



Mass Spectrometry: Detectors Review

Sharad Medhe

Department of Chemistry, Dayalbagh Educational Institute, Dayalbagh, Agra, India

Email address:

sharadmedhe@gmail.com

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Abstract: In Mass spectrometry separation of ions takes place on the basis of their mass to charge ratio. Mass spectroscopy is an advanced and powerful technique for qualitative and quantitative analysis. Detector plays an important role in mass spectrometer for the separated charged ions. Results are displayed as spectra of the relative abundance of detected ions as a function of the mass-to-charge ratio. The detector with desirable properties in mass spectrometer should have high amplification, Fast time response, Low noise, High collection efficiency, Low cost, Narrow distribution of responses, Same response for all masses, Large dynamic range, Long term stability, Long life and can be Mounted outside of the vacuum if possible. Type of mass detectors and their working capacity reviewed in the present article. These mass detectors are a] Electron Multiplier, Faraday cups, Photographic plates, Scintillation counter, channel electron Multipliers, Resistive anode Encoder image Detectors, High mass detection detectors); b] Conversion Dynodes- Helium leak detectors, Advanced detectors; c] Cryogenic Detectors-Multi Pixel Photon counter and d] Other Detectors- TQD Tandem Quadrupole MS Detector, Photonics BI Polar Maldi TOF Detector and Flexar SQ 300 MS Detector. It is also observed that evolution in mass spectrometry always takes place as per the type and need of analysis.

Keywords: Mass Spectroscopy, HPLC-MS, Detectors

1. Introduction

Mass spectrometer is an analytical device which used to detect the separated charged ions. The journey of ions starts from the inlet system- source- analyser and ends at detector by striking on it. Mass detector mainly detect the current signal generated from the passes or incident ions which are absolute or relative concentration of each analyte [1]. Detector output after amplification is traced on a recorder. The detectors are

considered to be the brain of instrument.

The best detector are defined on the basis of High amplification, Fast time response, Low noise, High collection efficiency, Low cost, Narrow distribution of responses, Same response for all masses, Large dynamic range, Long term stability, Long life and can be Mounted outside of the vacuum if possible [2].

As Instrumentation part of mass spectrometer consist of six divisions.

Table 1. Division and Type of mass Spectrometer.

Sr. No.	Division of Mass spectrometer	Type
1	Inlet system	Solid, Liquid and Gas
2	Ion Source	A] Gas Phase-Electron impact, Chemical ionization and field ionization B] Desorption-Field desorption, Electro spray ionization, matrix assisted desorption ionization, Plasma desorption, Fast atom bombardment, Secondary ion mass spectrometry and thermo spray ionization
3	Mass Analyser	Quadrupole, TOF, Ion Trap, FTICR A] Electron Multiplier, Faraday cups, Photographic plates, Scintillation counter, channel electron Multipliers, Resistive anode Encoder image Detectors, High mass detection detectors
4	Ion Detector	B] Conversion Dynodes- Helium leak detectors, Advanced detectors C] Cryogenic Detectors- Multi Pixel Photon counter D] Other Detectors-TQD Tandem Quadrupole MS Detector, Photonics BI Polar Maldi TOF Detector, Flexar SQ 300 MS Detector
5	Vacuum system	-

Sr. No.	Division of Mass spectrometer	Type
6	Recorder	-

2. Detectors

2.1. Ion Detectors

2.1.1. Electron Multiplier

An electron multiplier is used to detect the presence of ion signals emerging from the mass analyzer of a mass spectrometer. It is essentially the “eyes” of the instrument. The task of the electron multiplier is to detect every ion of the selected mass passed by the mass filter. How efficiently the electron multiplier carries out this task represents a potentially limiting factor on the overall system sensitivity. Consequently, the performance of the electron multiplier can have a major influence on the overall performance of the mass spectrometer. The basic physical process that allows an electron multiplier to operate is called secondary electron emission. When a charged particle (ion or electron) strikes a surface it causes secondary electrons to be released from atoms in the surface layer [3]. The number of secondary electrons released depends on the type of incident primary particle, its energy and characteristic of the incident surface.

