



Detection of sugars in concentrated syrups and fermentation broth samples

Introduction:

SHINE CIC-D200E can measure various types of carbohydrates, including concentrated sugars and fermentation broth. These carbohydrates are the carbon and energy sources for microorganisms, and detection can monitor the metabolic efficiency of carbon sources, avoiding carbon source starvation or excessive by-products, and ensuring the yield of target products (such as amino acids); Being able to determine the fermentation stage based on the sugar consumption curve and dynamically adjust the process (such as supplementing carbon sources and terminating fermentation); Controlling residual sugars can reduce subsequent purification impurities (such as Maillard reaction products) and ensure product purity; Simultaneously optimizing carbon source conversion rate, reducing raw material costs, and ultimately ensuring that the product meets industry quality standards

Table 1: Detection items

Anion	Galactose	Glucose	Sucrose	Fructose
	Ribose	Lactose	Maltose	-

Keywords: Concentrated syrups, Fermentation broth, Ion Chromatograph.

Instruments and equipment

- **Ion chromatograph:** CIC-D200E
- **Ultra pure water machine:** EU-20

Qingdao Shine Chromatograph Technology Co., Ltd





Requirements

Reagents

Unless otherwise specified, all reagents used are superior grade. Commercially available certified standard solutions for galactose, glucose, sucrose, fructose, ribose, lactose, maltose (1000 mg/L).

Ultra pure water

When preparing standard samples manually or diluting real samples, please use ASTM filtration and deionization requirements that meet the specifications listed in the table 2.

Table 2: Ultra pure water specification.

Specification	
Ions Resistivity	≥18.25MΩ·cm
Organics-TOC	<10ppb
Iron/Transition Metals	<1ppb
Pyrogens	<0.03Eu/mL
Particulates (>0.2μm)	<1unit/mL
Colloids-Silica	<10ppb
Bacteria	<1cfu/mL

Chromatography conditions

Table 3: Analysis conditions

Instrument	CIC-D200E
Eluent	A: 200mM NaOH B: 200mM NaOH+250mM NaAc C: Ultra pure water 0.0-10.0 min 8%(A)+92%(C) 10.0-25.0 min 50%(A)+50%(C) 25.0-40.0 min 50%(A)+50%(B) 40.0-70.0 min 50%(A)+50%(B) 70.1-85.0 min 8%(A)+92%(C)

Flow rate	0.4 mL/min
Injection volume	25 μL
Analytical column	Dionex CarboPac PA20
Column oven temperature	30°C

Table 4: Electrochemical detector conditions

Mode: Pulse Ampere

Reaction time: Ts=200 ms

Electrode: Sencell gold electrode

Attenuation: 200 μA

Filter: 0.050 Hz

Time/s	Voltage/V	Integral status
0.00	0.10	-
0.20	0.10	Start
0.40	0.10	End
0.41	-2.0	-
0.42	-2.0	-
0.43	0.6	-
0.44	-0.10	-
0.50	-0.10	-

Sample preparation

Dilute the sample to an appropriate multiple, filter through a 0.22 μm membrane, and inject directly for analysis.

