Rapid and Robust Profiling of Carbohydrates in Fruit Juices using HPLC with ELSD

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Introduction

The predominant sugars in fruit juice are the monosaccharides, glucose and fructose, and the disaccharide, sucrose. The ratio of these three sugars differs in each type of fruit juice. However, for each single fruit, the ratio is relatively constant. In the production of "pure" fruit juices, the juice must be extracted by mechanical means and must not contain any added material. The mechanical extraction and concentration of the juice is normally carried out in the country where the fruit is grown. The concentrate is shipped to an intermediate country or the country where the juice is to be consumed, where it is reconstituted to produce the "pure" fruit juice product. The juice concentrate is an expensive commodity and one way of increasing profit is to extend the juice by the addition of sucrose and water, which are considerably cheaper. This extension of the juice is a form of adulteration, not detectable by the measurement of °Brix, as this assesses total dissolved sugar and not the ratio of the individual sugars.

Instrumentation

Hi-Plex resin is ideal for the analysis of processed foods that contain a significant quantity of sugar, and provide a profile of both naturally occurring and added sugars. To determine the ratio of sucrose, glucose and fructose, a rapid, reliable and robust method is required. There are a number of HPLC methods to quantify these three sugars, with one of the most simple being the use of a calcium ligand exchange column, Hi-Plex Ca, with water as the eluent.Sugars do not have a UV chromophore and therefore the RI detector has to be used if the solutes are to be analyzed without any derivatization. An improvement in sensitivity for carbohydrates can be achieved by using an evaporative light scattering detector, the Varian ELSD. In addition to an increase in sensitivity, this detector also gives a more stable, drift-free baseline, which can improve the precision of the quantitation.

Column: Hi-Plex Ca, 300 x 7.7 mm
Detection: RI or Varian ELSD (neb=80 °C, evap=80 °C, gas=1.0 SLM)

Materials and Reagents

Eluent: Water

Conditions

Flow Rate: 0.6 mL/min
Temperature: 85 °C

Results and Discussion

Figures 1 and 2 show the separation of orange juice and apple juice, respectively, and clearly show that the ratio of the three sugars differs in the two juices, sucrose being the main sugar in the orange juice and fructose in the apple juice.

The stability of the Varian ELSD can clearly be seen in the carbohydrate separations of two additional samples of orange and apple juice, as shown in Figures 3 and 4.

Conclusion

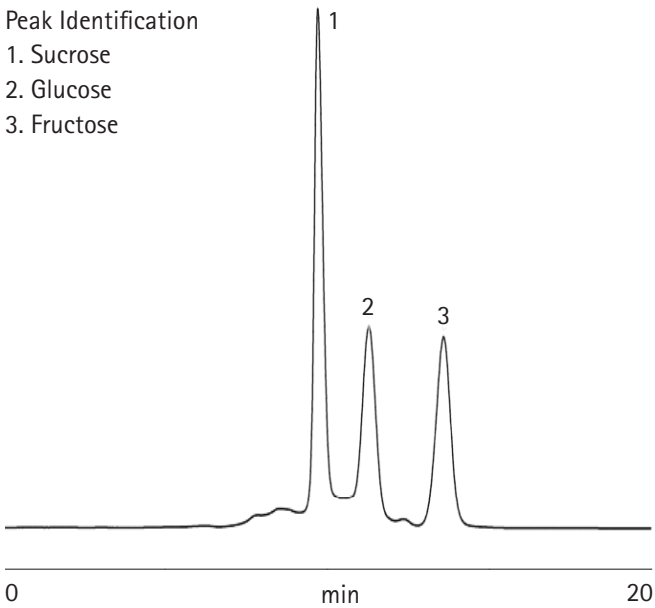

Figure 1. Sugar ratios in orange juice shown by HPLC with a Hi-Plex Ca column and RI detection.