Dynodes made up of copper-beryllium which transduces the initial ion current and electron emitted by first dynode is focused magnetically from dynode to the next. Final cascade current amplified more than million times [4].

There are two basic forms of electron multipliers that are commonly used in mass spectrometry: the discrete-dynode electron multiplier and the continuous-dynode electron multiplier (often referred to as a channel electron multiplier or CEM). All ETP electron multipliers are of the discrete-dynode type. A typical discrete-dynode electron multiplier has between 12 and 24 dynodes and is used with an operating gain of between 10^4 and 10^8 , depending on the application. In GC/MS applications, for example, the electron multiplier is typically operated in analog mode with a gain of around 105 [5]. For a new electron multiplier, this gain is typically achieved with an applied high voltage of ~1400 volts. (Figure 1)

As this is most sensitive detector. It protected from stray ions, neutral and cosmic rays. Then the background count rate is normally less than the 0.01 counts per second(c/s). However multiplier must also be protected from intense ion beams ($>5 \times 10^6$ c/s) as these can rapidly leads to its destruction.

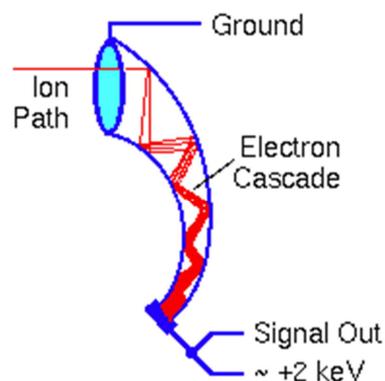
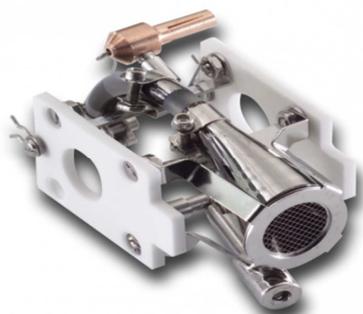


Figure 1. Electron multiplier by Varian California, USA (Agilent Technologies).

2.1.2. Faraday Cups

The Faraday cup is named after the name of Michael Faraday who first theorized ion around 1830. The metal cup placed in the path of the ion beam and is attached to an electrometer which measures the ion beam current. The basic principle is that the incident ions strike the dynode surface which emits electrons and induces a current which is amplified and recorded. So technically it is more an ion collector than detector. Basically in a cup the ions entered and transfer their charge to the cup [6]. Charge is usually transferred to electronics outside the vacuum system. The type of electronics determines whether measured as a charge, current or voltage. Some factors like mass, energy and charge of ion, angle of incidence, material of cup, and nature of ions i. e. monoatomic or polyatomic determines the number of secondary electrons. In this the charge of positive ion is neutralized by a flow of electrons and electron flow causes potential drop over resistor. By passive and active technique one can reduce the effect of secondary electrons. In passive cup make up with a material that generates fewer secondary electrons. The cup should be deep and narrow. In active technique the magnetic field to confine electrons to cup. Slit plate (repellor or plate) placed before cup with negative voltage, electrons that leave cup are forced back in to the cup (Figure 2).

In Faraday cup the dynode electrode is made up of secondary emitting material like CsSb, GaP or BeO. It is ideally suited to isotope analysis. Since Faraday cup only be used in an analog mode it is less sensitive than other detectors that are capable of operating in pulse counting mode. There are some drawbacks like material in the ion beams can be deposited on the surface of the cup (or even react with it). This surface layer can generate capious secondary electrons which can be avoided by coating the cup with graphite (or making it out of graphite) enhances the lifetime as well reduces the secondary electron generation [7].



Figure 2. Faraday cup by IOT innovative surface Technology, Germany.

