



Food & Beverage Series

MEASUREMENT OF GLUCOSE AND SUCROSE IN POTATOES

Application Note 218LS
YSI Life Sciences



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INTRODUCTION

Dextrose (D-glucose) and sucrose concentrations in complex matrices such as potatoes can be measured directly and quickly using the YSI 2900 Series Biochemistry Analyzer. YSI's unique enzyme technology provides for rapid dextrose and sucrose measurement. Measurements are virtually unaffected by color, turbidity, density, pH, or the presence of reducing substances.

When a YSI 2900 Series Biochemistry Analyzer is equipped with a dextrose membrane, both sucrose and dextrose concentrations can be measured. This is accomplished by first determining the glucose concentration. The sucrose is then hydrolyzed to dextrose, and the total dextrose concentration is measured. The difference in the responses corresponds to the sucrose concentration.

After a sample is injected into the sample chamber, the dextrose diffuses to the glucose membrane, which contains glucose oxidase, and is oxidized to hydrogen peroxide and D-glucono- δ -lactone. The hydrogen peroxide is detected amperometrically at the platinum electrode. The current produced is directly proportional to the hydrogen peroxide and dextrose concentrations. For more information on this system, refer to the Operations Manual.

I. MATERIALS & SETUP

- A. YSI 2900 Series Biochemistry Analyzer - equipped with a 2365 Glucose Membrane and 2357 Buffer.
- B. Glucose standards (2.50 g/L, 9.00 g/L).
- C. Buffer Diluent (40 g/L NaH_2PO_4 , 10g/L Na_2HPO_4 in reagent water).
- D. Invertase - Sigma Chemical Company I-4504 recommended.
- E. Connect the 2900 Series instrument to a suitable power source.
- F. Perform the instrument and membrane daily checks described in the Operations Manual.

- G. Volumetric glassware (Class A recommended).
- H. The following instrument setup is recommended:
Sample Size 25 μL

Probe A Parameters

Chemistry	Glucose
Unit	g/L
Calibrator	2.50
End Point	30 Sec

Autocal Parameters

Temperature	1°C
Time	30 Min
Sample	5 Sam
Cal Shift	2%

II. METHOD

- A. Weigh 100 to 200 grams of washed and peeled potatoes. For information on sample selection, see J. R. Sowokinos, *American Potato Journal*, 50, 333-334 (1978).
- B. Juicerate the potatoes in an Acme Juicerator and collect the juice in a beaker. Wash the juicerator three times with 100 mL portions of buffer diluent. Wait two to three minutes between washings.
- C. Quantitatively transfer the combined juice and buffer to a 500 mL volumetric flask. Rinse the beaker with several small (10 mL) aliquots of buffer and transfer to the flask. Dilute to the mark with buffer. Refrigerate for one hour prior to analysis.*
- D. Remove about 3 mL of the solution from C and add ~2 mg of invertase enzyme. Stir gently until dissolved. Cover the sample and allow incubation at room temperature for 20 minutes before analysis.
- E. Calibrate the 2900 series instrument with a 2.50 g/L glucose standard solution.
- F. Check the linearity of the membrane at least once a day by injection of a glucose linearity check solution (9.00 g/L). Refer to the Operations Manual for specifications.

continued

- G. Assay the sample prepared in C by aspiration into the 2900 Series. This is the free glucose concentration (D_{free}).^{**}
- H. Assay the sample prepared in D (with invertase). The value reported is the sum of the free glucose and that produced from sucrose hydrolysis (D_{total}).
- I. Calibrate frequently as described in the Operations Manual.

* For potato samples with low glucose and sucrose levels, consider increasing the ratio of potato sample to the volume of extracting buffer, or consider increasing the sample size aspirated into the instrument (II.H).

** The linear range of the 2900 Series instrument may be increased to 25.0 g/L. This can be done by decreasing the sample size to 10 μ L and checking the linearity with a 25.0 g/L standard.

III. CALCULATIONS

Example: A 223 g potato sample was prepared as described in II. When the sample from II.C was assayed, the value reported (D_{free}) was 2.13 g/L glucose. The value reported for the sample from II.D (with invertase) was 3.36 g/L dextrose (D_{total}).

To calculate % glucose, multiply the reported value (D_{free}) by the appropriate dilution factor.

To calculate % sucrose, subtract D_{free} from D_{total} and multiply by the appropriate dilution and mass ratio factors.

$$\begin{aligned} \text{\% Sucrose:} \\ (3.36 \text{ g/L} - 2.13 \text{ g/L}) \times \frac{0.500 \text{ L}}{223 \text{ g}} \times \frac{342.30 \text{ g/mole sucrose}}{180.16 \text{ g/mole dextrose}} \\ = 0.00524 \text{ g sucrose/g potatoes} \\ = 0.52\% \text{ (w/w)} \end{aligned}$$

ORDERING INFORMATION

YSI Part Numbers:

2900	Biochemistry Analyzer
2365	Glucose Membrane Kit
2776	Glucose Standard Solution (2.50 g/L)
2777	Glucose Standard Solution (25.0 g/L)
1531	Glucose Standard Solution (9.00 g/L)
2357	Buffer Kit
2363	Potassium Ferrocyanide Test Solution
2392	NaCl Solution (for membrane installation)

For further information, please contact:

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$\begin{aligned} \text{\% Glucose:} \\ 2.13 \text{ g/L} \times 0.500 \\ \text{L/223 g} \end{aligned}$	$\begin{aligned} &= 0.00478 \text{ g glucose/g} \\ &\text{potatoes} \\ &= 0.48\% \text{ (w/w)} \end{aligned}$
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