

Mass Spectrometry

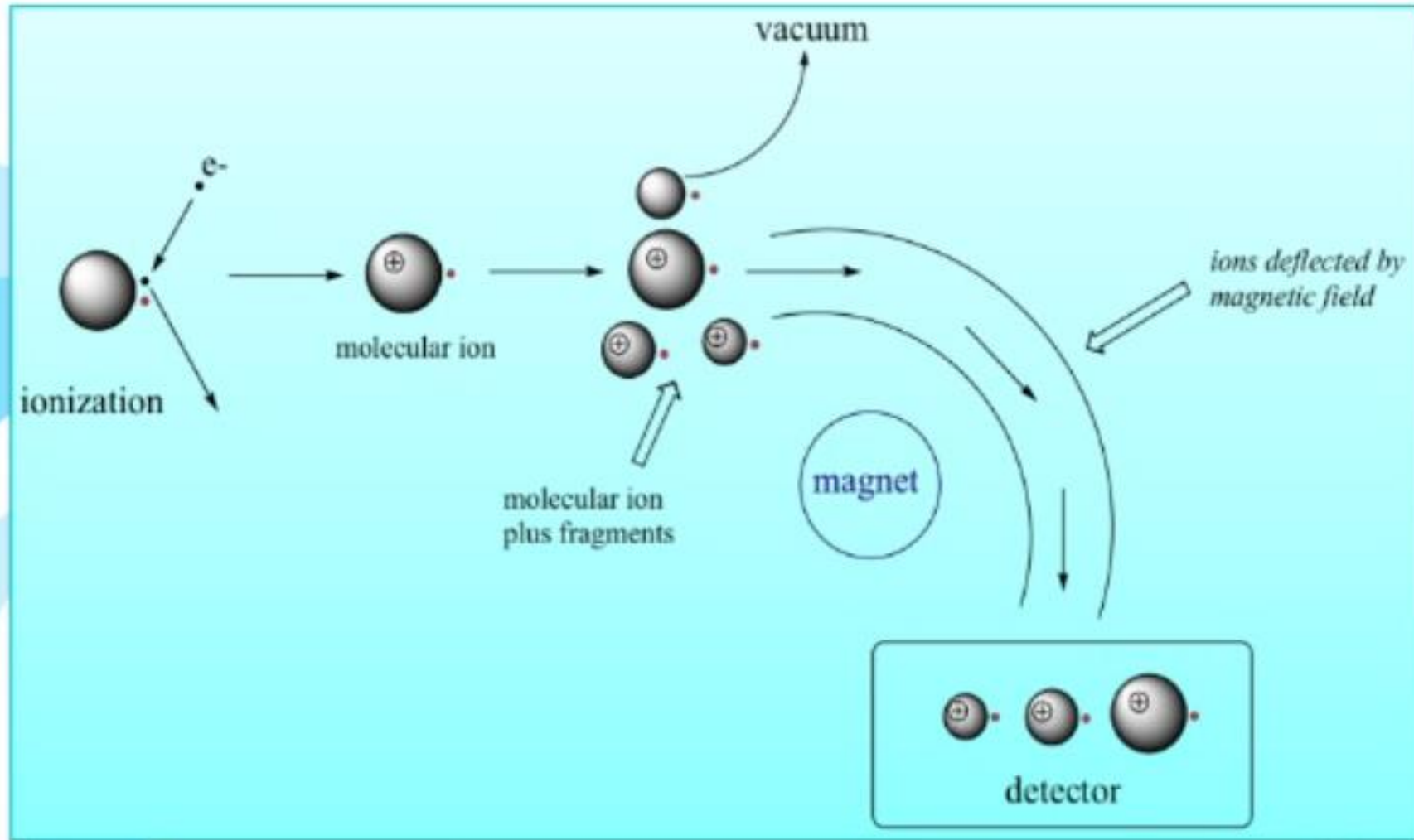
➤ WHAT IS MASS SPECTROMETRY ?

Mass spectrometry is an instrumental technique in which sample is converted to rapidly moving positive ions by electron bombardment and charged particles are separated according to their masses.

➤ WHAT IS MASS SPECTRUM ?

Mass spectrum is a plot of relative abundance against the ratio of mass/charge(m/e).