2.1.3. Photographic Plates

Photographic plate integrates the ion signals over a period of time. The photo plates are processed by the usual photographic techniques and read with the aid of densitometer. It can detect ions of all masses simultaneously and provides reverse-geometry. It is a time integrating device. These detector generally used with radiofrequency spark instruments [8]. This is the simplest and oldest type of detector and can be used in plane-focusing instruments and detect all ions and the intensity of the mark on the film is proportional to the abundance of the ions. The main advantage of photographic plate detector is when it is used in double focusing mass spectrometer in which the whole or major part of the mass spectrum is focused in a plane. In this case one can make use of the integration action of the photographic plate. When the ion strikes the plate they leave the dark tracks on plate when the plate is developed. The intensity of these dark tracks is related to the number of ions of mass to charge ratio striking the plate at each point [2] and [9] (Figure 3).

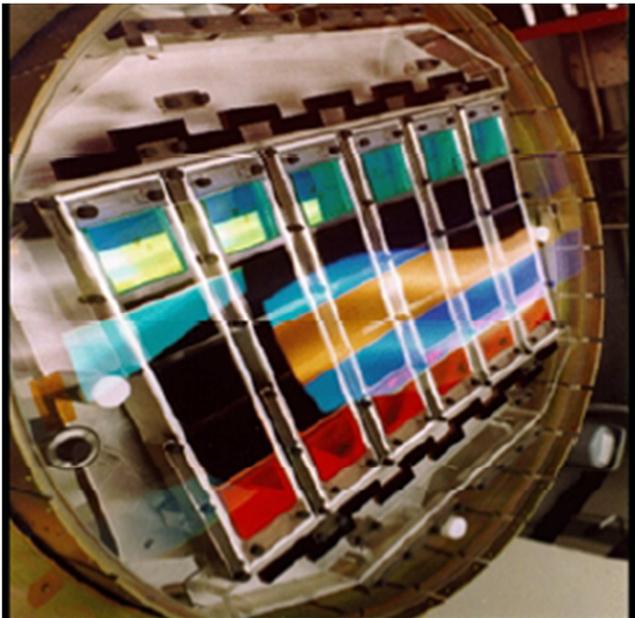


Figure 3. Photographic Plate by Encyclopedia Britannica, Mass spectroscopy 2012.

2.1.4. Scintillation Counter

The radio isotopes apart from causing ionization radiation emit photons of light cause excitation. This excitation can be

detected and quantified. The detection and measurement of this excitation is known as scintillation and the instrument which detects the light using a photo multiplier is known as scintillation counter. The electron pulse which is detected by the photomultiplier is a result of conversion of light into electrical energy. The modern electronic scintillation counter was invented in 1944 by sir Samuel Curran. With two different techniques scintillation can be counted i. e. Solid Scintillation (external) counting and liquid scintillation counting (integral).

In solid scintillation counting there is a case the sample is placed close to a floor crystal (crystallized silver activate zinc sulphides) for alpha emitters; sodium iodide for gama emitters; anthracene or stilbene for beta emitters; which in turn placed adjacent to a photomultiplier. This photomultiplier is connected to a high voltage supply and a scalar. Solid scintillation counting is particularly useful for measurement of gama emitting isotopes. This is so the gama rays are electromagnetic radiation and only rarely collide with neighbouring atoms to cause ionization or excitation; obviously the densely packed atoms in a crystal provide better chance of collision. On the other hand solid scintillation counting is not satisfactory for weak beta emitters. (^3H , ^{14}C and ^{35}S) since even the highest energy negatron have a very low penetrating power. (Figure 4)

In liquid scintillation counting the radioactive sample is suspended in a scintillation system composed of solvent and appropriate scintillator. This technique is extremely useful for quantitation of soft beta emitters. The radioactive sample is dissolved or suspended in a scintillation system composed of solvent and primary and secondary scintillators. The radiation from the suspended sample molecule collides with a solvent molecule imparting a discrete amount of its energy to the solvent molecules. The solvents used in LS counting are ethanol, acetone, ethyl glycol, dimethyl ether, 1,4 dioxane, xylene, methoxybenzene (anisole) and toluene .



Figure 4. Scintillation counter detector by Scionix, Netherlands.

