Gas Chromatography

Gas chromatography

Gas chromatography is one of the most versatile of all the chromatographic technique. It was first described by Martin in 1952.

Gas chromatography is a special form of chromatography used for separating and identifying chemicals in sample. It involves the separation of volatile material in vapors state. It is most widely used for qualitative and quantitative analysis of the sample because it has high sensitivity and reproducibility and speed of resolution. In this chromatograph both partition and absorption phenomena is possible. If absorption take place then it is called as Gas solid chromatography, where as when partition process take place it is known as Gas liquid chromatography.

Basic principle

Gas chromatography separates the component of the mixture on the basis of difference in the partition coefficient of the volatilized compound between the stationary liquid or solid phase and moving gas phase. As the compounds are carried by the gas and after leaving the column it passed through the detector that is linked via an amplifier to a recorder, which turn records a peak as each analyte passes through the detector.

Instrumentation

The gas chromatogram basically consists of following instrumentation.

Carrier gas

The most commonly used carrier gases in Gas chromatography are Helium, Nitrogen, Hydrogen and mixture of 95% Argon and 5% Methane. The selection of carrier gas depends on the type of detector used. Hydrogen and Helium are most suitable used

carrier gas with thermal conductivity detector because of their thermal conductivity. Nitrogen and Helium gas is suitable with Flame ionization detector. Argon and Methane combination is suitable for Electron Capture detector.

Flow Control

It is used to regulate the flow of carrier gas.

Injecting port

The sample of chromatographic analysis is dissolved in suitable solvent such as Acetone, Heptanes' and methanol. Chlorinated organic solvents are generally avoided as they contaminated the detector. The sample inlet system is called as inject port is heated to high temperature for vaporizing the sample quickly which is to be analyzed. After diluting the sample in to suitable solvent it is introduced in to the injecting port with the help of micro syringe.

Stationary phase

It is thin film of liquid contained within the column categorized as gas liquid chromatography, where as in gas solid chromatography the fixed phase consist of solid material such as silica, alumina and porous polymers. In gas liquid chromatography the stationary phase is non volatile liquid e.g. polyethylene glycolsqualene are held as thin layer on the solid support such as silica.

Column

Generally the column made of copper, aluminum stainless steel and glass. Glass is mostly preferred due to inert nature. There are two type of column.

- Packed column
- Capillary column

Packed column

In packed column the stationary phase is thin film of liquid that is fixed on to the small granular particles packed in to the column. This column usually made up of stainless steel or glass. They are 1.5 to 10m in length.

Capillary column

It is made up of glass and is much longer then the packed column. It length varies from 15-160m. These types of column very narrow. The column wall coated with the active materials. These columns are flexible so very long column can be bound in to a small coil.

There are two types of columns Known as **wall coated open tubular (WCOT) column** and **support coated open tubular (SCOT) column**. In WCOT column the stationary phase is coated directly on to the wall of the capillary tubing. as due to the presence of the small amount of the stationary phase only small amount of sample may be injected at one time. In SCOT column a support material is bounded to the wall of capillary column and the stationary phase is coated on this support. The capacity of SCOT is higher than WCOT.

Detector

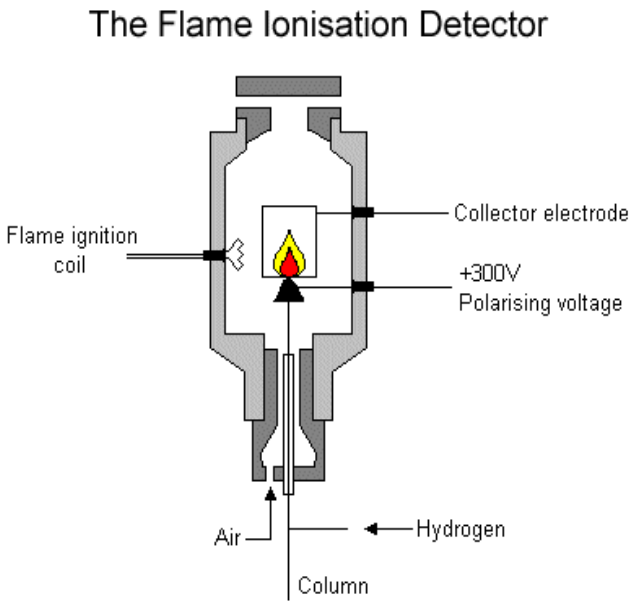
Several detectors have been designed for the analysis of component in GC. The function of the detector is to detect and measure the different component s of the sample as they emerge out from the column. the most commonly used detector are

