

Citrus Juice Quality Testing

FOOD & BEVERAGE SERIES



Key quality control (QC) parameters for citrus juices include:

- Scotts Oil Test/Recoverable Oil (% d-limonene)
- Brix
- Acidity (% citric acid)
- BAR value (Brix/Acid Ratio)
- Color Measurements
- Flavor Assessment

Xylem Lab Solutions has a variety of tools to help support your quality test protocols in the citrus beverage laboratory and manufacturing operations that can improve your speed, confidence, and safety.

Most every specific food industry (dairy, meat, etc.) has its own specific quality measurements, and citrus is no exception. These parameters are routinely and regularly measured by citrus processors who must consider U.S. regulations, USDA quality grading programs, and internal and customer product specifications.



a xylem brand

Scott Oil Test

The volatile components of citrus juice are what give it its distinctive flavor. Although most of these desirable compounds are found at extremely low levels (parts per million: ppm), they are not commonly quality checked. An exception is d-limonene, the major hydrocarbon in citrus oils. It does not contribute to the citrus juice flavor, however, too much of it can cause an unpleasant bitter sensation in the mouth or tongue known as "oil burn." The Scott Oil Test uses distillation and bromate-bromide titration to monitor the levels of d-limonene. The results are reported as % oil by volume. Most orange juices contain 0.015% to 0.025% oil, which is a level that will not give significant oil burn and is well below USDA grade A and B maximums.

The challenge is that the Scott Oil Test is time-consuming, especially the manual distillation step. The VAPODEST automatic distillation equipment has proven to save time for a large citrus juice manufacturer. This manufacturer runs about 50 samples a day at an estimated time of 7-8 minutes per sample.

The VAPODEST cuts the testing time down to 1.5 minutes per sample, resulting in a time savings of more than 80% from over 400 minutes to 65 minutes.



Gerhardt VAPODEST

Xylem is the exclusive North American distributor of C. Gerhardt GmbH & Co. KG

There are also other benefits of moving to the automated VAPODEST distillation system including:

1. **Safety**
 - a. Designed to protect users from contact with hazardous substances throughout the distillation and analysis process
 - b. Illuminated distillation chamber
 - c. A self-diagnosis feature that detects errors early and automatically switches to a safe mode
 - d. Soft start feature to control strong early reactions, allowing for adjustable steam power from 1-100%.
2. **System Flexibility**
 - a. Range of product models for your desired automation and ISO 17025 requirements
 - b. Tube sizes from 100, 250, 300, 400, 800 and 1200 ml
3. **User level Management and Password protection**
 - a. Individual user rights
 - b. Automatic logging of all work steps
 - c. Tamper proof data storage
4. **7-inch full color display**
 - a. Intuitive control and easy to understand icons
 - b. Smart and visible notifications of error, missing resources, and service

"7-8 minutes to do the distillation we were doing manually versus now it takes us a 1 minute 30. So that was huge time savings and cost savings for us as well. That is why we really wanted to do it on the VAPODEST."

Quality Assurance Supervisor
Leading Beverage Manufacturer

Brix



Degrees Brix (symbol °Bx) is the sugar content of an aqueous solution. One degree Brix represents 1 gram of sucrose in 100 grams of solution and indicates the strength of the solution as a percentage by mass. This measurement correlates to the product's taste, quality, and even nutritional density. Refractometers are used to measure this value. Refractometers measure the index of refraction, which describes how fast a light beam travels through a medium compared to a vacuum. This relationship is described by the formula:

$$n = c / v$$

Refractometers are straightforward instruments to use in your process, but it is important to choose one that offers durability and reliability so that you do not have wasted downtime, while maintaining confidence in your results. Cleanability is also critical. Whether, you are running 10 or hundreds of samples a shift, you want it to be easy and fast. Bellingham + Stanley has been manufacturing high-quality instrumentation since 1914. The RFM340-T is an ideal and reliable solution for high-throughput laboratories and demanding manufacturing operations. The RFM is a touchscreen digital model with Peltier temperature control and 3 decimal places of Brix precision.

"Bellingham and Stanley refractometers are very reliable. You know, I have been here 10 years. That is the only refractometer we have ever had here at the plant. We have had very little issues."