Energy transfer in liquid scintillation and subsequent floor excitation occurs like, the solvent molecule which has become excited as a result of collision with the radiation emits light as it

come back to ground state, and this process is known as phosphorescence. Due to the peculiar chemical nature of the solvents. The solvents emit light of very short wavelength which falls in the range of 260-340nm. This range is too short to be detected by most existing instruments. To circumvent this problem a second molecule is added to the system, this compound known as a primary fluor, it absorbs light in the range of 260-340nm. The longer wavelength light can be further increased (for efficient detection) by using a secondary fluor. The secondary fluors absorb light emitted by the primary fluors and emit light with maximum in the visible region. The fluorescent nature of the compound depends on their aromaticity and number of pi (Π) bonds e. g. Primary fluorescent is PPO (2,5 diphenyloxazole) and secondary fluorescent is POPOP (1,4 bis-5 phenyl oxazol-2-yl-benzene). The amount of light yielded by the fluors is then taken up by photomultipliers which then convert light energy into an identical electrical signal that can be easily manipulated and measured. Samples containing same concentration of radioactive sample may produce different number of counts and this discrepancy is expressed in terms of counting efficiency.

Counting efficiency = $\frac{\text{Counts per minutes of the radioactive standard}}{\text{disintegration/minute of the radioactive standard}} \times 100$.

Scintillation counter detector is good because as soft beta emitters not detectable by GM (Geiger Muller) counters can be detected with about 50% efficiency. Unlike different GM tubes for different sample types, virtually any type of sample can be accommodated in Scintillation counter and its radioactivity can be determined accurately. High counter rates are possible. In this technique sample preparation is relatively easier. There is chemiluminescence also observed.

Some drawbacks with this technique as there may be quenching, cost per sample of LS counting is significantly higher than GM counter. High voltage to multiplier gives rise to electronics events in the system which contribute to high background even [10].

2.1.5. Channel Electron Multipliers

Electron multipliers have been used as detectors in mass spectrometers for over fifty years. There are two basic types of multipliers in use: the first include the copper-beryllium (CuBe), discrete dynode multipliers, which are the oldest and which trace their roots to photomultiplier tube technology. It has an advantage of being able to produce high output currents (in excess of 100mA), but suffers from the disadvantage of being relatively unstable when repeatedly exposed to atmosphere.

In recent years, new structures have been fabricated based on aluminum dynodes, which are reportedly less susceptible to degradation but are bulky and relatively expensive. The second type of multiplier is the continuous dynode multiplier. The vast majority of these are fabricated of glass, although some are constructed from coated ceramic materials or are a combination of glass and ceramic. These detectors are, in general, much more suitable for applications requiring

frequent exposure to atmosphere. Most of these detectors are of the single channel type; however, microchannel plates (two dimensional arrays of single channels) have been used in applications involving simultaneous imaging of an entire mass spectrum and Time-of-Flight Mass Spectrometry.

Channeltron® Single Channel Electron Multipliers (CEMs) are durable and efficient detectors of positive and negative ions as well as electrons and photons. The basic structure and operation of the Channeltron® CEM is a glass tube having an inner diameter of approximately 1mm and an outer diameter of 2, 3, or 6mm is constructed from a specially formulated lead silicate glass. When appropriately processed, this glass exhibits the properties of electrical conductivity and secondary emission. Today, CEMs are the most widely used detector in quadrupole and ion trap mass spectrometers and find many applications in magnetic sector instruments as well.



Figure 5. Channeltron® Single Channel Electron Multipliers by SPECS, GmbH, Germany.

The first successful multipliers were fabricated in 1958 by Goodrich and Wiley, then with Bendix Research Labs. These were followed closely by similar developments at Mullard Research Labs and the Laboratoire d'Electronique et de Physique Appliquee (L.E.P.). The Channeltron® CEM was first manufactured in the U.S. by the Electro-Optics Division of Bendix Corporation until 1973. This division was purchased by the management and the name changed to Galileo Electro-Optics Corporation. BURLE INDUSTRIES, INC. subsequently purchased the Galileo Scientific Detector Products group and formed the wholly owned subsidiary—BURLE ELECTRO-OPTICS, INC. In the mid 1970s, use of the Channeltron® CEM in laboratory based analytical instruments, and in particular mass spectrometers, became of significant interest. Their stable glass surfaces could withstand repeated cycling between vacuum and atmosphere without the degradation in performance common to CuBe discrete dynode multipliers. New CEMs were constructed of materials capable of sustaining the higher bias currents required for efficient operation in the analog mode.

