APPLICATION BRIEF

LIQUID CHROMATOGRAPHY

Accelerating Beverage Quality Control Using HRes Fast-LC

Introduction

Consumers are continually demanding more choices in the offerings from food and beverage companies to accommodate personal preferences in taste, nutritional value and overall product quality. Beverage providers are continually offering alternative product formulations with different artificial sweetener and flavor combinations. This product variety leads to further complexity with respect to formulation control on the manufacturing plant floor to assure that the right combination of flavors and sweeteners is going into the correct product at the appropriate concentration.

The specific levels of components, flavors and both artificial and natural sweeteners in soft-drink beverages impart a unique characteristic to a beverage product and are therefore of great importance to the beverage industry. Because these levels are measured as part of the ongoing QA/QC process, sample throughput is critical in order to support a streamlined manufacturing process.

High performance liquid chromatography (HPLC) has been a well accepted method for monitoring the concentration of sugars and artificial sweeteners in foods and beverages. Research and quality-control personnel have worked diligently through the years to reduce HPLC analysis times to improve time to product release and facility productivity. Recent improvements have been implemented in HPLC systems to support the use of sub-3 µm stationary phases at higher flow rates and elevated pressures. These new HRes fast-LC systems can provide revolutionary improvements in both analysis time and separation efficiency.

The purpose of this application note is to demonstrate the improved throughput which can be achieved for the HPLC determination of preservatives, sweeteners, flavors and additives in soft-drink beverages.

Authors
Roberto Troiano
Luca Piatti
Eric Denoyer
Frank Corden

PerkinElmer, Inc.
710 Bridgeport Avenue
Shelton, CT 06484 USA

PerkinElmer®
precisely.

Experimental

A PerkinElmer® Series 275 HRes™ UV/Vis LC System, comprised of a binary high-pressure blending (10,000 psi) pump, a high-throughput autosampler with high-pressure injector valve (>10,000 psi), a high-speed UV/Vis detector (50 pts/sec) fitted with a high-efficiency 2.4-µL flow cell, was used. Both HRes and conventional methodologies were compared using the conditions in Table 1.

Beverage samples were diluted 1:1 with water and filtered with a 0.45 µm Acrodisc® (Pall Corp.) filter before injection. A standard solution mix of selected preservatives, flavors, sweeteners and other typical constituents of beverages was prepared with 50 ppm of each compound in water: acetonitrile 90:10.

Results

Figure 1 (Page 3) shows chromatograms for flavors and sweeteners using conventional and HRes methodology. These chromatograms demonstrate how much productivity can be improved by using HRes fast-LC technology. An 8x improvement in throughput was achieved with the Series 275 HRes LC System utilizing a column packed with the smaller 1.9-µm packing material compared to conventional methodology. As is commonly observed, peak order changes under the higher flow and higher pressure conditions used with HRes methods. However, the HRes chromatogram illustrates that common components in beverages can still be separated with excellent resolution, even with the significant throughput improvement.

Components of two common beverages – espresso coffee and orange soft drink – were measured using HRes methodology. The HRes chromatograms of these are compared with that of the standard mix in Figure 2 (Page 3).

These chromatograms illustrate how common components of beverages can be efficiently separated and determined by HRes fast-LC in under 2.5 min.

Conclusions

Consumers are increasingly aware of the additives and native components of the beverages and other food products they consume. Regulations and customer perceptions drive a goal of increased food quality and safety, and in the analytical methods used to monitor progress towards this goal.

Developments in HPLC equipment and methodology are improving the accuracy and throughput of QA/QC profiling of food products, allowing more determinations to be made more readily. Throughput improvements of 5-10x can be achieved without sacrificing separation efficiency.

The Series 275 HRes UV/Vis LC System is built upon proven PerkinElmer micro-binary pump technology, and can be used for both conventional and HRes methodology. Methods can be developed across a wide range of operating pressures, greatly expanding separation capabilities of the LC laboratory. This flexibility facilitates method transfer and the adoption of faster HRes LC methods, without having to abandon proven, reliable conventional methods in the same lab. Higher productivity can be achieved without sacrificing separation efficiency and simple, turnkey HRes methods such as the one illustrated here can be developed and implemented readily.