Quality Assurance Supervisor ,
Leading Beverage Manufacturer

"These are much easier to clean. So, we really like that fact. "

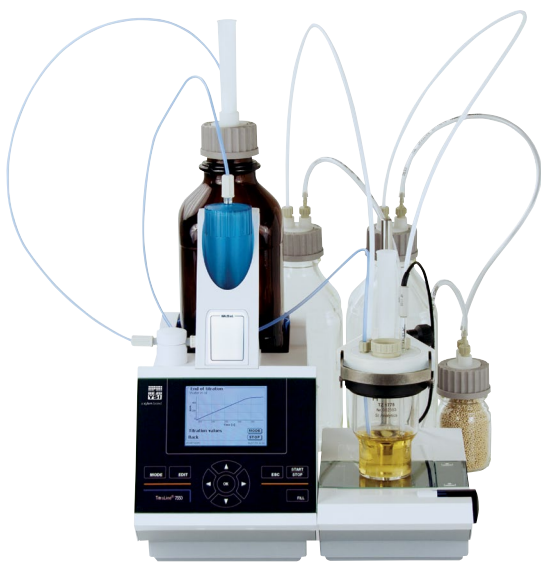
Quality Assurance Supervisor ,
Leading Beverage Manufacturer

Additionally, the RFM340-T offers:

1. 7-inch high-definition touchscreen display
2. Peltier Temperature Control critical for precise Brix readings and calculating BAR (Brix/Acid ratio).
3. Flat prism for easy cleaning
4. Reliability
5. Capable of measuring non-homogenous samples such as fruit juice with pulp, perfect for the citrus industry
6. Durability for trouble free continuous use.
7. RFID (Radio Frequency Identification) swipe technology, providing clearance and an audit log of users and instrument configuration making it an excellent choice for FDA-regulated environments operating in accordance with 21 CFR Part 11

All refractometers are made and tested to the highest standards and are supplied with a unique serial number and Certificate of Conformity ensuring every instrument you buy may be traced to NIST and ICUMSA standards.





YSI TitroLine 7000



Bellingham + Stanley
RFM340-T

Acidity

The acidity, or titratable acidity, is a common measurement of the citric acid content of a juice and is accomplished by titration of a known volume of sample with an aqueous alkali solution to end point. Acidity is a key quality attribute of citrus juice and is responsible for the characteristic tartness or sourness of these products. Measurement of acidity indicates fruit maturity, is used in the correction of the soluble solids measurement and in the BAR calculation. It is normally reported as % citric acid.

The acidity can be done by manual titration but for rapid and precise results the Titroline™ series of automatic titrators are a perfect solution. **The Titroline 7000, with over 50 user methods can easily be configured to determine your % citric acid in a fast and reliable way.** The Titroline 7000 calibrates through wireless sensor technology on the ID- Electrodes. These ID- electrodes send their specific data wirelessly to the titrator. Therefore, the TitroLine® 7000 always uses the correct calibration data and erroneous measurements are excluded.

BRIX/Acid Ratio (BAR)

The BAR is a derived value and is calculated by dividing the acid and temperature corrected Brix value by the % by weight citric acid value. This ratio is a key quality indicator of fruit maturity and citrus juice quality. The BAR value is used to understand the sweet/tart balance of the citrus juice. Low BAR will be too sour, while high BAR can lack flavor. The BAR is used for precise juice blending to ensure consistency in finished goods. Brix results from the Peltier controlled RFM340-T refractometer control and the Titroline 7000 % Citric Acid allow for the utmost confidence for your juice blending operation.



Flavor

Flavor is the final quality test, but it is also the most difficult to objectively measure in the quality laboratory. It relies on experience and training. Rubric grading and reliable quality results from the testing helps remove bias.

So, pour yourself a glass and take a sip.

The goal of citrus juice processing is to preserve the character of the incoming fruit with careful handling, processing, and quality control checks. Xylem lab solutions can support you along the way and save you time and money while providing reliable and precise results.

Set your lab up for success. Contact an expert.

<https://www.ySI.com/project-consulting-laboratory>

Sources

<https://citrusindustry.net/2022/10/24/quality-aspects-of-citrus-juices/>

http://citrech.it/_media/fmc-procedures-for-analysis-of-citrus-products.pdf

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