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Trusted Answers

Useful Strategies for Modernizing USP Methods

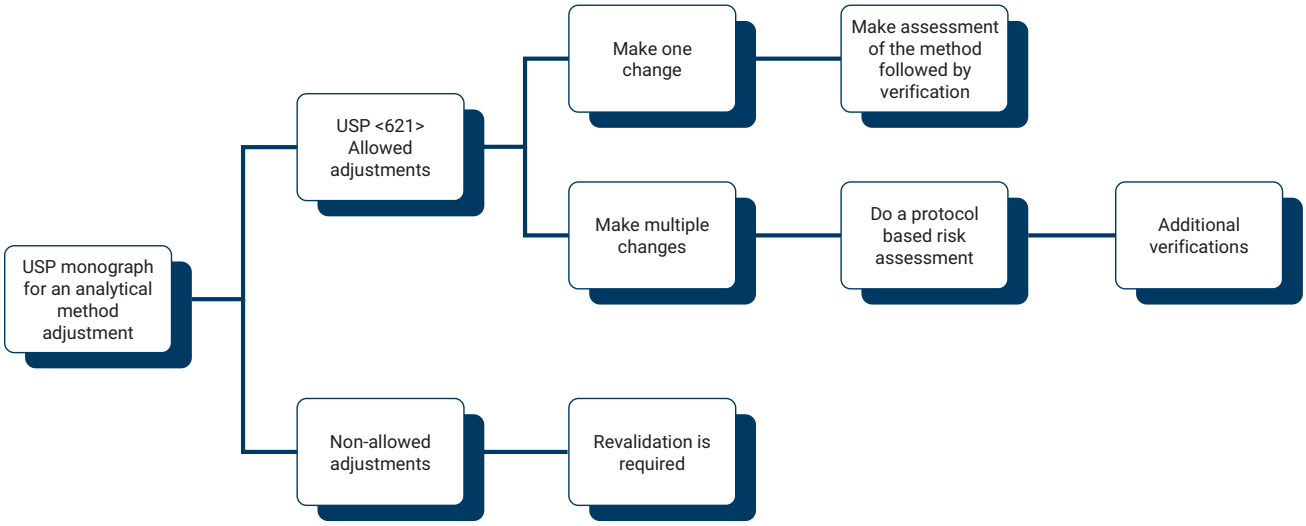
Application Compendium

Modernization of USP Methods Application Compendium

Foreword

The pharmaceutical industry is undergoing a transformative shift, driven not only by the demand for more efficient and sustainable analytical methodologies but also by evolving regulatory expectations. Central to this evolution is the U.S. Pharmacopeia (USP), which, in collaboration with the United States Food and Drug Administration, European Pharmacopoeia, and British Pharmacopoeia, is leading a global initiative to modernize monographs and general chapters to reflect current scientific standards. This modernization effort aims to replace outdated, nonspecific tests with advanced techniques such as high-performance liquid chromatography (HPLC) and ion chromatography (IC), enhancing the accuracy, safety, and reliability of pharmaceutical testing. As these standards become enforceable and increasingly adopted worldwide, laboratories must align with these changes to maintain compliance and ensure product quality. In this complex regulatory landscape, organizations are seeking reliable partners who can provide both technical expertise and strategic guidance to help navigate modernization requirements and uphold the integrity of their analytical practices.

Assessment of Analytical Methods



This application compendium showcases Agilent's commitment to supporting the modernization of small-molecule analytical methods. Each application note demonstrates practical, real-world strategies for improving method performance, sustainability, and regulatory compliance, utilizing our innovative portfolio of instruments, columns, and software.

Agilent is your partner in progress. Bring your scientific vision to life with our expert support and cutting-edge solutions. Together, we can work to streamline and elevate your method modernization, achieving the precision, robustness, and reliability your laboratory demands.

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As the pharmaceutical industry continues to evolve, so to must the analytical techniques that support the development, quality, and safety of small-molecule therapeutics. This application note compendium presents eight application notes that exemplify Agilent's innovative approaches to updating and enhancing analytical methods, serving as a practical guide for laboratories seeking to align with USP modernization efforts while embracing sustainability, efficiency, cost-savings, and analytical excellence.

Explore our range of modernization strategies, including: optimizing LC methods to superficially porous particle (SPP)-based columns for improved throughput and cost savings; updating the use of legacy instrumentation to more future-ready technology; adopting greener practices like reduced solvent consumption and the use of helium as a carrier gas in GC; and many more. For more information on USPs modernization initiatives and resources, visit Agilent's **Revisions per USP 621**.

LC method modernization

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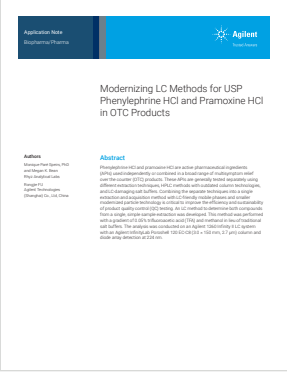
LC remains a cornerstone of pharmaceutical analysis, yet many small-molecule testing methods still rely on outdated column technologies, legacy instrumentation, and environmentally or LC-damaging mobile phases. Not only does this impact accuracy and reproducibility of testing results but also leads to workflow inefficiencies, higher costs, and lack of sustainability.

