability for PCR/MS/electrochemical analysis.

Purdue researchers have developed a high-flow-rate wet inertial impactor that uniquely uses a nebulizer to collect airborne nanoparticlesâ€”including pathogens and engineered particlesâ€”directly into a liquid medium. Originally designed for viruses, the system has been adapted for efficient capture of a broad range of nanoscale contaminants (viruses, bacteria, trace metals, organic particulate matter). Unlike conventional methods such as impingers or filter-based systems, this device achieves superior efficiency and sampling volume while preserving particle viability for downstream analysis. It enables both real-time detection and post-sampling analysis via PCR, mass spectrometry, or electrochemical sensors.

Technology Validation:

Validated in controlled lab environments using sodium chloride (cubic morphology) and polystyrene latex (spherical morphology) under both dry and wet conditions. Demonstrated effective collection of airborne particles with diameters as small as 70 nm, establishing a cutoff diameter of approximately 70 nm. Achieved nearly 100% collection efficiency for particles larger than the 70 nm cutoff.

Advantages

1.First known nebulizer-based inertial impactor for direct liquid capture

2.High sampling flow rate enables large air volume collection

3.Broad particle size selectivity (customizable inlets)

4.High efficiency for PM2.5 and nanoparticles (70 nm)

5.Direct liquid capture preserves sample viability

6.Real-time and indirect sensing compatibility

Technology ID
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Category
Biotechnology & Life Sciences/Biomarker Discovery & Diagnostics
Aerospace & National Security/Defense, Electronics, & Surveillance Technologies
Biotechnology & Life Sciences/Analytical & Diagnostic Instrumentation

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7.Operates reliably in high-humidity environments

8.Superior to existing technologies in flow and capture

Applications

1.Occupational safety monitoring (e.g., OSHA compliance for heavy metals)

2.Environmental nanoparticle surveillance

3.Pandemic/pathogen aerosol detection

4.Industrial hygiene assessments

5.Research into airborne nanoparticle exposure

TRL: 4

Intellectual Property:

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