Recent developments in Channeltron® CEM technology have extended the dynamic range (BURLE's exclusive EDR option), improved detection efficiency at higher masses, and enhanced lifetime under the less than ideal environments

typically encountered in mass spectrometers [11].

2.1.6. Resistive Anode Encoder Image Detectors

The resistive anode encoder (RAE) is the position-sensitive detector. It is used to digitally record images of ions. The background count rate is high. But it is constant over a period

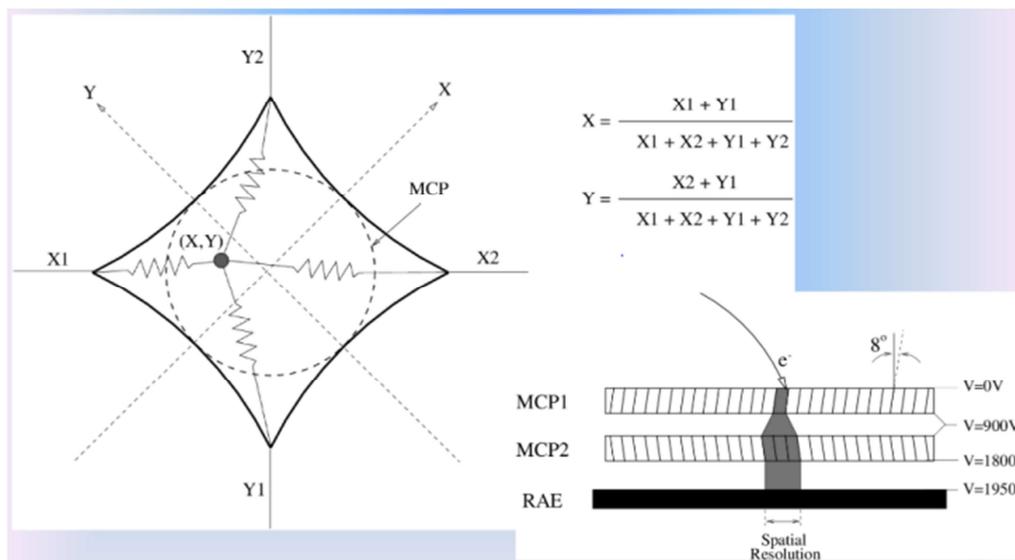


Figure 6. The resistive anode encoder detector by http://apapes.physics.uoc.gr/work_package_6.php.

An ion strikes on a channel in the first of two microchannel plates. The ion to electron conversion results formation of pulse of electrons that emerge back of the first plate to initiate a second electron cascade in the channels of the second plate comprises a thick resistive film which deposited on a ceramic plate. The geometry of this detector is designed to avoid image distortion. The charged pulse is partitioned off to four electrodes at the corners of the resistive plate. The pulses are amplified and then passed to the position computer to calculate the X and Y positions [12] (Figure 6).

2.1.7. High Mass Detection Detectors

There has been significant increase in interest in detection of ions that have high mass. The definition of high mass depends on ones perspective that those engaged in residual gas analysis, high mass of ion might be anything in excess of 200Da. While LC/MS and biomedical applications require detection of ions from tens and even hundreds of thousands of Daltons and GC/MS application may require detection of ions from 700-2000 Daltons. The detection efficiency decreases nearly exponentially with increasing mass of ions and becomes negligible to solve this problem several approaches have been developed, including the use of higher impact energies and high energy conversion dynodes.

