



Parameter and Sample Type

Turbidity in Clear Juices

Introduction

To produce clear juice products, the clarification process is intended to modify clarity, color, flavor, and/or stability of juices. The Orion AQ3010 quickly and simply determines turbidity in clear juice samples. Because the light source is infrared, the measurement is independent of color.

References

E.I. Benitez and J.E. Lozano, Effect of Gelatin on Apple Juice Turbidity, Latin American Applied Research, 37:261-266 (2007).

Result Statistics

See page 2.

Recommended Equipment

Orion AQ3010 Turbidity Meter; Orion AC3V25 Turbidity Vials.

Required Solutions

Orion AC301S Turbidity Standards; 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

Note: the Orion AC301S Orion Turbidity styrene divinylbenzene (SDVB) polymer 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 1 NTU standard. The zero should read <0.1 NTU and the 1 NTU standard should read within +/- 10%, e.g., 0.9 – 1.1 NTU.

If the 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

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

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

Gently invert the filled sample vial a few times to mix well the sample 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

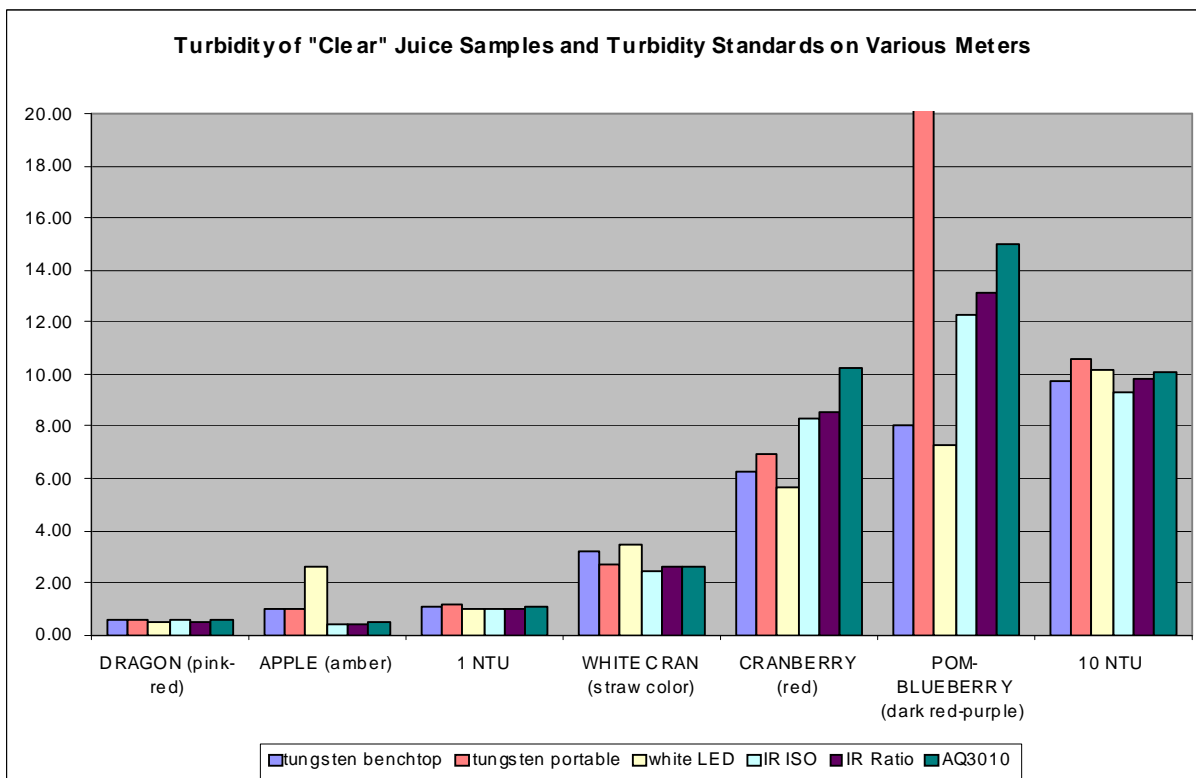
If improved accuracy is desired, pay close attention to 1) the cleanliness of the sample vials; 2) the quality of the TFW; 3) the handling of the standards and samples; 4) use of matching vials; 5) storing clean vials filled with TFW; 6) use vials free of scratches or other imperfections. For improved low-level accuracy, ensure that a clean vial filled with TFW reads < 0.1 NTU before using that vial to test clear juice. 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.



Results Statistics

Various clear juices and standards were tested for turbidity on different meters and the AQ3010 meter. Results are listed in the chart and are graphed below for comparison.

	tungsten benchtop	tungsten portable	white LED	IR ISO	IR Ratio	AQ 3010
DRAGON (pink-red)	0.56	0.59	0.54	0.55	0.53	0.59
APPLE (amber)	0.97	1.03	2.63	0.40	0.41	0.53
1 NTU	1.09	1.20	1.06	1.05	1.01	1.08
WHITE CRAN (straw color)	3.18	2.67	3.44	2.46	2.58	2.66
CRANBERRY (red)	6.30	6.99	5.69	8.30	8.52	10.23
POM-BLUEBERRY (dark red-purple)	8.01	23.93	7.26	12.30	13.15	14.99
10 NTU	9.71	10.60	10.20	9.34	9.84	10.09



- Note that all meters show good standard recovery at 1 and 10 NTU.
- In general, there is agreement among the meters for lightly colored clear juices.
- The AQ3010 and other IR meter readings are expected to be a more accurate indication of true sample turbidity for deeply colored clear juices, since color is not a significant interference to the IR light signal.
- The tungsten meter readings are affected by the deeply colored juice samples, especially the non-ratio portable tungsten meter, because white light is strongly absorbed by the deeply colored samples.