

Measuring clarity in wine

Goal

This application note describes how to measure the turbidity of red, white, and rosé wine samples using a Thermo Scientific™ Orion™ AQUAfast™ turbidity meter. Turbidity measurements can be performed to evaluate chill haze, protein stability, and wine clarity.

Introduction

Thermo Scientific™ Orion™ AQUAfast™ AQ3010 and Orion™ AQUAfast™ AQ4500 Turbidity Meters (Cat. No. AQ3010, AQ4500) enable quick and simple determination of the clarity of white, rosé, and red wine samples. No solution preparation or meter setup is required. Each turbidity meter is equipped with an infrared (IR) light source, so turbidity measurements are not affected by wine color. The AQUAfast AQ4500 meter is also equipped with a white light source that is suitable for water turbidity measurements.

Recommended equipment and reagents

- Thermo Scientific™ turbidity standards (Cat. No. AC301S) and vials (AC3V25) for the Orion AQUAfast AQ3010 Turbidity Meter
- Thermo Scientific™ turbidity standards (Cat. No. AC45ST) and vials (AC2T24) for the Orion AQUAfast AQ4500 Turbidity Meter
- Turbidity-free water (TFW, obtained via filtration through a 0.1 µm filter) or reagent-grade water

Meter performance check (calibration verification)

The standards for Orion AQUAfast turbidity meters are styrene-divinylbenzene (SDVB) polymer primary standards. They do not require preparation or dilution prior to use, and they never need mixing. Do not shake the standards, as this will introduce bubbles that will cause measurements to be inaccurate until they dissipate.

Checking the Orion AQUAfast AQ3010 Turbidity Meter

Check the accuracy of your meter by reading one or more turbidity standards included with the meter at the level of interest. An example of a suitable performance check would be reading the zero standard (0.02) and the 20 NTU standard. The reading for the zero (0.02) standard should be <0.1 nephelometric turbidity unit (NTU), and the reading for the 20 NTU standard should be within ±10% (18–22 NTU).

Checking the Orion AQUAfast AQ4500 Turbidity Meter

Review the certificate of analysis for the turbidity standards and record the expected turbidity values for the standards in IR ratio mode, then set the meter to IR ratio mode. Check meter accuracy by reading one or more turbidity standards at the level of interest. A suitable performance check would be reading the zero standard (0.02) and the 1 NTU standard. The reading for the zero standard should be <0.1 NTU, and the reading for the 1 NTU standard should be within $\pm 10\%$ of the expected value according to the certificate of analysis.

If a meter performance check fails for either meter, take the following corrective actions:

Wipe the vial carefully with a lint-free wipe to remove all fingerprints and liquid drips on the exterior. Handle the vial by the cap only and remeasure.

Tap the vial gently three times and let it sit for 60 seconds to release the bubbles, then remeasure.

Use a clean vial that reads <0.1 NTU when filled with TFW. Empty the vial, shake out the excess TFW, and pour fresh turbidity standard into the clean vial. Wipe the vial carefully and measure the standard again. Note: Most failed performance checks are due to standards that have aged in glass vials. Disposing of the aged standard and refilling the vial with a fresh pour usually results in a successful performance check.

Sample vial storage, soaking, and rinsing

Fill sample vials with TFW for storage. Immediately after use, clean the vials with laboratory detergent and rinse multiple times with TFW. Note: Standards may be stored in the supplied glass sample vials until standard readings are no longer within specification. See the meter performance check section for corrective actions to take when a standard reading is out of specification.

Sample storage and preparation

Allow samples to warm to room temperature prior to measurement. Mix the samples well, but do not introduce bubbles by shaking them. Rinse a clean vial twice with a small portion of the sample, mix the sample again, and fill the rinsed vial.

Calibration

Calibration of the Orion AQUAfast AQ3010 Turbidity Meter

The meter is shipped pre-calibrated. The performance of the meter is very stable, so it does not require frequent calibration. If a standard reading does not meet the performance criteria, take all necessary corrective actions as described in the performance check section. If corrective actions fail and recalibration is necessary, perform recalibration only for the points that failed. Pour fresh standards into clean vials. Handle the vials by the caps only and remove all fingerprints and liquid drips on their exteriors with lint-free wipes.

