

Measuring the Dissolved Oxygen of Wine in Tanks

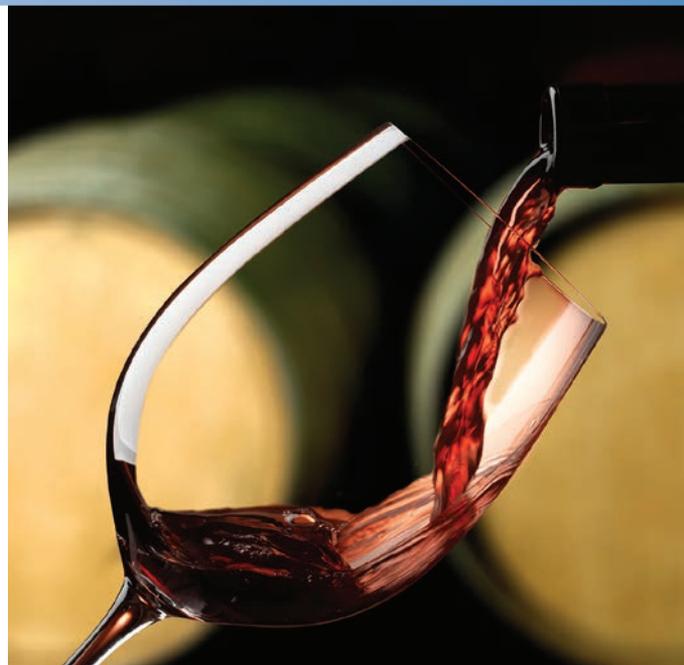
Water Analysis Instruments, Thermo Fisher Scientific

Key Words

Wine quality, dissolved oxygen, RDO sensor, portable meter, beverage testing.

Goal

The following application note describes how to reliably measure the oxygen content of wine directly in the tank, using a Thermo Scientific™ Orion™ Rugged Dissolved Oxygen (RDO) Sensor with automatic temperature compensation and a Thermo Scientific™ Orion Star™ A223 RDO/DO portable meter.



Introduction

Wineries have become increasingly concerned with the oxygen incorporation in the wine during the bottling process. This is an extremely important issue that influences wine quality, stability, and longevity. 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. The concentration of molecular oxygen should be measured in the wine before bottling begins, and throughout the entire wine making process.

By using a Thermo Scientific Orion RDO optical dissolved oxygen sensor and a Thermo Scientific Orion Star A223 RDO/DO portable meter, reliable oxygen measurements can be made directly in the tanks which hold the wine.

Equipment

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

Solutions

- Deionized water (DI)

Luminescence-Based Dissolved Oxygen Method

The oxygen content of wine must be monitored throughout the wine-making process. Using the RDO sensor with built-in automatic temperature compensation and a portable meter, reliable measurements can be made directly in the tanks which hold the wine.

RDO Sensor Setup

Refer to the RDO Optical Dissolved Oxygen Sensor User Guide for detailed assembly and preparation instructions for the RDO sensor. Place the RDO sensor into a calibration sleeve and moisten the sponge in the calibration sleeve with deionized water. Connect the RDO sensor to the 9-pin MiniDIN input on the meter. Once assembled, the RDO sensor can be used immediately.

Meter Setup

Turn the Star A223 RDO/DO portable meter on. The meter should automatically detect the type of DO sensor and update the measure type to RDO. In the measurement mode, set the measurement units to mg/L. Access the setup menu and update the RDO/DO 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

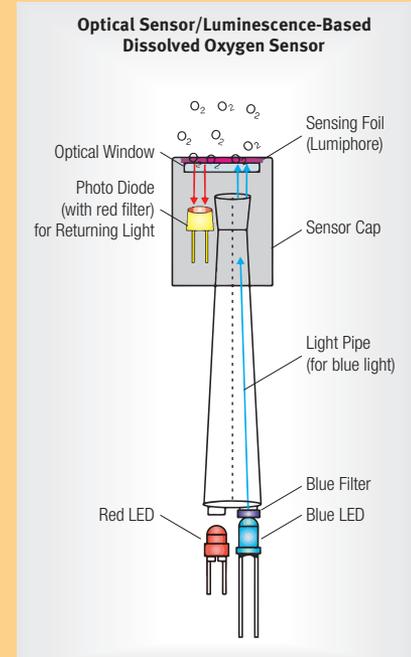
The RDO sensor should read between 98 and 102 % saturation in the calibration sleeve after calibration. The RDO sensor should stabilize during calibration within 2 minutes when working properly. Make sure to thoroughly rinse and blot dry the DO sensor after measuring samples and before placing into the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

Sensor Rinsing, Soaking and Storage

After each sample measurement, rinse the RDO 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 RDO sensor in the calibration sleeve or a biochemical oxygen demand (BOD) bottle with water-saturated air. For long-term storage, keep the RDO sensor in the calibration sleeve.

Luminescence-Based Dissolved Oxygen Sensing

The Orion RDO Optical Dissolved Oxygen Sensor measures dissolved oxygen in liquid with a luminescence-based optical sensor. Using an optical sensor, the luminescence-based method monitors the time it takes to quench an excited lumiphore, which is inversely proportional to the concentration of oxygen.



luminescence-based is one of the three affirmed methods for dissolved oxygen measurement by the American Society for Testing and Materials (ASTM). The other two methods are the Winkler titration method and the electrochemical membrane method – both of which can also be performed using the Star A223 RDO/DO portable meter and Orion polarographic DO probe.

Sample Preparation and Preservation

Dissolved oxygen can be measured directly in the tank. Samples cannot be preserved. Measure samples on location for the best results, or immediately following sample collection. If samples must be collected and moved, use an air-tight container, fill completely with no air space, and keep the container sealed until immediately before measuring the sample.

