UV/Vis Application Note

Reliable Concentration Determination

LabX Workflow with Balance and UV/Vis

Manual workflows in analytical laboratories often create risks such as transcription errors, calculation inconsistencies, incomplete documentation, and challenges with data integrity, compliance, and efficiency. METTLER TOLEDO LabX® laboratory software provides such a solution by enabling seamless integration of multiple instruments into one centrally controlled workflow.

One example of this powerful integration is the combination of a UV/Vis spectrophotometer with a precision balance. When connected and steered through LabX, these instruments enable automated workflows that guarantee 100% data integrity and a complete audit trail for regulatory compliance. Dissolution values and other key parameters are calculated automatically, eliminating transcription or calculation errors, while on-screen step-by-step guidance ensures consistent performance that is independent of the user's expertise level.

This UV/Vis–balance workflow is just one illustration of thousands of possible applications where instrument integration through LabX can significantly improve reliability, reduce user dependency, and accelerate laboratory operations—all within a unified, compliance-ready platform.

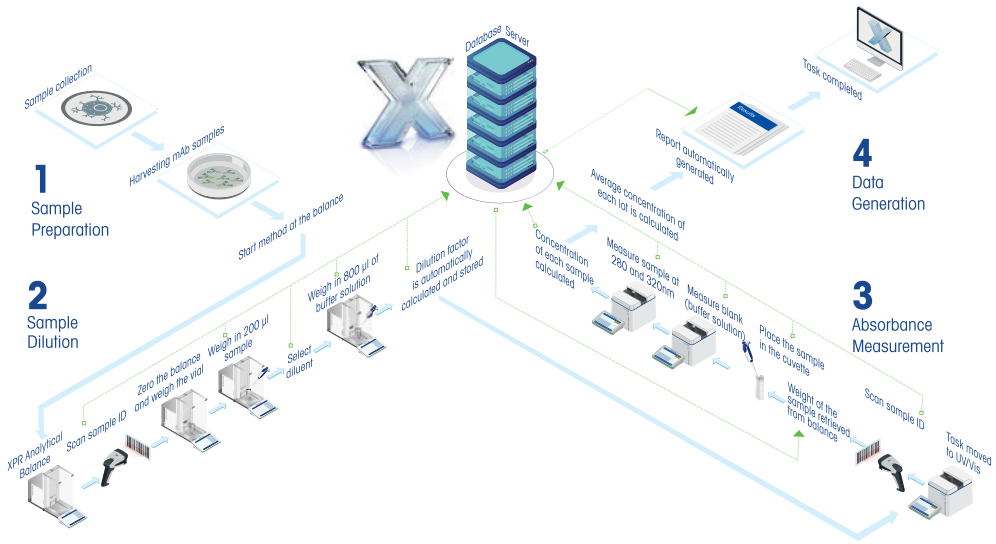

Figure 1: LabX workflow integrating a balance and UV/Vis spectrophotometer for automatic dissolution value transfer and automated result calculation.

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Introduction

This application note presents an example workflow where a balance and UV/Vis spectrophotometer are integrated through LabX software for solution preparation and concentration analysis.

In this workflow, the concentration of a stock solution is calculated automatically from the recorded sample weight and dilution, providing accurate reference values without manual intervention.

The prepared stock solution is then applied to determine the concentration of an unknown sample using spectroscopic measurement, with all data and calculations processed centrally by LabX.

Automatic transfer of balance data into the spectrophotometric workflow removes the risk of transcription errors, while digital guidance ensures consistent operation independent of the user's experience level.

While shown here for stock solution preparation and concentration determination, the same approach can be adapted to a wide range of spectroscopic and quantitative applications in analytical laboratories.

Materials and Method

Instruments and Accessories

- UV/VIS Excellence Spectrophotometer (e.g., UV7 30254726)
- Analytical balance (e.g., XPR225DR 30594483)
- Electronic Pipette (e.g., LTS E4-10MLXLS 17012313), XLS-10 µL (17014409)
- Rainin pipette 100–1000 µL (e.g., 17014382) and tip (e.g., 30296781)
- Volumetric flask 10, 100 and 500 mL
- Ultrasonic bath

Samples and Reagents

- Bovine serum albumin (BSA) sample
- Tris (hydroxymethyl) aminomethane. Hydrochloride, (TRIS- HCl), 99%
- Disodium ethylenediaminetetraacetate dihydrate (EDTA –Na2), 99%
- Hydrochloric acid, 37%
- Sodium Hydroxide, ≥97.0%
- Deionized (DI) water

Measurement

Reagent Preparation

1.0 M Tris-HCl (Sol. A)

- Weigh 1.576 g of Tris-HCl into a 10 mL beaker. Add 5 mL of DI water and sonicate to dissolve.
- Adjust pH of solution to 8.0 using 0.1 M NaOH.
- Transfer the solution to 10 mL volumetric flask and dilute up to the mark with DI water.

