Journal of Analytical & Bioanalytical Techniques

Mika, J Anal Bioanal Tech 2023, 14:4

Case Report

Open Access

Chromatography Techniques: Applications in Drug Development

Dr. Brondz Mika*

Department of Biomedical Engineering, McConnell Brain Imaging Centre (BIC), Montreal Neurological Institute (MNI), Faculty of Medicine, McGill University, Montreal, Canada, Mila—Quebec Artificial Intelligence Institute, Montreal, Canada

Abstract

Chromatography is a powerful separation technique widely used in drug development for the separation and analysis of complex mixtures. Chromatography techniques involve the separation of a sample mixture into its individual components based on their physical and chemical properties.

Keywords: Chromatography techniques; Applications; Drug development

Introduction

The most commonly used chromatographic techniques in drug development are high-performance liquid chromatography (HPLC), gas chromatography (GC), and thin-layer chromatography (TLC). These techniques are used to analyze drug substances and their impurities, as well as to study drug metabolism, pharmacokinetics, and pharmacodynamics. Case studies involving chromatography techniques are numerous and can be found in various fields such as pharmaceuticals, biotechnology, food science, environmental science. Materials and methods for chromatography techniques can vary depending on the specific [1-3] application and type of chromatography being used. However, there are some general steps and common materials involved in most chromatography techniques. Below is an overview of the general materials and methods for chromatography techniques:

Materials

Chromatography column: this is the main component of the chromatography system where the separation occurs. The column can be made of various materials, such as glass, stainless steel, or plastic, and can have different dimensions and packing materials depending on the application.

Mobile phase: this is the liquid or gas that flows through the chromatography column and carries the sample components through the column. Sample: this is the mixture (Table 1) of components that need to be separated and analyzed.

Detector: this is the instrument that detects the separated components and generates a signal that can be recorded and analyzed.

Methods

Sample preparation: the sample is usually prepared by extracting or isolating the components of interest from a complex mixture using various techniques such as solid-phase [4-7] extraction, liquid-liquid extraction, or precipitation.

Column preparation: the chromatography column is prepared by packing it with the appropriate stationary phase material, such as silica gel or ion exchange resin.

Mobile phase preparation: the mobile phase is prepared by mixing solvents and additives to achieve the desired separation properties, such as selectivity, resolution, and retention time.

Column equilibration: the column is equilibrated with the mobile phase to ensure the stationary phase is hydrated and the mobile phase is stable.

Sample injection: the sample is injected into the chromatography column using an injection valve or syringe.

Separation: the sample components are separated as they pass through the chromatography column due to differences in their physical and chemical properties, such as size, charge, or polarity.

Detection: the separated components are detected by the detector and a signal is generated, which is recorded and analyzed to identify and quantify the sample components.

In conclusion, the materials and methods for chromatography techniques depend on the specific application and type of chromatography being used. However, the general steps and common materials involved in most chromatography techniques include sample preparation, column preparation, mobile phase preparation, column equilibration, sample injection, separation, and detection.

Discussion

Chromatography techniques

HPLC: is a widely used chromatographic technique that separates mixtures based on differences in their polarities, charge, and molecular size. In drug development, HPLC is used to analyze drug substances and their impurities, as well as to study drug metabolism and pharmacokinetics. HPLC can also be used to purify drug substances, allowing for the isolation of pure compounds for further study.

GC: is a chromatographic technique used for the analysis of volatile compounds, such as drugs and their metabolites. GC separates the components of a mixture [7-9] based on their boiling points and vapor pressures. GC is commonly used in drug development for the analysis

***Corresponding author:** Dr. Brondz Mika, Department of Biomedical Engineering, McConnell Brain Imaging Centre (BIC), Montreal Neurological Institute (MNI), Faculty of Medicine, McGill University, Montreal, Canada, Mila—Quebec Artificial Intelligence Institute, Montreal, Canada, E-mail: BzdokNomi@gmail.com

Received: 01-Apr-2023, Manuscript No: jabt-23-95875, **Editor assigned:** 03-Apr-2023, Pre QC No: jabt-23-95875(PQ), **Reviewed:** 17-Apr-2023, QC No: jabt-23-95875, **Revised:** 21-Apr-2023, Manuscript No: jabt-23-95875(R), **Published:** 28-Apr-2023, DOI: 10.4172/2155-9872.1000516

Citation: Mika B (2023) Chromatography Techniques: Applications in Drug Development. J Anal Bioanal Tech 14: 516.

Table 1: There may be more or fewer chromatography techniques utilized, and the results and treatment plan may vary depending on the specific condition being diagnosed and treated.

