
Spectral Analysis of Fruit Juices

Introduction

UV/Visible spectroscopy has been applied for some time in the routine testing of fruit juices, especially orange juice, for authenticity. A standard form of the method is contained in a battery of tests, used to check for conformance to the FDA Code CFR21.146.

Extensive databases of varieties and types of juices have been built up, following work by Petrus in the Florida Department of Citrus, U.S.A. Six key wavelengths form the basis of screening; those at 456nm, 443nm and 425nm indicate the level of carotenoids whereas those at 325nm, 280nm and 245nm the presence of polyphenols, flavanoids and ascorbic acid, respectively.

Spectral detail is especially useful for interpretation of varietal differences. For example, early season varieties have lower colouration, which could otherwise be wrongly interpreted by colorimetric measurements as dilution. The peak at 280nm is characteristic of flavanoid concentration and the peak at 250nm indicates vitamin C. If this peak is well resolved and there is relatively lower than expected absorbance at 250nm, there is some indication of the addition of pulpwash. The absorbance ratio 443/325nm has been proposed by Petrus for detection of pulpwash adulteration.

Monitoring fruit juice stability at specific wavelengths over time at elevated temperatures is also widely used to test the effectiveness of stabilisers and packaging materials as the spectral data can give an overall impression of the chemical changes or deterioration that may be occurring in the sample.

Method

5ml of juice is added to 95 ml of methanol, mixed and centrifuged at 5000rpm for 30 seconds. The supernatant is then placed in a 1cm pathlength cell.

To monitor stability over time, the sample should be centrifuged at 5000rpm for 5 minutes prior to being filtered through grade 50 paper. Supernatant should be placed in a tightly stoppered 1cm pathlength cell and monitored at 32°C to simulate storage at elevated temperatures.



Libra S5/S5H

Spectra can be scanned over the range 330-830nm and displayed on the screen using the arrow keys to highlight and expand regions of interest. All results can be output to PC using the spreadsheet interface software (80-2112-23) and the serial cable (80-2105-97).

Libra S11/S12

Spectra can be scanned over the range 200-999nm (325-999nm for the Libra S11) at a bandwidth of 5nm, and viewed on the display. There is an absorbance ratio mode. The absorbance sum at 443, 325 and 280 proposed by Petrus as an indicator of pulpwash adulteration can be displayed. All results can be output to PC using the spreadsheet interface software supplied with the serial interface adapter lead (80-2109-02).

Libra S11/S12 can be used in conjunction with the Acquire Lite PC software (80-2112-24). Thus, scans can be overlaid, stored, retrieved and compared in adjacent windows. Furthermore, absorbance data can be manipulated mathematically for smoothing and derivatives.

Libra S21/S22

Spectra can be scanned over the range 190-900nm (325-900nm for the Libra S21) at a bandwidth of <3nm, and viewed on the display (note that single point measurements can be made between 901 and 1100nm). There is an absorbance ratio mode. The absorbance sum at 443, 325 and 280 proposed by Petrus as an indicator of pulpwash adulteration can be displayed. All results can be output to PC using the spreadsheet interface software (80-2112-23) and the serial cable (80-2105-97).

Use of the Peltier heated single cell holder with the Libra S22 is ideal for the stability tests over time. Over 20 hours, results show that the wavelengths between 280nm and 365nm increase steadily, indicating changes in the levels of carotenoids and polyphenols. Since these influence the flavour and acceptability of the juice, even relatively short periods of exposure to warmer ambient temperatures can have an effect on product quality.

Libra S21/22 can be used in conjunction with the Acquire PC software (80-2115-31). Thus, scans can be overlaid, stored, retrieved and compared in adjacent windows. Furthermore, absorbance data can be manipulated mathematically for smoothing and derivatives.

Libra S32

Spectra can be scanned over the range 190-1100nm at a bandwidth of <1.8nm, and viewed on the display. There is an absorbance ratio mode. The absorbance sum at 443, 325 and 280 proposed by Petrus as an indicator of pulp wash adulteration can be displayed. All results can be output to PC using the spreadsheet interface software (80-2112-23) and the serial cable (80-2105-97).

Libra S32 can be used in conjunction with the Acquire PC software (80-2115-31). Thus, scans can be overlaid, stored, retrieved and compared in adjacent windows. Furthermore, absorbance data can be manipulated mathematically for smoothing and derivatives.

Comment

The rapid scanning facilities of the Libra spectrophotometers make them suitable for factory-based rapid screening of fruit juice samples prior to acceptance by processors and packers.

Ordering Information

Libra S5	80-2115-00
Libra S5H	80-2115-01
Libra S11	80-2115-15
Libra S12	80-2115-10
Libra S21	80-2115-25
Libra S22	80-2115-20
Libra S32	80-2115-30

Reference

Petrus D.R. and Attaway J.A., J. Association of Off Anal.Chemists 63, 6, 1317-1381, (1980).