

USE OF PHYSICOCHEMICAL METHODS IN PHARMACEUTICAL ANALYSIS OF MEDICINES

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The modern pharmaceutical industry requires highly accurate, selective, and rapid analytical methods for quality control of medicines. Physicochemical methods of analysis play a crucial role in the identification, standardization, and quantitative determination of active pharmaceutical ingredients in medicinal products. The

application of instrumental analytical techniques significantly improves the reliability of pharmaceutical analysis and ensures compliance with international quality standards.

The purpose of this study is to analyze the effectiveness and practical application of physicochemical methods in pharmaceutical analysis of medicines. Particular attention is paid to spectrophotometric, chromatographic, electrochemical, and optical methods widely used in pharmaceutical practice.

Physicochemical analysis methods are based on measuring physical properties associated with the chemical composition of substances. Among the most commonly used methods in pharmaceutical analysis are ultraviolet-visible (UV-Vis) spectrophotometry, infrared spectroscopy, high-performance liquid chromatography (HPLC), thin-layer chromatography (TLC), potentiometry, and fluorimetry.

UV-Vis spectrophotometry is widely used for quantitative determination of biologically active compounds due to its simplicity, sensitivity, and rapidity. This method allows determination of flavonoids, phenolic compounds, alkaloids, and vitamins in pharmaceutical preparations. The analytical signal is based on the absorption of electromagnetic radiation by molecules in the ultraviolet and visible regions.

Chromatographic methods are considered among the most informative analytical techniques in modern pharmaceutical chemistry. High-performance liquid chromatography provides high selectivity and sensitivity in multicomponent analysis. HPLC is extensively used for the determination of impurities, active substances, and degradation products in medicines.

Thin-layer chromatography remains an important screening method for identification of medicinal plant raw materials and phytochemical compounds. The method is characterized by simplicity, low cost, and visual evaluation of chromatographic zones.

Infrared spectroscopy is applied for structural identification of pharmaceutical substances. The IR spectra of compounds contain characteristic absorption bands corresponding to functional groups, enabling qualitative analysis and authentication of medicinal substances.

Electrochemical methods, including potentiometry and conductometry, are effectively used for quantitative analysis of ionic compounds and pharmaceutical solutions. These techniques are characterized by high precision and relatively simple instrumentation.

The integration of modern instrumental technologies into pharmaceutical analysis contributes to improving drug quality control systems and ensuring patient safety. Physicochemical methods enable rapid detection of falsified medicines, determination of active ingredient concentration, and monitoring of stability during storage.

Therefore, physicochemical methods are essential tools in pharmaceutical analysis and quality assurance of medicinal products. Their further development and implementation remain important directions in pharmaceutical science and analytical chemistry.

References

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