APPLICATION NOTE

Measuring the dissolved oxygen of wine in tanks

Key Words: Wine quality, dissolved oxygen, DO, optical 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™ Optical Dissolved Oxygen Sensor with automatic temperature compensation and a Thermo Scientific™ Orion Star™ A223 Dissolved Oxygen (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 varietals. 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 Optical Dissolved Oxygen Sensor and a Thermo Scientific Orion Star A223 Dissolved Oxygen (DO) Portable Meter, reliable oxygen measurements can be made directly in the tanks which hold the 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)

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 tanks which hold the wine.

Optical DO Sensor Setup

Refer to the Optical Dissolved Oxygen Sensor User Guide for detailed assembly and preparation instructions for the sensor. Place the optical DO sensor into the calibration sleeve and moisten the sponge in the calibration sleeve with deionized water. 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 Star A223 Dissolved Oxygen (DO) Portable Meter on. The meter should automatically detect the type of DO sensor and update the measure type to optical DO. In the measurement mode, set the measurement units to mg/L. 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

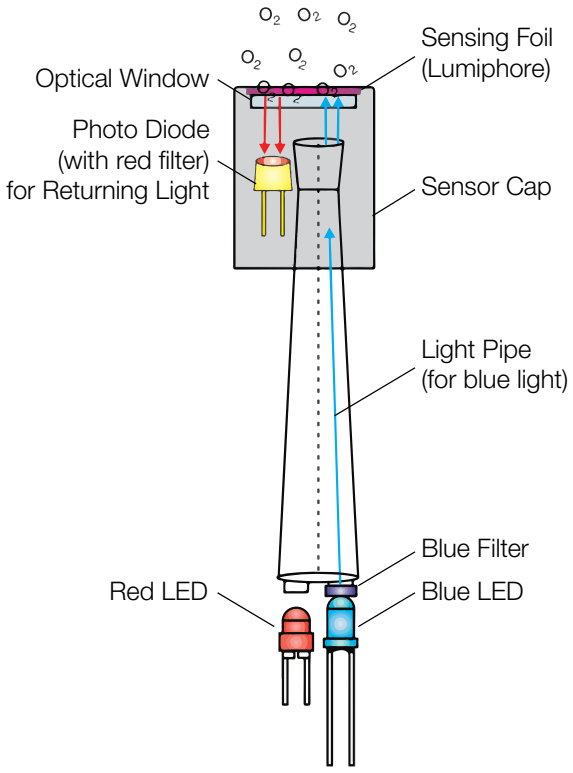
The optical DO sensor should read between 98 and 102 % saturation in the calibration sleeve after calibration. The optical DO sensor should stabilize during calibration within 2 minutes when working properly. Make sure to thoroughly rinse and blot dry the optical DO sensor after measuring samples and 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.

Luminescence-Based Dissolved Oxygen Sensing

The Orion 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 Dissolved Oxygen Sensing 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 Dissolved Oxygen (DO) Portable Meter and Orion polarographic DO probe.

Optical Sensor/Luminescence-Based Dissolved Oxygen Sensor



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

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 optical DO probe. Perform a water-saturated air (Air) calibration with the optical DO 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 optical DO 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 optical DO 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 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 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 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.

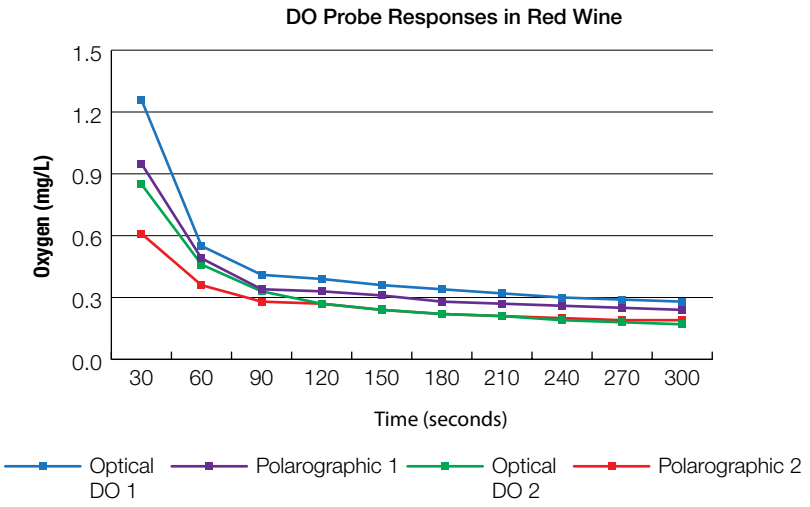
Notes

- 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 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 Samples

	Oxygen (mg/L)			
	Sample 1		Sample 2	
Minute	Optical DO	Polargraphic	Optical DO	Polargraphic
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



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

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Summary

Using an Orion Star A223 Dissolved Oxygen (DO) portable meter with an optical dissolved oxygen sensor enables wineries to continually produce high quality wines. Because the optical DO sensor allows the wine to be measured directly from the tank, 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.

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
Thermo Scientific Orion Optical DO Sensor with 6 Meter Cable	087020MD
Thermo Scientific Orion Optical DO Sensor with 10 Meter Cable	087030MD
Thermo Scientific Orion Optical DO Sensor with 15 Meter Cable	087050MD
Thermo Scientific Orion Optical DO Sensor with 30 Meter Cable	087100MD
Accessories	
Calibration Sleeve for Optical DO Sensors	087003
Stainless Steel Protective Sensor Guard for Optical DO Sensors	087002
RS232 Computer Cable	1010053

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