

Simultaneous Measurement of Dextrose and Sucrose in Cereal Products

I. Introduction

Dextrose (D-glucose) and sucrose concentrations in complex matrices such as cereal products can be measured directly and quickly using the YSI 2700 SELECT Biochemistry Analyzer. YSI's unique enzyme technology provides for specific dextrose and sucrose measurements. Measurements are virtually unaffected by color, turbidity, density, pH, or the presence of reducing substances.

When a Dual-Channel 2700 SELECT Biochemistry Analyzer is equipped with a dextrose and a sucrose membrane, simultaneous measurement of both analytes is possible. Because dextrose interferes with sucrose analysis, it is necessary to follow this protocol when analyzing for sucrose in the presence of dextrose.

When a sample is injected into the sample chamber, the sucrose diffuses to the sucrose membrane, which contains invertase, mutarotase, and glucose oxidase. The sucrose is hydrolyzed to α -D-glucose and fructose. The mutarotase allows for the quick equilibrium of glucose between its a and b forms. In the presence of glucose oxidase, the β -D-glucose (dextrose) is oxidized to hydrogen peroxide and D-glucono- δ -lactone. The hydrogen peroxide is detected amperometrically at the platinum electrode surface. The dextrose in the sample diffuses to both the dextrose and sucrose membranes, which contain glucose oxidase, and is oxidized as well. Subtracting the response of the dextrose membrane from the response of the sucrose membrane yields the response due to sucrose alone. The dextrose response is taken directly from the dextrose membrane. The algorithm in the instrument software calculates the net concentrations. For more information on this system, refer to Section 4 in the Operations Manual.

II. Materials and Setup

- A. YSI Dual-Channel 2700 SELECT Biochemistry Analyzer - equipped with a 2703 Sucrose Membrane, a 2365 Dextrose Membrane and 2357 Buffer.
- B. Dextrose (2.50 g/L, 9.00 g/L) and Sucrose (5.00 g/L, 25.0 g/L) standard solutions..
- C. Buffer Diluent (40 g/L NaH_2PO_4 , 10g/L Na_2HPO_4 in reagent water).
- D. Connect the 2700 SELECT to a suitable power source.
- E. Perform the instrument and membrane check described in the Operations Manual (Section 3).
- F. Volumetric glassware (Class A recommended).
- G. The following instrument setup is recommended.

Sample size: 25 μL
 Sample Station # 3
 CalMethod Two Station

Black Probe Parameters

Chemistry Dextrose
 Unit g/L
 Calibrator 2.50 g/L
 End Point 30 Sec
 CalStation# 1

White Probe Parameters

Chemistry Sucrose
 Unit g/L
 Calibrator 5.00 g/L
 End Point 30 Sec
 CalStation# 2

Autocal Parameters

Sample Error ON
 Temperature 1°C
 Time 15 Min
 Sample 5 Sam
 Cal Shift 2%

III. Method

- A. Grind sample to a fine powder.
- B. Weigh 1.000 to 5.000 g of powdered sample.
- C. Transfer the sample to a 100 mL volumetric flask, using buffer diluent to rinse and dilute. Fill the flask to the mark with buffer and mix. Allow the solution to equilibrate for about twenty minutes before analysis.
- D. Calibrate the 2700 SELECT with 2.50 g/L dextrose and 5.00 g/L sucrose standard solutions (at Stations #1 and #2, respectively).
- E. Check the linearity of the membrane at least once a day by injection of dextrose (9.00 g/L) and sucrose (25.0 g/L) linearity check solutions. Refer to the Operations Manual (Section 3) for specifications.
- F. Assay the sample prepared in B by aspiration into the 2700 SELECT.*
- G. Calibration frequently as described in the Operations Manual (Section 6).

* The linear range of the system is 0 to 25.0 g/L for both dextrose and sucrose. The combined concentration of dextrose + sucrose cannot exceed 25 g/L. If the sum of the values reported exceeds this, further dilution of the sample is required. If the dextrose concentration exceeds the sucrose concentration, accuracy and precision may be compromised due to the software algorithm that subtracts dextrose from sucrose. To avoid compromising accuracy refer to Application Note 315.

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IV. Calculations

To calculate % dextrose and sucrose, multiply the values reported by the appropriate dilution factor.

Example: A cereal sample (4.336 g) was prepared and assayed as described. The values reported were 0.62 g/L dextrose and 9.88 g/L sucrose.

% Dextrose:

$$0.62 \text{ g/L} \times 0.100\text{L}/4.336\text{g} = 0.0143\text{gdextrose/gcereal} \\ = 1.43\% \text{ (w/w)}$$

% Sucrose:

$$9.88 \text{ g/L} \times 0.100\text{L}/4.336\text{g} = 0.2279\text{gsucrose/gcereal} \\ = 22.8\% \text{ (w/w)}$$

V. Samples Tested

Several cereal samples were assayed using YSI technology and HPLC. The results are listed below.

Sample	Sucrose(%)		Dextrose(%)		Label(%)*
	YSI	HPLC	YSI	HPLC	
A	35.0	36.0	1.24	0.96	38.8
B	21.4	22.2	0.85	0.50	21.1
C	22.4	23.1	1.52	1.52	24.6
D	17.4	18.3	0.27	0.07	28.0
E	25.2	25.4	1.61	1.33	28.2
F	29.8	27.9	3.51	4.14	35.2
G	32.2	31.1	3.01	2.42	38.7
H	32.9	30.4	0.71	0.43	38.7
I	5.40	6.70	1.03	0.70	7.0

* Label information reported as "Sucrose and Other Sugars."

VI. Ordering Information

YSI No.	
2700	Biochemistry Analyzer
2365	Dextrose Membrane Kit
2776	Dextrose Standard Solution (2.50 g/L)
1531	Dextrose Standard Solution (9.00 g/L)
2703	Sucrose Membrane Kit
2780	Sucrose Standard Solution (5.00 g/L)
2778	Sucrose Standard Solution (25.0 g/L)
2357	Buffer Kit
2363	Potassium Ferrocyanide Test Solution
2392	NaCl Solution (for membrane installation)

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