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Lossless Ion Mobility Spectrometer with Axial Diffusion Constriction

Technology ID
2025-LARR-70927

Category
Biotechnology & Life Sciences/Analytical & Diagnostics Instrumentation

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Researchers have developed an advanced ion mobility-mass spectrometry (IM-MS) system that significantly enhances molecular characterization for clinical diagnostics. This innovative system addresses a key limitation in traditional IM by restricting axial diffusion of molecular ions, broadening signal peaks and producing much higher resolution. The new approach utilizes varying electric fields, e.g., precisely defined and controlled linearly decreasing triangular fields, within an ion mobility drift cell to constrain ions in the axial direction as they separate, thereby improving accuracy and selectivity. By integrating this technique into the widely-used Structure for Lossless Manipulation (SLIM) system, the novel technology enables quasi-infinite resolution and precise differentiation of isomeric, isotopomeric and isotopologic compounds. The upgraded system's miniaturization features renders it more portable and suitable for clinical applications, paving the way for real-time diagnostics, improved disease monitoring, and personalized treatment strategies.

Technology Validation:

Evaluations demonstrate that integrating varying electric fields with Structure for Lossless Manipulation (SLIM) technology significantly enhances ion mobility resolution by effectively restricting axial diffusion. This innovation enables superior separation of molecular ions, outperforming traditional ion mobility spectrometry (IM) techniques in precision and sensitivity.

Advantages:

-Higher Resolution & Selectivity

-Enhanced Molecular Characterization

-Real-Time Diagnostics

-Broader Clinical Applications

Applications:

-Clinical Diagnostics & Healthcare

-Pharmeceutical & Drug Development

-Metabolomics & Lipidomics

-Forensic Science & Security

Publication:
https://www.sciencedirect.com/science/article/pii/S1387380625000247

TRL: 3

Intellectual Property:

Provisional-Patent, 2024-12-06, United States

Keywords: High-resolution ion mobility,Axial diffusion-restricted IM,SLIM-integrated mass spectrometry,Real-time molecular diagnostics,Isomeric compound differentiation,Portable clinical MS system,Enhanced molecular separation,Next-generation metabolomics tool,Precision diagnostic instrumentation,Advanced IM-MS healthcare platform