

Measuring the pH of yogurt

For efficient manufacturing and quality control

Introduction

Measuring the pH value of yogurt is important for the efficient manufacturing and quality control of the product. The main challenges with this are cold temperatures and preventing junction clogs, which can cause poor accuracy and slow response. The 8172BNWP Thermo Scientific™ Orion™ ROSS™ Sure-Flow™ pH Electrode with Sure-Flow junction prevents clogging. The Thermo Scientific™ Orion™ ROSS™ Reference System provides fast response and accurate readings when testing samples that vary in temperatures.

Recommended equipment

Thermo Scientific™ Orion Star™ A211 pH Meter Difficult Sample Kit, Cat. No. STARA2114, which includes the ROSS Sure-Flow pH Electrode, Cat. No. 8172BNWP, ATC temperature probe, Cat. No. 927007MD, pH 4-7-10 buffers and storage solution;

Optional: NIST-calibrated thermometer; Thermo Scientific™ Orion Star A Series Compact Printer, Cat. No. STARA-106; Thermo Scientific™ Orion™ Automatic Stirrer Probe and Paddle, Cat. No. 096019; Thermo Scientific™ Barnstead™ Smart2Pure™ 12 UV Water Purification System, Cat. No. 50129890 or other suitable water purification system.

Required solutions

pH 4.01 and 7.00 buffers (Cat. No. 910104, 910107); ROSS electrode filling solution (Cat. No. 810007); ROSS storage solution (Cat. No. 810001) or standard storage solution (Cat. No. 910001); reagent-grade water (RGW); 1 N Hydrochloric Acid; 1 N Sodium Hydroxide



Solutions preparation

Prepare 1 N hydrochloric acid (HCl) by dissolving 42 mL of concentrated HCl in a 500 mL volumetric flask with RGW, or purchase from a commercial source. Prepare 1 N sodium hydroxide (NaOH) by dissolving 20 g NaOH in a 500 mL volumetric flask with RGW, or purchase from a commercial source.

Meter setup

Connect the pH electrode and ATC probe to the meter. Connect the stirrer probe to the meter (optional). Set the meter measurement mode to pH. In the meter setup mode, set pH resolution to 0.01, calibration buffer to USA, and read type to continuous. If the ATC is connected properly, the true temperature (not the reference 25.0) will be displayed on the screen.

Electrode setup

See the electrode user guide for preparation of the electrode.

Electrode performance check

Check slope (see Calibration section) and drift. Drift may be checked by comparing a 1-minute to 2-minute reading. Results should agree with desired criteria. See troubleshooting section of user guide if slope and/or drift are not acceptable. Be sure the electrode is working properly before making measurements.

Sample preparation

Before removing any portion of sample for analysis, mix it with a spatula until homogeneous. Repeat mixing before each subsequent portion is removed for analysis. Place about 50 mL of sample into a 100 mL beaker.

Calibration –pH and temperature

See meter user guide for calibration procedure directions. Calibrate the ATC against a NIST-calibrated thermometer, if needed. Perform a two-point pH calibration using pH 4.01 and 7.00 buffers at room temperature. Stir the buffer during calibration. The electrode slope should be between 92 and 102%. If the slope is not within that range, perform electrode maintenance and/or use fresh buffer solution. Repeat the calibration until satisfactory results. Check calibration by reading pH 4 buffer. Value should be within 0.03 pH units of the tabulated value for that temperature (see the table on page 3).

Analysis

Place pH and ATC probes in sample, gently stirring the sample with the probes for about 15 seconds to remove air bubbles, equilibrate the sensor to sample temperatures, and speed the electrode response. The pH value and temperature will be displayed. Continue measurement for 1 minute for yogurt samples at room temperature and for 2-3 minutes for samples at refrigeration temperature or until pH readings are stable (for example stable to +/- 0.01 pH/min). Record the result. Rinse the pH and ATC probes with RGW to remove any sample left on the sensor and junction.

