

Measuring Clarity in Wine

Water Analysis Instruments, Thermo Fisher Scientific

Key Words

wine clarity, turbidity, beverage quality, fermentation, barrel testing, filtration, wine tank testing.

Goal

The following application note explains how to measure the turbidity of red, white and rosé wine samples using a Thermo Scientific™ Orion™ AQUAfast™ turbidity meter. The analysis of wine turbidity may be used to evaluate chill haze, protein stability, and wine clarity. In this note, the evaluation of wine clarity is described.



Introduction

The Orion AQ3010 and AQ4500 Turbidity Meters allow quick and simple determinations of the clarity of white, rosé, and red wine samples. The following application note explains how to measure the clarity or “turbidity” of various wine samples using the AQ4500 in infrared mode and the AQ3010. Because the light source is infrared, the turbidity measurement is independent of color.

Recommended Equipment

- Orion AQ3010 Turbidity Meter and Orion AC3V25 Turbidity Vials
- OR
- Orion AQ4500 Turbidity Meter and Orion AC2T24 Turbidity Vials

Required Reagents and Solutions

- Orion AC301S Turbidity Standards (if using AQ3010)
- Orion AC45ST Turbidity Standards (if using AQ4500)
- Turbidity-free water (TFW), e.g., by filtration through 0.1 um filter, or equivalent water

Solutions Preparation

None

Meter Setup

None

Meter Performance Check/Calibration Verification

Orion AC301S and AC45ST styrene divinylbenzene (SDVB) polymer turbidity standards never need mixing. Do not shake the standards as this will introduce bubbles and cause them to read inaccurately until the bubbles dissipate.

AQ3010

Check meter accuracy by reading one or more turbidity standards (included with the meter) at the level of interest. For example, read the zero (0.02) and the 20 NTU standard. The zero should read <0.1 NTU and the 20 NTU standard should read within $\pm 10\%$, e.g., 18-22 NTU.

AQ4500

Review certificate of analysis of the turbidity standards and record the expected turbidity values for the IR Ratio mode.

Set the meter to the IR Ratio mode. Check meter accuracy by reading one or more turbidity standards at the level of interest. For example, read the zero (0.02) and the 1 NTU standard. The zero should read <0.1 NTU and the 1 NTU standard should read within $\pm 10\%$ from the expected value according to the Certificate of Analysis.

If the AQ3010 or AQ4500 meter performance check fails, take corrective actions as follows:

1. Wipe the vial carefully with a lint-free wipe to remove all fingerprints and liquid drips from the exterior, handle the vial by the cap only, and remeasure.
2. Tap the vial gently three times and let the vial sit for 60 seconds to allow for bubbles to release, then remeasure.
3. Using a clean vial (which reads <0.1 NTU when filled with TFW), pour a fresh portion of turbidity standard into the clean vial, wipe carefully, and measure.

Sample Vial (Cuvette) Storage, Soaking, and Rinsing

Store vials filled with TFW. Immediately after use, clean sample vials with laboratory detergent and rinse multiple times with TFW. **Note:** Standards may be stored in supplied glass sample vials until the standard reading is no longer in specification. See *Meter Performance Check* section for corrective actions when a standard reads out of specification.

Sample Storage and Preparation

In general, allow the samples to warm to room temperature before measurement. Mix the sample well, but do not introduce bubbles by shaking the sample. Use a little of the sample to rinse a clean sample vial twice. Mix the sample again and fill the rinsed vial.

Calibration - AQ3010

The meter is shipped precalibrated. The meter performance is very stable and does not require frequent

calibration. If a standard reading is not within criteria, take all necessary corrective actions (as described in the *Meter Performance Check* section) to improve meter readings. If corrective actions fail and recalibration is necessary, perform the recalibration only on the points that failed and do so with fresh portions of standard poured into clean vials. Ensure that all fingerprints and liquid drips have been removed from the exterior of the vial with a lintfree wipe before using. Handle vials by the cap only.

Calibration – AQ4500

The meter is shipped precalibrated. The meter performance is very stable and does not require frequent calibration. If a standard reading is not within criteria, take all necessary corrective actions (as described in the *Meter Performance Check* section) to improve meter readings. If corrective actions fail and recalibration is necessary, perform the recalibration in IR Ratio mode (see the *Initial Calibration* section of the Meter User Guide and an example on page 3).

Analysis

Gently invert the filled sample vial a few times to mix the sample well without introducing bubbles. Wipe the sample vial to remove all traces of liquids and fingerprints, place into meter, and press the measure key. Record the reading. Press the measure key to take duplicate measurement(s). Continue until readings stabilize and results agree, for example, within 5% or ± 0.02 NTU, whichever is higher.

