Beverage production quality control FAQs

In beverage production, laboratory quality control (QC) tests ensure product safety, consistency, and compliance with regulatory standards. From ingredient sourcing to final product, rigorous testing prevents contamination, off-flavors, and deviations in quality that could compromise consumer health and brand integrity.

Following are several common frequently asked questions relating to QC testing routinely performed in beverage manufacture.

What are some of the typical laboratory QC tests used in beverage production? When and why are laboratory filters used?

Several key testing procedures rely on laboratory filtration. These include general clarification, analytical chemistry, and microbiological analysis. The correct selection of filtration devices used in these tests can significantly impact laboratory efficiency and accuracy of results.

General sample filtration and clarification steps are used across a variety of sample preparation procedures prior to analysis.

In analytical chemistry testing, filtration is used to remove particulate matter from a sample before analysis. Particulate contamination may block sensitive parts of analytical instrumentation and interfere with the analysis. Filtration helps ensure more accurate and reliable results.

The membrane filtration (MF) technique is widely used in microbiology due to its accuracy, sensitivity, and suitability for testing clear liquids. Filtration concentrates microorganisms from a liquid sample onto a membrane filter when performing the technique. This allows for the subsequent cultivation and enumeration of colonies, facilitating the detection and quantification of microbial contamination in the sample.

Why can general filtration be necessary in some analysis applications?

General sample filtration and clarification steps help protect analytical equipment from clogging and damage from particulates. Performing filtration also removes dissolved gas from samples to be tested. Particulates and gas can distort analysis measurements, leading to incorrect analytical results.

Clarification is particularly important when performing spectroscopic techniques. Particulates, undissolved solids, and other impurities can clog instrumentation, impact optical components, scatter light, and reduce signal quality, leading to inaccurate measurements.

In spectroscopic techniques like UV-Vis, IR, and Raman spectroscopy, the presence of particulates can cause baseline noise and reduce clarity of the spectral data.

How and what filters do I use for clarification in laboratory tests?

To use, place cellulose filter papers in a funnel and pass your sample though under gravity. This method is highly recommended and also degases samples, which can be important when processing carbonated beverages.

Whatman™ Grade 1, 2, 52, and 93 filter papers are suitable for a range of clarification and degassing processes, have excellent particle retention, and provide a high rate of particulate removal. Some are available as pre-folded fluted papers.

Glass fiber filter papers are an alternative to cellulose filter paper. They provide fast, effective clarification and degassing of a large volume of aqueous solutions.

Passing a smaller volume of sample through a syringe filter device is an alternative method of clarifying when a shorter preparation time is important and sample volume not as critical.

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Whatman GD/X™ syringe filters include a prefilter designed for filtering high-particulate samples. There is also an option to include a specific membrane filter within the device to save time on analytical preparation.

Why is microbial testing of beverages important, and why are filters used in these tests?

Microbiological testing is essential in quality control for beverage production, as it guards against spoilage and pathogenic organisms that could lead to foodborne illnesses.

Non-alcoholic beverages, can become a breeding ground for bacteria, yeasts, and molds if not appropriately handled. This is due to their often-high sugar content and water-based formulation. Regular microbial analyses, such as testing for total viable counts and specific pathogens, help in early detection of contamination.

Microbiological tests are conducted on raw materials, production environments, and finished products to ensure each stage of the production chain is hygienic and meets safety standards. By identifying potential risks early, microbiological QC minimizes product recalls and enhances consumer trust.

The membrane filtration (MF) technique is widely used for microbial analysis of beverages due to its accuracy, sensitivity, and suitability for testing clear liquids. This method allows for the detection and enumeration of microorganisms, such as bacteria, yeasts, and molds, that may be present even at low levels.

Membrane filtration effectively isolates these microorganisms by filtering large volumes of the sample through a fine membrane, typically with a pore size of 0.45 µm, which retains microbial cells on the membrane surface.

Once filtration is complete, the membrane is transferred to a suitable growth medium and incubated, where any viable microorganisms present will grow into colonies. This method allows for the enumeration of colony-forming units (CFUs), which provides a clear quantitative assessment of microbial load.

