Applications of mass spectrometry in clinical biochemistry: An overview.

Brown John*

Department of Chemistry, Stanford University, California, USA

Mass spectrometry (MS) has been a pivotal technique in scientific research for decades, enabling the accurate identification and quantification of molecules based on mass-to-charge ratio. However, its use was previously confined to research laboratories, due to its complexity, high cost, and the requirement for specialist operators. Advances in technology have simplified mass spectrometry systems, reducing costs and introducing them into the clinical laboratory setting. Clinical biochemistry, the study of biochemical mechanisms within the human body related to disease conditions, has seen mass spectrometry increasingly incorporated into its toolbox. This article explores the broad applications of mass spectrometry in clinical biochemistry and its role in enhancing diagnostics, therapeutics, and understanding of disease pathways. [1].

One of the most important clinical applications of mass spectrometry is therapeutic drug monitoring (TDM). TDM involves measuring drug concentration levels in a patient's bloodstream to optimize dosage for maximum efficacy and minimal toxicity. Mass spectrometry provides the sensitivity and specificity necessary for accurate and reliable TDM, especially for drugs with narrow therapeutic ranges such as antiepileptics, immunosuppressants, and certain anti-cancer drugs. Mass spectrometry has revolutionized newborn screening, allowing simultaneous testing for several congenital metabolic disorders from a single dried blood spot sample. Tandem mass spectrometry (MS/MS) has been particularly beneficial in this area, enhancing the detection of amino acid disorders, fatty acid oxidation disorders, and organic acidemias. Early detection enables prompt intervention and management, significantly improving health outcomes for affected infants [2].

Vitamin D deficiency is a global health concern linked to numerous diseases, including osteoporosis, cardiovascular disease, and certain cancers. The complexity of Vitamin D metabolism and its various forms have made its accurate assessment challenging. Mass spectrometry provides the specificity needed to distinguish and quantify the various forms of Vitamin D, contributing to more accurate diagnoses and treatments. Mass spectrometry plays a crucial role in proteomics, the large-scale study of proteins. Proteins are vital indicators of physiological states and disease conditions, and their study can lead to the discovery of novel biomarkers. Mass spectrometry aids in the identification, quantification, and characterization of proteins, offering insights into disease pathways and potential therapeutic targets [3].

In the realm of endocrinology, mass spectrometry has significantly improved the analysis of steroid hormones. Traditional immunoassays are often plagued by issues of cross-reactivity and lack of standardization. In contrast, mass spectrometry offers improved specificity, allowing for accurate measurement of low concentration steroids and aiding in the diagnosis and monitoring of endocrine disorders. Clinical toxicology, dealing with the detection and interpretation of toxins in the body, also benefits from mass spectrometry. Whether it's identifying drugs of abuse, diagnosing poisoning, or monitoring environmental or occupational exposure to toxins, mass spectrometry offers unrivaled sensitivity and specificity. The ability to screen for multiple toxins in a single analysis is particularly beneficial in emergency situations, where rapid and accurate diagnosis is critical.

While mass spectrometry has made a significant impact on clinical biochemistry, challenges remain. Skilled operation and interpretation of results require specialized training. The high cost of equipment can be a barrier for smaller laboratories. Furthermore, the development of standardized protocols is crucial for inter-laboratory comparability of results [4].

Technological advancements continue to push the boundaries of mass spectrometry. High-resolution mass spectrometry (HRMS) promises to improve identification and quantification of compounds. Advances in sample preparation techniques aim to simplify processes and reduce analysis time. The integration of mass spectrometry with other technologies like liquid chromatography (LC-MS) and gas chromatography (GC-MS) enhances its capabilities, offering even more precise analysis, mass spectrometry has firmly established its place within the clinical laboratory, playing a vital role in diagnostics, therapeutics, and disease understanding. As the technology continues to evolve, we can expect an expanding role for mass spectrometry in clinical biochemistry, transforming our ability to understand and combat disease [5].

References

1. Buck RC, Franklin J, Berger U, et al. Perfluoroalkyl and polyfluoroalkyl substances in the environment: terminology, classification, and origins. Integr Environ Assess Manag. 2011;7(4):513-41.
2. Ritscher A, Wang Z, Scheringer M, et al. Zurich statement on future actions on per-and polyfluoroalkyl substances (PFASs). Environ Health Perspect. 2018;126(8):084502.

***Correspondence to:** Brown John, Department of Chemistry, Stanford University, California, USA, E-mail: mailto: brownjohn@stanford.edu

***Received:** 20-July-2023, Manuscript No. AACBC-22-108304; **Editor assigned:** 21-July-2023, PreQC No. AACBC-22-108304(PQ); **Reviewed:** 04-Aug-2023, QC No. AACBC-22-108304; **Revised:** 04-Aug-2023, Manuscript No. AACBC-22-108304(R); **Published:** 16-Aug-2023, DOI:10.35841/aacbc-7.4.157*

***Citation:** John B. Applications of mass spectrometry in clinical biochemistry: An overview. J Clin Bioanal Chem. 2023;7(4):157*

3. Baabish A, Sobhanei S, Fiedler H. Priority perfluoroalkyl substances in surface waters-a snapshot survey from 22 developing countries. Chemosphere. 2021;273:129612.
4. Sorengard M, Lindh AS, Ahrens L. Thermal desorption as a high removal remediation technique for soils contaminated with per-and polyfluoroalkyl substances (PFASs). PloS one. 2020;15(6):e0234476.
5. Mahinroosta R, Senevirathna L. A review of the emerging treatment technologies for PFAS contaminated soils. J Environ Manag. 2020;255:109896.

Citation: *John B. Applications of mass spectrometry in clinical biochemistry: An overview. J Clin Bioanal Chem. 2023;7(4):157*