

Introduction to Chromaster 5280[®] Autosampler and 6310 Column Oven

Katsutoshi Shimizu¹, Yushi Harada², Atsuki Morisaki², Minling Pei², Masaru Tomioka²

1. Introduction

We have recently made two new additions to the lineup of modules for the Chromaster series of instruments: the 5280 autosampler and the 6310 column oven.

The 5280 autosampler uses the direct-injection method and supports operation at a pressure tolerance of 60 MPa. The direct-injection method allows microscopic sample volumes to be injected without loss. In addition, support for operation at a pressure tolerance of 60 MPa enables the use of columns with particle sizes under 2.0 μm and core shell columns; this not only allows conventional HPLC analysis but also improves separation performance and reduces analysis times.

In the 6310 column oven, we have taken the column oven from the ChromasterUltra Rs lineup and made it controllable within the Chromaster system. Compared to its predecessor, the 5310 column oven, the 6310 boasts an expanded temperature control range and improved heating and cooling capability, making it a good choice for a wide variety of applications.



Fig. 1 The Chromaster (including the 6310 column oven)

2. Features of the 5280 autosampler

(1) Support for microscopic sample volumes and reduced carryover

The use of the direct-injection method, in which the sampling needle is incorporated into the analytical flow path, ensures that samples may be gathered via suction and injected without waste (no sample loss), making the method a powerful technique for measuring samples with microscopic volumes.

(2) Improved reproducibility allows high-accuracy analysis

By synchronizing the timing of sample injection with the operation of the liquid transport system, the instrument achieves reproducibility with peak retention times, ensuring the acquisition of highly reliable analytical results.

(3) High pressure tolerance

The pressure tolerance has been improved to 60 MPa. This extends the choice of columns, enabling support for a wide variety of analytical applications.

(4) Operating conditions compatible with those for L-2200 autosampler

Because the structure of the flow path is similar to that of its predecessor, the L-2200, appropriate operating conditions are easily adapted from those for the L-2200.

3. Features of the 6310 column oven

(1) Wide temperature-control range

The standard instrument comes equipped with a Peltier-based temperature-control system that allows not only heating but also cooling. The temperature may be controlled over the wide range of [room temperature - 15°C] - [room temperature + 75°C] (temperature control range 4-90°C).

(2) Highly accurate temperature control

The temperature is controlled to a high degree of accuracy: within $\pm 0.1^\circ\text{C}$ over the entire range.

(3) Improved heating and cooling capabilities

Heating and cooling capabilities have been significantly improved, and system startup times have been reduced. The temperature rises from room temperature to 40°C in 4 minutes.

(4) Improved data reproducibility via pre-heating

The addition of a low-capacity preheater ensures stable peak retention times even with varying environment temperatures—and dramatically reduces the internal volume associated with peak dispersion. (Capacity of preheater unit: 1 μL).

(5) Waste-liquid tank

A waste-liquid tank may be placed beneath the 6310 column oven to store waste liquids expelled from the system (capacity: 3 L).

(6) MEM column fitting (option)

The Hitachi-developed Moment-Enhancing Mechanism allows pressure-tolerance performance of 140 MPa via hand-tightening and reduces internal volume.

4. Applications

In Supplement II to the Japanese Pharmacopoeia, 16th edition, enacted in February 2014, the test items for D-mannitol were revised, and analysis via HPLC was added. Purity (4) related substances and assay for D-mannitol involve analysis at 85°C using a column with a length of 300 mm, requiring an instrument with enough capacity to accommodate a wide column, and temperature control to ensure stable operation at high temperature. Here we present the results of analyses of D-mannitol using a system configured with the 5280 autosampler and the 6310 column oven in accordance with the assay of Supplement II to the Japanese Pharmacopoeia, 16th edition.

D-mannitol assay: Confirmation of system suitability

Standard solution: Dissolve 0.5 g of D-mannitol in pure water and adjust to yield a total volume of 10 mL (5 %).

System suitability test solution (1): Dissolve 0.25 g each of D-mannitol and D-sorbitol in pure water and adjust to yield a total volume of 10 mL (2.5% each)

System suitability test solution (2): Dissolve 0.5 g each of maltitol and isomalt in pure water and adjust to yield a total volume of 100 mL (0.5% each).

Add pure water to 2 mL of this solution to yield a total volume of 10 mL (0.1% each).

