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Ion Focusing and Manipulation at Atmospheric Pressure using Gas Phase Ions as Ion Optical Elements

An innovative ion focusing method operates at atmospheric pressure to improve mass spectrometer efficiency, eliminate complex sample preparation, and deliver cleaner, higher-resolution mass spectra data.

Researchers at Purdue University have developed an approach to improve the resolution and focus of mass spectrometers. By manipulating and focusing molecular ions produced by electrospray ionization, the method is able to significantly increase resolution and ion abundance. Ion focusing at atmospheric pressure has until now not generally been attempted. Focusing is currently done after ions enter the reduced pressure region of the mass spectrometer interface. The method developed at Purdue instead enables the accommodation of a broad array of samples without the need for complex preparation techniques. With improved sample ion focus, mass spectrometers will be able to produce data that is cleaner and easier to achieve.

Advantages

-Eliminates the need for any special sample preparation

-Improved focusing of sample ions, leading to cleaner mass spectra data

-Improved efficiency of mass spectrometers

-Can be seamlessly integrated into existing mass spectrometers

-Designed to work with Nanoelectrospray Ionization-Mass Spectrometry (nESI-MS), an already popular method due to its speed, sensitivity, and versatility

Applications

-Mass spectrometry, as used in diverse industries such as:

-Forensic toxicology

Technology ID
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Category
Materials Science & Nanotechnology/Materials Testing & Characterization Tools
Biotechnology & Life Sciences/Analytical & Diagnostic Instrumentation

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-Metabolomics

-Proteomics

-Clinical research.

-Food and drug testing

-Environmental science

-Mass spectrometer manufacturing

Technology Validation:

To validate this technology, researchers performed tests in which test ions were successfully enveloped by ions of the opposite charge, improving focus. This was done under atmospheric pressure using DC voltage only.

Related Publications:

Brett M. Marsh, Saquib Rahman, Victoria M. Benkowski, Shane Tichy, R. Graham Cooks,

Space charge compensation in air by counterion flow in 3D printed electrode structure, International Journal of Mass Spectrometry, Volume 468, 2021, 116637, ISSN 1387-3806, https://doi.org/10.1016/j.ijms.2021.116637.

TRL: 3

Intellectual Property:

Provisional-Gov. Funding, 2021-05-28, United States | PCT-Gov. Funding, 2022-05-26, WO | NATL-Patent, 2023-11-22, United States | NATL-Patent, N/A, Europe

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