Application Note

Seamless Data Flow for HPLC

From Weighing to Analytical Result

Quantitative HPLC analysis is an important technique used in most quality control or analytical laboratories. Critical decisions about product batches are made based on the results of these analyses, so it is vital that the final analytical results are correct and reliable. To ensure accurate results are obtained at the end of the process, it is equally important to ensure that the steps at the beginning of the process are carefully executed and recorded correctly. Calibration standards must be accurately prepared, and the weight and concentration data must be clearly documented and managed throughout the process. Any errors in weighing data or calculations in the initial stages will be propagated throughout the process, leading to errors in the final result. The implications of bad decisions based on incorrect analytical results could be disastrous.

This application note describes an integrated workflow and data flow of weighing data, starting with the preparation of samples and standards and ending with chromatographic analysis in the HPLC. The solution delivers efficient and error-free chromatographic workflows (LC or GC) for analytical labs, with confidence in the data generated.

METTLER TOLEDO

Introduction—Chromatography in Analytical R&D and QC Laboratories

Quality assurance and control laboratories (QA/QC) are responsible for checking and releasing products. Various validated methods are deployed to verify the quality of a production batch. In QA/QC laboratories of pharmaceutical and related industries, assay and impurity (concentration/content and composition) of products are commonly checked using chromatographic techniques like HPLC or GC. These methods employ the use of known reference substances as calibration standards, to achieve traceable results from the evaluation. For quantitative analysis, the exact concentration of the standards is required to determine the concentration of a substance in a product. Running such analyses multiple times a day requires an extensive effort for the proper preparation of samples and calibration standards, as well as for the analysis and interpretation with continuous data generation and data transfer of all relevant parameters.

Quantitative HPLC Analysis

In order to quantify the exact concentration of one or multiple compounds within a sample using an HPLC, additional analyses with calibration standards must be run. These calibration standards are pure and contain only the reference substance(s) to be analyzed in a solvent, at a defined concentration for a single point calibration. However, to be more precise, a multi-level calibration with deployment of calibration standards of various concentrations, covering a range which includes the estimated or nominal concentration of the sample, are required.

Preparation of Calibration Standards

To prepare these calibration standards, the reference substance must be dispensed carefully and its weight documented. The substance can then be dissolved in the solvent. After entire dissolution, the concentration of the solution must be accurately calculated to ensure a correct analysis. Calibration standards at other concentrations can either be prepared directly, or through a dilution series of the stock solution. The prepared concentrations of the standard should cover a range which includes the expected concentration of the sample.

Figure 1: Sample Preparation for HPLC Analysis.

Calibration Curve and Analysis

After transferring all the required data from the preparation process into the chromatography data system, the HPLC analyzes the calibration standards. The signal intensity (peak area or peak height) can then be plotted against the known concentration of the standard. This allows the creation of a calibration curve for the analysis. When the sample is injected, the signal intensity of the corresponding peak can be compared to the calibration curve. In this way, the concentration of the sample can be identified.

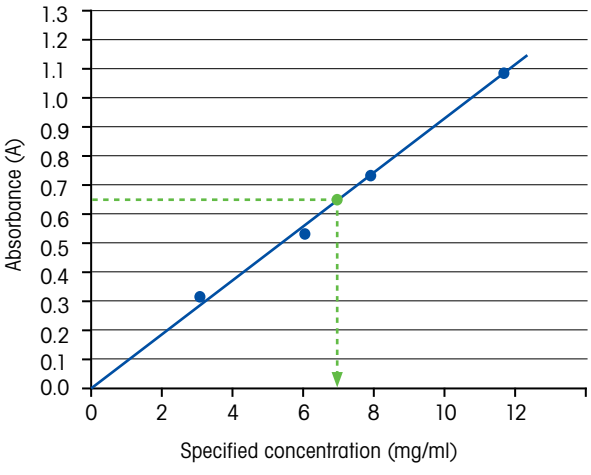

Figure 2: Four-point calibration curve and analyzed sample.

Solution—LabX – OpenLab Plugin

Figure 3: The LabX – OpenLab Plugin automatically transfers weighing data to OpenLab CDS through LabX for error free chromatography results.

The seamless integration of Agilent OpenLab CDS and and LabX offers digitalized and scalable weighing solutions for better chromatography results.

