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Journal of Chromatography & Separation Techniques

Editorial

A Short Note on Chromatography: Its Types and Applications

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DESCRIPTION

Chromatography has emerged as a formidable technique in the laboratory for the separation and identification of various chemicals in a mixture since its introduction. Chromatography takes use of the polarity differences between molecules in a mixture. In this approach, a liquid functions as a mobile phase and it sweeps over a bed of particles termed the stationary phase. A sample solution containing the to-be-separated combination is injected into the mobile phase, which travels through the stable stationary phase. The components in the mixture are separated depending on their relative affinity to the two phases. Molecules with a higher affinity for the stationary phase travel slower than those with a lower affinity. The separated molecules are then identified by comparing them to established standards.

Types of chromatography

Chromatography has developed over the years depending on the different demands for molecule separation. Several forms of chromatography are now utilized in labs across the world for a variety of applications. Some of the more important categories are covered briefly below:

1. Paper chromatography entails using wet paper as a stationary phase and a liquid solvent as a mobile phase. When the components are separated, they appear as spots on the dried paper.
2. Liquid chromatography employs silica and alumina as stationary phases and organic solvents as mobile phases.
3. Thin layer chromatography entails coating a plastic or glass sheet with a thin layer of an adsorbent such as alumina (Al_2O_3) or silica (SiO_2). After chromatographic separation, components are separated based on their affinity to the adsorbent and appear as isolated spots on the sheet.
4. Column chromatography was indeed equivalent to thin layer chromatography in that it employs the same stationary and mobile phases. The difference here is that both phases are confined within a vertical glass column, and the separation process takes time.
5. Gas Chromatography (GC): In GC, an inert gas (such as Helium, Nitrogen, or Argon) is used as the mobile phase, and the stationary phase is frequently composed of silicon polymers. The sample combination is placed into the stationary phase-lined column and selectively adsorbed. As the molecules are separated, they are recognised by a detector as they exit the column.
6. High Performance Liquid Chromatography (HPLC): HPLC is a type of column chromatography that is more sophisticated. In HPLC, a sample combination is placed into the mobile phase (typically a solvent), which is then pushed at high pressure into a densely packed analytical column for fast separation of the sample molecules. This separation is based on the molecules' affinity for both the mobile phase and the particles covering the column (the stationary phase).
7. Ion-exchange chromatography is a technique used to separate ions and polar compounds based on their affinity for an ion exchanger. It facilitates the separation of charged molecules like proteins, amino acids, and nucleotides. In this case, the mobile phase is frequently a conductive solution (determined by salt concentration). Specific ionic features, such as the quantity and placement of charges on the molecule, influence the adsorption of the sample molecules to an oppositely charged solid support.

The separation includes adjusting variables such as ionic strength and pH such that solute molecules are released from the column in the order of their binding strengths, with the least strongly bound compounds eluted first.

Chromatography's applications

The following are some of the most important uses of chromatography in various industries:

- To keep track of air quality and test drinking water
- Drug detection in urine and other bodily fluids
- Chemical fingerprinting and species identification
- In the pharmaceutical industry, materials are purified and chemical compounds are analysed for trace impurities in order to distinguish chiral molecules.
- Separation and analysis of additives, preservatives, vitamins, and proteins to identify toxins and pollutants in food for quality control in the food business.

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Received date: 27-Dec-2021, Manuscript No. JCGST-21-e161; **Editor assigned:** 30-Dec-2022, PreQC No. JCGST-21-e161 (PQ); **Reviewed:** 13-Jan-2022, QC No. JCGSR-21-e161; **Revised:** 18-Jan-2022, Manuscript No. JCGST-21-e161(R); **Published:** 25-Jan-2022, DOI: 10.35248/2329-9096-22.10.629.

Citation: Allen S (2022) A Short Note on Chromatography: Its Types and Applications. J Chromatogr Sep Tech. 13: e161.

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