Calibration

Prepare the calibration sleeve by moistening the sponge, squeezing out excess water, and inserting the RDO probe. Perform a water-saturated air (Air) calibration with the RDO probe in the prepared calibration sleeve. The water from the sponge will saturate the air in the calibration sleeve and act as the calibration standard. A stable reading of 100.0 % saturation should be displayed within about two minutes during the calibration.

Analysis

Rinse the RDO sensor with deionized water and blot excess rinse water off with a lint-free cloth. If measuring below the tank surface, attach the stainless steel sensor guard to the sensor to weigh and sink the sensor to the desired tank depth.

Place the RDO sensor in the tank, making sure that the temperature sensor is also submerged in the sample. 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 RDO 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 RDO 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 Star A223 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.thermoscientific.com/OrionMeters. 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 include: calibration, check of the thermistor (temperature sensor) response against a calibrated NIST-traceable thermometer, and recovery of an air-saturated deionized water sample.

Notes

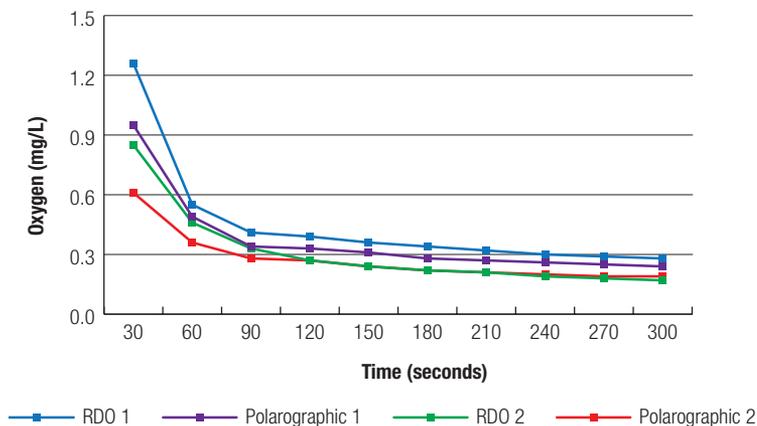
- Keeping the calibration sleeve clean and free from water or sample droplets is essential to getting good calibration and read back values in water-saturated air. Rinse the RDO sensor thoroughly with deionized water and wipe excess water with a lint-free cloth prior to putting the sensor in the calibration sleeve.
- RDO sensors do not require stirring or a sample stream for accurate measurements.
- RDO sensors are offered with 3, 6, 10, 15 or 30 meters cable lengths.
- 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 RDO cap must be replaced every 365 days. The remaining RDO cap life can be viewed in the RDO/DO channel setup menu. The meter will display an error message when the RDO cap needs to be replaced.

Results

Dissolved Oxygen Readings in Wine Sample

Minute	Oxygen (mg/L)			
	Sample 1		Sample 2	
	RDO	Polarographic	RDO	Polarographic
1	0.55	0.49	0.46	0.36
2	0.39	0.33	0.27	0.27
3	0.34	0.28	0.22	0.22
4	0.30	0.26	0.19	0.20
5	0.28	0.24	0.17	0.19

DO Probe Responses in Red Wine



Summary

Using an Orion Star A223 RDO/DO portable meter with an RDO optical dissolved oxygen sensor enables wineries to continually produce high quality wines. Because the RDO sensor is designed to measure the wine directly in the tank, dissolved oxygen measurements can be made with speed and accuracy. The speed, accuracy and precision of the RDO sensor is equivalent or superior to current DO measurement techniques.

Visit www.thermoscientific.com/water for additional information on Thermo Scientific Orion products, including laboratory and field meters, sensors and solutions for pH, ion concentration (ISE), conductivity and dissolved oxygen analysis plus spectrophotometry, colorimetry and turbidity products.

To purchase an Orion Star A223 RDO/DO portable meter, Orion RDO sensor and other related products, please contact your local equipment distributor and reference the part numbers listed below.

Product	Description	Part Number
Portable Meters	Thermo Scientific Orion Star A223 RDO/Dissolved Oxygen Portable Meter	STARA2230
	Thermo Scientific Orion Star A223 RDO/Dissolved Oxygen Portable Meter Kit with RDO Optical DO Sensor, Portable Meter Armor, Field Case and USB Computer Cable	STARA2235
	Thermo Scientific Orion Star A326 pH/RDO/DO Portable Meter Kit with ROSS Ultra Low Maintenance Gel pH/ATC Electrode, RDO Optical DO Sensor, Portable Meter Armor, Field Case, Calibration Solutions and USB Computer Cable	STARA3265
	Thermo Scientific Orion Star A329 pH/ISE/Conductivity/RDO/DO Portable Meter Kit with ROSS Ultra Low Maintenance Gel pH/ATC Electrode, Conductivity Sensor, RDO Optical DO Sensor, Portable Meter Armor, Field Case, Calibration Solutions and USB Computer Cable	STARA3295
RDO Sensors	Thermo Scientific Orion RDO Sensor with 3 Meter Cable	087010MD
	Thermo Scientific Orion RDO Sensor with 6 Meter Cable	087020MD
	Thermo Scientific Orion RDO Sensor with 10 Meter Cable	087030MD
	Thermo Scientific Orion RDO Sensor with 15 Meter Cable	087050MD
	Thermo Scientific Orion RDO Sensor with 30 Meter Cable	087100MD
Accessories	Calibration Sleeve for RDO Sensors	087003
	Stainless Steel Protective Sensor Guard for RDO Sensors	087002
	RS232 Computer Cable	1010053

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