Thermal conductivity detector (TCD)

In TCD there is heated filament over which the carrier gas flows at steady speed. The heat loss is constant and filament remains at a constant temperature. When carrier gas flow through it the component in the carrier gas change the rate of heat loss. There for the temperature of tungsten filament is altered which further change the resistance of the filament and converted in to electrical signals. It works on the Wheat stone bridge. This electrical signal is amplified and recorded.

Flame Ionized Detector

FID has become the most commonly used detector in GC. In FID a flame is maintained by an independent stream of air and hydrogen near which a metal loop electrode is positioned and kept at constant electric potential. When carrier gas passes through the flame along with analytical components it decomposed the analytical components producing positive and negative ions that change the electrode potential. These changes are recorded as signals on the chart. It is most commonly used for the most organic component.



Retention time

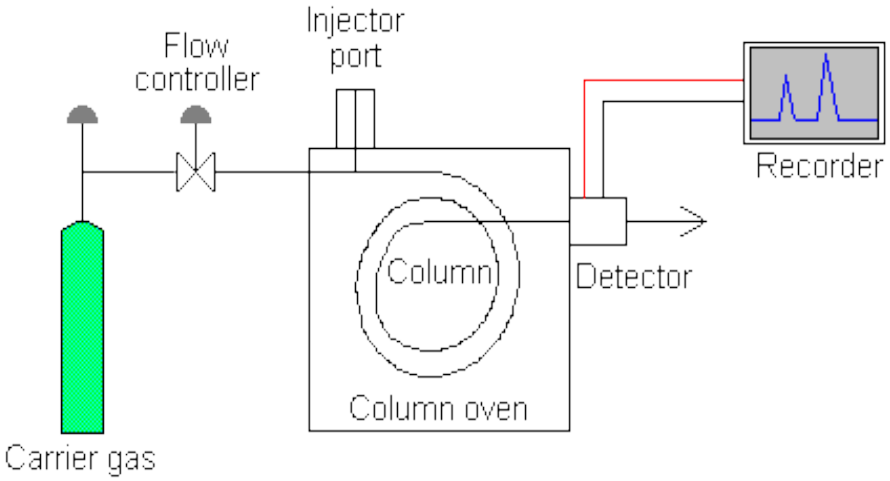
It may be defined as the interval of time between the introduction of the sample mixture in to the column and elution of the different components of the mixture. Retention time remains the same under given conditions. It is most useful for the identification of the components.

Recorder

The written record of the separation of the component is called Chromatogram. I typical chromatogram will shows a number of peaks corresponds to one component of the mixture. It can be obtained with the help of printer.

Applications

- The most important aspect of GAS chromatography is its ability to separate and detect small amount of variety of drugs in a complex mixture.
- It is used for the analysis of gases such as carbon monoxide or other natural gases by directly injected in to the column.
- It is used in blood alcohol analysis. It is also used in the analysis of paints fibers and polymers. These polymers are heated at high temperature in a special chamber called as Pyrolyzer. The long chain molecules are broken in to simple volatile products and get detect.
- The petroleum products like Kerosene, petrol, diesel are detected more efficiently by this technique.
- It is used for the identification of the different component of the pesticides or insecticides.



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