The MF technique is particularly advantageous in the beverage industry because it accommodates testing of large sample volumes, and can detect of very low levels of microbial contaminants that might otherwise go undetected in smaller sample sizes. This sensitivity is critical for non-alcoholic beverages, which, unlike alcoholic ones, lack ethanol's antimicrobial properties and thus require rigorous microbial control to ensure shelf stability and consumer safety.

Furthermore, the MF technique is a highly adaptable method that can be applied to test for a wide range of microorganisms by simply using different selective media and incubation conditions. This flexibility allows beverage manufacturers to test for specific pathogens, spoilage organisms, or indicator microbes relevant to their products. As a result, membrane filtration is a preferred method for ensuring the microbial quality of beverages, helping manufacturers meet regulatory standards and maintain product integrity across batches.

Which filters should I use for microbial testing in laboratory quality tests?

Membrane filters are offered in a range of pore sizes, colors, and packaging varieties. Pore size selection may be specifically stated in some standard methods, while others suggest a suitable pore size range. When the technician is offered a range, pore size is selected to provide the optimal recovery of the target organism(s) balanced by the desired flow rate to filter the sample efficiently.

Various membrane filter color options are also available. The colors provide contrast of the recovered colonies against the membrane surface, allowing accurate identification and quantification. The selection of a white, black, or green membrane is based on the target organism, the type of specialized selective growth media used, and whether the media induces a colony color to develop that would stand out better against the background color.

Sterile MCE membranes are designed, and quality control tested for the concentration and recovery of microorganisms by the MF technique. We offer a range of membrane types, colors, and pore sizes to meet your testing needs.

Can the microbiology MF technique be performed using different workflows?

The MF technique can be performed by utilizing different laboratory workflows, which may implement reusable hardware, partially disposable products, or individual disposable funnels. When selecting the best workflow approach and choosing microbiology products, maximizing efficiency and controlling contamination are paramount.

We supply a range of microbiology solutions, including membranes, membrane dispensers, manifolds, disposable funnels, ready-to-use filter funnels, reusable funnels, pumps, and manifolds. Our products allow microbiologists to choose their workflow based on laboratory size, number of technicians, handling preferences, and budget. Microcheck™ beverage monitors are suitable for busy labs that need ready-to-use disposable filter funnels. The funnels convert to a petri dish for culturing, or the membrane can be removed and placed on a separate agar dish.

We provide microbiology manifolds and pumps that can be used in tandem with our Microcheck beverage monitor products, or alternatively, they can be used with separate membranes and reusable funnels.

Our manifolds are available in a 3-place format, which can be easily coupled together to form a 6-place manifold. The modular design allows for easy separation for disinfection and/or sterilization.



Our flexible microbiology solutions include sterile membrane filters, dispensers, funnels, and manifolds.

Why is analytical chemistry essential in beverage QC testing, and why are analytical chemistry sample preparation steps performed?

High-performance liquid chromatography (HPLC) and other chromatographic techniques are essential tools in the quality control processes of non-alcoholic beverage manufacturing. These methods enable precise identification and quantification of components within complex beverage matrices, such as juices, soft drinks, and flavored waters.

By separating, detecting, and quantifying various ingredients, including sugars, acids, vitamins, and preservatives, HPLC helps ensure the consistency and safety of each batch. For instance, determining sugar profiles is crucial in managing sweetness levels, meeting regulatory requirements, and providing consumers with a consistent taste experience.

HPLC and complementary methods like gas chromatography (GC) and ion chromatography (IC) are employed to detect additives, such as preservatives and artificial sweeteners, at trace levels. This is particularly important in the quality control of non-alcoholic beverages, as the presence of unwanted or excessive additives could impact flavor, shelf-life, or even pose health risks. By monitoring concentrations of preservatives like sodium benzoate and potassium sorbate, these methods help manufacturers adhere to food safety standards and prevent microbial growth. Chromatographic techniques also ensure that natural flavors and aromas remain stable and balanced, preserving the intended sensory profile over the product's shelf life.

Furthermore, chromatographic analysis is invaluable for detecting potential contaminants and degradation products, such as pesticides in juice-based drinks or toxins that might arise during storage.

With growing consumer demand for clean-label and health-conscious beverages, manufacturers use HPLC and related methods to confirm the absence of harmful substances and assure product purity. By establishing rigorous analytical testing regimes using chromatography, beverage manufacturers can enhance their quality control, ensuring compliance with regulatory standards and bolstering consumer trust in their products.