The integrated solutions of METTLER TOLEDO and Agilent Technologies allows the automatic and seamless transfer of weighing data and its metadata from the LabX™ Balance software to the OpenLab CDS. This solution allows to significantly reduce potential errors, by avoiding any need for manual transcription or calculation throughout the entire analytical workflow. The solution can be used with a barcode scanner, for accurate identification of samples and batches. Weighing information, such as sample amount or compound concentration, calibration levels, etc., are all transferred automatically.

XPR Solutions for Sample and Standard Preparation
The Excellence analytical balances support the highest requirements for safety, efficiency, and compliance. The portfolio offers readabilities from 0.002 mg to 0.1 mg and capacity up to 320 g to cover all your analytical weighing needs. The XPR Automatic Balance sets a new standard in weighing with the automatic dispensing of powders and liquids. The modular portfolio allows for simple and manual workflows, as well as more automated processes with solvent or powder dispensing modules, with optional sample changers, or even fully automated robotic systems. All solutions are perfectly suitable for standard preparation workflows, with their connectivity to the LabX software.

XPR Solutions for Sample and Standard Preparation

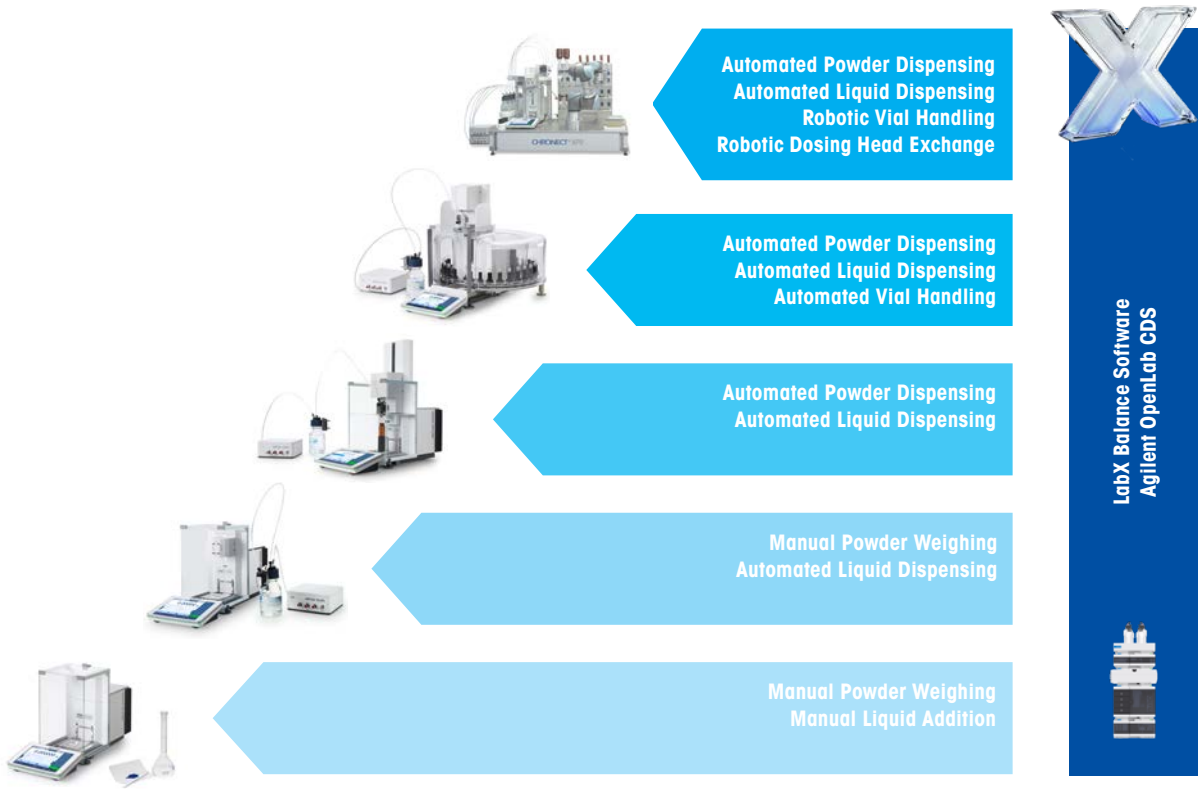

Figure 4: XPR balance portfolio the seamless preparation of samples and calibration standards, from manual to full automation.

