

Measuring the dissolved oxygen of wine in the bottle

Key Words: Wine quality, dissolved oxygen, DO sensor, optical sensor, portable meter, beverage testing.

Goal

The following application note describes how to reliably measure the oxygen content of wine directly in the bottle, using a Thermo Scientific™ Orion™ Optical Dissolved Oxygen Sensor with automatic temperature compensation and a Thermo Scientific™ Orion Star™ A223 Dissolved Oxygen (DO) Portable Meter.

Introduction

A bottle of wine's oxygen content has a great effect on its quality, stability and longevity. This is why monitoring and controlling the oxygen incorporation at different stages of the wine-making and bottling process is becoming a growing concern for wineries. Although oxygen is a part of the wine's natural aging process, adverse levels can cause discoloration to white wines and flavor degradation to both white and red varieties. To ensure the consumer is getting the highest quality product, measuring the concentration of molecular oxygen of wine after bottling is very important. By using an Orion Optical Dissolved Oxygen Sensor and an Orion Star A223 Dissolved Oxygen (DO) Portable Meter, reliable oxygen measurements can be made directly in the bottles of wine.



Equipment

- Orion Star A223 Dissolved Oxygen (DO) Portable Meter Kit – includes optical DO sensor, portable meter armor, field case and USB computer cable (Cat. No. STARA2235) or
- Orion Star A223 DO Portable Meter (Cat. No. STARA2230) or equivalent Orion portable DO meter
- Optical DO Sensor – includes calibration sleeve and stainless steel sensor guard (Cat. No. 087010MD)
- Silicone tubing

Solutions

- Deionized water (DI)

Luminescence-Based Dissolved Oxygen Method

The oxygen content of wine must be monitored throughout the wine-making process. Using the optical DO sensor with built-in automatic temperature compensation and a portable meter, reliable measurements can be directly in the wine bottle.

DO Sensor Setup

Refer to the Optical DO Sensor User Guide for detailed assembly and preparation instructions for the optical DO sensor. Place DO sensor into the calibration sleeve. Remove the sponge from the bottom of the calibration sleeve. Moisten it with DI water, squeeze out excess water, and replace the sponge. Connect the optical DO sensor to the 9-pin MiniDIN input on the meter. Once assembled, the optical DO sensor can be used immediately.

Meter Setup

Turn the meter on. The meter should automatically detect the type of DO sensor and update the measure type to optical DO. Access the setup menu and update the channel settings to the following, as needed:

- Measure Mode: Auto
- Measure Unit: mg/L
- Resolution: 0.01
- Read Type: Auto Read
- Baro Pressure: Auto
- Salinity Correct: Manual (0.0)

Update the instrument settings to the following, as needed:

- Export Data: On
- Data Log: On
- Date / Time: Set current date & time

Sensor Performance Checks

A properly calibrated optical DO sensor should read between 98 and 102% saturation in the calibration sleeve. If not, recalibrate the sensor. The optical DO sensor should stabilize during calibration within 2 minutes when working properly. Make sure to thoroughly rinse and blot dry the optical DO sensor after measuring samples and before placing into the calibration sleeve (see Comments section). Refer to the optical DO sensor user manual if the sensor does not pass the performance checks.

Sensor Rinsing, Soaking and Storage

After each sample measurement, rinse the optical DO sensor thoroughly with deionized water and blot the sensor dry with a lint-free cloth. For short term storage, overnight or between measurements, keep the optical DO sensor in the calibration sleeve or a biochemical oxygen demand (BOD) bottle with water-saturated air. For long-term storage, keep the optical DO sensor in the calibration sleeve.

Sample Preparation and Preservation

No sample preparation required. Dissolved oxygen can be measured directly in the wine bottle.

Calibration

If not already done, prepare the optical DO sensor according to the DO Sensor Setup procedure. Perform a water-saturated air (Air) calibration with the optical DO probe in the prepared calibration sleeve. A stable reading of 100.0 % saturation should be displayed within about two minutes.

Analysis

Slide a ring of silicon tubing over the optical DO sensor, sliding it up the probe to just below the threads. For details see Notes below. Rinse the optical DO sensor with deionized water and blot excess rinse water off with a lint-free cloth. Place the optical DO sensor in the bottle. The silicone ring should make a seal with the bottle. Place the bottle on its side so the neck becomes flooded with wine, covering both the dissolved oxygen and temperature sensors on the optical DO probe. Initiate a reading using the Auto Read measurement mode by pressing the measure key on the meter keypad. For best results, take a second reading to ensure the dissolved oxygen measurement is fully stabilized, as it may take the optical DO sensor one to two minutes to fully stabilize in the wine sample. Use the second stable value for the oxygen content of the wine. Both readings will be saved in the meter data log.

Comments

It is important to thoroughly clean the optical DO sensor after sample measurement. Rinse with deionized water and thoroughly blot all excess water with a lint free cloth several times before putting the sensor in the calibration sleeve. Rinsing following the completion of all sample measurements should take 5 to 10 minutes. The Orion meter data log collects up to 1000 measurement sets with time and date stamp and the non-volatile meter memory preserves data, even with loss of power. Download Orion Star Com software to facilitate the transfer of the data log from the meter to a computer at www.thermofisher.com/orionsoftware. Use the Orion Star Com software to export data to a Microsoft® Excel® spreadsheet or as a comma separated value file (.csv) or print data to a network or local printer.

