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Micromass ZQ Mass Spectrometer

The Waters Micromass ZQ™ Detector with an HPLC system is used to determine mass-to-charge ratio (m/z) for a wide range of analytes.

Micromass ZQ Detector -- The ZQ Detector is a quadrupole mass analyzer that can determine the mass-to-charge ratio (m/z) of diverse analytes. An HPLC system, or syringe pump, delivers liquid sample to the instrument's analyzer source. There the sample molecules ionize by means of one of two ionization modes: electrospray (ESI) or atmospheric pressure chemical ionization (APCI).

In ESI mode, sample molecules ionize in solution before they reach the source. On entering the evacuated source, they begin a desolvation process. In APCI mode, an electrical discharge inside the source ionizes the sample molecules whereupon they undergo desolvation. The ions ultimately reach the quadrupole, which separates them according to their mass-to-charge ratios. A photomultiplier then detects the mass-separated ions, amplifies their signals, and sends the mass information to the data system.

Probes -- An electrospray ionization (ESI) probe or an atmospheric pressure chemical ionization (APCI) probe introduces the sample to the ion source.

Sample Inlet -- Either of two methods deliver solvent and sample to the installed probe:

- An HPLC system – Delivers the eluent from an HPLC analysis.
- A built-in syringe pump – Delivers standard solutions or infusions of unknown samples.

Vacuum System -- An external rotary (roughing) pump and an internal split flow turbomolecular pump combine to create the source vacuum. The turbomolecular pump evacuates the analyzer and ion transfer region. Vacuum leaks and electrical or vacuum pump failures cause vacuum loss, which protective interlocks guard against. The system monitors turbomolecular pump speed and continuously measures vacuum pressure with a built-in Pirani gauge. The gauge also serves as a switch, discontinuing detector operation when it senses vacuum loss. A vacuum isolation valve isolates the source from the mass

analyzer, allowing routine source maintenance without venting.

Mass analyzer (Quadrupole) -- The mass analyzer separates ions by mass-to-charge ratio (m/z).

Data System -- The data system collects information from the mass analyzer and includes these components:

- MassLynx software
- An external workstation
- An embedded PC

Software controls the workstation-based data system and mass detector through the detector's embedded PC. Use MassLynx, to tune the instrument, set up and run the HPLC system, and acquire and process data. When they are part of the system, the software also controls the autosampler and the divert and injector valves. The workstation uses a Windows NT, Windows 2000, or Windows XP color graphical environment and allows full user interaction with the keyboard or mouse. A network link communicates between the workstation and the detector's embedded PC. MassLynx acquires and stores data from conventional LC detectors simultaneously with data the mass detector acquires. It can also acquire data from selected systems, such as a Photodiode Array Detectors.

Principles of Operation



Electrospray Ionization (ESI) -- In ESI, a high electrical voltage charges the eluent as it emerges from a nebulizer, producing an aerosol of charged droplets. As the solvent evaporates, the droplets shrink, developing a charge dense enough to eject ions from their surfaces (ion evaporation). The mass analyzer then sorts the singly or multiply charged ions by mass-to-charge m/z ratio. The analyzer source can accommodate eluent flows of up to 1 mL/min. Performance is enhanced by reducing the rate of eluent flow at the ion source.

Atmospheric Pressure Chemical Ionization (APCI) -- A heated nebulizer vaporizes the sample. The sample ions then merge with solvent ions in the atmospheric source, enabling proton transfers between the solvent and sample ions. APCI

generally produces both protonated and deprotonated molecular ions from the sample. For positive ions, this ionization occurs by means of a proton transfer mechanism. For negative ions, the mechanism is proton abstraction.

MassLynx 4.0 Software -- MassLynx 4.0 software permits these operations:

- Configuring the instrument
- Creating HPLC inlet and MS methods that define operating parameters for a run
- Tuning and calibrating the mass detector
- Running samples
- Monitoring the run
- Acquiring and Processing data
- Reviewing and Printing data



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