

Simultaneous Measurement of Dextrose and Sucrose in Peanut Butter

I. Introduction

Dextrose (D-glucose) and sucrose concentrations in complex matrices such as peanut butter can be measured directly and quickly using the YSI 2700 SELECT Biochemistry Analyzer. YSI's unique enzyme technology provides for rapid 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 α and β 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

- YSI Dual-Channel 2700 SELECT Biochemistry Analyzer - equipped with a 2703 Sucrose Membrane, a 2365 Dextrose Membrane and 2357 Buffer (See III. C.).
- Dextrose (2.50 g/L, 9.00 g/L) and Sucrose (5.00 g/L, 25.0 g/L) standard solutions..
- Buffer Diluent (40 g/L NaH₂PO₄, 10g/L Na₂HPO₄ in reagent water).
- Connect the 2700 SELECT to a suitable power source.
- Perform the instrument and membrane check described in the Operations Manual (Section 3).
- Volumetric glassware (Class A recommended).
- The following instrument setup is recommended:

Sample size:	25 μ L
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

- Weigh between 5.00 and 10.0 grams of peanut butter to be analyzed.
- Transfer the sample to a beaker and add about 50 mL of buffer. Allow the sample to stir until the peanut butter is in solution.
- 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.
- Calibrate the 2700 SELECT with 2.50 g/L dextrose and 5.00 g/L sucrose standard solutions (at Stations #1 and #2, respectively).
- 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.
- Assay the sample prepared in C by aspiration into the 2700 SELECT.*
- Calibrate 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: 6.65 g of peanut butter was diluted to 100 mL in a Class A volumetric flask. When assayed, the values reported were 1.21 g/L dextrose and 3.22 g/L sucrose.

% Dextrose:

$$\begin{aligned} 1.21 \text{ g/L} \times 0.100 \text{ L}/6.65 \text{ g} &= 0.0182 \text{ g dextrose/g peanut} \\ &\quad \text{butter} \\ &= 1.82 \% \text{ (w/w)} \end{aligned}$$

% Sucrose:

$$\begin{aligned} 3.22 \text{ g/L} \times 0.100 \text{ L}/6.65 \text{ g} &= 0.0484 \text{ g sucrose/g peanut} \\ &\quad \text{butter} \\ &= 4.84 \% \text{ (w/w)} \end{aligned}$$

V. 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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