Chromatography

Chromatography is a general term that is applied for a wide variety of separation techniques based on the partitioning or distribution of a sample (solute) between a moving or mobile phase and a fixed or stationary phase.

1. Stationary Phase

It is characterized by a high surface area and get the separation of the result physiological interaction for the Material to be estimated Material to be estimated and portable by the mobile phase and this phase either solid or liquid.

2. Mobile Phase

Is the phase that carries the material to be separated and passes from the top of the stationary phase and this phase is either liquid or gas.

There are many chromatography methods and for accurate study, chromatography methods should be classified.

Chromatography classification

The chromatographic procedures can be subdivided according to the various techniques applied, or to the physicochemical principles play role in the separation.

A-The chromatographic procedures according to the various mobile phases can be divided into three parts:

1-Gas chromatography (GC).

2- Supercritical fluid chromatography (SFC) .

3- Liquid chromatography (LC).

B- The liquid chromatography can be divided into:

1- **Paper chromatography (PC).**

2- **Column chromatography.**

3- **Thin layer chromatography (TLC).**

Ion - Exchange Chromatography

The term "ion exchange" means the exchange between ions have the same charged between a solution and a solid material that contact with the solution but does not dissolve in it. It is called an (Ion - Exchanger).

The ion-exchanger is characterized by its own charge, and have a porous molecular structure that allows the movement of ions and solvent molecules through it in and out freely.

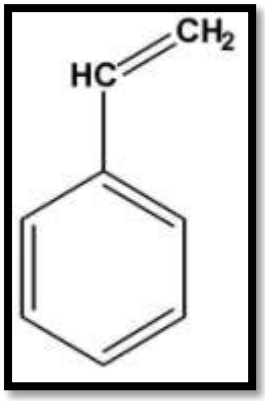
There are many materials that are suitable for this purpose, such as natural materials, including some types of clay and soil where the phenomenon of ion exchange was discovered for the first time in clay and soil, where it was noted that the dissolved salts ions in the water are exchange with the ions associated with soil, The clay usually contains in its crystalline structure an increase of the positive or negative charge, This charge is equivalent with the ions that have the opposite charge that are can change able with ions have the same charge soluble in the solution and in contact with the clay particles

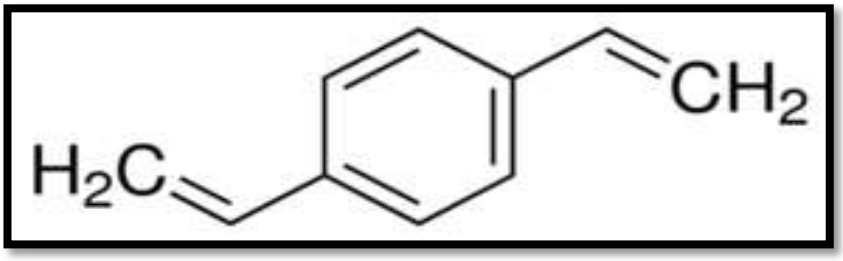
$$2R^{-}Na^{+} + Ca^{+2} \leftrightarrow (R^{-})_2Ca^{+2} + 2Na^{+}$$

On the exchanger in solution on the exchanger in solution

R^- : Is the body of the exchanger that carries a negative charge in the case of the cation exchanger which is always equated with a positive ion charge such as Na^+ an ion exchange component $R^- Na^+$.

The stationary phase in ion-exchanger chromatography is Polymer particles (polystyrene) which is linked by side with (Divinyl benzene) , that called (Resin).The vinyl group in the ring can be easily exchanged when added an active acidic groups.





Styrene **Divinyl benzene**

Types of ion exchanger resins:-

There are four main types of ion exchanger resins used in analytical chemistry:

Type Exchanger	Effective functional groups
A- Cation exchanger	
1-Strong acid	Sulfonic acid SO_3H^+
2-Weak acid	Carboxylic acid $COOH^+$
B- Anion exchanger	
1-Strong base	Quaternary ammonium grou $R\text{-}CH_2N^+(CH_3)_3$
2-Weak base	Poly amine $R\text{-}NH_3$

Types of ion exchangers

1- **Natural exchangers such as zeolite , soil**
2- **Structural exchangers: can be divided into :**

1. Non-organic ion exchangers

These exchangers are divided into two parts:

- **Aluminum silicate**

It is a cation exchange consists from the mixing of aluminum sulphate and sodium silicate to produce a gel containing aluminum ions that can be replaced with calcium ions or ammonium or other ions. Although these exchanges have a high exchange capacity but

it's easily decomposed by acids and base. The most important use of these exchanges in the estimation of ammonium ion.

- **Hydroxyl Oxides**

The precipitate (iron oxide or aluminum oxide) which have a positive charge (as a cationic exchanger) and their ability to ions exchange are small, While the hydroxyl oxides of quaternary metals (Sn, Tn, Zr) are more useful in the ion exchange.

2. Organic exchangers

are industrial resin have a high molecular weight containing an effective group of organic polymers that are insoluble in water and can combine with a large number of electrically charged groups and are used in analytical chemistry and are available in the granules form ranging from
(0.02 - 0.04 mm)