Mass Spectrometry & Purification Techniques

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Perspective

Instrumentation and Applications of Mass Spectrometry

Janku Dashbazar*

Department of Chemical Engineering, University of Jimma Institute of Technology, Jimma, Ethiopia

DESCRIPTION

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-charge ratio. Mass spectrometry is used in many different fields and is applied to pure samples as well as complex mixtures.

A mass spectrum is a type of plot of the ion signal as a function of the mass-to-charge ratio. These spectra are used to determine the elemental or isotopic signature of a sample, the masses of particles and of molecules, and to elucidate the chemical identity or structure of molecules and other chemical compounds. In a typical MS procedure, a sample, which may be solid, liquid, or gaseous, is ionized, for example by bombarding it with a beam of electrons. This may cause some of the sample's molecules to break up into positively charged fragments or simply become positively charged without fragmenting. These ions (fragments) are then separated according to their mass-to-charge ratio, for example by accelerating them and subjecting them to an electric or magnetic field.

Instrumentation

This method is used to measure known materials, to detect unknown compounds within a sample, and to elucidate the structure and chemical properties of various molecules present in the sample. This method affects the ionization energy of molecules, hence it is known as mass spectroscopy. Mass spectroscopy was mainly composed of the inlet system, ionization, deflector, and ion detector. This method includes four stages: ionization, acceleration, deflection, and detection. In actual, when the sample is passed through the inlet system, it gets vaporized before being transported into the ionization chamber, where it is attacked by a stream of electrons radiated by an electrically heated metal coil. In particular cases, the collision will hit an electron from the particle, resulting in a positively charged ion. Most of the ions formed have a positive charge, as it is tough to remove a second electron from an already positive ion. The positively charged ions are getting away from the ionization chamber, which are positively charged and permit through negatively charged splits that pass and accelerate this into a beam. The stream of positively charged ions is then repelled by a magnetic field. The number of ions is deflected by depending on the charge of the ion and the mass of the ion, where the positive charge is separated based on their mass and charge. Lighter ions will be repelled more than heavier ones. The molecules that have more mass by charge ratio are the lighter ions. When an ion breaks out the detector, the charge of the molecule gets neutralized, and this produces an electrical current. This process is proportional to the mass and charge of the ion; these are sent to a computer for analysis. Thus, a mass spectrum band is generated, which shows the various mass by charge values of ions present in the sample and their relative masses.

CONCLUSION

The main advantages of mass spectroscopy are that it can separate the various components based on their structure. It is used to detect unknown components present in the sample. Mass spectroscopy can distinguish co-eluting compounds more easily. It can detect volatile components from non-volatile components. Mass spectroscopy is also used in investigations of microbial communities and bioremediation. It can also detect the molecular weight of the component to classify the isotopes of a substance. The main disadvantage of mass spectroscopy is that it cannot identify hydrocarbons that yield similar ions and it's unable to explain optical and geometrical isomers apart.

Correspondence to: Janku Dashbazar, Department of Chemical Engineering, University of Jimma Institute of Technology, Jimma, Ethiopia, E-mail Jankudashbazar@gmail.com

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