2.2. Conversion Dynodes

Conversion dynode is used to increase the secondary electron emission characteristic for high mass ions and reduce the mass discrimination of the detector. It is a simple metal separate surface which can be held at a high voltage at 3 to 20kV or more. The potential of dynode serves to accelerate the

of time and a maximum count rate must be less than 4×10^4 c/s. Because this detector uses microchannel plate for the ion to electron conversion. So the detector discriminates between the species.

ions to a point where good conversion efficiency for either electrons or secondary ions occurs. The CEM used to detect the secondary electrons emitted from the dynode surface. It is used to detect the positive ions or the conversion products are thought to be the lower mass ions and electrons. The high negative potential on the dynode surface serves to direct electrons towards the channel electrons multipliers input which is held at a low negative potential. A high positive potential on the Conversion Dynode will not produce many secondary electrons being collected by the CEM since the dynode will tend to recapture electrons [13] and [14]. They are as follows.

2.2.1. Helium Leak Detectors

This is a helium-specific partial pressure analyzer. It detects the helium applied as a tracer or probe gas. It consist a mass spectrometer tube tuned on helium. Its own vacuum system capable of 10^{-5} mbar in the spectrometer tube. A sensitive and stable amplifier valve and auxiliary pumps for interfacing to vacuum system. A display used for monitoring leak rates. Sensitivity is 10^{-10} mbar or better.

A helium leak detector permits the localization of leaks and the quantitative determination of the leak rates, i.e. the gas flow through the leak. Such a leak detector is therefore a helium flow meter. In practice the leak detector performs this task by firstly evacuating the part which is to be tested so that the gas from the outside may enter through an existing leak due to the pressure difference present if there is a leak then helium can enter in to the system from the leak (for example by using a spray gun). This helium flows in to the leak detector and is detected [15] (Figure 7).

It is very fast, more sensitive more reliable, improved product quality, easy operation and cost saving.

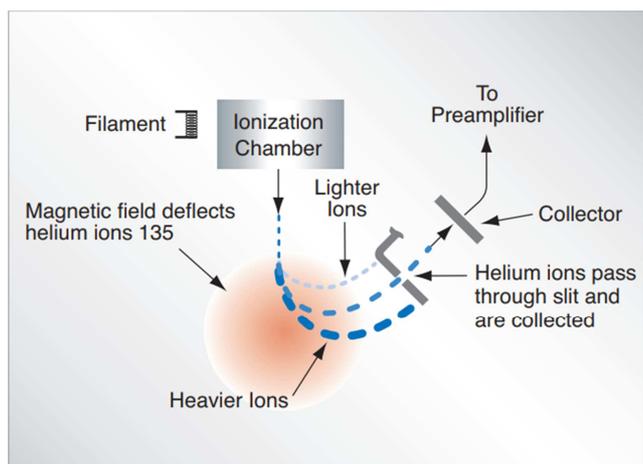


Figure 7. Helium leak detector process by Agilent Leak detectors Brochure.

2.2.2. Advanced Detectors

At present routine DNA analysis is done by mass spectrometry is seriously constrained to small DNA fragments and the application of mass spectrometry on those procedures that identify short DNA sequences. This approach helps the molecular biologists which are associated with LBLs Human Genome Centre to identify reluctant DNA sequences and vector contamination in clones, thereby improving sequencing efficiency. With the use of conventional electron multipliers one of the limitations of the mass spectrometry in DNA analysis is its poor efficiency. To solve this problem, alternative detection schemes which works on heat pulse detection is developed. When ion strike a detector, the kinetic energy of striking ions converted into heat and then measures indirectly such heat pulse. Developing a type of cryogenic detector called superconducting tunnel junction device which produces photons when ions strike the detector [16]. This detector does not base on the principle of production of secondary electrons. This type of detector to be at least two order of magnitude which is more sensitive, on an area-normalized basis, than micro channel plate ion detectors. These detectors could extend the upper mass limit large ions. In this electrospray ion sources generate ions of mega-Dalton DNA with minimum fragmentation but the mass spectrometric analysis of these large ions usually leads only to a mass/charge distribution. If charge of ions is known, actual mass data could determine. To solve this problem develop a detector that will measure the velocity and charge of individual ions. Mass analyze DNA molecules in the 1 to 10 mega Dalton range using charge-detection mass spectrometry. In this technique, individual electro-spray ions are strike through a metal tube which detects their image charge. When ions of known energy are sampled than simultaneous measurement of their velocity provides a way to measure their mass, By this method several thousand of ions can be analyzed in a few minutes, thus generating statistically significant mass values regarding the ions in a sample population [17].