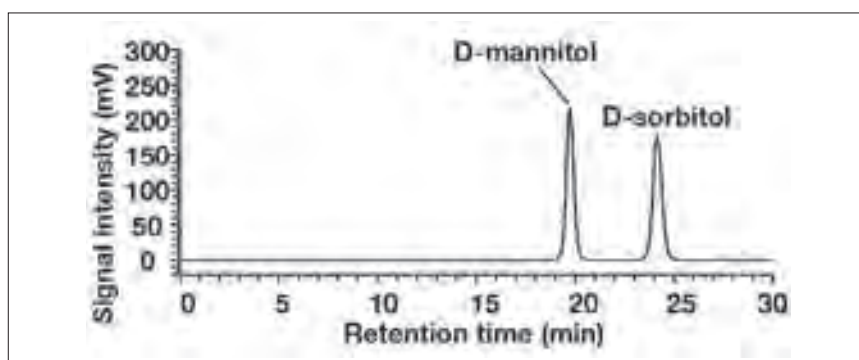


Fig.2 Chromatogram of system compliance test solution 1

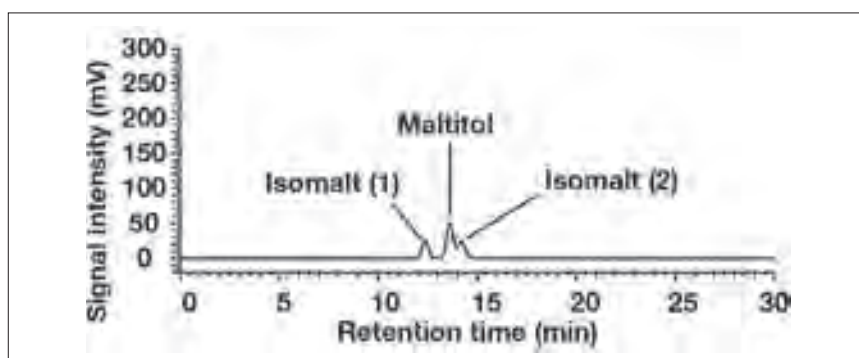


Fig.3 Chromatogram of system compliance test solution 2

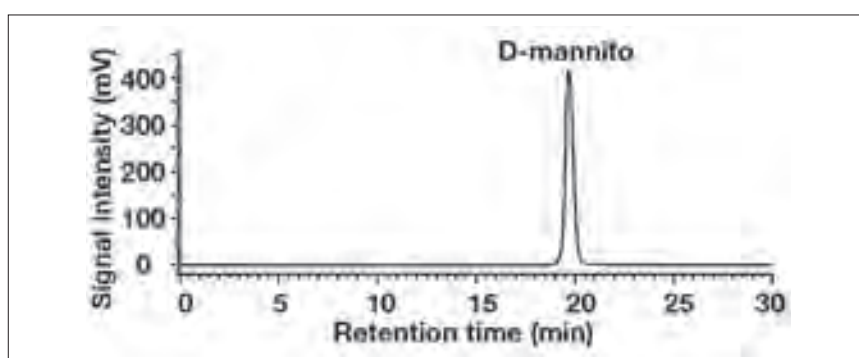


Fig.4 Chromatogram of standard solution

Measurement conditions

Moving phase : H₂O
Flow volume : 0.5 mL/min
Column : CARBOsep COREGEL-87C 7.8 mm I.D. × 300 mmL (Transgenomic)
Column temperature : 85°C
Detection : RI
Injection volume : 20 µL

Table 1 Results for D-mannitol assay and system suitability

	Item	Specification	Results of measurement
System performance (relative retention time) (Figures 2, 3)	D-mannitol - isomalt (1)	Approximately 0.6	0.63
	D-mannitol - maltitol	Approximately 0.69	0.69
	D-mannitol - isomalt (2)	Approximately 0.73	0.73
	D-mannitol - D-sorbitol	Approximately 1.2	1.23
System performance (resolution) (Figure 1)	D-mannitol - D-sorbitol	2.0 or higher	5.74
System repeatability (Figure 4)	D-mannitol Relative standard deviation (n=6) in peak area (%)	1.0 or lower	0.21

Table 1 shows the results for D-mannitol assay and system suitability. Measured results for all test items were in compliance with specifications.

5. Conclusions

In this article we presented the key features of two new modules for the Chromaster series: the 5280 autosampler and the 6310 column oven. In future work we plan to continue our efforts to support new applications of these new modules.

References

1) Supplement II to the Japanese Pharmacopoeia (2016).

Authors

*1 Katsutoshi Shimizu

Analytical Application Engineering Section Tokyo 1
Hitachi High-Tech Science Corporation

*2 Yushi Harada, Atsuki Morisaki, Minling Pei, Masaru Tomioka

Optical Instruments Design Department
Hitachi High-Tech Science Corporation