Table 1. HPLC Conditions.

	HRes	Conventional
Column	Brownlee™ HRes Aqueous DB-C18 100-mm length x 2.1-mm I.D. 1.9-µm	Brownlee Aqueous DB-C18 250-mm length x 4.6-mm I.D. 5-µm
Operating Pressure	8600 psi (593 bar)	2000 psi (138 bar)
Mobile Phase	A:Acetonitrile B:O-Phosphoric acid 0.1% v/v	A:Acetonitrile B:O-Phosphoric acid 0.1% v/v
Gradient	Step 0 = time 2.5 min - 12% A - 88% B	Step 0 = time 10 min - 10% A - 90% B
	Step 1 = time 1.0 min - 30% A - 70% B curve 5 (Convex)	Step 1 = time 25 min - 50% A - 50% B curve 1 (Linear)
	Step 2 = time 1.5 min. - 45% A - 55% B curve 5	
Flow	0.75 mL/min	1.5 mL/min
Temperature	70 °C	30 °C
Detector Wavelength	210 nm	210 nm
Injection Volume	5 µL	15 µL

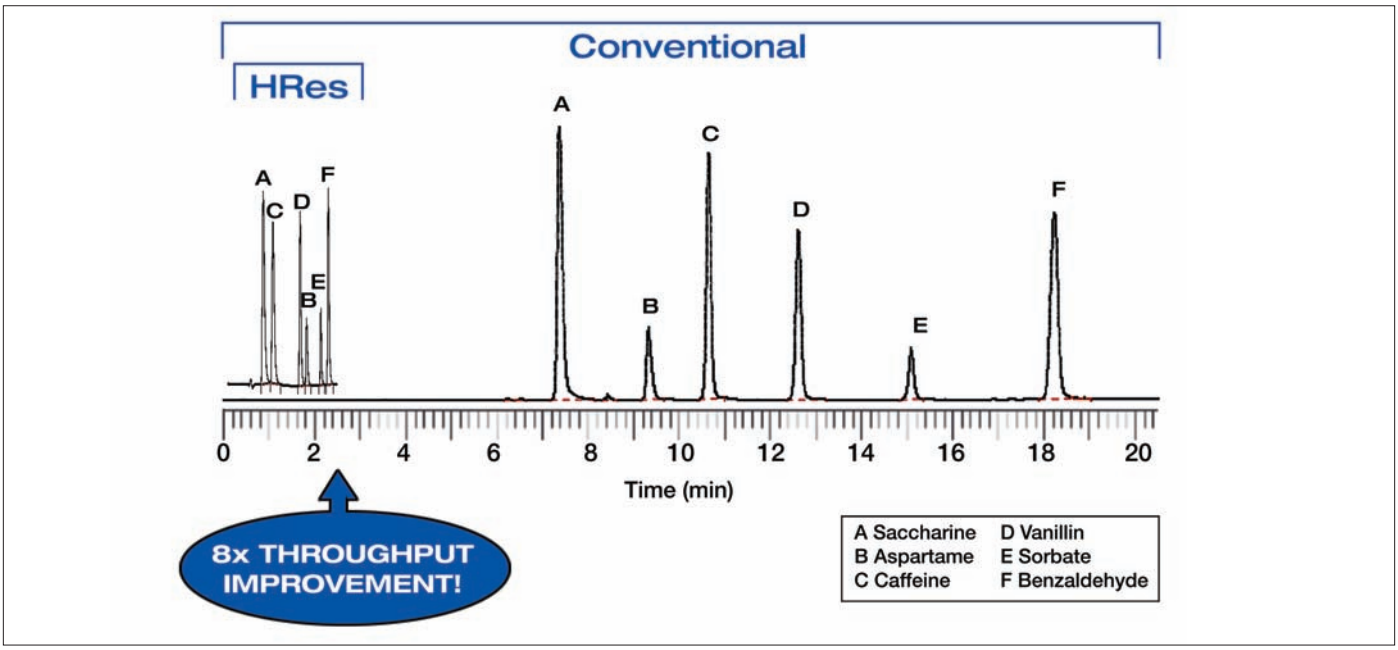

Figure 1. 8x improvement in throughput can be achieved using HRes fast-LC technology for the determination of sweeteners and flavors in beverages.

