

# Multiparameter Analysis for Sugar Color

## LabX Workflow with Refractometry and UV/Vis

Determining sugar solution color involves manual steps using refractometers, spectrophotometers, and reference tables. This fragmented process increases transcription errors, slows analysis, and reduces laboratory efficiency.

METTLER TOLEDO LabX® laboratory software addresses these challenges by integrating instruments into a unified digital workflow. Measurements are automatically captured, corrected, and calculated following standardized methods without manual input.

The software guides operators step by step, reducing training needs and ensuring consistent analysis. All results, along with metadata, are securely stored in a centralized, traceable database. Reports can be generated instantly, saved electronically, or exported to LIMS (Laboratory Information Management System), streamlining documentation and compliance while eliminating paper-based inefficiencies.

By automating data transfer, calculations, and reporting, LabX minimizes errors, accelerates turnaround, and delivers a reliable, modern solution for sugar producers. This digital approach offers improved quality control confidence through enhanced accuracy, efficiency, and traceability.



Figure 1: Schematic of R5 and UV5 multiparameter LabX workflow set-up.

## Introduction

This application note highlights the LabX method, which integrates multiparameter analysis of sugar color into a fully automated workflow. LabX streamlines the measurement of refractive index and UV/Vis absorbance, providing a unified process for sugar solution color determination.

LabX automates data transfer, correction, and calculation following internationally recognized ICUMSA® standards. Validation on raw sugar, brown sugar, and colored syrup samples demonstrated excellent repeatability and reproducibility, ensuring reliable and robust results for routine quality control.

## Material and Method

### Instruments and Accessories

- UV/VIS Excellence Spectrophotometer (e.g., UV5 30254725)
- Excellence Refractometer (e.g., R5 30474904)
- Analytical balance (e.g., XPR205 30355411)
- Quartz cuvettes 10 mm (e.g., 30258738)
- LabX software (e.g., 30247984)
- Nitrocellulose (nc) membrane filters, pore size 0.45 µm
- Vacuum pump and Buchner funnel
- Ultrasonic bath

### Samples and Reagents

- Brown raw sugar samples
- Hydrochloric acid (HCl; aq) (0.1 M)
- Sodium hydroxide (NaOH; aq) (0.1 M)
- Deionized water (DI water)

## Measurement

### Sample Preparation

- Prepare the solution by weighing defined sugar and water aliquots according to the ICUMSA® color ranges.

### Procedure

- Measure the refractometric dry substance (RDS) with an Excellence Refractometer, using the built-in ICUMSA® table [3].
- Use RDS to obtain the density of the test solution,  $\rho$  [4].
- Calculate the concentration of sample solids in solution from RDS [4].
- Determine absorbance  $A_s$  at 420 nm using water as a reference standard for zero absorbance.

- Calculate the color in ICUMSA® units,  $IU_{7.0}$  and express the results to the nearest 10  $IU_{7.0}$ .

## Measurement Parameters

### 1. Refractometer

Measuring temperature	20.00 °C
Result 1	T[Brix_ICUMSA_nD(nD)]
Result 2	The density ( $\rho$ ) is calculated in LabX according to the respective ICUMSA formulas [4]
Result 3	The concentration (c) is calculated in LabX according to the respective ICUMSA formulas [4]

### 2. UV/Vis Spectrophotometer

Method	Fixed Wavelength
Pathlength	1 cm
Measurement time	5 s
Wavelength	420 nm
Background correction	1-point at 720 nm
Result 4	ICUMSA (A420*1000) / (path length* concentration [ $IU_{7.0}$ ])

## Results

The measured ICUMSA® colors range from 2760 to 3710  $IU_{7.0}$ . For the sample, Brown 1 and Brown 2, 10 g sugar and cell length 1 cm was used.

The color is calculated automatically by using the LabX software [5]. Thereby the values from the refractometer are automatically transferred via LabX to the UV/Vis spectrophotometer and used there to calculate the final color result.

All data are stored in a central database and a report is created automatically.

Sample	Brown 1	Brown 2
Sugar solution (%)	10	10
Path length (cm)	1	1
Mean color ( $IU_{7.0}$ )	3710	2760
Measured absolute repeatability*	8	10
Max. permitted repeatability	300	300
Std Dev	11.33	12.24
Srel (%)	0.31	0.44

Table 1. Mean values from raw sugar samples obtained on a UV5 Excellence Spectrophotometer (n=6). All color values are given in  $IU_{7.0}$ .

\*As defined by ICUMSA® [2], the absolute difference between two results obtained under repeatability conditions

\* ICUMSA® is a trademark of ICUMSA Ltd. and Verlag Dr. Albert Bartens KG.

The repeatability of the raw sugar measurements was excellent for all measured samples and within the maximally tolerated absolute values between the two results. ICUMSA® defines these values for raw sugars between 110 IU<sub>7.0</sub> and 300 IU<sub>7.0</sub> respectively, depending on the color range of the sample. The maximally tolerated repeatability for raw sugars is only specified starting from 500 IU<sub>7.0</sub>.

## Conclusion

By automating refractive index measurement, and UV/Vis absorbance recording, LabX delivers instant, accurate ICUMSA® color values with excellent repeatability and regulatory compliance. Compared to competitors, LabX provides a fully integrated and guided digital workflow that eliminates manual steps and reduces errors. It securely stores all data in a central database, enabling complete traceability. LabX offers customizable reporting and seamless integration with Laboratory Information Management Systems (LIMS), enhancing productivity and quality assurance for routine sugar color analysis.

## Reference

- [1] Jansen T.M.; Raw sugar quality from a refiner's perspective; Proc Aust Soc Sugar Cane Technol Vol 31; 512-520; 2009
- [2] ICUMSA Method GS1/3-7 Determination of the Solution Colour of Raw Sugars, Brown Sugars and Colored Syrups at pH 7.0, Official (2011)
- [3] ICUMSA Specification and Standards SPS-3 Refractometry and Tables, Official (2000)
- [4] ICUMSA Specification and Standards SPS-4 Densimetry and Tables, Official (1998)
- [5] LabX ICUMSA GS1/3-7 methods

## Further Information

- ▶ [UV/VIS Excellence Spectrophotometers](#)
- ▶ [Refractometers](#)
- ▶ [LabX Software](#)