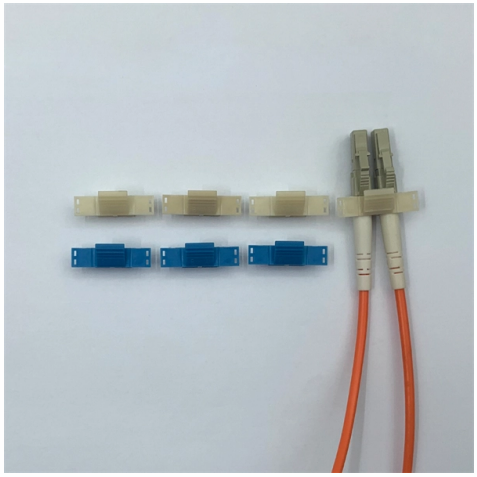
Ion Detection by Spectrometer



Overview

Ion sensing based on frequency-dependent physico Here, the authors present a physics-based and AI-assisted model linking ion-specific properties to enable.

Key Takeaways

Ion detection in spectrometry involves generating ions from analytes and measuring them using specialized detectors to identify and quantify substances.

Principles of Ion Detection

Ion detection in spectrometry begins with ionization, where molecules are converted into charged particles. These ions are then separated based on properties such as mass-to-charge ratio (m/z) in mass spectrometry or mobility in a carrier gas in ion mobility spectrometry (IMS). The separated ions are finally detected using devices that convert ion impacts into measurable electrical signals.

Ion Mobility Spectrometry (IMS)IMS separates ions in the gas phase according to their mobility through a buffer gas under an electric field. The drift time of ions is characteristic of their size, shape, and charge, allowing substance identification.

IM

S is highly sensitive and can detect trace amounts of volatile organic compounds (VOCs) or biomolecules, often in portable, field-deployable devices.

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Advanced IM

S systems, such as high-field asymmetric waveform IMS (FAIMS), enhance selectivity and flexibility for on-site applications. Mass Spectrometry (MS) and Ion DetectorsIn mass spectrometry, ions are separated by mass analyzers (e.g., time-of-flight, quadrupole, ion trap) and detected using ion detectors. Common detectors include: Electron Multipliers (EM): Amplify single ions into measurable electron currents, enabling single-ion counting.

Faraday Cups (FC): Measure ion currents directly, suitable for high ion flux but less sensitive at low currents. Photomultiplier Conversion Dynodes: Convert ion impacts into photons for detection, often used in specialized setups.

Hyphenated Techniques

Ion detection can be combined with chromatography for enhanced separation. For example, Ion Chromatography–Mass Spectrometry (IC–MS) couples ion separation in solution with mass-based detection, providing highly accurate, multi-dimensional analysis. This approach is widely used in environmental, biomedical, and chemical research.

Applications

Security and Defense: Detection of explosives, drugs, and chemical warfare agents. Environmental Monitoring: Trace gas analysis and pollutant detection. Biomedical Diagnostics: VOC analysis for disease markers.

Food and Pharmaceutical Quality Control: Identification of contaminants and active compounds.

Summary

Ion detection by spectrometers relies on ionization, separation, and sensitive detection.

IM

S provides rapid, portable detection of gas-phase ions, while MS offers high-resolution mass-based analysis. The choice of ion detector and potential hyphenation with chromatography depends on the required sensitivity, selectivity, and application context. These technologies enable precise, real-time analysis across diverse scientific and industrial fields.

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Article Content

Ion sensing based on frequency-dependent physico

Here, the authors present a physics-based and AI-assisted model linking ion-specific properties to enable reliable ion detection and quantification.

Ion Detection in Mass Spectrometry | Springer Nature Link

A review of the principles of ion detect is discussed. These principles include secondary electron emission, analog and pulse-counting detection, basic and advanced detector designs. In

Ion Mobility Spectrometer (IMS)

At the heart of this module is a silicon chip that integrates an ion filter and ion detector and is designed as a component of an ion mobility spectrometer (IMS). This concept makes it possible to detect

Ion mobility spectrometry

Ion mobility spectrometry (IMS) is a method of conducting analytical research that separates and identifies ionized molecules present in the gas phase based on the mobility of the molecules in a

How Are Ions Detected in a Mass Spectrometer: A Detailed Guide

This article aims to provide a detailed, technical guide on how ions are detected within different mass spectrometers, explaining the physics, instrumentation, and engineering principles

Electrochemical Sensors for Heavy Metal Ion Detection in Aqueous

They can detect a wide range of heavy metals providing real-time monitoring and are cost-effective and enable multiparametric detection. Various sensing applications necessitate severe

Mass spectrometry

Mass spectrometry (MS) is an analytical technique that is used to measure the mass-to-charge ratio of ions. The results are presented as a mass spectrum, a plot of intensity as a function of the mass-to

Mass Spectrometer

A mass spectrometer consists of the three basic components: an ion source, a mass analyzer, and an ion detection system. The components of the mass spectrometer are housed within a vacuum

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Hiden Analytical | Advanced Mass Spectrometry Solutions

Hiden Analytical designs & manufactures quadrupole mass spectrometers for gas analysis, electrochemistry, plasma, surface science & advanced research.

Helium Leak Detector factory

China Helium Leak Detector Manufacturer, Anhui Wanyi Science and Technology Co., Ltd. is Liquid Chromatography Instrument factory, offering quality products at factory prices.

Urinary Gas Chromatography-Based Metabolomics for Early Detection

New high-resolution analytical techniques such as gas chromatography-time-of-flight mass spectrometry (GC-TOF-MS) and gas chromatography-ion mobility spectrometry (GC-IMS)

Explosive Trace Detection Market: USD 2.72 Bn by 2031, Driven by ...

Explosive Trace Detection Industry Segmentation By Product Type Handheld Portable/Movable Fixed By Detection Technology Ion Mobility Spectrometry (IMS) Mass

Detection of explosives by positive corona discharge ion mobility ...

In this work, we demonstrated that common explosives can be detected in the positive mode of ion mobility spectrometry with a reasonable detection limit. After modification of the

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Mass spectrometry-driven water analysis for sensitive detection of pollutants in drinking and wastewater Industrial and agrochemical analysis Robust LC-MS/MS technology for in-depth analysis in

Mass spectroscopy | PPTX

This document provides an overview of mass spectrometry. It begins with introductions to spectroscopy and mass spectroscopy. The basic principles of mass spectrometry are that molecules are ionized,

The top mass spectrometry releases at ASMS 2026

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The system comes with MALDI and desorption electrospray ionization (DESI) imaging sources, making it the first multipass cyclic ion mobility and ion mobility spectrometry system to be

Agilent 7890A–7000C Gas Chromatography Triple Quadrupole Mass Spectrometer

The instrument operates on the principle of tandem mass spectrometry: analytes eluting from the GC column are ionized via electron impact (EI), subjected to precursor ion selection in Q1, collision

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