Simple mass spectrometry



BASIC PRINCIPLES

Organic molecules are bombarded with electron

converted into Highly energetic positively charged ions
(Molecular ions or Parent ions)

Further break up into smaller ions
(Fragment ions or Daughter ions)

The formed ions are separated by Deflection in Magnetic
field according to their Mass and Charge

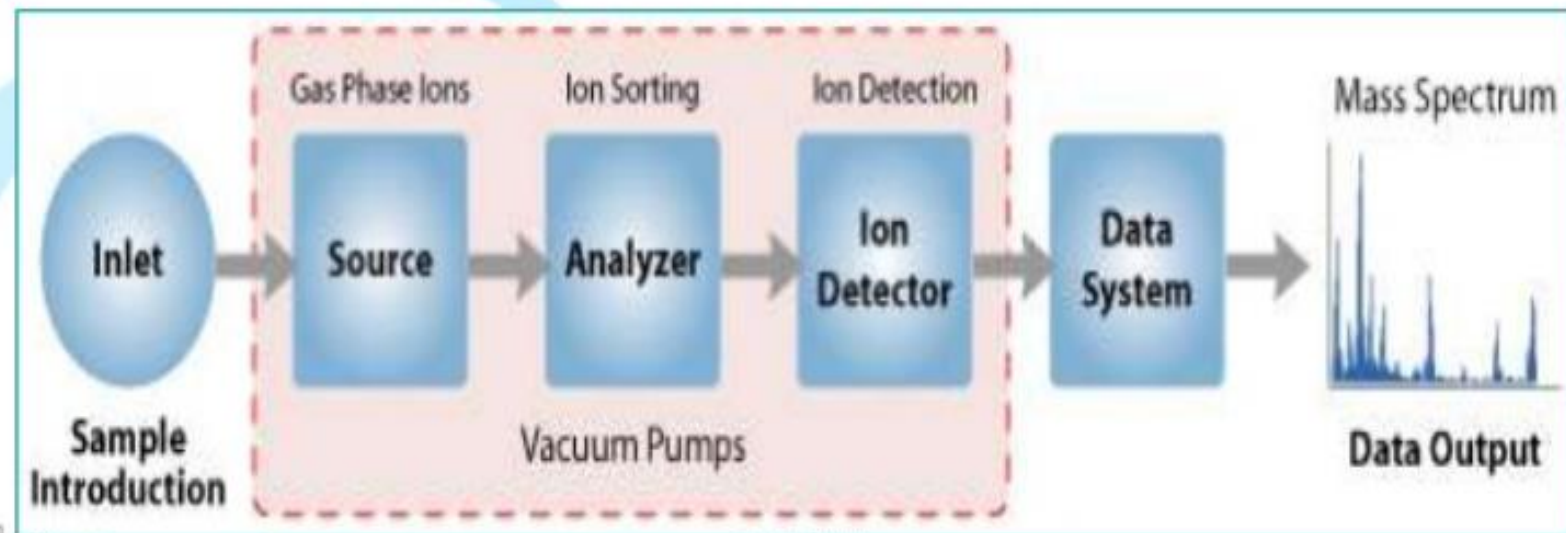
MASS SPECTRUM

Components of mass spectrometer

- Inlet system
- Ion source

Ionisation methods

- Mass Analysers
- Ion Detectors
- Vacuum System



Ion sources:-

❖ The ion source is the part of the mass spectrometer that ionizes the material under analysis (the analyte).