Calibration of the Orion AQUAfast AQ4500 Turbidity Meter

The meter is shipped pre-calibrated. The performance of the meter is very stable, so it does not require frequent calibration. If a standard reading does not meet the performance criteria, take all necessary corrective actions as described in the meter performance check section. If corrective actions fail and recalibration is necessary, perform recalibration in IR ratio mode using fresh portions of standard poured into clean vials. See the initial calibration section of the user guide and an example on page 3.

Analysis

Gently invert a filled sample vial a few times to mix the sample well without introducing bubbles. Wipe the vial to remove all traces of liquid and fingerprints, place it in the meter, and press the measure key. Record the reading and press the measure key to take additional readings. Continue until the readings stabilize and the measurements agree to within 5% or ± 0.02 NTU, whichever is higher.

Quality control (QC)

The recommended QC procedures include calibration verification, turbidity-free water analysis (optional), and inclusion of sample duplicates.

Improving accuracy with low-level samples

If greater accuracy is desired, pay close attention to:

- The cleanliness of the sample vials
- The quality of the TFW
- Handling of standards and samples
- Use of matching vials
- Storing clean vials filled with TFW
- Using vials without scratches or other imperfections

To improve low-level accuracy, ensure that a clean vial filled with TFW reads <0.1 NTU before using the vial to test highly filtered wine. If the reading is not below 0.1 NTU, discard the vial or set it aside for further cleaning. If no clean vials have readings below 0.1 NTU, it may be necessary to degas the TFW or obtain a cleaner source. See ASTM Test Method D6855 for Determination of Turbidity Below 5 NTU in Static Mode for more information about measuring samples with low turbidity.

Results

Various red, white, and rosé wine samples were collected at different stages of the winemaking process and tested for turbidity using two Orion AQUAfast AQ3010 meters and two Orion AQUAfast AQ4500 meters. The results are shown in Figure 1. Standard NTU values and recoveries obtained with each meter are shown in Tables 1 and 2.