LabX Software

LabX supports efficient solution preparation with automatic calculations, documentation, and data processing for METTLER TOLEDO lab products. Metadata are automatically captured and saved in a centralized database. LabX provides step-by-step guidance through your SOP (Standard Operating Procedure) with clear on-screen instructions. All calculations are performed automatically, which helps minimize transcription errors. The software guarantees a high degree of process security and enables fulfilment of the FDA ALCOA+ requirements for data integrity. With LabX, full traceability of results is achieved, as all weighing data is centrally stored and easily accessible for audit purposes. Customized reports of results can be generated at any time, manually or automatically, at the end of a procedure. LabX saves a considerable amount of time and significantly reduces errors. Efficiency is improved and output increased.

OpenLab Software

OpenLab CDS is a chromatography data system from Agilent that combines productivity, usability, and data integrity. With the single user interface of Sample Scheduler for OpenLab, you can plan and schedule your analysis and control your Agilent LC or GC systems as well as other vendors' chromatographic instruments in the lab, to reduce lead-time, get full overview about your analyses and instruments assigned to you and streamline people onboarding, training and support.

Sample Scheduler for OpenLab is an add-on software that enhances the functionality of OpenLab CDS. Sample Scheduler improves your lab's output by providing analysts with an easy-to-use web-interface to manage their workload and send analyses to any and the next available instrument. Analysts can move freely through the lab operating their entire tasks by the mobile web-application having at their fingertips. Lab task balancing, workload optimization and instrument utilization can be improved. Lab managers will appreciate the full lab overview from a desktop or mobile device and enjoy improved lab productivity.

Infinity II HPLC

The Agilent 1260 Infinity II LC System is a robust high-performance liquid chromatography (HPLC) instrument that offers the widest choice of modules for analytical HPLC and entry-level UHPLC. It delivers the performance, reliability, and robustness required to have the highest confidence in your daily results.

Seamlessly integrated analytical workflow (including sample and standard preparation steps)