Quality Control (QC)

Recommended QC procedures may include: calibration, check of the thermistor (temperature sensor) response against a calibrated NIST-traceable thermometer, and measurement of a zero DO solution, such as 5% sodium sulfite.

Notes

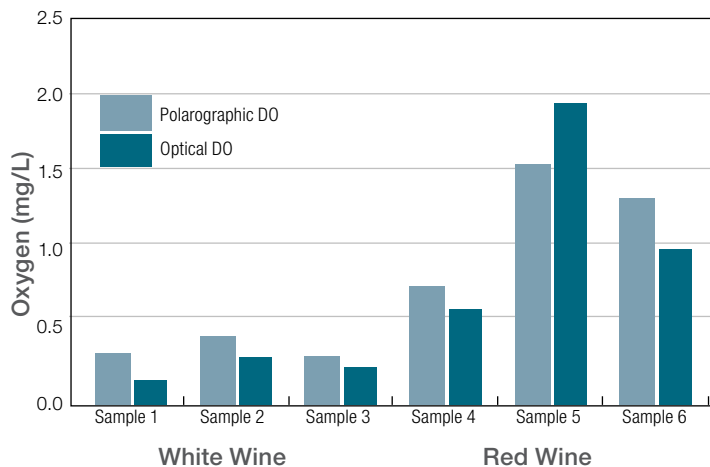
- Silicone tubing is necessary to make a seal so the bottle can be laid on its side, immersing the probe and temperature sensor in the sample while keeping all of the wine in and ambient oxygen out of the bottle. The optical DO sensor and temperature sensor are not immersed in the sample if the bottle is sitting upright. Use a piece of soft silicone tubing with an inner diameter of 1/2 to 5/8 inch and outer diameter of 5/8 to 3/4 inch with a wall thickness of 1/8 inch. Cut a ring of tubing that is 1/4 to 1/2 inch wide. Before measuring the wine sample in the bottle, slide the ring onto the probe and push it up to just below the threads.
- Keeping the calibration sleeve clean and free from water or sample droplets is essential to getting good calibration and read back values in water-saturated air. Rinse the optical DO sensor thoroughly with deionized water and wipe excess water with a lint-free cloth prior to putting the sensor in the calibration sleeve.
- Optical DO sensors do not require stirring or a sample stream for accurate measurements. The speed, accuracy, and precision of the optical DO sensor are equivalent or superior to the traditional polarographic sensor measurement.

- If readings are slow or inconsistent, ensure the temperature sensor is completely submerged in the sample.
- If the temperature sensor is not in the sample, the DO readings will be incorrect.
- The optical DO cap must be replaced every 365 days. The remaining optical DO cap life can be viewed in the channel setup menu. The meter will display an error message when the optical DO cap needs to be replaced.

Results

Dissolved Oxygen Readings in Wine Bottles

Oxygen (mg/L)				
	White Wine		Red Wine	
	Optical	Polarographic	Optical	Polarographic
Sample 1	0.35	0.17	0.80	0.64
Sample 2	0.46	0.32	1.61	2.01
Sample 3	0.34	0.26	1.39	1.04
Temperature (°C)	21.5	21	21.3	21.1



Thermo Scientific™ Orion™ Optical DO Sensor

Summary

Using an Orion Star A223 Dissolved Oxygen (DO) Portable Meter with an optical DO sensor enables wineries to continually produce high quality wines. Since the optical DO sensor allows the wine to be measured directly in the bottle, dissolved oxygen measurements can be made with speed and accuracy. The speed, accuracy and precision of the optical DO sensor is equivalent or superior to current DO measurement techniques.

To purchase an Orion Star A223 DO Portable Meter, Orion Optical DO Sensor and other related products, please contact your local equipment distributor and reference the part numbers listed below.



Thermo Scientific™ Orion Star™ A223 Dissolved Oxygen Portable Meter Kit

Ordering Information

Product	Cat. No.
Portable Meters	
Thermo Scientific Orion Star A223 Dissolved Oxygen Portable Meter	STARA2230
Thermo Scientific Orion Star A223 Dissolved Oxygen Portable Meter Kit with Optical DO Sensor, Portable Meter Armor, Field Case and USB Computer Cable	STARA2235
Thermo Scientific Orion Star A326 pH/DO Portable Meter Kit with ROSS Ultra Low Maintenance Gel pH/ATC Electrode, Optical DO Sensor, Portable Meter Armor, Field Case, Calibration Solutions and USB Computer Cable	STARA3265
Thermo Scientific Orion Star A329 pH/ISE/Conductivity/DO Portable Meter Kit with ROSS Ultra Low Maintenance Gel pH/ATC Electrode, Conductivity Sensor, Optical DO Sensor, Portable Meter Armor, Field Case, Calibration Solutions and USB Computer Cable	STARA3295
Optical DO Sensors	
Thermo Scientific Orion Optical DO Sensor with 3 Meter Cable	087010MD
Accessories	
Calibration Sleeve for Optical DO Sensors	087003
Stainless Steel Protective Sensor Guard for Optical DO Sensors	087002
RS232 Computer Cable	1010053

Find out more at thermofisher.com/water

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