Measuring haze in beer

Key words

Turbidity, beer, turbidimeter, physical stability, beer turbidity meter, haze, haze meter, EBC 9.29 haze in beer, total haze after chilling, chill-haze, chill haze testing, nephelometer, ASBC Beer-27, beverage quality, portable turbidity meter, beer turbidity meter, turbidity calibration standards.

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 portable 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 in cold temperatures, and then disappears once the beer warms up, this is known as “chill haze.” The Orion AQUAfast AQ3010 Turbidity Meter can be used to quickly and simply measure the haze or turbidity in various types of beers. To show the performance of the AQ3010 meter, several different types of beer samples were measured using several different turbidity meters. Additional instructions for testing the chill haze of beer samples can be found at the end of the application note.

Recommended equipment

- Orion AQUAfast AQ3010 Turbidity Meter (Cat. No. AQ3010)
- Thermo Scientific™ Vials for Orion AQUAfast Turbidity Meter (Cat. No. AC3V25)
- Stir rod or stirring equipment
- (For chill haze testing) Thermometer, water, or ice-bath at 0°C

Required reagents and solutions

- Thermo Scientific™ Turbidity Standards for Orion AQUAfast Turbidity Meter (Cat. No. AC301S)
- Turbidity-free water (TFW), e.g., prepared by reverse osmosis (RO) or by filtration through 0.2 µm filter, whichever yields acceptable results.

Solutions preparation

None

Meter setup

None

Meter performance check/calibration verification

Note: The styrene divinylbenzene (SDVB) polymer–based Turbidity Calibration Standards for Orion AQUAfast Turbidity Meter do not require mixing. Do not shake the standards as this will introduce bubbles and cause inaccurate measurements until the bubbles dissipate.

Check the meter’s accuracy by reading one or more turbidity standards (included with the meter) at the level of interest. For example, read the zero (0.02 NTU) and the 20 NTU standard. The zero should read <0.1 NTU and the 20 NTU standard should read within ±10%, i.e., 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 readings. Remove a portion of the beer to a beaker excluding any settled sediments. 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

1. If improved accuracy is desired, pay close attention to:
2. The cleanliness of the sample vials
3. The quality of the TFW
4. The handling of the standards and samples
5. Use of matching vials
6. Storing clean vials filled with TFW
7. 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.

Results

The turbidity of four types of beers, a DI water (TFW) sample, and a 10 NTU standard were measured at room temperature by a variety of different turbidity meters to demonstrate the performance of the AQ3010. Visually, the lager was the most turbid, the pilsner was the clearest, and the stout was dark to the eye making it hard to determine the turbidity visually.

Summary

The table and chart below show that there is known variation in the turbidity readings of different meters having different light sources and different detection schemes. The AQ3010 results compare well with other turbidity meters, while the AQ3010 is smaller and simpler to use than the other meters tested. All results are in NTUs.

Notes for chill haze testing[1]

- Place beer in 0°C bath and hold for 24 hours.
- Pre-chill the sample vial in 0°C bath.
- 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.
- 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.

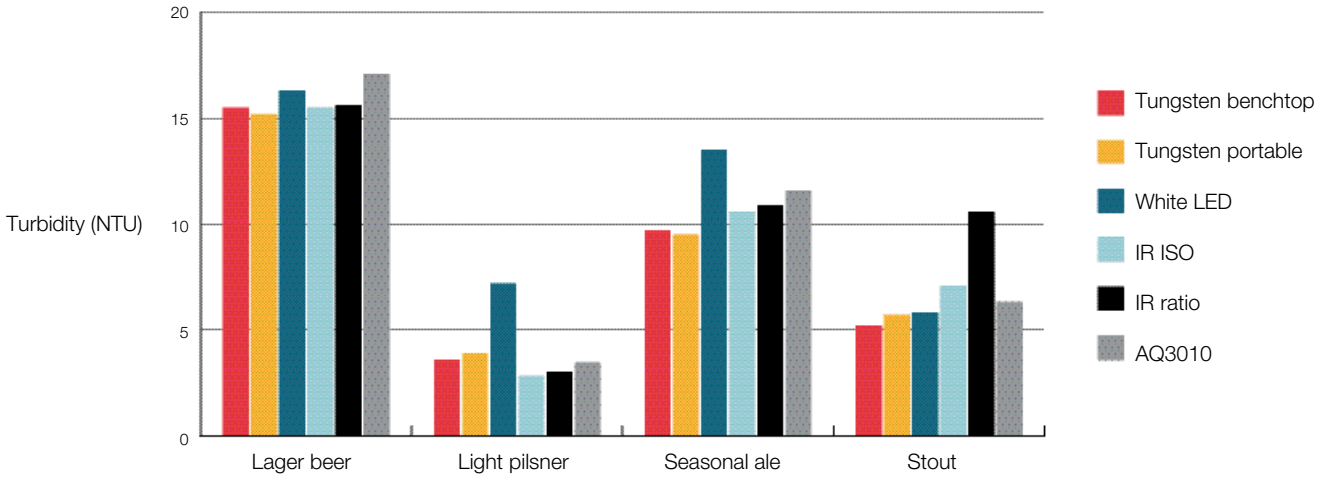

Figure 1. Turbidity of various beers as measured by different meter types

Ordering information

	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	9.7	10.6	10.2	9.3	9.8	10.2

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