Standard chromatogram

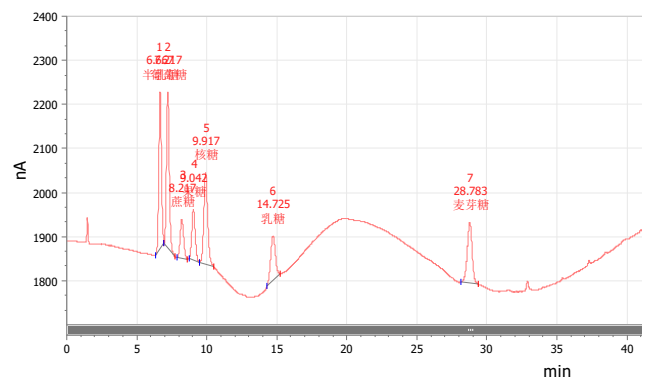


Figure 1. Chromatogram of 1ppm standard

Blank chromatogram

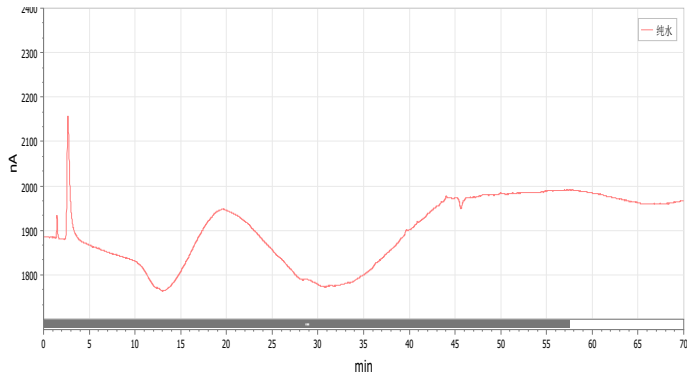


Figure 2. Chromatogram of blank

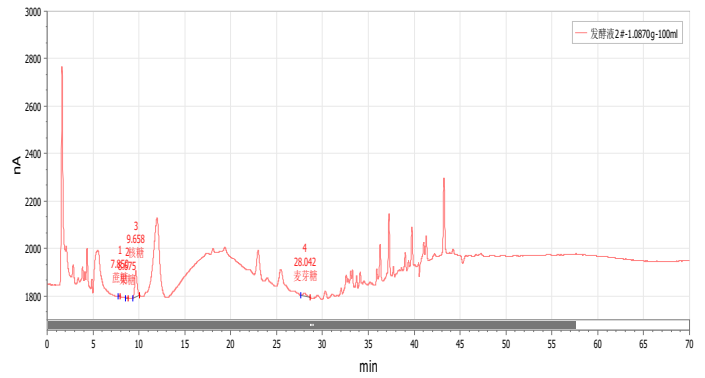


Figure 6. Chromatogram of fermentation broth 2#

Sample chromatogram

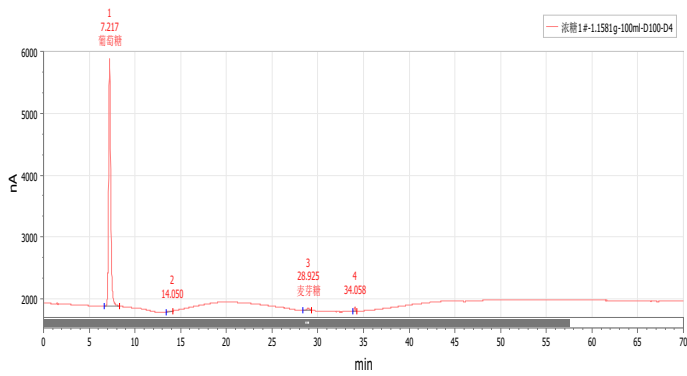


Figure 3. Chromatogram of concentrated syrups 1#

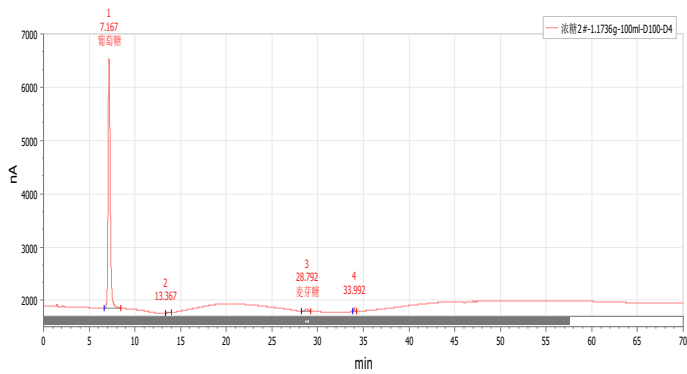


Figure 4. Chromatogram of concentrated syrups 2#

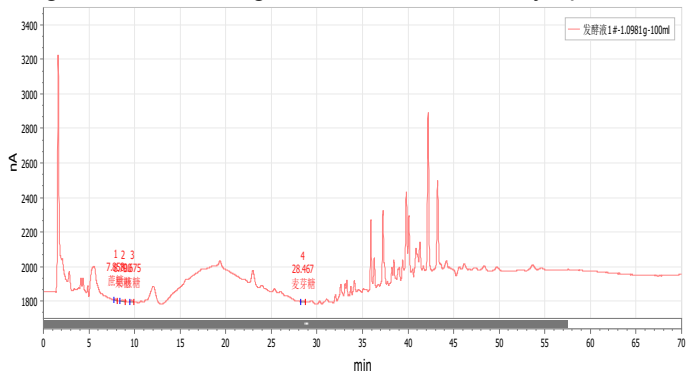


Figure 5. Chromatogram of fermentation broth 1#

Results and calculations

Table 5: Sample test result (Unit: mg/kg)

Sample Name	Gala cose	Glu cos e	Sucr ose	Fruct ose	Ribo se	Lact ose	Malt ose
Concen trated syrups 1#	ND	58.6	ND	ND	ND	ND	0.65 3
Concen trated syrups 2#	ND	69.5	ND	ND	ND	ND	0.63 1
Ferme ntation Broth 1#	ND	ND	0.00 0651	0.00 0505	0.00 0286	ND	0.00 0183
Ferme ntation Broth 2#	ND	ND	0.00 0218	0.00 017	0.00 4516	ND	0.00 0112

Note: ①ND indicates not detected or below the detection limit; ②The measured value has been adjusted for blank values; ③ Test results may vary between different methods and laboratories.

Feasibility analysis and conclusion

The above experiments prove that the detection method has good resolution and is suitable for the determination of the content of the components to be measured in the sample.