Electrode cleaning

If the electrode becomes slow to respond and drifts, clean it as follows:

1. Rinse the electrode with DI water to remove the contamination, drain, and refill with fresh filling solution.
2. If the problem still exists, clean the electrode by alternately soaking in 1 N HCl, 1 N NaOH, and 1 N HCl for 30 seconds in each; then soak in pH electrode storage solution for 5 minutes. Between each solution, rinse the electrode with RGW.

3. If the electrode is still slow or drifts, use Orion pH electrode cleaning solutions: for removal of protein deposits, use Thermo Scientific™ Orion™ 900021 pH Electrode Cleaning and Solution A. For removal of oil and grease, use Thermo Scientific™ Orion™ 900024 pH Electrode Cleaning and Solution D. For removal of bacterial contaminants, use Thermo Scientific™ Orion™ 900022 pH Electrode Cleaning and Solution.

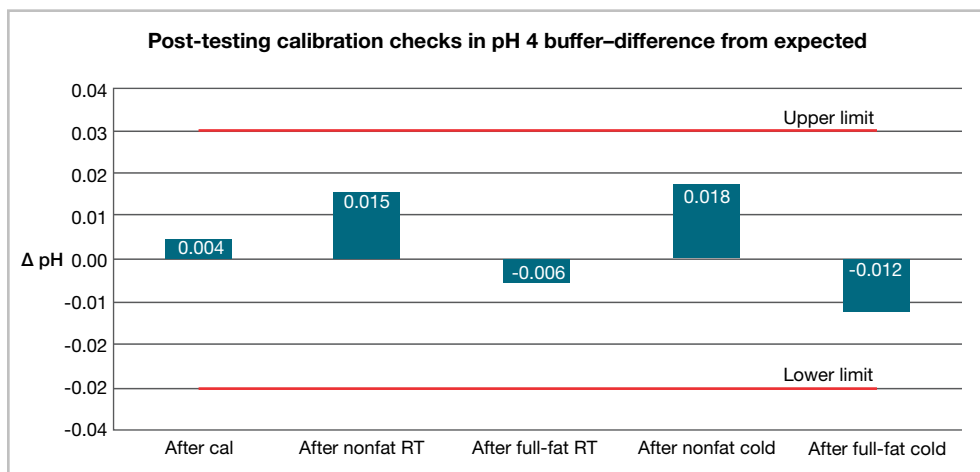
Quality control (QC)

Recommended QC procedures include: calibration and calibration verification, sample duplicates, slope, drift, and continuing calibration checks.

Results for pH of nonfat vanilla yogurt w/sugar and plain full-fat yogurt at room and at refrigeration temperatures measured with the Orion ROSS 8172BNWP Sure-Flow Electrode

Sample	Time (min)	Avg pH (n=5)	STDEV
Nonfat vanilla yogurt with sugar at room temperature	1	4.38	0.05
Plain full-fat yogurt at room temperature	1	4.34	0.03
Nonfat vanilla yogurt with sugar at cold temperature	2	4.39	0.09
Plain full-fat yogurt at cold temperature	2	4.37	0.08

- The pH measurement results of 20 yogurt samples (five replicates of each, the nonfat vanilla yogurt and the plain full-fat yogurt, at room and at refrigeration temperatures) demonstrated good agreement between multiple replicates of the same yogurt sample (STDEV < 0.1 in pH units) within the expected pH range for yogurt of pH 4.25 to 4.5.
- As shown in the above table, it typically takes only one minute to obtain accurate and repeatable readings in both yogurts at room temperature. Electrode response is 2-3 minutes in yogurts at cold temperature.



The above chart demonstrates that after testing 20 yogurt samples at room and at refrigeration temperatures, the 8172BNWP Orion™ ROSS™ Sure-Flow™ pH Electrode performs well. It still reads the pH 4 buffer within +/- 0.03 pH of the expected buffer pH.

Temperature-corrected values for pH 4.00 buffer

°C	0	10	20	30	40	50	60	70	80	90
pH	4.00	4.00	4.00	4.02	4.03	4.06	4.09	4.12	4.16	4.21

See a more detailed table (including buffers 7.00 and 10.01), at thermofisher.com/electrochemistry.

Find out more at thermofisher.com/electrochemistry