From Standard to Practice: Chromai Ultra-High Performance Liquid ChromatographyEnabling Precise and Compliant Detection of Sugars in Food

1. Introduction

Sugars are the primary raw and auxiliary materials in the food industry, and are also one of the main components of most food products. The National Health Commission and the State Administration for Market Regulation jointly issued GB 28050-2025, the National Food Safety Standard for Nutrition Labeling of Pre-packaged Foods, which replaces GB 28050-2011 and comes into effect on March 16, 2027. The key revision mandatorily requires the labeling of fatty acid content as well as specific values for fructose, glucose, sucrose, maltose, and lactose. It also mandates the statement "Children and adolescents should avoid excessive intake of salt, oil, and sugar," thereby improving consumers' precise understanding of food nutritional components.

This application note references Method 1 of GB 5009.8-2023 (National Food Safety Standard: Determination of Fructose, Glucose, Sucrose, Maltose, and Lactose in Food), using the Chromai Ultra-High Performance Liquid Chromatograph (UHPLC) with amino column separation and a differential refractive index (RID) detector. This method enables efficient and accurate determination of sugar content in food.

2. Experimental Section

2.1 Instrumentation

Leaps Ultra-High Performance Liquid Chromatograph (Chromai Technologies), comprising:

- P40 Quaternary Gradient Pump
- A10C Autosampler
- C10 Column Oven
- D60L Differential Refractive Index Detector (RID)

2.2 Solution Preparation

Mixed Standard Stock Solution: Accurately weigh approximately 0.1g each of fructose, glucose, sucrose, maltose, and lactose into a 5mL volumetric flask. Dissolve in water, add 0.25mL acetonitrile, and dilute to volume with water.

Standard Calibration Solutions: Dilute appropriate aliquots of the mixed standard stock solution

with ultrapure water to obtain six calibration standards at concentrations of 0.5, 1.0, 2.0, 4.0, 6.0, and 10.0mg/mL.

2.3 Chromatographic Conditions

Parameter	Condition
Mobile Phase	Acetonitrile : Water = 75 : 25 (v/v)
Flow Rate	1.0 mL/min, isocratic elution
Column	Lotus NH_2, 4.6 mm × 250 mm, 5 µm
Injection Volume	10 µL
Column Temperature	30 °C
RID Temperature	30 °C

3. Results and Discussion

3.1 Standard Chromatogram

Figure 1 presents the chromatogram of the mixed standard solution. The five target sugars — fructose (1), glucose (2), sucrose (3), maltose (4), and lactose (5) — were baseline-resolved under the optimized chromatographic conditions. The resolution between all adjacent peaks exceeded 1.5, meeting the requirements of the national standard.

