Rapid monitoring of carbohydrates in food with capillary electrophoresis

Application Note

Food

Authors

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Abstract

Processed food often contains additives such as sweeteners or preservatives. For regulatory compliance the concentration of these substances needs to be monitored. This is important to ensure the consumer's protection and also has economic implications. In Japan, for example, the tax rate of imported juice depends on the sucrose content. Non-derivatized carbohydrates can rapidly be determined using capillary electrophoresis with indirect UV-detection. The method's simplicity and stability make it suitable for the application in routine labs.

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Experimental

Carbohydrate analysis was performed using the Agilent Capillary Electrophoresis system equipped with DAD detection and Agilent ChemStation software. The method is based on the use of the Agilent Basic Anion Buffer (Agilent part number 5064-8209) together with a standard bare fused silica capillary (Agilent part number G1600-62211).

Prior to first use, a new capillary was flushed with run buffer for 15 minutes (at 1 bar). Between analyses the capillary was flushed 4 minutes from an extra buffer vial into waste. Sample preparation was simple and consisted, even in the case of yogurt, of only dilution and ultrafiltration for protein removal.

Equipment

- Agilent Capillary Electrophoresis system
- Agilent ChemStation
- Agilent Basic Anion Buffer

Results and discussion

Figure 1 shows the analysis of orange juice and yogurt in comparison with a carbohydrate standard. The standard assay was linear over the range 50–10 000 ppm with $r^2 > 0.999$. Method detection limits were 7–15 ppm. Sucrose levels were 43 g/L in orange juice and 109 g/L in yogurt. Fructose and glucose in orange juice were determined as 23 g/L and 25 g/L, respectively. The yogurt contained 26 g/L lactose. Repeatability was < 0.16 % RSD for migration times and < 2.3 % RSD for peak areas (n = 6).

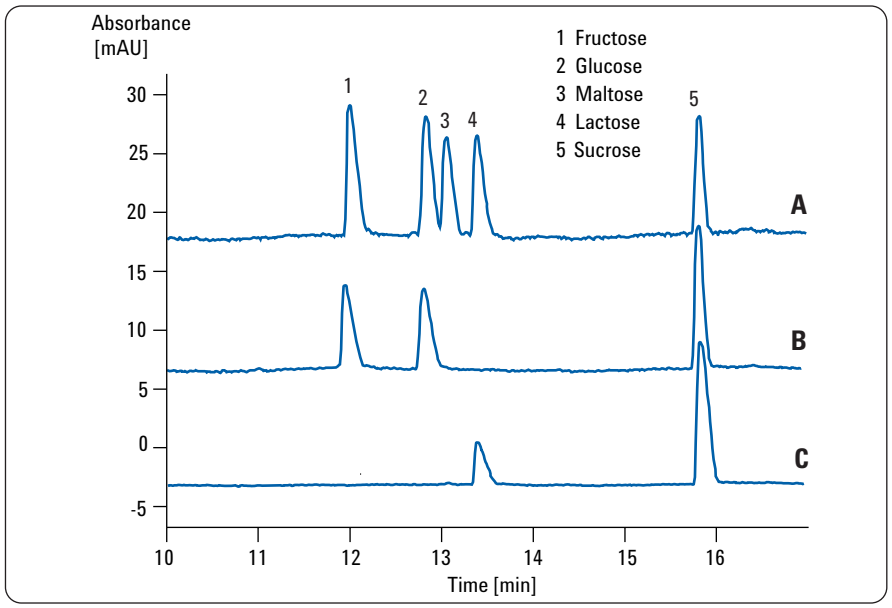

Figure 1
Analysis of sugars in orange juice and yogurt.

Chromatographic conditions

Sample:	A Carbohydrate standard (1000 ppm each)
	B Orange juice (diluted with H_2O 1:20, filtered through 0.22-µm filter)
	C Yogurt (diluted with H_2O 1:20, filtered through 30 kDa cut-off filter)
Injection:	6 seconds at 50 mbar
Capillary:	Bare fused silica capillary total length 80.5 cm, effective length 72 cm, internal diameter 50 µm (Agilent part number G1600-62211)
Buffer:	Agilent Basic Anion Buffer (Agilent part number 5064-8209)
Voltage:	-25 kV
Temperature:	15 °C

Detection signal: 350/20 nm, reference 275/10 nm

High performance liquid chromatography (HPLC) with refractive index detection is routinely used for the analysis of carbohydrates in food, yielding low ppm detection limits when modern equipment is used. However, capillary electrophoresis with indirect UV-detection, providing the same sensitivity at short overall run times, can be a worthy complement. This is especially true for complex sample matrices, which present challenges for the classical stationary phases used for carbohydrate analysis by HPLC. This makes the method applicable to a wide range of food with complex matrices.

In Japan, the method presented here is routinely applied as a quick screening for carbohydrates in fruit juices, whiskey or rice plant sap.

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