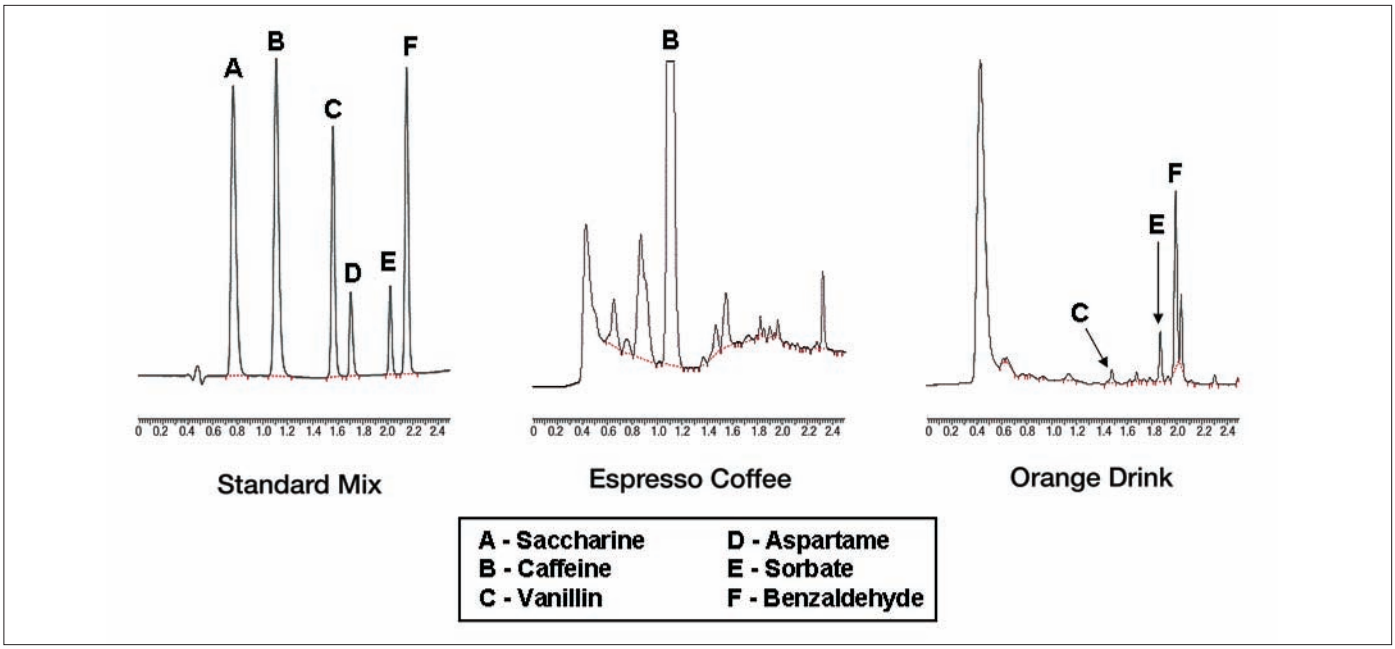

Figure 2. Common components of beverages can be determined by HRes fast-LC in less than 2.5 min.

PerkinElmer, Inc.
940 Winter Street
Waltham, MA 02451 USA
Phone: (800) 762-4000 or
(+1) 203-925-4602
www.perkinelmer.com

PerkinElmer®
precisely.

For a complete listing of our global offices, visit www.perkinelmer.com/lasoffices

008254_01