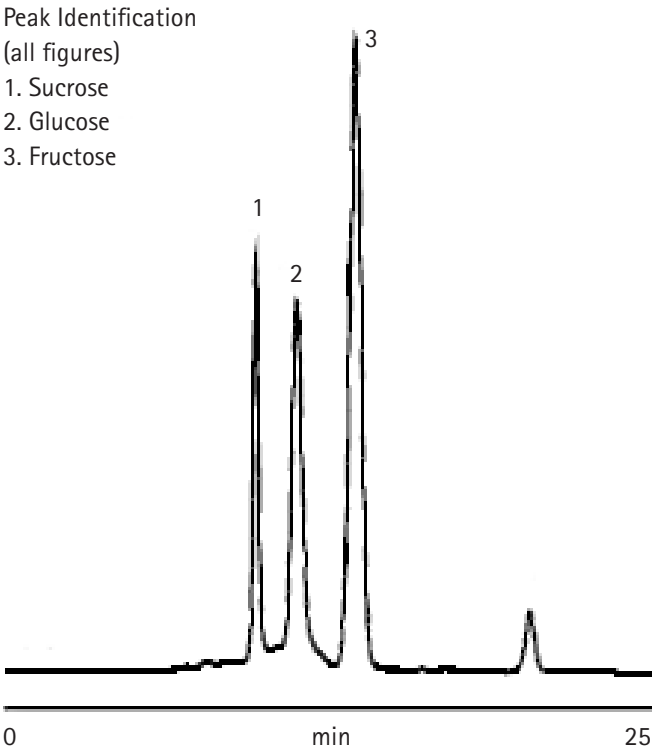

Figure 2. Sugars ratios in apple juice indicated by HPLC with a Hi-Plex Ca column and RI detection.

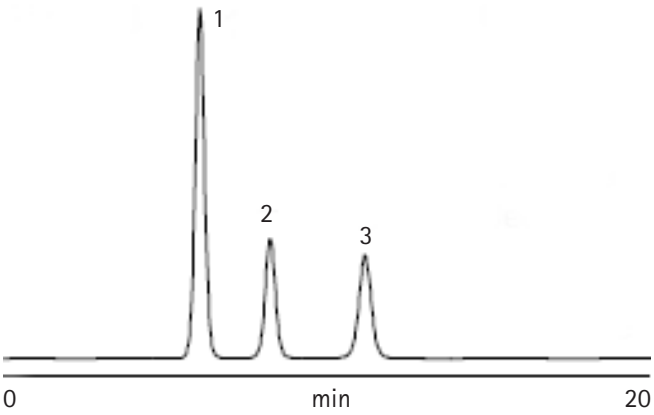

Figure 3. Sugar ratios in orange juice revealed by HPLC with a Hi-Plex Ca column and the Varian evaportive light scattering detector.

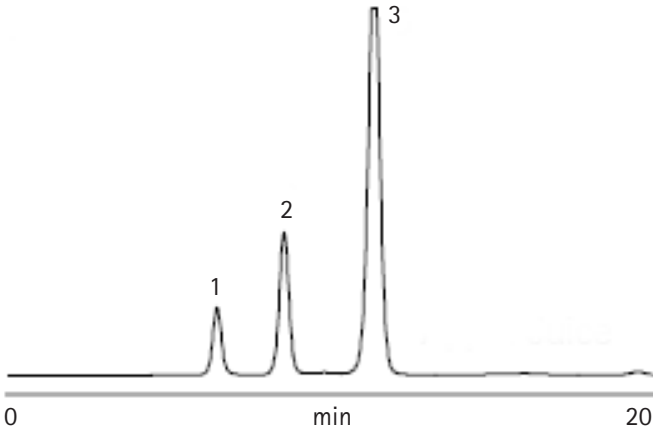

Figure 4. Sugar ratios in apple juice revealed by HPLC with a Hi-Plex Ca column and the Varian evaportive light scattering detector.

Hi-Plex columns are packed with sulfonated resin giving a fundamental improvement in performance to overcome the problems of low efficiencies and high back pressures encountered with 'soft' gels. The columns are available in calcium form for the analysis of carbohydrates in fruit juices, to meet the growing demand for more detailed product information for labelling and control purposes. The robust design of the Varian evaporative light scattering detector allows the nebulizer and evaporator to operate at very high temperatures, efficiently handling the high boiling point solvents that other ELSDs simply cannot manage.
Using Hi-Plex and the Varian ELSD, accurate determination of composition and content is ensured.

These data represent typical results. For further information, contact your local Varian Sales Office.

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