

Applications and Importance of Analytical Chemistry in Pharmaceutical Industry

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Opinion Article

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ABOUT THE STUDY

The pharmaceutical business has a considerable impact on analytical chemistry, particularly throughout the drug development phase when it provides quality assurance, safety, and efficacy of novel drugs. In the pharmaceutical sector, a variety of analytical methods are employed, but chromatography methods like HPLC, LC-MS, GC, and GC-MS are the most often used methods. These methods are the industry standard for examining polymorphism in novel drugs. However, because of its precision and speed of measurement, spectroscopic equipment is also employed in this sector. A novel drug molecule with therapeutic action to treat or prevent disease and it serves as the basis for the drug development process. The drug molecules, also known as active pharmaceutical ingredients, are examined for just to determine a possible medication that treats or prevents disease and that can be available to the public (APIs). In order to streamline the drug production process and characterize drug compounds along the process, it is crucial to have effective analytical procedures.

Instruments and techniques are used in analytical chemistry to distinguish, find, and measure the materials. Each of the three approaches can be used alone or combined with another. Some molecules are isolated through separation. Analytes are recognized and detected using qualification procedures and their concentration is ascertained using quantitative methods.

Additionally, traditional wet chemistry techniques as well as instrumental approaches are used in analytical chemistry. Traditional qualitative procedures for separation include precipitation, extraction, and distillation. Differentiations based on color, melting point, boiling temperature, solubility, or radioactivity are examples of other techniques of identification. Additionally, standard quantitative analytical techniques quantify the amount using changes in mass or volume. The three main instrumental techniques that are typically employed for separation are

chromatography, electrophoresis, and field-flow fractionation. After the target analyte has been isolated, concentration can be determined using qualitative and quantitative techniques. This is frequently accomplished by continuing to characterize and analyze the sample with the same instrument after separation or by employing different spectroscopic techniques. The same equipment is frequently used in classical instrumental methods to separate, detect, and quantify materials.

Applications

- Forensic science, bio analysis, clinical analysis, environmental analysis, and materials analysis are a few fields where analytical chemistry is used. Performance (sensitivity, detection limit, selectivity, robustness, dynamic range, linear range, accuracy, precision, and speed) and cost are two major factors that influence analytical chemistry research (purchase, operation, training, time, and space). The most common and all-encompassing of the principal branches of modern analytical atomic spectrometry are optical and mass spectrometry.
- The development of nanotechnology has been impossible without the use of analytical chemistry. With the use of chemical characterizations, scientists may observe atomic structures using surface characterization tools, electron microscopes, and scanning probe microscopes.
- Analytical chemistry has been crucial in advancing our understanding of fundamental science and its many practical applications, including biomedical applications, environmental monitoring, industrial manufacturing quality control, forensic science, and others.
- Analytical chemistry has expanded into a variety of new biological disciplines as a result of recent advancements in computer automation and information technology. For instance, the completion of human genome projects was made possible by automated DNA sequencing devices, which led to the development of genomics.

Modern analytical chemistry highly depends on instrumentation. Academics frequently concentrate on either novel applications and findings or novel analytical techniques. An analytical chemist might be engaged in the discovery of a chemical present in blood that raises the risk of cancer. The employment of a tunable laser to boost the specificity and sensitivity of a spectrometric approach could be part of an effort to create a new technique. Many methods are maintained purposefully static after they are developed so that data can be compared over extended periods of time. This is especially true for forensic, environmental, and industrial quality assurance (QA) applications.