Quality Control (QC)

Recommended QC procedures include: calibration verification, turbidity-free water analysis (optional), and sample duplicates.

Notes for Improved Accuracy of Low-Level Samples

If improved accuracy is desired, pay close attention to:

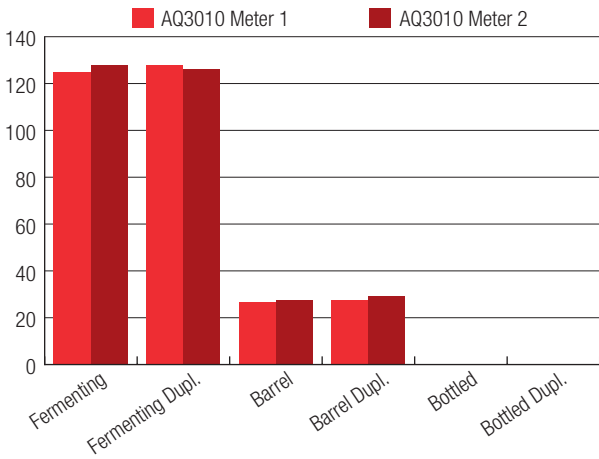
1. The cleanliness of the sample vials.
2. The quality of the TFW.
3. The handling of the standards and samples.
4. Use of matching vials.
5. Storing clean vials filled with TFW.
6. Use vials free of scratches or other imperfections.

For improved low-level accuracy, ensure that a clean vial filled with TFW reads <0.1 NTU before using that vial to test highly filtered wine. If a clean vial does not read <0.1 NTU, discard it or set it aside for further cleaning. If no clean vials read <0.1 NTU, the TFW may need degassing or a cleaner source of TFW may be required. See *ASTM D6855 Test Method for Test Method for Determination of Turbidity Below 5 NTU in Static Mode* for more information about low level turbidity readings.

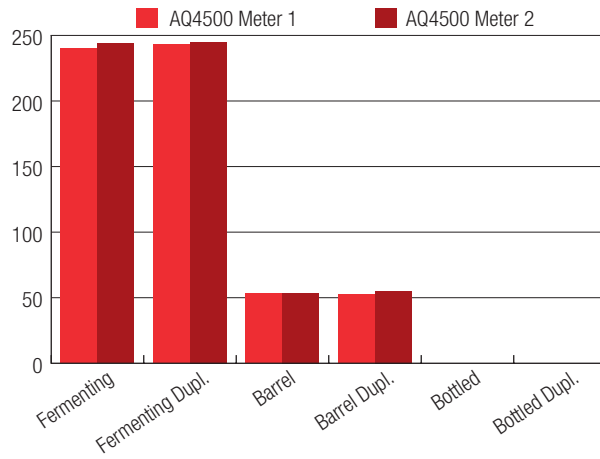
Result

Various wine samples, taken at different stages of the winemaking process, were tested for turbidity on the AQ3010 and AQ4500.

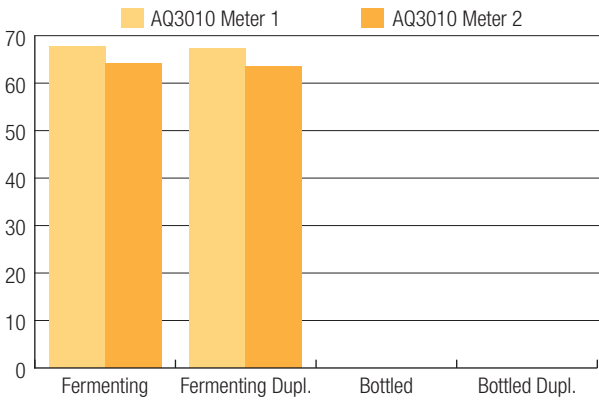
Turbidity of Red Wine (AQ3010)



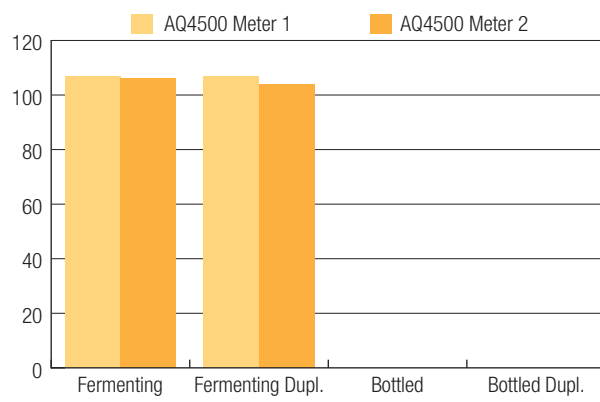
Turbidity of Red Wine (AQ4500)