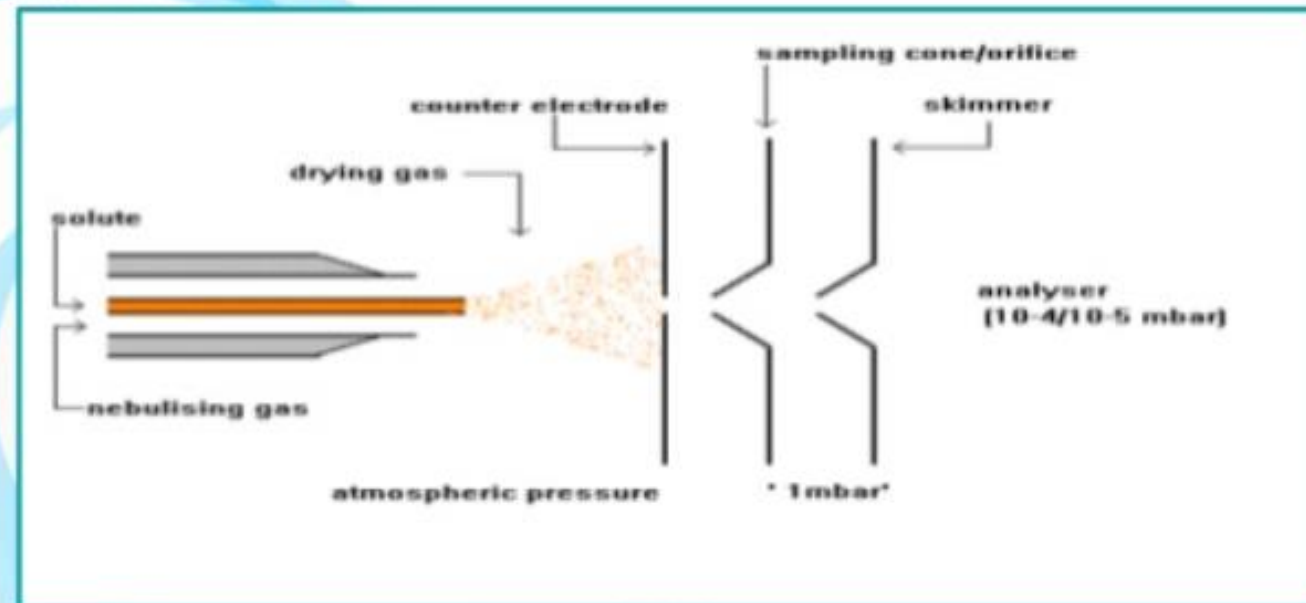
❖ The ions are then transported by magnetic or electric fields to the mass analyzer.

❖ Molecular ions are formed when energy of the electron beam reaches to **10-15 eV**.

❖ Fragmentation of the ion reaches only at higher bombardment energies at **70 eV**.

