Asian Journal of Chemistry Vol. 8, No. 4 (1996), 775–778

HPLC Method for Characterisation of Carbohydrates in Fresh and Processed Fruit Juices

GYAN P. SHARMA, I. CHAKRABORTI*, BIJENDER P. TYAGI
R.K. SARIN and S.S. RAGHAV
Food Research and Standardization Laboratory
Navyug Market, Ghaziabad-201 001, India

Estimation and characterisation of glucose, fructose, sucrose, maltose and lactose by high performance liquid chromatography (HPCL) was performed in fruit juices in both fresh and processed forms. Following extraction, HPLC analysis took approximately 17 min for complete analysis. A good recovery was also obtained from a variety of fruit juices. The method suggests an update of available carbohydrate literature quantitatively in Indian and international fruit products.

INTRODUCTION

For characterisation of individual sugars, several time-consuming and sometimes difficult techniques have been used for a variety of food products. These techniques might be enzymatic, polarimetric, copper reduction method [1], spectrophotometric[2], paper chromatography[3] and GLC[4]. But in recent years, several investigators[5, 6] have demonstrated the value of High Performance Liquid Chromatography (HPCL) for the analysis of sugars in confectionary products, honey, jelly and oil-seed flours. Now applicability of HPLC to various fields of food science has become very extensive and also it allows a rapid characterization of many nutritionally significant carbohydrates in food products.

Putting the work further in line, we have studied the profile of five individual sugars *viz.*, fructose, glucoses sucrose, maltose and lactose in some fresh, processed fruit juices and fruit shakes. Simultaneous quantisation of these sugars in fruit juices can be important from the standpoint of formulation and quality control. Thus the objective of the present study is to evaluate the HPLC method for the analysis of sugars in fruit juices and suggest more accurate quantisation of sugars in fruit juices.

EXPERIMENTAL

The HPLC system includes a Water Associates 820 Workstation, 501 Pump, U6K Injector and R401 Differential RI Detector, the column (3.9 mm id × 30 cm) with Microbondapack/Carbohydrate packing material (Waters Associates). HPLC mobile phase used consisted of filtered and degassed HPLC grade acetonitrile/water (80/20 v/v). Flow rate was kept at 1.8 mL/min. The concentra-

tion of sugar in the samples was obtained by comparison of peak area of samples to those of standard sugar solutions of known concentration.

Samples of fresh, processed juices and the mango shake prepared from mango pulp and milk were collected from local market. After filtration, sugars were extracted by methanol/water/acetic acid (79/20/1) from known quantity of all fruit juices. The mango shake after defatting was extracted by ethanol/H_2O (83:17) at 70–80°C maintaining the pH near neutral in order to prevent the inversion of sucrose. This solvent system at higher temperature was chosen so as to facilitate the quantitative extraction of lactose along with other sugars.

To determine the recovery of added fructose, glucose, sucrose, maltose in fruit juices and lactose in mango shake, the respective sugars were added in amount equal to the amount present in the sample. Spiked samples were analysed for the sugars. Recoveries were calculated, based on the increase in peak area due to the added sugars.

RESULTS AND DISCUSSIONS

Data in Tables-1 and 2 reflects the contents and recoveries of sugars in various kinds of fruit juices. The recovery of sugars from fruit juices varied from 91.43 to 110.23%. The sugar extraction solvent systems suggested earlier, for the food products was also tried and it was found that they gave low recovery percentage in case of fruit juices. Maximum recovery was obtained only in aforementioned extraction condition. The highest variation of recovery was observed only in case of mango shake, possibly because of its highest fibre content, but in case of other fruit juices it gave good recovery and reproducibility.

TABLE-1
SUGAR ANALYSIS DATA IN FRESH AND PROCESSED FRUIT JUICES BY HPLC

Fruit juice	Glucose	Fructose	Sucrose	Maltose	Lactose	Total solid
Apple (P)	4.31	8.05	1.12	0.91	—	15.82
Grape	6.20	8.72	0.80	—	—	16.92
Grape (P)	7.90	8.59	1.34	0.89	—	19.71
Lime sweet	3.87	4.62	<0.10	—	—	10.20
Orange	4.22	4.17	0.40	—	—	11.56
Pomegranate	4.61	7.73	0.32	—	—	13.88
Pineapple	7.01	6.54	<0.12	—	—	16.95
Mango shake	6.90	8.86	4.87	—	2.48	29.84
Mixed fruit juice (P)	5.91	7.42	3.19	0.52	—	19.72

P—Processed

Values are mean of 3 observations.