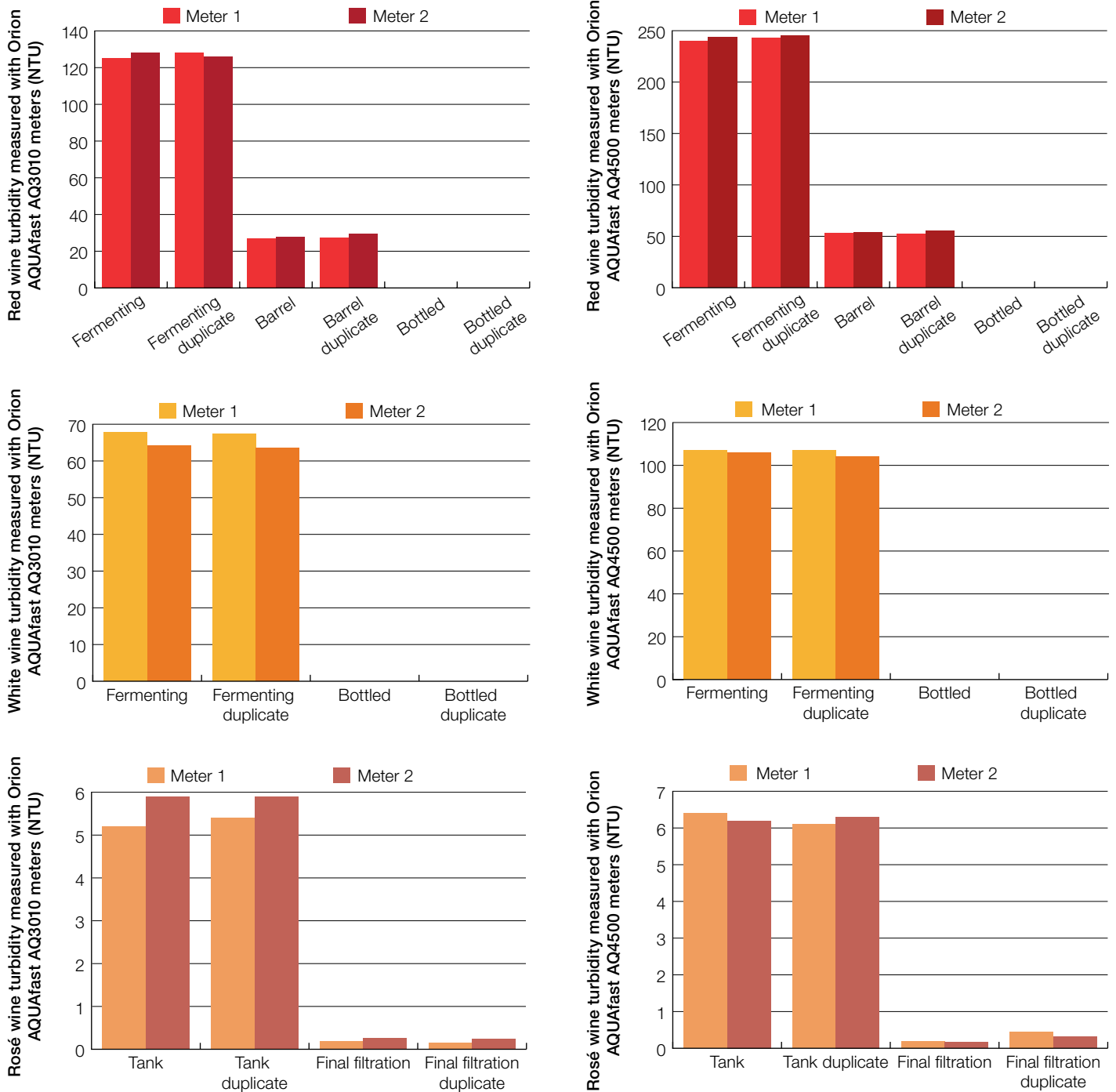


Figure 1. Turbidity of wine samples collected at different stages of the winemaking process.

Table 1. Results of turbidity standard tests performed with two Orion AQUAfast AQ3010 Turbidity Meters.

Expected NTU	Meter 1 (NTU)	Recovery	Meter 2 (NTU)	Recovery
0.02 (<0.1 NTU)	0.00	NA	0.00	NA
20	18.9	94.5%	20.1	100.5%
100	96.3	96.3%	101	101.0%
800	772	96.5%	798	99.8%

Table 2. Results of turbidity standard tests performed with two Orion AQUAfast AQ4500 Turbidity Meters.

Expected NTU	Meter 1 (NTU)	Recovery	Meter 2 (NTU)	Recovery
<0.1	0.00	NA	0.03	NA
0.93	0.95	102.2%	0.93	100.0%
9.54	9.30	97.5%	9.65	101.2%
99.4	99.6	100.2%	99.8	100.4%
708	742	104.8%	722	102.0%

Summary

Orion AQUAfast AQ3010 and AQ4500 Turbidity Meters enable accurate measurement of the turbidity of red, white, and rosé wines at various stages of the winemaking process. The infrared light source allows readings to be unaffected by the

deep color of red wine or the blush color of rosé wine. Both meters reliably pass performance checks without requiring recalibration. The AQUAfast AQ4500 Turbidity Meter also has a white light source that is suitable for water turbidity testing.

Ordering information

Product	Description	Cat. No.
Turbidity meters	Orion AQUAfast AQ3010 Turbidity Meter	AQ3010
	Orion AQUAfast AQ4500 Turbidity Meter	AQ4500
Accessories	Vials for the Orion AQUAfast AQ3010 Turbidity Meter	AC3V25
	Vials for the Orion AQUAfast AQ4500 Turbidity Meter	AC2T24
Solutions	Orion AQUAfast AQ4500 turbidity standards (0, 1, 10, 100, 1,000 NTU)	AC45ST
	Orion AQUAfast AQ3010 turbidity standards	AC301S
Water purification system*	Barnstead Smart2Pure Water Purification System	50129890

* Please contact your local sales representative for support to select the best water purification system for your application and visit thermofisher.com/labwater.