

Adsorption chromatography:

It has been found that closely related substances with almost similar physical and chemical properties which cannot be separated from one another by ordinary means, are adsorbed to different extents on the surface of adsorbents. This facilitates their separation and purification. If a solution containing different solutes is poured down a column filled with a finely divided adsorbent, the solute most readily absorbed is retained on the top layer along with smaller amounts of the other constituents, while the less readily adsorbed constituents are held on lower portions of the column. A partial separation of the constituents of the mixture is thus easily achieved. A fuller separation is possible by repeating, and modifying the process.

This process of separation, also known as column chromatography, was first developed in 1900 by Day, an American petroleum chemist. However a more extensive study was made in 1906 by Tswett, a Polish botanist. He observed that when a solution of plant pigments in petroleum ether is passed slowly through a column packed with alumina, a number of horizontal bands of different colours are produced in the column. This is evidently, due to the fact that different constituents of the mixture are adsorbed to different extents. The most readily adsorbed constituent is held at the top. The others with decreasing order of adsorbabilities are held up in different zones down the column in the same order. This, of course gives only a partial separation of the various constituents as some of the less readily adsorbed constituents are still present mixed up

with the more readily adsorbed constituents and so on.

The initial separation of the various coloured constituents can be improved by passing either the original or some other suitable solvent slowly through the column. The solvent used is called eluent. The various coloured zones then become more sharply defined. Therefore, the name chromatography, which implies, colour, was given to this technique.

The banded column of the adsorbed constituents is called a chromatogram.

The process of improving the separation by passing the original solvent or some other suitable solvent, is known as development of the chromatogram.

The solvents used in chromatography have three functions to perform:

1. They dissolve the mixture of various constituents and introduce them into the column. The solvents used for this purpose are generally non polar (such as benzene and petroleum ether) since adsorption takes place more readily from such solvents.
2. They are introduced into the column for the development of the chromatogram. In this process, the various zones of the chromatogram get separated sharply from one another. The solvents when used for this purpose are termed as, developers. The developer is generally a solvent in which the components of a mixture are not highly soluble. It is usually a liquid of low molar mass. Attempt is often made, to use the same solvent which is used for introducing the mixture, as a developer. But it is not always

possible. Hence, other suitable solvents are used quite often.

3. They are also used for removing the various constituents of a mixture from the chromatogram after it is properly developed. The solvents used for this purpose are called eluents. A good eluent must be a liquid which can dissolve readily the various components. It must also get itself to some extent. This helps in displacing components from the column. Further, the eluent should be a low boiling liquid

so that it can easily be removed from the recovered component.

Sometimes it is desirable to use two eluents one after the other. If one eluent can desorb only a portion of an adsorbate, the second, a more powerful eluent, maybe used to desorb the remaining portion of the adsorbate. Thus, it benzene is used as the first eluent, ether may be used as the second eluent.

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