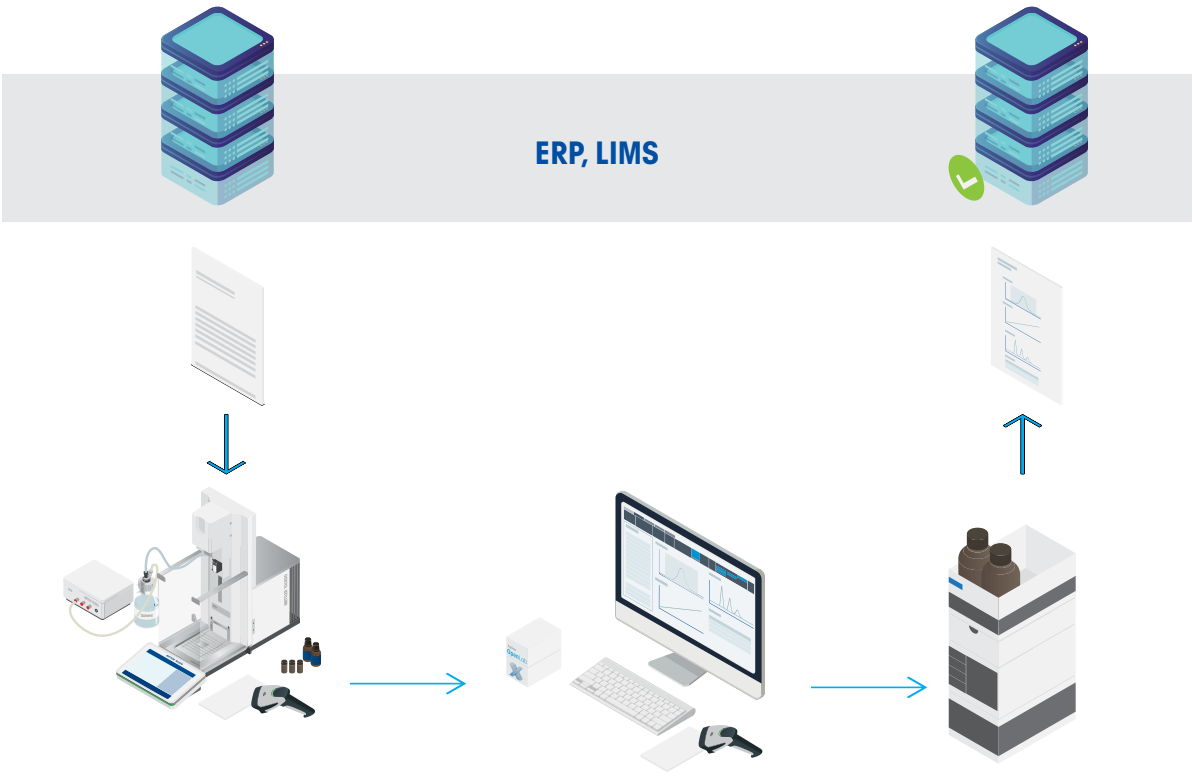

Figure 5: Data flow from sample preparation to analysis with LabX and OpenLab.

A workflow, using the integrated solution is described in detail in the following table.

	Standard Preparation Process	
1	Start with Analytical Request, containing the analytical order and analytical method as well as barcode labes	
2	Log in to balance terminal and start LabX weighing task	
3	Identify Batch ID and vials with barcode sanner	
	Manual Workflow (Analyitcal Balance)	**Automatic Workflow (Automatic Balance)**
4	Manually dispense the target amount into an empty vial/volumetric flask	The dosing module accurately dispenses the required amount into a vial
5	Manually fill a volumetric flask with solvent up to the line	The dosing module accurately dispenses the required amount of solvent into a vial (calculated based on the actual weight of powder)
6	If required, the samples must be filtered and transferred into HPLC vials	
7	LabX calculates the actual concentration of the stock solution and transfers the concentration value, substance name and Batch ID to the Sample Scheduler	
8	Set up an analysis sequence based on the received data within Sample Scheduler and select a free LC instrument	
9	The HPLC injects the samples and the calibration standards and runs the analysis	
10	Review the results within OpenLab CDS	
11	The calibration curve is created automatically, and the concentration of the sample can be determined	

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Benefits of the Integrated Data Flow between LabX and OpenLab

1. Automatic Data Transfer
The seamlessly integrated solution enables direct and automatic transfer of weighing data, including metadata (such as Batch-ID, User, Compounds, Task ID, etc.) from the balance to the chromatography data system. This supports you in taking a step towards a digital and paperless lab.

2. Error-free calculations
The LabX software automatically calculates the required amount of solvent and the resulting concentration even if working with a volumetric flask. Thus, no manual calculations are required in a sample and standard preparation process.

3. Reduce transcription errors
Automatic data transfer produces a drastic reduction of the risk of transcription errors. Manual transcription of weighing data often leads to inaccurate analytical results. In a digital and automatic process workflow, the reliability of these steps can be greatly improved.

4. Full traceability
Every process step is recorded in the LabX Software and available for later investigation if needed. Weighing data and required metadata is transferred to the CDS but the full weighing data (such as balance calibration data) are stored in LabX and can be found via the LabX Task ID.

5. Compliance with ALCOA+ Requirements
The CFR part 11 compliant LabX software can support you with the fulfilment of the FDA ALCOA+ requirements for data integrity.

6. Improved productivity of standard preparation and analysis
Automated workflows with the liquid or the powder dispensing module will have a positive impact on throughput and productivity. Automated dispensing saves excessive time spent trying to achieve precise and accurate low target amounts of powders manually.

7. Simple operation and guided workflows
Start your weighing task with just one touch on your balance display. LabX Balance guides you step-by-step through your SOP with clear onscreen instructions.

Conclusion

The seamlessly integrated software solutions of METTLER TOLEDO and Agilent Technologies enable improved sample preparation, analysis, and automatic data management workflows for HPLC or GC analysis. Risk of transcription or calculation errors is reduced to a minimum, while the efficiency of the process is improved. The software solutions offer a high degree of workflow automation and support you with the fulfilment of the FDA ALCOA+ requirements for data integrity.

Collaboration with Agilent Technologies

With the LabX–OpenLab plugin METTLER TOLEDO and Agilent Technologies are connecting their product portfolios. Offering digitalized and scalable sample preparation process for better chromatography results.

Agilent Technologies, Inc. provides application-focused solutions to the life sciences, diagnostics, and applied chemical markets worldwide. Agilent Technologies, Inc. was incorporated in 1999 and is headquartered in Santa Clara, California.

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