Ion Exchange Chromatography

Definition: It is the reversible process of separation of ions based on their affinity towards the ion exchanger.

Introduction:

- 1. Column used for ion exchange are characterized by the presence of charge group covalently attached to the stationary phase.
- 2. Anion exchanger contain bound positive group covalently attached ion exchange chromatography retention is based on attraction between the solute ions and charge sites bound to stationary phase.
- 3. to stationary phase whereas cation exchangers contain bound negative groups.

Instrumentation of ion exchange chromatography:

1)Pump:

The IC pump is consider to be one of the most important component in the system which has to provide continuous constant flow of the eluent though the injector, column and detector.



2)Injector:

Sample introduction can be accomplished in various ways. The simplest method is to use an injection valve. Liquid samples may be injected directly and solid samples need only to be dissolved in an appropriate solvent.



3)Columns:

Depending on its ultimate use and area of application, the column material may be stainless steel, titanium, glass or an inert plastic such as PEEK. The column can vary in diameter from about 2mm to 5 cm and in length from 3 cm to 50 cm depending on whether it is to be used for normal analytical purposes, microanalysis, high speed analyses or preparative work.



4)Suppressor:

The suppressor reduces the background conductivity of the chemicals used to elute samples from the ion-exchange column which improves the conductivity measurement of the ions being tested. IC suppressors are membrane-based devices which are designed to convert the ionic eluent to water as a means of enhancing the sensitivity.



5)Detectors :

Electrical conductivity detector is commonly use.



6)Data system:

In routine analysis, where no automation is needed, a preprogrammed computing integrator may be sufficient. For higher control levels, a more intelligent device is necessary, such as a data station or minicomputer.



Application of ion exchange chromatography:

- 1. An important use if ion exchange chromatography is in the routine analysis of amino acid mixtures.
- 2. The twenty principle amino acid from blood seium or from the hydrolysis of protein are separated and used I clinical diagnosis.
- 3. In the analysis of products of hydrolysis of nucleic acid in these way information is gain about the structure of these biological function as carriers of hereditary information.
- 4 . Chelating raisings are used to collect trace metals from Sea water.

Mechanism of ion exchange process :

A most common ion exchange system includes a water swollen ion exchange material and surrounding aqueous solution. Ion exchange like any heterogeneous process it's a complished by transfer of ions to nay from of interphase boundary; that is the chemical reaction itself, diffusion inside the material and diffusion in the surrounding solution should be consider as ion exchange.

1)The tern countarioun has two interpretation

2)It can be use a exclusively for ions inside the ion exchanger3)It can be used in broad sense weather in the exchanger or any external solution



Fig.: Mechanism of ion exchange process.

Factors affecting ion exchange :

- 1. Nature of exchange resin.
- 2. Chemical variables.
- 3. Physical variables.
- 4. Ion exchange constant.
- 5. Surface area.
- 6. Temperature.
- 7. Composition of cation.
- 8. Length of column.
- 9. Ionic strength.
- 10.Ion exchanger resin

Classification :

1. Strongly acidic cation exchanger :

Sulphonic acid group attach to sterin and divinyl benzene co polymer.

2 .Weakly acidic cation exchanger :

Carboxylic acid group attach to acrylic and divinyl benzene co-polymer.

3. Strongly basic anion exchangers :

Quaternary ammonium groups attach to sterin and divinyl benzene co polymer.

4. Weakly basic anion exchanger :

Polyalkyle amine group attach to sterin and divinyl benzene co-polymer.

Physical Properties Of Ion Exchange Resin :

1. Cross Linling :

It affects swelling

2. Swelling :

When resin swell polymer chain srreads apart.

3. Partical Size And Porosity :

Increase in surface area and decrease in partical size will increase the rate of ion exchange.

4.Reagenration :

Cation exchange resins are regenerated by treatement with acid, then washing with water.

Reference :

1) Gurdeep R Chatwal, page no.2662 to 2672

- 2) Robert H Willard (seventh edition) page no.633
- 3) Dr.A.V. Kasture (Volume 2nd) page no.39 to 47
- 4) Arthur I Vogel page no.805 to 809

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