0.5 M Disodium ethylenediaminetetraacetate dihydrate (Sol. B)

- Weigh 18.16 g of EDTA-Na2 into a 100 mL beaker. Add 50 mL of DI water, sonicate to dissolve.
- Adjust the pH to 8 using 0.1 M NaOH solution.
- Transfer the solution into a 100 mL volumetric flask. Dilute the solution up to the mark with DI water.

TE buffer [1, 2]

Add 5 mL Sol. A and 1 mL Sol. B in a 500 mL volumetric flask and dilute the solution up to the mark with DI water.

Protein stock solution (200 mg/mL)

- Open the "StockSolution.lmt" method in LabX.
- The sample details and the desired concentration details are mentioned in the balance method.
- Enter sample ID and then follow the on-screen instructions on the balance.
- LabX calculates the real stock solution concentration in the unit mg/mL based on the recorded weight and the final volume (5 mL).

This calculated ratio value is accessed by the UV/Vis method in LabX to determine the corrected concentration of the unknown samples

Note: The ratio value is calculated as follows:

$$= \frac{\text{Obtained real stock solution concentration}}{\text{Desired concentration of solution}}$$

Variable protein concentration

Prepare unknown sample solutions as listed in table 1 in 100 mL volumetric flasks. Dilute up to the mark with TE buffer.

Sample ID	Pipette 200 mg/mL BSA [mL]
Sample 1	0.1
Sample 2	0.5
Sample 3	1.0
Sample 4	1.25

Table 1: Unknown protein concentration sample.

Sample Preparation

The system automatically refers to the LabX® database and assigns the corresponding dilution factor when the sample ID is scanned.

Measurement Parameters

1. Balance XPR225DR

Method name	Stock Solution
Substance name	BSA
Weight tolerance	2 %
Desired concentration	200 mg/mL
Calculated quantity	(Desired Conc*5)/1000
Weight 1	Weight of sample
Weight 2	Weight after dilution
Real Conc. of stock solution	Weight 1/ Weight 2
Ratio	Real Conc. of stock solution/Desired Conc. of stock solution

2. UV7

Method	Fixed Wavelength
Path length	10 mm
Measurement time	5 s
No of wavelengths	1
Wavelength	280 nm
Background correction	1-Point, 340 nm
Calculation (R1)	Concentration DilF*A(280,340) / (Path*PercExtCoeff/10)
Calculation (R2)	Corrected concentration R1*Data access ResultValue

Note: According to literature, the percentage extinction coefficient for BSA protein is (6.67 g/100 mL)$^{-1}$ cm^{-1} [3]

Results

The concentration of unknown samples is measured in six replicates and tabulated in the table 2.

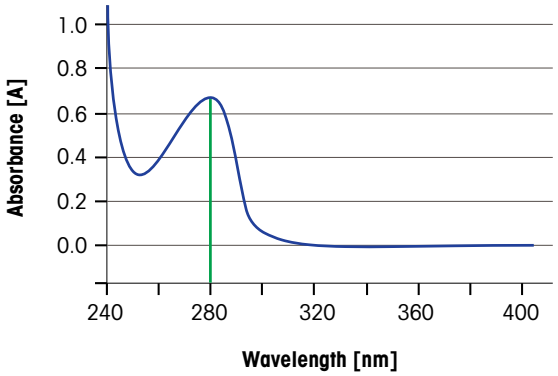

Figure 2: Spectrum of BSA sample.

Sample	Mean Conc. [mg/mL]	SD [mg/mL]	RSD [%]
Sample 1	0.23	0.00	0.84
Sample 2	0.99	0.00	0.48
Sample 3	1.99	0.02	0.76
Sample 4	2.43	0.01	0.56

Table 2: Actual concentration of BSA sample.

Sample	Mean Conc. [mg/mL]	SD [mg/mL]	RSD [%]
Sample 1	0.23	0.00	0.84
Sample 2	0.99	0.00	0.48
Sample 3	1.99	0.02	0.76
Sample 4	2.43	0.01	0.56

Table 3: Corrected concentration of sample.

Conclusion

Unlike competing solutions that address only parts of the workflow, LabX uniquely integrates balances and spectroscopic analysis into a single controlled process. It ensures automated data transfer and calculations that maintain complete data integrity while meeting stringent regulatory requirements.
At the same time, built-in digital guidance standardizes workflows across users, minimizing operator dependency and improving consistency. Together, these advantages transform routine tasks into reliable, audit-ready processes, setting a new benchmark for laboratory accuracy, compliance, and efficiency.

Reference

[1] TE Buffer
[2] Preparation of EDTA solution
[3] Protein Extinction Coefficients

Further Information

- **UV/Vis Spectrophotometry**
- **Life Science Toolbox for UV/Vis Spectroscopy**

UV/Vis Application Note

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