The applications are to study the low energy beta decays to investigate the existence of massive nutrients. It is also used in biological macromolecules e. g. DNA sequence, Proteins, and polymers are essential for research in modern biochemistry and for the fabrication of new materials and medications.

2.3. Cryogenic Detectors

Multi Pixel Photon Counter

The Multi Pixel Photon counter (MPPC) is developed by HAMAMATSU PHOTONICS K. K. and it is one of the products of Si-PM (Silicon Photo multiplier) family which was originally developed in Russia. It is designed as photon counting device based on structures of a Si APD which was adopted by CERN (CMS). This device is a solid state photon counter having Multi pixelated Geiger-mode APDs with self quenching resistance [18]. It consists of 100-1600 small avalanche photo diodes (APD) in 1mm x 1mm sensitive region. MPPC is an excellent photon counting device as it is compact, insensitive to magnetic field, High gain (~106), low bias voltage (~70V) and its low cost. Since each pixel exist in two states "Fired" and "not fired" the MPPC have multi-pixel structure. By counting number of Fired pixel one can know number of photons injected into the detector (Figure 8).

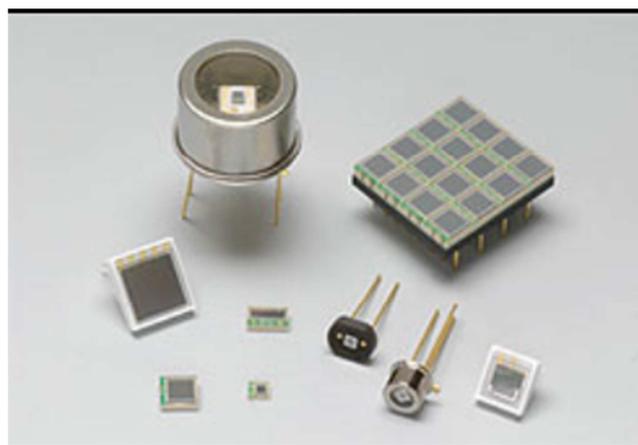


Figure 8. Multi Pixel Photon counter by HAMAMATSU PHOTONICS K. K.

2.4. Other Detectors

2.4.1. TQD Tandem Quadrupole MS Detector

Use of two or more mass analyser in a single instrument where one purifies the analyte ion from a mixture using magnetic field and the other analyzes fragments of the analyte ion for identification and quantification.

KEVO® TQD TANDEM QUADRUPOLE MS DETECTOR-

The Waters® Xevo® TQD is an advanced bench top tandem quadrupole mass detector. This detector collect high specific quantitative data for target compounds, while provides the ability to visualize all other components. With a wide range of ionization options including Atmospheric Pressure Photo Ionization (APPI), Atmospheric Pressure GC (APGC) and the Atmospheric Solids Analysis Probe (ASAP), the Xevo TQD is ideally suited to a variety of qualitative and

quantitative applications. This detector has wide range of ionization capabilities today, future-proofing for the innovation. These are designed to reduction of complexity; insure correct result and increase ease of use is delivered every time [19] (Figure 9).



Figure 9. TQD TANDEM QUADRUPOLE MS DETECTOR.

2.4.2. Photonis Bipolar Maldi Tof Detector

These detectors improve the detection efficiency of very high mass of ions. It has large 250 mm² collection area which allows higher sensitivity without the need for higher post acceleration voltage. It consist of a high-sensitivity microchannel plate, a photomultiplier and a high speed scintillator which can detect both positive and negative ions with 30 kV isolation [20].(Figure 10)



Figure 10. Photonis Bipolar Maldi Tof Detector by PHOTONIS USA.

This detector has advanced design in ion source and mass spectrometry technology that Provides soft ionization in rugged design. This detector attains a new level of sample insight through speed, confirmatory analysis and high sensitivity.

