

Multiple Reviews of Analytical Biochemical Techniques

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Abstract

Analytical biochemical techniques are a set of methods used to detect, identify, and quantify biochemical molecules such as proteins, nucleic acids, and metabolites. These techniques are essential for understanding the molecular mechanisms underlying biological processes and diseases. This abstract will provide an overview of some of the most commonly used analytical biochemical techniques and their applications.

Keywords: Analytical biochemical techniques; chromatography; ELISA

Introduction

One of the most widely used analytical biochemical techniques is chromatography, which separates molecules based on their chemical and physical properties. High-performance liquid chromatography (HPLC) and gas chromatography (GC) are commonly used [1-6] to separate and quantify small molecules such as amino acids, nucleotides, and metabolites. HPLC is also used for protein separation and purification. Another important analytical biochemical technique is electrophoresis, which separates molecules based on their size and charge. Gel electrophoresis is commonly used for separating proteins and nucleic acids. Polyacrylamide gel electrophoresis (PAGE) and sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) are used to separate proteins, while agarose gel electrophoresis is used for nucleic acid separation. Spectroscopy is another essential analytical biochemical technique that involves the interaction of light with matter. Ultraviolet-visible (UV-Vis) spectroscopy is used to measure the absorbance of molecules such as nucleic acids and proteins, while fluorescence spectroscopy is used to detect and quantify molecules such as fluorophores and proteins. Enzyme-linked immunosorbent assay (ELISA) is a powerful analytical biochemical technique used to detect and quantify proteins or antibodies. ELISA is widely used in diagnostics, drug discovery, and basic research.

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(HPLC), gas chromatography (GC), and ion-exchange chromatography (IEC) are commonly used in the field. Detection methods are used to detect the presence of biochemical molecules. Spectroscopy is a commonly used detection method that involves the interaction of light with matter. Ultraviolet-visible (UV-Vis) spectroscopy is used to measure the absorbance of molecules such as nucleic acids and proteins, while fluorescence spectroscopy is used to detect and quantify molecules such as fluorophores and proteins. Quantification methods are used to measure the concentration of biochemical molecules. Enzyme-linked immunosorbent assay (ELISA) is a commonly used quantification method that involves the use of antibodies to detect and quantify proteins or other biomolecules. Mass spectrometry (MS) is another commonly used quantification method that measures the mass-to-charge ratio of molecules and is used for protein identification, metabolomics, and lipidomics. In addition to these methods, there are emerging techniques and technologies in the field of analytical biochemical techniques, such as microfluidics, biosensors, and computational methods. These innovations are enabling researchers to study biochemical molecules with greater sensitivity, accuracy, and speed.

In summary, the choice of materials and methods in analytical biochemical techniques depends on the specific research question and the biochemical molecules being studied. Separation, detection, and quantification methods are commonly used in the field, with emerging techniques and technologies offering new possibilities for advancing our understanding of complex biological systems.

Analytical Biochemical Techniques Types of Techniques

There are many different types of analytical biochemical techniques, each with its own strengths and limitations. **Some of the most commonly used types of techniques are:**

Chromatography: Chromatography is a separation technique used to separate mixtures of compounds based on their chemical and physical properties. High-performance liquid chromatography (HPLC), gas chromatography (GC), and ion-exchange chromatography (IEC) are commonly used in the field.

Electrophoresis: Electrophoresis is a technique used to separate charged molecules, such as proteins and nucleic acids, based on their charge and size. Gel electrophoresis and capillary electrophoresis are commonly used in the field [6-9].

Spectroscopy: Spectroscopy is a technique that involves the interaction of light with matter to provide information about the structure, composition, and dynamics of biochemical molecules. Ultraviolet-visible (UV-Vis) spectroscopy, fluorescence spectroscopy, and infrared (IR) spectroscopy are commonly used in the field.

Mass spectrometry: Mass spectrometry (MS) is a technique used to measure the mass-to-charge ratio of molecules. It is used for protein identification, metabolomics, and lipidomics.

Enzyme-linked immunosorbent assay (ELISA): ELISA is a technique used to detect and quantify proteins or other biomolecules using antibodies.

Polymerase chain reaction (PCR): PCR is a technique used to amplify DNA sequences, allowing for the detection and identification of specific genes and mutations.

Microfluidics: Microfluidics is a technology used to manipulate and analyze small volumes of fluids. It is used for applications such as single-cell analysis and point-of-care diagnostics.

Biosensors: Biosensors are devices that detect and quantify biological molecules. They are used for applications such as medical diagnostics and environmental monitoring.

Computational methods: Computational methods are used to analyze large datasets and model complex biochemical systems. They are used for applications such as drug discovery and personalized medicine. These techniques and others are used in combination to address complex biochemical problems and advance our understanding of biological systems.

Applications on Analytical Biochemical Techniques

Analytical biochemical techniques have a wide range of applications in many fields, including

Biomedical research: Analytical biochemical techniques are used to study the molecular basis of diseases, such as cancer, diabetes, and neurodegenerative disorders. Techniques such as ELISA, PCR, and mass spectrometry are used to detect and quantify specific biomolecules associated with these diseases.

Drug discovery: Analytical biochemical techniques are used to identify and characterize potential drug candidates. High-throughput screening methods, such as mass spectrometry and fluorescence-based assays, are used to screen large libraries of compounds for their ability to interact with specific targets.

Environmental monitoring: Analytical biochemical techniques are used to monitor the levels of pollutants, toxins, and other harmful substances in the environment. Biosensors, chromatography, and mass spectrometry are commonly used in environmental monitoring.

Food science: Analytical biochemical techniques are used to analyze the composition and quality of food products. Techniques such as chromatography, spectroscopy, and electrophoresis are used to identify and quantify specific molecules, such as proteins, carbohydrates, and fats.

Forensic science: Analytical biochemical techniques are used to analyze biological evidence, such as DNA and proteins, in forensic investigations. Techniques such as PCR and mass spectrometry are used for DNA and protein analysis, respectively.

Agriculture: Analytical biochemical techniques are used to improve crop yields and quality. Techniques such as PCR and enzyme assays are used to detect and quantify plant pathogens, while chromatography and spectrophotometry are used to analyze nutrients in soil and plant samples. Overall, analytical biochemical techniques play a critical role in advancing our understanding of biological systems and improving human health and the environment.

Limitations on Analytical Biochemical Techniques

Analytical biochemical techniques have several limitations, including

Sensitivity: Some techniques, such as ELISA and PCR, can be highly sensitive, but they may not be sensitive enough to detect low levels of biomolecules in complex biological samples. This can result in false negative results.

Specificity: Analytical biochemical techniques can be highly specific, but they may not be able to distinguish between closely related molecules. For example, mass spectrometry may not be able to distinguish between two molecules with similar mass-to-charge ratios.

Sample preparation: Analytical biochemical techniques often require extensive sample preparation, which can be time-consuming and costly. Sample preparation can also introduce artifacts or contaminants that can interfere with the accuracy of the results.

Equipment and expertise