

Integration of Analytical Techniques (HPLC & FTIR) for Enhanced Quality Assurance in Drug Formulation

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Abstract: *The pharmaceutical industry is expected to adhere to strict quality control (QC) standards to ensure that its herbal medicinal preparations remain consistent, safe, and effective. High-Performance Liquid Chromatography (HPLC) and Fourier Transform Infrared (FTIR) spectroscopy are two examples of such technologies that are used frequently due to their dependability and complementary analytical capability. While fast, non-destructive analysis based on molecular and functional group determination is offered by FTIR, HPLC provides great sensitivity, selectivity, and accuracy in the quantitative detection of active medicinal ingredients and impurity profiling. The principles, applications, and benefits of combining HPLC with FTIR to improve the quality of pharmaceuticals are reviewed in this paper. It is stressed that they are used together to check the quality of raw materials, in-process quality control, stability and shelf-life testing, and identify the formulation discrepancies and batch-to-batch differences. The topicality of this combined solution in the regulatory compliance, the quality risk management and the development of the analytical methods is also described. Moreover, new developments in green analytical chemistry and process analytical technology are emphasized, which points to the opportunities of HPLC-FTIR integration as the way of enhancing efficiency and sustainability in the quality control laboratories*

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