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REVIEW ARTICLE GAS – CHROMATOGRAPHY (GC)

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ABSTRACT

Gas chromatography is a term used to describe the group of analytical separation technique used to analyze volatile substance in the gas phase. In gas chromatography, the components of a sample are dissolved in a solvent and vaporized in order to separate the analyte by distributing the sample between two phases: a stationary phase and a mobile phase. The mobile phase is chemically inert gas that serves to carry the molecules of the analyte through the heated column. Gas chromatography is one of the sole forms of chromatography that does not utilize the mobile phase for interacting with the analyte. The stationary phase is either a solid adsorbant, termed gas-solid chromatography (GSC), or a liquid on an inert support termed gas - liquid chromatography (GLC). Gas chromatography is an instrumental technique used forensically in drug analysis, arson, toxicology analyse of other organic compounds.

KEYWORDS: Gas chromatography (GC), gas-solid chromatography (GSC), liquid chromatography (GLC).

INTRODUCTION

Gas chromatography is an analytical technique that is widely used to separate and analyze gaseous and volatile compounds. Modern gas chromatography was invented in 1952 by James and Martin. From the beginning of the 1950s, this method was first used to isolate amino acids. GC is a fast and very sensitive method. Both qualitative and quantitative analysis can be done by GC. It can also be the number of minutes analyzed by GC. In gas chromatography, the sample is dissolved in a solvent and evaporated. Split analytics. The sample is distributed between two phases: stationary phase and mobile phase. The liquid phase is helium or nitrogen etc. is a chemically inert gas such as gas chromatography is a unique type of solid phase chromatography that does not require interaction with the analyte. Chromatographic separation methods are without any doubt the most frequently employed analytical techniques for compositional analysis .Chromatography (GC) 50 years ago, GC has been used to help determine food composition, discover our nutritional needs, improve food quality, and introduce novel foods.

Gas chromatography is technique used for separation of volatile substance, or substance that can be made volatile, from one another in a gaseous mixture at high temperatures.

PRINCIPLE

In gas-solid chromatography, a solid adsorbent is used as the stationary and separation phase.In gas-liquid chromatography with a stationary phase adsorption processSolid consists of a thin layer of immobile liquid with support and separation through the process of division. Gasliquid chromatography is the most commonly used method. The separated sample is first vaporized and then mixed with the gas Mobile stage. In the stationary phase, faster particles travel more slowly & in the stationary phase, the less soluble components travel faster. So are the components. The sample solution stored in the device, which is separated together for distribution, enters the gas stream that passes through the separator pipe called "column". (Helium or nitrogen is called carrier gas.) Various components are separated inside the column. The detector measures the amount of components leaving the column. To measure a sample with an unknown concentration, a standard sample with a known concentration is injected into the instrument. The peak retention time (outer form) and area of the standard sample are compared with the test sample to calculate the concentration.

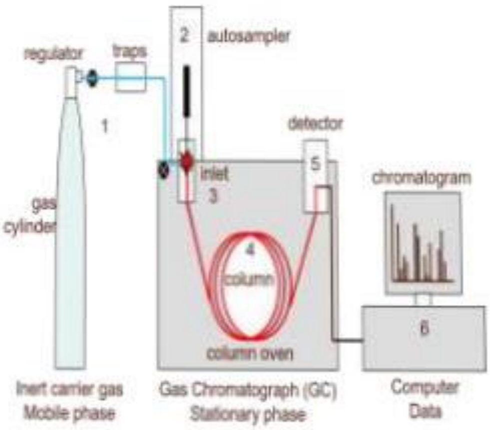

Fig. 1.