Sample preparation filtration is an important preventive maintenance step prior to performing HPLC or other chromatographic techniques.

Filtration protects the instrument's pump, valves, and tubing from damage or clogging due to particulate introduced by unfiltered samples or mobile phase. Sample filtration also prevents particulates from building up within the packing media of the HPLC column, leading to flow rate fluctuation and blocking that can affect data quality and reduce column life.

Typically, as the sample volume used in HPLC and UHPLC is minimal, syringe filters and other similar filter devices are used to filter the sample.

Which syringe filters should I use for analytical HPLC or UHPLC sample preparation filtration in laboratory QA/QC tests?

When determining the best syringe filter to use, it is recommended to follow SOPs or standards which state the parameters of the syringe filter or media to be used.

When selecting a syringe filter the following considerations should be made:

- Pore size: Typically, when using a standard HPLC column, a 0.45 µm filter will offer effective protection; however, if you're using a UHPLC column with a much smaller packing size, it's recommended to use a 0.2 µm filter.
- Chemical compatibility of the media: The solvent type and polarity of the sample will require the media to be chemically compatible with it, this helps prevent unwanted extractables, unwanted analyte binding and ensures consistency in membrane pore size throughout sample filtration.
- Sample volume: The total volume of sample filtered will determine the size of the syringe filter required.
- Certification: Syringe filters with HPLC or UHPLC certification may be required.

Puradisc™ syringe filters are general lab syringe filters for many applications. They are available in a range of filtration media and pore sizes to filter samples of diverse chemical solvents, compounds, and sample types.

Whatman GD/X syringe filters include a prefilter designed for filtering high particulate samples. There is also an option to include a specific membrane filter within the device to save time on analytical preparation.



Choose from our range of syringe filters with various diameters, pore sizes, and membrane options to suit your specific needs

Are there solutions to reduce laboratory waste when performing sample preparation?

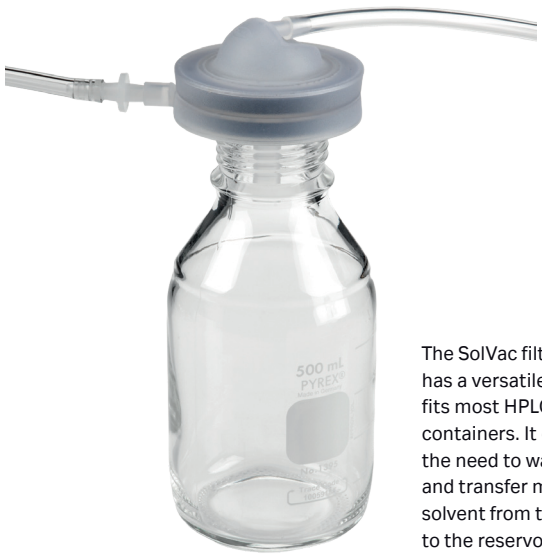
The selection of the correct filtration device will help reduce waste. For example, if you have a smaller sample volume using a 13 mm syringe filter will generate less waste than using a larger 25 mm version. Likewise, if a larger volume of sample is required using one 25 mm syringe filter would generate less waste than using two or three 13 mm devices to filter a sample.

The waste involved in the use of a syringe filter, vial, cap, and syringe can be considerable when processing numerous samples. For users concerned about these impacts we offer Mini-UniPrep™ syringeless filters. This solution acts as an all-in-one syringeless filter available in a range of materials, membranes, and pore sizes to suit any application. An additional advantage of our Mini-UniPrep syringeless filters is that multiple samples can be processed at once, and the vials loaded directly into an autosampler.

How important is filtration of the mobile phase in addition to samples for HPLC and UHPLC?

This is often overlooked by analysts as they will typically purchase HPLC grade reagents from reputable suppliers. Filtration of the mobile phase is as important as filtration of samples as even HPLC grade reagents can contain waste particles that impact both the performance of the system and data quality.

Cytiva offers a range of membranes for use in our SolVac™ filter holder. The SolVac filter holder sits on top of the receiving vessel and draws directly from the source bottle, reducing the risks associated with lifting heavy bottles to pour into a funnel.



The SolVac filter holder has a versatile design that fits most HPLC bottles and containers. It eliminates the need to wash flasks and transfer mobile phase solvent from the flask to the reservoir.

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