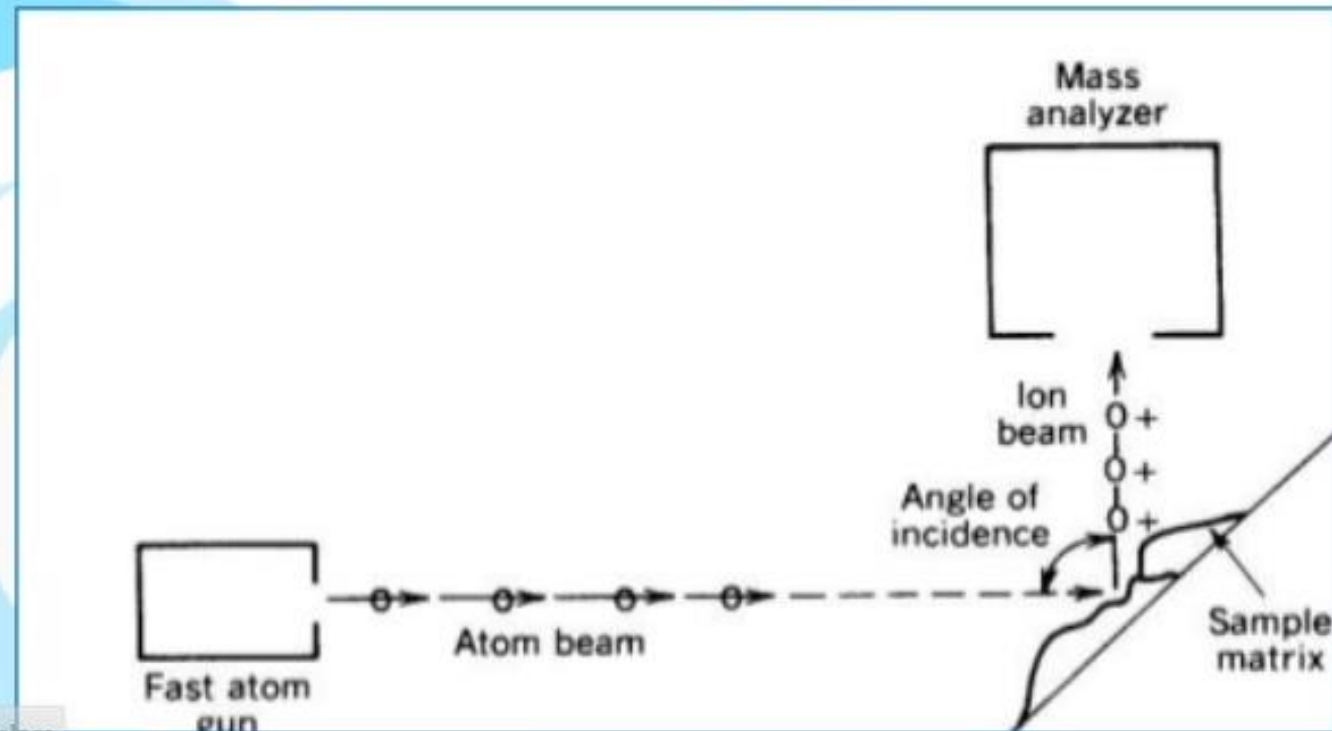
Electrospray ionisation:-

- The ESI source consists of a very fine needle and a series of skimmers.
- A sample solution is sprayed into the source chamber to form droplets.
- When droplets carry charge exit the capillary end, as the solvent evaporates, the droplets disappear leaving highly charged analyte molecules.



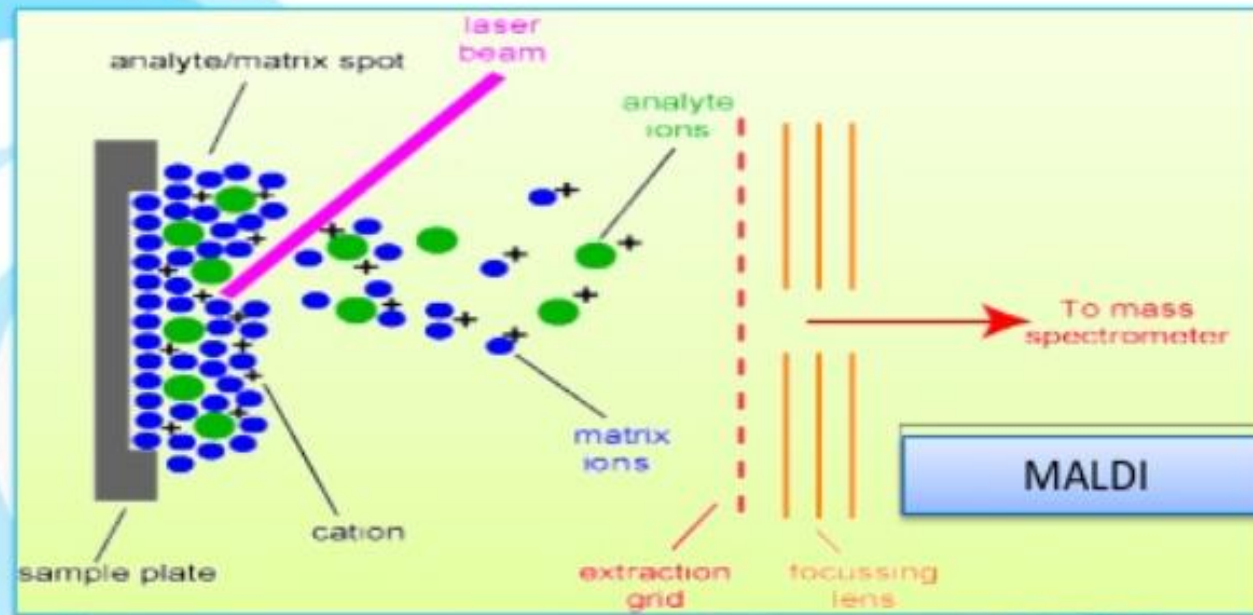
Fast atom bombardment:-

- Argon gas ionised by hot filament and focused beam that bombards the sample.
- Beam impinges the sample, a series of molecular reactions occur and analyse in MS analyser.
- Ex:- **Insulin, Amino glycosides, Phospholipids.**



MALDI:-

- MALDI is a **LIMS** method of vaporizing and ionizing and sample molecules are dispersed in a solid matrix such as nicotinic acid.
- A **UV laser** pulse ablates the matrix which carries some of the large molecules into the gas phase in an ionized form so they can be extracted into a mass spectrometer.