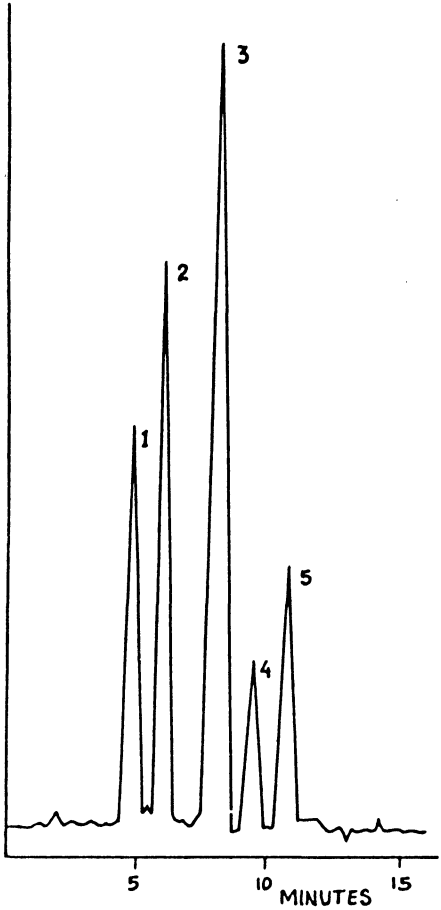

Fig. 1. Chromatogram of sample of mango shake: (1) Fructose, (2) Glucose, (3) Sucrose, (4) Lactose

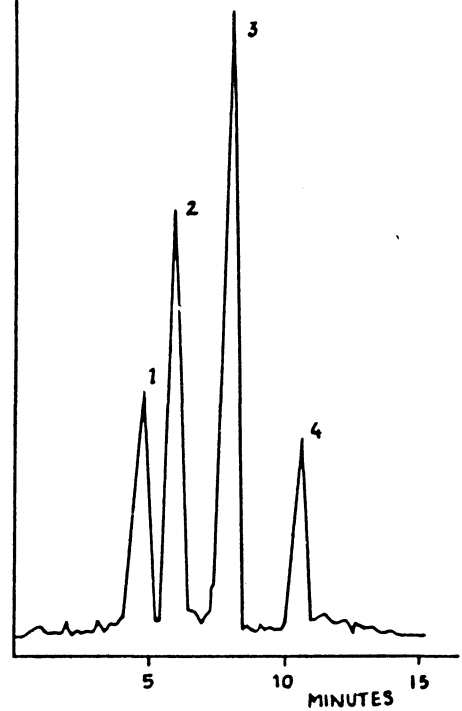

Fig. 2. Chromatogram of standard sugars: (1) Fructose, (2) Glucose, (3) Sucrose, (4) Maltose, (5) Lactose.

TABLE-2
RECOVERY OF ADDED SUGARS FROM SOME FRUIT JUICES

Juice	Glucose	Fructose	Sucrose	Maltose	Lactose
Apple (P)	98.80 ± 2.60	98.20 ± 2.13	98.91 ± 2.20	96.61 ± 2.35	—
Grape	99.21 ± 2.1	98.22 ± 2.60	—	—	—
Lime sweet	99.13 ± 2.57	98.58 ± 2.22	—	—	—
Mixed fruit juice (P)	98.17 ± 2.41	99.62 ± 3.73	99.69 ± 3.30	98.73 ± 2.97	—
Mango shake	102.01 ± 8.22	98.53 ± 7.10	96.72 ± 4.21	—	98.31 ± 3.44

Values are mean of seven observation: mean ± SD

P—Processed

The chromatograms of samples and standards are shown in Figs. 1 and 2 respectively. The total elution time for five sugars was 11 min. Data obtained in

our study was compared with available Indian[8] and International data[9, 10] and it was felt that carbohydrate literature in these sources needs further expansion and updating. However, Thus HPLC has enabled the quantisation of five sugars rapidly and accurately.

REFERENCES

1. D. Pearson, The Chemical Analysis of Food, Churchill-Livingstone, New York (1976).
2. R.M. McCready, E.D. Ovcay and M.A. Grauger, *J. Association of the Official Analytical Chemists (AOAC)*, **57**, 336 (1974).
3. C.Y. Lee, R.S. Shallenberger and M.T. Vittum, *N.Y. Food Life Sci. Bull.*, 1 (1970).
4. G.G. Birch, *J. Food Technol.*, **8**, 229 (1973).
5. D.J. Timbie and P.G. Keeney, *J. Food Sci.*, **42**, 1590 (1977).
6. J.E. Thean and W.C. Funderberk (Jr.), *J. Association of the Official Analytical Chemists (AOAC)*, **60**, 838 (1977).
7. E.C. Conard and J.K. Palmer, *Food Technol.*, **30**, 84 (1976).
8. S.G. Balasubramaniam, Nutritive Values of Indian Foods, NIN, ICMR, Hyderabad (India) (1974).
9. Delmonte, Nutrition Guide, Delmonte Cor. (1974).
10. USDA, ARS, Handbook, p. 456.

(*Received*: 18 April 1996; *Accepted*: 30 July 1996) AJC-1132