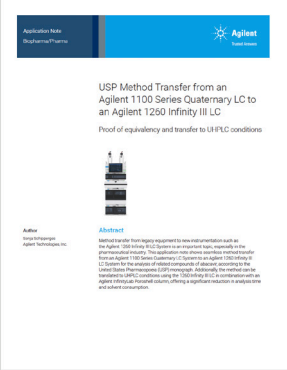
Modern LC technologies—such as SPP columns and UHPLC systems—enable scientists to significantly reduce analysis time, solvent consumption, and operational costs while achieving robust analytical performance, data quality, and regulatory compliance.

The following application notes illustrate practical solutions for implementing LC method modernization. The examples presented here include:



Combining the analysis of two APIs into a single, efficient testing method with LC-friendly mobile phases and smaller modernized particle column technology

Read application note



Seamlessly transferring a USP monograph method from a legacy LC to a new, future-ready UHPLC system

Read application note

Sustainability and cost-saving enhancements

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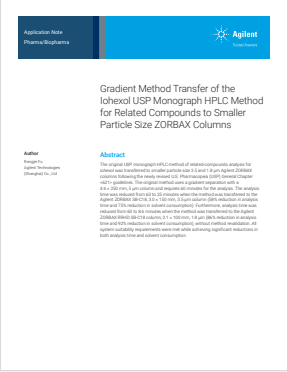
The first step in enhancing sustainability and cost-savings is through reduction of time, resources, and waste. By adopting streamlined workflows with shorter run times, laboratories can use significantly less mobile phase per analysis. This not only cuts down the volume of costly and often environmentally hazardous organic solvents but also reduces energy consumption and instrument wear. In turn, this leads to lower operational costs, less hazardous waste, and more efficient use of staff time—delivering both environmental and economic benefits without compromising performance.

The following application notes illustrate practical solutions for:



Improving gradient separations by transferring to smaller columns to reduce solvent use and analysis time

Read application note

Simplifying GC method transfer of residual solvent analysis from using helium to the more sustainable and cost-effective hydrogen carrier gas

Read application note

Revisions to USP General Chapter <621>

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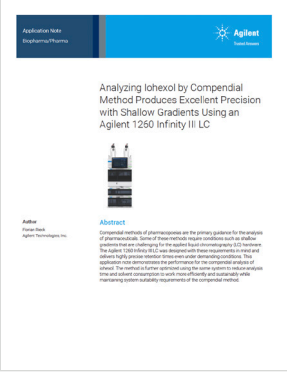
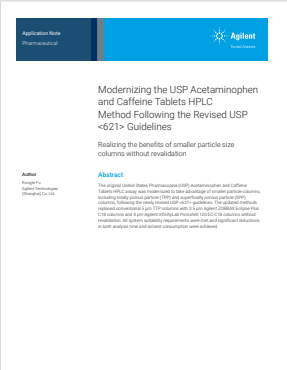
Historically, strict method parameters limited the ability of laboratories to optimize efficiency, sustainability, or newer instrumentation. The revision of USP <621> Chromatography now allows for greater flexibility in method adjustments, including changes to column dimensions, particle sizes, flow rates, and gradient conditions, as long as system suitability is maintained. With this new revision, laboratories are empowered to modernize their legacy methods without the need for full revalidation, helping them adopt more efficient and environmentally conscious techniques without compromising on performance or compliance.

The following application notes illustrate how these new revisions can be applied in practice, including:



Refining a compendial method for an API with modern LC equipment, reduced analysis time, and less solvent consumption

Read application note



Applying USP <621> revisions to modernize the acetaminophen and caffeine tablets HPLC assay with smaller particle size columns for improved performance without revalidation

Read application note

Excipient and API impurities analysis

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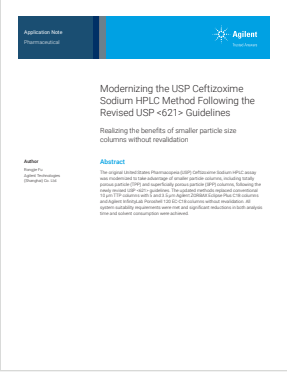
Excipients and impurities play a critical role in influencing the safety, stability, and performance of pharmaceutical products. Therefore, their accurate analysis is essential throughout drug development and quality control processes. As formulations become increasingly complex and regulatory standards continue to evolve, traditional analytical strategies—particularly those involving LC—often lack the ruggedness, speed, and sensitivity required to meet modern expectations.

Modernization of LC methodologies enables analysts to detect and quantify excipients and impurities with significantly improved precision. In addition to enhanced analytical performance, these updated methods offer benefits such as reduced analysis time, improved sustainability, and cost savings, making them highly valuable in today's regulatory and operational landscape.

The following application notes present practical solutions for:



Modernizing a USP assay for an API by replacing outdated 10 µm columns with smaller particle columns without revalidation, enabling significant improvements in efficiency.

Read application note

Easily converting a USP impurity analysis to SPP columns with faster analysis and higher resolution

Read application note

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Modernize your methods with confidence

The USP's initiative to modernize monographs and the revised USP Chapter <621> provides greater flexibility for method adjustments, empowering scientists to adopt these innovations while remaining within compendial guidelines. By modernizing your current USP methods, you can not only prepare your laboratory for evolving regulatory requirements but also enhance operational efficiency—saving you time, money, and resources.

Providing easy access to real-world strategies for method modernization, Agilent offers a roadmap for transforming outdated methods into high-performance, sustainable, and future-ready workflows. As your reliable partner, we can provide the expertise, technologies, and solutions to update your small-molecule analytical methods with confidence.

For more information, visit:
www.agilent.com/en/solutions/biopharma-pharma/pharmaceutical-small-molecules

www.agilent.com/en/solutions/biopharma-pharma/pharmaceutical-small-molecules/pharmaceutical-method-development/usp-621-chromatography

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