2.4.3. Flexar SQ300 MS Detector

The detector designed by PerkinElmer. It is the ultimate single quadrupole MS Detector a cutting edge instrument with

latest ion source technology. The improved quality of this detector is due to the instrument working in mass range 20-3000 u, Mass accuracy ± 0.1 u/24 hr; $\pm 3^\circ\text{C}$; Mass Axis stability ± 0.1 u/24 hr; $\pm 3^\circ\text{C}$; Mass Scan rate 10,000 u/sec; Resolution (FWHM): $0.6u \pm 0.1$; Polarity Switching: standard and Quantitative Dynamic range: 10^5 .



Figure 11. Flexar SQ300 MS Detector by PerkinElmer.

3. Discussion

The Mass detectors has a vital role in Mass spectroscopy in Electron multiplier the basic physical process to operate it is called secondary electron emission. The number of secondary electrons released directly proportional to the type of incident primary particle, its energy and characteristic of the incident surface. The two basic forms of electron multipliers are discrete-dynode electron multiplier and the continuous-dynode electron multiplier. Even though multiplier must also be protected from intense ion beams ($>5 \times 10^6$ c/s) to avoid destruction. Faraday cup works on principle that incident ions strike the dynode surface which emits electrons and induces a current which is amplified and recorded. As it is only be used in an analog mode makes it less sensitive than other detectors. Photographic plate is the simplest and oldest type of detector, detect all ions and the intensity of the mark on the film is proportional to the abundance of the ions. The intensity of these dark tracks is related to the number of ions of mass to charge ratio striking the plate at each point. In scintillation counting detector the electron pulse which is detected by the photomultiplier is a result of conversion of light into electrical energy. The radiation from the suspended sample molecule collides with a solvent molecule imparting a discrete amount of its energy to the solvent molecules. Due to the peculiar chemical nature of the solvents it emits light of very short wavelength which falls in the range of 260-340nm. Although this range is to short to be detected by most exciting instrument to circumvent this problem a second molecule is added to the system. Most of the time the channel Electron multipliers (CEM) detectors are of the single channel type; however, microchannel plates 1 is used in Time-of-Flight Mass Spectrometry. Today, CEMs are the most widely used detector due to its broad applications

Recent developments in Channeltron® CEM technology improved detection efficiency at higher masses, and enhanced lifetime under the less than ideal environments. In the resistive anode encoder image detector -The pulses are amplified and then passed to the position computer to calculate the X and Y positions. In High mass detection detector higher impact energies and high energy conversion dynodes used for enhancement. In conversion Dynodes the high negative potential on the dynode surface serves to direct electrons towards the channel electrons multipliers input which is held at a low negative potential. A high positive potential on the Conversion Dynode will not produce many secondary electrons being collected by the CEM since the dynode will tend to recapture electrons. Helium Leak Detector, it permits the localization of leaks and the quantitative determination of the leak rates, i.e. the gas flow through the leak. It is very advantageous. Advanced detectors, analyzes DNA molecules in the 1 to 10 mega Dalton range using charge-detection mass. By this method several thousand of ions can be analyzed in a few minutes, thus generating statistically significant mass values regarding the ions in a sample population. It is highly used in modern biochemistry for the fabrication of new materials and medications. The working of Multi Pixel Photon counter based on each pixel exist in two states "Fired" and "not fired" the MPPC have multi-pixel structure. By counting number of Fired pixel the number of photons injected into the detector is measured. In TQD Tandem Quadrupole MS Detector collects high specific quantitative data for target compounds, while provides the ability to visualize all other components. These are designed to reduction of complexity; insure correct result and increase ease of use is delivered every time. In Photonis Bipolar Maldi Tof Detector consist of a high-sensitivity microchannel plate, a photomultiplier and a high speed scintillator which can detect both positive and negative ions with 30 kV isolation.

4. Conclusion

Mass Spectrometry is now developing into a mature technique and modern instrumentation allows for routine and robust operation. Mass Detectors plays a crucial role in Mass spectroscopy. On the basis of mass to charge ratio separated ions get detected by using different type of detectors. This manuscript gives the brief discussion about various kinds of mass detector that are required while working with mass spectroscopy. Recently a lot of research going on developing more advanced mass detectors which covers all the field of analysis and the mass instrument become reach to new era.

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