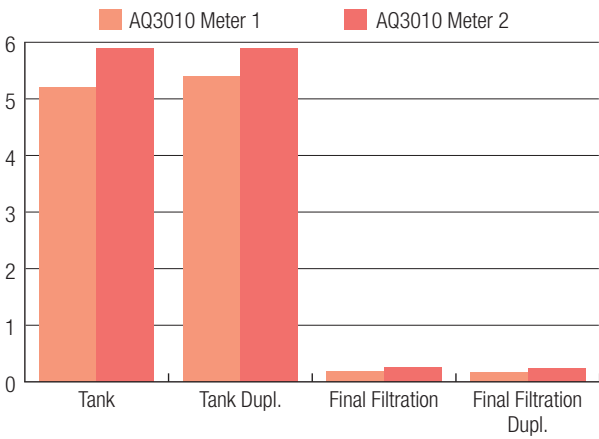
Turbidity of White Wine (AQ3010)



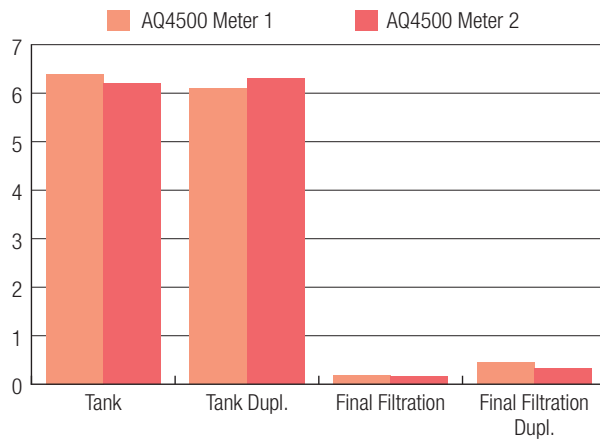
Turbidity of White Wine (AQ4500)



Turbidity of Rosé Wine (AQ3010)



Turbidity of Rosé Wine (AQ4500)



Results of Testing Turbidity Standards using an AQ3010 Meter

| Expected Value | AQ3010 Meter 1 | % Recovery | AQ3010 Meter 2 | % Recovery |
|----------------|----------------|------------|----------------|------------|
| 0.02NTU (<0.1) | 0.00 | NA | 0.00 | NA |
| 20NTU | 18.9 | 94.4% | 20.1 | 100.5% |
| 100NTU | 96.3 | 96.3% | 101 | 101.0% |
| 800NTU | 772 | 96.5% | 798 | 99.8% |

Results of Testing Turbidity Standards using an AQ4500 Meter

| Expected Value | AQ4500 Meter 1 | % Recovery | AQ4500 Meter 2 | % 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

The Orion AQ3010 turbidity meter allows accurate measurement of red, white, and rosé wines at various stages of the wine-making process. The infrared light source allows readings which are not affected by the deep color of red wines or the blush color of rosé wines.

The Orion AQ4500 turbidity meter allows accurate measurement of red, white, and rosé wines at various stages of the wine-making process. When measurements are performed in the infrared ratio mode, readings are not affected by the deep color of red wines or the blush color of rosé wines.

To purchase an Orion turbidity meter and other related accessories and solutions, please contact your local equipment distributor and reference the part numbers listed below:

| Product | Description | Part Number |
|-----------------|--|-------------|
| Turbidity Meter | Thermo Scientific Orion AQUAfast AQ3010 Turbidity Meter | AQ3010 |
| | Thermo Scientific Orion AQUAfast AQ4500 Turbidity Meter | AQ4500 |
| Accessories | Thermo Scientific Orion Turbidity Vials, for use with the AQ3010 | AC3V25 |
| | Thermo Scientific Orion Turbidity Vials, for use with the AQ4500 | AC2T24 |
| Solutions | Thermo Scientific Orion Turbidity Standards (0, 1, 10, 100, 1000 NTU), for use with the AQ4500 | AC45ST |
| | Thermo Scientific Orion Turbidity Standards, for use with the AQ3010 | AC301S |



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Water Analysis Instruments

North America
Toll Free: 1-800-225-1480
Tel: 1-978-232-6000
info.water@thermo.com

Netherlands
Tel: (31) 020-4936270
info.water.uk@thermo.com

China
Tel: (86) 21-68654588
wai.asia@thermofisher.com

India
Tel: (91) 22-4157-8800
wai.asia@thermofisher.com

Singapore
Tel: (65) 6778-6876
wai.asia@thermofisher.com

Japan
Tel: (81) 045-453-9175
wai.asia@thermofisher.com

Australia
Tel: (613) 9757-4300
in Australia (1300) 735-295
InfoWaterAU@thermofisher.com

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