MASS ANALYSERS

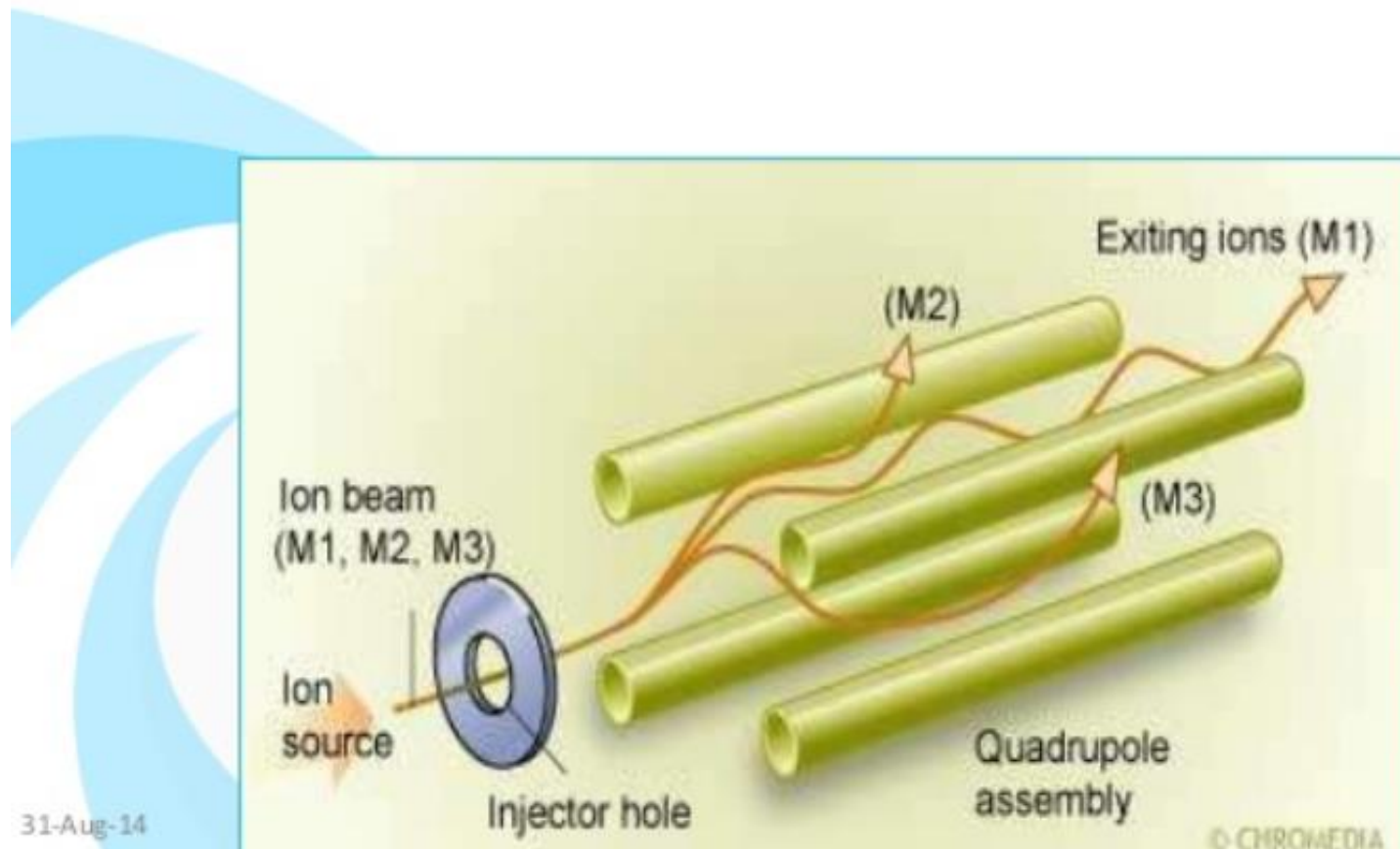
An ion, after leaving ion source, the ions are separated according to their m/e ratio.

In this area, the ions are accelerated by both electrostatic and magnetically

QUADRUPOLE MASS ANALYSER

The quadrupole consists of two pairs of parallel rods with applied DC and RF voltages.

Ions are scanned by varying the DC/Rf quadrupole voltages.



TIME OF FLIGHT ANALYSER

- TOF analyzer – ions are accelerated through a flight tube and the time of flight to the detector is measured.
- Typical flight times are 1 to 50 μs .