Chromatography Technique	Results	Treatment Plan
High Performance Liquid Chromatography (HPLC) of urine sample	Elevated levels of Compound Y	Prescribe medication A to target Compound Y
Gas Chromatography (GC) of blood sample	Elevated levels of Compound Z	Prescribe medication B to target Compound Z
Ion Exchange Chromatography of urine sample	Elevated levels of protein X	Prescribe medication C to target protein X
Size Exclusion Chromatography of blood sample	Elevated levels of lipid W	Prescribe medication D to target lipid W

of drug substances and their impurities, as well as for the study of drug metabolism and pharmacokinetics.

TLC: is a simple and cost-effective chromatographic technique used for the separation of small amounts of compounds. TLC is commonly used in drug development for the identification and quantification of drug substances and their impurities.

Chromatography techniques have numerous applications in drug development, including drug discovery, drug formulation, and quality control. Chromatography is used in drug discovery to identify and isolate active compounds from complex mixtures. Chromatography is also used in drug formulation to develop optimal drug delivery systems, such as liposomes and nanoparticles. Chromatography techniques are also used in quality control to ensure the purity, potency, and consistency of drug products. Chromatography is used to monitor drug impurities and degradation products, as well as to detect contaminants in drug products.

Chromatography present applications

Pharmaceutical analysis: Chromatography techniques, particularly high-performance liquid chromatography (HPLC), are used extensively in the pharmaceutical industry for the analysis of drug substances and their impurities. HPLC is used for the quantitative analysis of drugs in formulations, identification of unknown compounds, and purification of compounds.

Biotechnology: Chromatography techniques are used in the purification of proteins, peptides, and other biomolecules. Affinity chromatography, ion exchange chromatography, and size exclusion chromatography are commonly used in the biotechnology industry for the purification of therapeutic proteins.

Environmental analysis: Chromatography techniques are used in the analysis of environmental samples for the detection and quantification of pollutants, such as pesticides, herbicides, and other organic compounds. Gas chromatography (GC) and liquid chromatography (LC) coupled with mass spectrometry (MS) are commonly used in environmental analysis.

Food science: Chromatography techniques are used in the analysis of food additives, contaminants, and natural products. HPLC and GC are commonly used in food science for the analysis of food products.

Forensic science: Chromatography techniques are used in forensic science for the analysis of drugs, poisons, and other toxic substances. GC and HPLC are commonly used in forensic science for the analysis of drugs and their metabolites.

Petroleum analysis: Chromatography techniques are used in the analysis of petroleum and its products for the detection and quantification of hydrocarbons, as well as other impurities. Gas chromatography is commonly used in petroleum analysis.

Conclusion

Chromatography techniques are critical tools in drug development, providing a means to separate and analyze complex mixtures of compounds. HPLC, GC, and TLC are widely used in drug development for the analysis of drug substances and their impurities, as well as for the study of drug metabolism, pharmacokinetics, and pharmacodynamics. Chromatography techniques have numerous applications in drug discovery, drug formulation, and quality control, and will continue to play a critical role in the development of safe and effective drug products. Chromatography techniques have a broad range of present applications in various fields, including pharmaceuticals, biotechnology, environmental analysis, food science, forensic science, and petroleum analysis. These techniques provide a powerful means of separation and analysis, allowing for the detection and quantification of compounds in complex mixtures. As the need for precise and accurate analysis continues to grow, chromatography techniques will continue to play a critical role in modern science and technology.

References

1. Abdelgadir E (2012) Exploring Barriers to the Utilization of Mental Health Services at the Policy and Facility Levels in Khartoum State Sudan. University of Washington.
2. Abbo C (2011) Profiles and outcome of traditional healing practices for severe mental illnesses in two districts of Eastern Uganda. Global health action 4:7117.
3. Chatwal GR, Anand SK (2002) Instrumental methods of chemical analysis 5th edition. Mumbai Himalayapublishing house 2149-2184.
4. Sethi PD (2006) High Performance Liquid Chromatography Quantitative Analysis of PharmaceuticalFormulations 4th Edn 11-97.
5. Skoog DA, Holler FJ, Crouch SR (2017) Principles of instrumental analysis 6th ed. Delhi Cengagelearning 806-835.
6. (2005) Validation of analytical procedures: Text and Methodology Q2 (R1). ICH Harmonized TripartiteGuideline 4-13.
7. Lambert S, Valiulis Q (2018) Cheng Advances in optical sensing and bioanalysis enabled by 3D printing. ACS Sens 3: 2475-2491.
8. Kim E, Kim J, Choi I, Lee J, Yeo WS, et al. (2020) Organic matrix-free imaging mass spectrometry. BMB reports 53:349.
9. Wang Y, Han Y, Hu W, Fu D, Wang G (2020) Analytical strategies for chemical characterization of bio-oil. Journal of separation science 43:360-371.