

An Insight into the Analytical Techniques

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Pharmaceutical field is related to the discovery of novel molecules, their formulation for the treatment of disease, but the presence of impurities in pharmaceuticals may cause serious side effects and physical and chemical incompatibilities. Hence, the use of various analytical techniques reduces or eliminates the impurities at various levels of pharmaceuticals development. Here, some analytical techniques are given along with their advantages which are used in research as well as also at various steps of pharmaceuticals manufacturing.¹

1. Titration: This analysis involves acid base titration, redox titration, precipitation titration, complexometric and non-aqueous titration.

Application:

- a. Functional group analysis.
- b. Estimation of drugs.
- c. Analysis of degradation products of pharmaceuticals.

Advantages:

- a. Saves time and labor.
- b. Precise.

2. Thin layer chromatography: It is a very simple, popular and basic technique which has a wide applicability.

Application:

- a. Any impurity in drugs could be screened.
- b. Can be used for quantitative analytical methods.
- c. Provides information about degradation products of pharmaceuticals.

Advantages:

- a. Less sample application is required and is cheap.
- b. Number of mobile phases can be selected.
- c. High amount of sample can be loaded.
- d. Sample distinction is possible.²

3. High performance thin layer chromatography (HPTLC): It is a very important separation technique which could be used for large number of samples.

Application:

Used for quantitative analysis of drugs such as alfuzosin and pentazocine.

Advantages:

- a. Reduced time.
- b. Easy to handle.
- c. Number of parameters could be studied.
- c. Results are reliable.

4. High-performance liquid chromatography (HPLC): This is a very precise, accurate method of separating complex molecules mixture.

Application:

- a. Useful in method development of Pharmaceutical drugs.
- b. To detect the contents of formulations.
- c. To estimate the drug content in biological fluids.
- d. To analyze the impurity in the sample.³
- e. To analyze the degradation products.

Advantage:

a. Sensitive, reliable, precise method for analysis.

5. Gas Chromatography (GC): It is a very useful and accurate chromatographic technique for the analysis of volatile compounds.

Application:

- a. Quantitative analysis of drugs, complex mixtures.
- b. Estimation of impurity in the samples.

6. UV visible spectroscopy: It is a very economical method which involves less manpower. This method is used to analyze pharmaceuticals which involves assay of drugs and estimation of active pharmaceutical constituent in formulation.⁴

7. Fluorimetry and phosphorimetry: These techniques utilize micro samples to test the formulation and biological samples.

8. Near Infrared spectroscopy (NIR) and Nuclear magnetic spectroscopy (NMR): NIR finds its application to test the raw material, product quality and monitoring the manufacturing process. NMR is applicable to test the impurity in the drug and also quantitatively assess the constituents of the formulation and biological samples.

9. Electrochemical and electrophoretic methods: Electrochemical methods like Voltammetry, polarography, amperometry, potentiometry are used to determine the drugs quantitatively. Capillary electrophoresis is useful to analyze pharmaceuticals polymers and inorganic ions.

10. Advancement in the hyphenated techniques like LC-NMR, CE-MS etc. have found wide application in analyzing pharmaceuticals and chiefly for bioanalytical and biotransformation studies.⁵

The analytical techniques discussed above are used in research, development of drugs, quality control in industries, clinical studies, analysis of structure etc. Utilization of these analytical techniques ensures a suitable formulation which satisfies the parameters of safe and effective dosage forms.

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