INSTRUMENTION

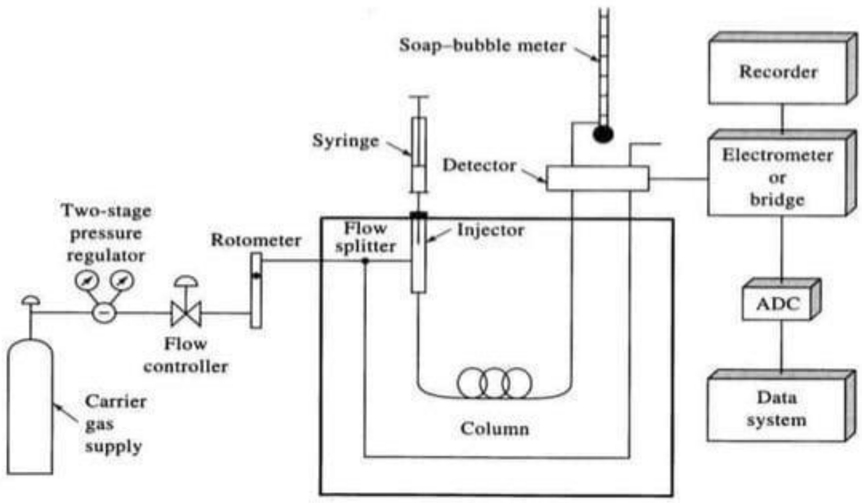

Fig. 2.

Gas chromatography consists of the following parts:

1. **Carrier gas supplier:** It is a mobile phase consisting of inert gases such as a hydrogen, helium, argon etc. The choice of carrier gas depends on nature of the sample, consumption, column efficiency, type of detector and so on.
2. **Sample injectors:** The sample injected usually ranges from 0.1-0.5 micro litre for gases and little amount of mg for solids. The sample that is carried out by the gases (mobile phase) to the column is connected to injector. It is injected through syringe and heated to rapid vaporization.
3. **Columns:** The column are stainless steel, copper, nickel or plastic tubes. There are two types of column in gas chromatography i.e.packed column. Packed column is generally used when the sample is large. Capillary column offers greater resolution in comparison with packed column.
4. **Detector:** The detector is a transducer in which the input chemical signal is converted into output electric signal. It is used for the continuous measurement of solute concentration of the carrier gas stream. The ideal detector should have the characteristics like high sensitivity rapid response and high signal to noise ratio.
5. **Recorder:** The signal from detector passes through amplifier through and then to the new recorder. The recorder consists of mobile recording pen and a recording chat strip.

APPLICATIONS

- Quantification of pollutants in drinking and waste water using official U.S. Environmental Protection Agency (EPA) methods.
- Quantification of drugs and their metabolites in blood and urine for both pharmacological and forensic applications.
- Identification of unknown organic compounds in hazardous waste dumps.
- Identification of reaction products.
- Analysis of industrial products for quality control.
- GC can be used for the direct separation and analysis of gaseous samples, liquid solutions, and volatile solids. If the sample to be analyzed is non-volatile, the techniques of derivatization or pyrolysis GC can be utilized.
- Gas chromatography (GC) has been an indispensable analytical technique in the application of fatty acid determinations in oilseed plant breeding, biosynthesis and human metabolism. As well as the characterization of complex mixtures of geometric isomers when combined with other chromatographic separations and spectroscopic identification

ADVANTAGES

1. Improved resolution – GC technology allows you to more easily separate closely related peaks in your data than other chromatographic methods such as thin layer chromatography (TLC). Parameters can be adjusted in real time to better resolve peaks that occur. GC is suitable for very complex mixtures such as fumes that TLC can hardly resolve.
2. Increased Analysis Speed – Operating parameters can be easily changed (even during an experiment), allowing sample analysis to be completed in minutes. Optimum resolution can be achieved quickly with GC.
3. Wider sample choice – A wider choice of volatile samples can be analyzed with GC. The ability to control the temperature of the process allows for samples with high boiling points to be analyzed.

4. Fully Quantitative – The software used in gas chromatography provides more accurate data than other techniques, making it a fully quantitative technique. For example, TLC requires additional equipment such as densitometers and processing steps, increasing the cost of all experiments.

CONCLUSION

From this we can conclude that GC is currently the most widely used analytical technique available for the separation and identification of compounds or complex mixtures. GC is the most widely used technique due to its speed, excellent resolution and sensitivity at several mg samples, and excellent accuracy and precision.

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