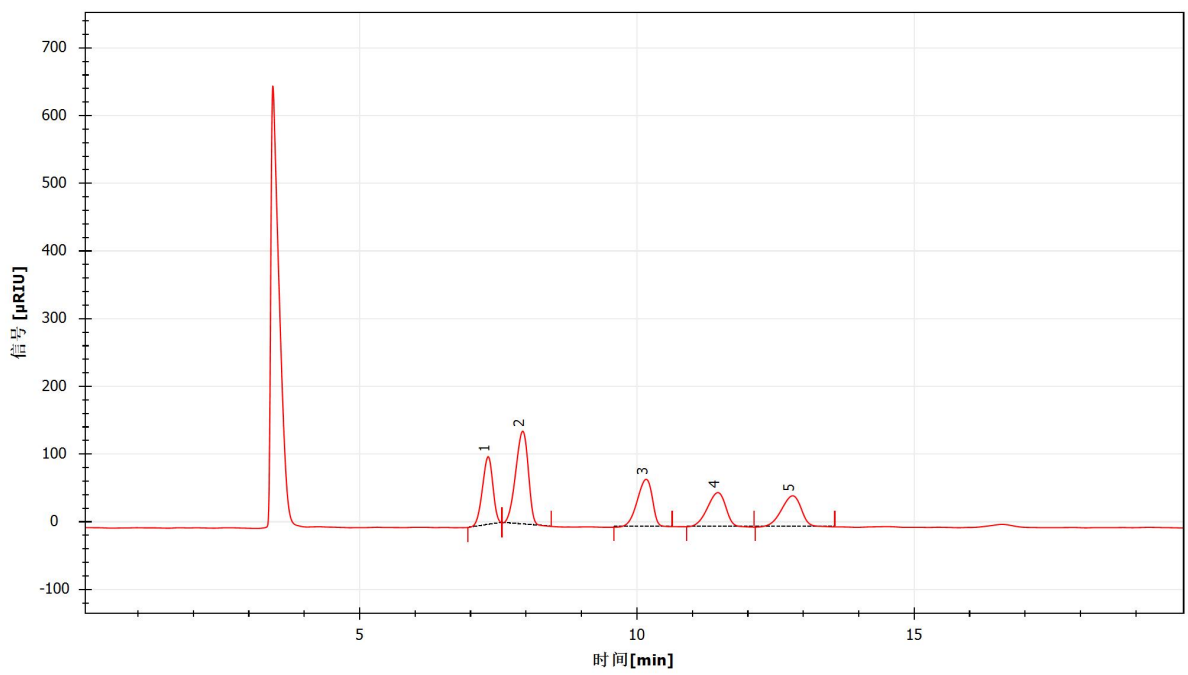

Figure 1: Chromatogram of the mixed standard solution

3.2 Linearity and Limits of Detection

Calibration curves were constructed over a concentration range of 0.5–10.0 mg/mL for each sugar. All linear correlation coefficients (R) were greater than 0.9995, demonstrating excellent linearity.

Analyte	Linear Equation	R	LOD (g/100g)
Fructose	y = 217.25x + 0.2048	0.9999	0.0516
Glucose	y = 359.82x − 9.0313	0.9998	0.0332
Sucrose	y = 257.17x − 34.461	0.9999	0.0571
Maltose	y = 198.4x − 2.3908	0.9998	0.0811
Lactose	y = 197.95x + 16.68	0.9999	0.101

3.3 Repeatability

Repeatability was evaluated by injecting the 2.0 mg/mL mixed standard solution six consecutive times. The relative standard deviations (RSDs) of retention time and peak area for all five sugars are summarized in Table 2.

Analyte	Retention Time RSD (%)	Peak Area RSD (%)
Fructose	0.07	1.89
Glucose	0.08	1.09
Sucrose	0.09	1.88
Maltose	0.10	1.72
Lactose	0.12	1.11

All retention time RSDs were below 0.12% and all peak area RSDs were below 1.89%, demonstrating excellent instrument repeatability.

3.4 Sample Analysis and Recovery

A commercial honey sample was analyzed using the validated method. The measured sugar contents are presented in Table 3. Lactose and sucrose were not detected in the honey sample.

Analyte	Measured Content (g/100g)
Fructose	34.56
Glucose	16.64
Maltose	3.20

Spiked recovery experiments were performed by adding 20 g/100g of each sugar to the honey matrix. The recovery rates are summarized in Table 4.

Analyte	Spike Level (g/100g)	Recovery (%)
Fructose	20	86.7
Glucose	20	91.4
Sucrose	20	86.5
Maltose	20	86.0
Lactose	20	98.0

Recovery rates ranged from 86.0% to 98.0%, meeting the acceptance criteria of the national standard method and confirming the accuracy and reliability of the method for real food matrix analysis.

4. Conclusion

This application note demonstrates that the Chromai Leaps UHPLC system, equipped with a Lotus NH_2 amino column and D60L differential refractive index detector, provides a robust, accurate, and highly repeatable solution for the simultaneous determination of five sugars (fructose, glucose, sucrose, maltose, and lactose) in food matrices.The Chromai UHPLC platform offers food testing laboratories an efficient, reliable, and standards-compliant analytical tool for routine sugar quantification.

Key performance highlights:

- Baseline resolution of all five sugars with resolution > 1.5 for all adjacent peak pairs
- Excellent linearity across 0.5–10.0 mg/mL with all R > 0.9995
- Outstanding repeatability: retention time RSD < 0.12%, peak area RSD < 1.89%
- Satisfactory spiked recovery: 86.0%–98.0% in honey matrix

The method is fully compliant with GB 5009.8-2023 and is well-suited to support the mandatory sugar labeling requirements introduced by GB 28050-2025, which takes effect on March 16, 2027. The Chromai UHPLC platform offers food testing laboratories an efficient, reliable, and standards-compliant analytical tool for routine sugar quantification.

5. References

- GB 5009.8-2023: National Food Safety Standard – Determination of Fructose, Glucose, Sucrose, Maltose, and Lactose in Food. National Health Commission of China.
- GB 28050-2025: National Food Safety Standard – General Rules for Nutrition Labeling of Pre-packaged Foods. National Health Commission & State Administration for Market Regulation.