APPLICATION NOTE

Measuring pH in wine and juice

Key Words: pH, red wine, wine-making, juice, proteins, sulfides, tannins, polyphenols.

Goal

The following application note includes the recommended equipment, procedures and maintenance for accurate pH readings.

Introduction

Since pH plays a critical role in wine making, measurements are taken throughout the winemaking process, from juice to finished wine. Typical pH levels in wine range from 2.9 to 3.9. Various components of juice and wine can challenge the performance of the pH electrode, including proteins, sulfides, tannins, and polyphenols. This note includes recommended equipment, procedures, and maintenance to assure accurate pH readings.

Recommended Equipment

- Thermo Scientific™ Orion™ pH meter (or equivalent)
- Thermo Scientific™ Orion™ ROSS™ Sure-Flow™ pH Electrode (Cat. No. 8172BNWP), Orion Green pH Combination Electrode (Cat. No. GD9156BNWP), or equivalent
- Automatic Temperature Compensation (ATC) probe (Cat. No. 927007MD)
- Stirrer (Cat. No. 096019)
- Swing arm and electrode holder (Cat. No. 090043)
- pH electrode storage bottle (Cat. No. 910003)

Recommended Solutions

- pH 4.01 and 7.00 buffers (Cat. No. 910104, 910107)
- Electrode filling solution (Cat. No. 810007 for 8172BNWP, or Cat. No. 910008-WA for GD9156BNWP)
- Orion ROSS storage solution (Cat. No. 810001) or pH electrode storage solution (Cat. No. 910001)
- Deionized water (DI)
- pH electrode cleaning solution A (Cat. No. 900021-WA)
- pH electrode cleaning solution D (Cat. No. 900024)
- ~75% alcohol solution (methanol or ethanol in water)

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Meter Setup

Connect the pH electrode, ATC probe, and stirrer to the meter. Set measurement mode to pH. In Setup, set the stirrer speed to 3, pH resolution to 0.01, buffer set to USA and read type to auto or continuous.

Note: When the ATC is connected properly, the true temperature (not the default 25.0) will be displayed on the screen. The ATC will measure buffer and sample temperatures and will ensure precise automatic temperature-compensated readings.

Electrode Calibration

Before sample testing, perform a two-point pH calibration using pH 4.01 and 7.00 buffers. (See Analysis instructions below for details on test protocol). The electrode slope should be between 92 and 102%.

Sample Preparation

Place about 50 mL of sample in a small, clean beaker (about 100 mL size).

Analysis

Place the pH electrode, ATC, and stirrer into the electrode stand. Rinse each with DI water. Place probes and stirrer into the sample, immersing about 1-2 inches into the solution. Stir the sample continuously. When the meter indicates the reading is stable, record the pH to two decimal places (e.g., 3.39) and the temperature to one decimal place. (If using Autoread mode, the meter will lock on the final reading and automatically log the readings, when the log function is turned on in Setup). Between readings, rinse the probes and stirrer with DI water to remove any remaining sample.

Electrode Storage

After testing is complete, rinse pH electrode thoroughly with the ~75% alcohol solution or immerse for 5 minutes, then rinse thoroughly with DI water. Cover the fill hole and store pH electrode in a bottle of electrode storage solution. Change the storage solution biweekly or monthly. ATC should be stored dry.

Electrode Maintenance

Fill the electrode to the level of the fill hole each day, prior to testing. Weekly or biweekly, empty the fill solution and replace with fresh fill solution.

Electrode Cleaning

If the electrode begins to exhibit drift and/or is slow to respond, clean it as follows: clean the electrode with Orion Cleaning Solution A according to the instructions, to remove proteins and restore the pH membrane. If further cleaning is desired, use Orion Cleaning solution D to remove organic compounds and restore the pH membrane.

Quality Control (QC)

Recommended QC procedures may include: calibration, calibration verification, sample duplicates, and/or QC samples.

Results of Measuring the pH of Red Wine

Precision	8172BNWP	GD9156BNWP
pH of Red Wine, avg. (n = 10)	3.41	3.42
Standard Deviation	0.02	0.01
Avg. Temp. (°C)	21.9	21.9
Avg. Response Time	< 30 sec	< 30 sec
Accuracy		
pH 4 Buffer, avg. (n = 6)	4.01	4.01
Difference From Expected	0.00	0.00
Standard Deviation	0.01	0.01

Precision

Both Orion pH electrodes demonstrated excellent precision between test results for multiple replicates of wine and pH buffer as follows:

- Red wine - showing a standard deviation of <0.02 pH units
- pH 4 buffer - showing a standard deviation of 0.01 pH units.

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Accuracy

Both Orion pH electrodes demonstrated excellent accuracy for multiple replicates of pH 4 buffer, showing a difference from expected value of 0.00 pH units (reads exactly as expected).

Speed

Both Orion pH electrodes demonstrated excellent response time. The time to a stable reading averaged less than 30 seconds for wine samples and pH 4 buffer.

To purchase Orion meters, electrodes and solutions, please contact your local equipment distributor and reference the part numbers listed below:

Ordering Information

Product	Cat. No.
Meters	
Thermo Scientific™ Orion™ Versa Star Pro™ pH Benchtop Meter Kit with Stand, ROSS™ Sure-Flow™ pH Electrode, ATC Probe, Stirrer Probe, pH 4/7/10 Buffers and ROSS Storage Solution	VSTAR13
Thermo Scientific™ Orion Star™ A211 pH Benchtop Meter Kit with Stand, ROSS™ Sure-Flow™ pH Electrode, ATC Probe, pH 4/7/10 Buffers and ROSS™ Storage Solution	STARA2114
Electrodes	
Thermo Scientific™ Orion™ ROSS™ Sure-Flow™ pH Electrode	8172BNWP
Thermo Scientific™ Orion™ Green pH Electrode	GD9156BNWP
Solutions	
Thermo Scientific™ Orion™ pH 4.01 and 7.00 Buffers	910104 and 910107
Thermo Scientific™ Orion™ Filling Solution for 8172BNWP or GD9156BNWP pH Electrodes	810007 or 910008-WA
Thermo Scientific™ Orion™ ROSS™ Storage Solution or pH Electrode Storage Solution	810001 or 910001
Thermo Scientific™ Orion™ pH Electrode Cleaning Solution A or D	900021-WA or 900024

References

1. Zoecklein et al. *Wine Analysis and Production.* Chapman and Hall. 1995.
2. AOAC International. *AOAC Official Method 960.19, pH of Wines.* Official Methods of Analysis (OMA), 16th edition. 1999. www.aoac.org

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