

Measuring Haze in Beer

Water Analysis Instruments, Thermo Fisher Scientific

Key Words

Turbidity, beer, haze, chill haze testing, beverage quality.

Goal

The following application note describes how to simply and quickly measure the haze or “turbidity” in beer using a Thermo Scientific™ Orion™ AQUAfast™ AQ3010 Turbidity Meter.



Introduction

The haze observed in beer is something the chemistry world refers to as “turbidity”. Depending on the type of beer, it can be a desired or undesired effect. Haze can result from proteins, polyphenols, and even carbohydrates in colloidal form. When beer haze is observed only cold temperatures, and then disappears once the beer warms up, this is known as “chill haze”. The Thermo Scientific Orion AQUAfast AQ3010 Turbidity Meter can be used to quickly and simply measure the haze or “turbidity” in various types of beers. Additional instructions for testing the chill haze of beer samples can be found at the end of the application note.

Recommended Equipment

- Orion AQ3010 Turbidity Meter
- Orion AC3V25 Turbidity Vials
- Stir rod or stirring equipment
- (For chill haze testing) Thermometer, water or ice-bath at 0 °C

Required Reagents and Solutions

- Orion AC301S Turbidity Standards
- Turbidity-free water (TFW), e.g., prepared by reverse osmosis (RO) or by filtration through 0.2 um filter, whichever yields acceptable results.

Solutions Preparation

None

Meter Setup

None

Meter Performance Check/Calibration Verification

Note: Orion AC301S 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.

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.

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

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 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 Preparation

Beer samples must be degassed prior to testing, as bubbles will cause biased high results. Remove a portion of the beer, not including any settled sediments, to a beaker. Stir the beer until all the gas has been released. If uncertain about degassing time, stir until further stirring does not change the turbidity reading.

Calibration

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 lint-free wipe before using. Handle vials by the cap only.

Analysis

After the sample has been degassed, wipe the sample vial to remove all traces of liquids and fingerprints, place into meter, and press the measure key. Take duplicate reading(s) until results agree within 5%.

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 beer. 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.

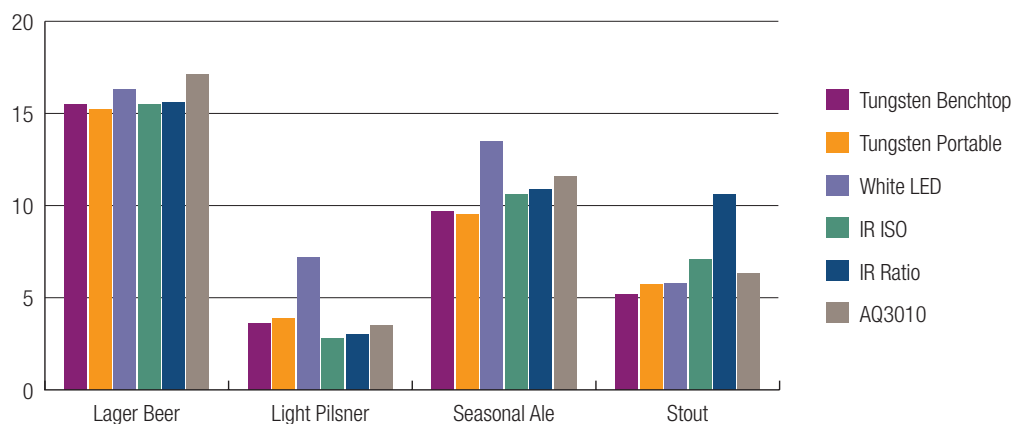
Result Statistics

Four types of beers, a DI water (TFW) sample, and a 10 NTU standard were tested at room temperature. The lager beer was visually the most turbid and the light pilsner was the clearest beer. The stout was dark to the eye, but had a relatively low turbidity.

Summary

The table and chart below show that AQ3010 results compare well with other turbidity meter results. All results are in NTUs.

	Tungsten Benchtop	Tungsten Portable	White LED Portable	IR ISO	IR Ratio	AQ3010
DI	0.06	0.12	0.03	0.03	0.03	0.00
Lager Beer	15.5	15.2	16.3	15.5	15.6	17.1
Light Pilsner	3.6	3.9	7.2	2.8	3.0	3.5
Seasonal Ale	9.7	9.5	13.5	10.6	10.9	11.6
Stout	5.2	5.7	5.8	7.1	10.6	6.3
10 NTU	9.71	10.6	10.2	9.34	9.84	10.2



Notes for Chill Haze Testing

1. Place beer in 0 °C bath and hold 24 hours.
2. Pre-chill the sample vial in 0 °C bath.
3. Without disturbing settled matter, transfer a portion of the sample to the pre-chilled sample vial. While holding at 0 °C, stir to degas the beer sample. Use a thermometer to verify the sample temperature. The thermometer may be used to stir and degas the sample.
4. Without warming the vial, place the cap on the sample vial, hold the sample vial by the cap and quickly wipe dry the degassed sample vial at 0 °C. Place into meter immediately, and take the reading for chill haze.



References

AOAC Method 970.14, Haze (Total) of Beer after Chilling, AOAC International, www.aoac.org.

To purchase an Orion AQ3010 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
Accessories	Thermo Scientific Orion AC3V25 Turbidity Vials	AC3V25
	Thermo Scientific Orion AC301S Turbidity Standards	AC301S

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