Brewing laboratory quality control FAQs

Several analytical and microbiological methods are used in brewing quality control. The correct selection of filtration devices used in these tests can have a major impact on laboratory efficiency and the accuracy of results.

Following are a number of common frequently asked questions relating to quality control testing routinely performed in beer production.

What are some of the typical laboratory QA/QC tests used in brewing? When and why are laboratory filters used?

All breweries, large and small, must meet a basic standard in their beers from both a regulatory standpoint and for long-term commercial viability. Consumers may expect a specific beer to look and taste the same everywhere they go, and they expect the beer to be safe and pleasurable to drink.

An effective laboratory QC/QA program executed throughout brewing workflows helps maintain uniformity of manufacturing processes and ensures consistent final products. This safeguards the taste profile, product safety, and overall quality of beer.

There are several key testing procedures that rely on laboratory filtration. These include: General clarification and degassing, alcohol testing, analytical chemistry, and microbiological tests. The correct selection of filtration devices used in these tests can have a major impact on laboratory efficiency and accuracy of results.

Why are clarification and degassing steps important in brewing analysis applications?

Clarification and degassing support accurate color analysis and help protect analytical equipment from clogging and damage from particulates. Passing a beer or wort sample through a filter removes particulates, such as yeast, and gases, such as CO_2, that could distort color determination and other measurements.

Examples of analytical tests where clarification and degassing are required prior to analysis include:

- Alcohol determination: used to monitor fermentation rates and to comply with legal regulations and alcohol taxation laws. Common analytical methods used to measure alcohol content include near-infrared spectroscopy and gas chromatography. Both methods require degassing and clarification steps before analysis.
- Color determination: An important measurement to monitor the brewing process and obtain a quality final beer with the desired color. The removal of particulates is a crucial sample preparation step prior to analysis, performed either visually or by UV/Vis spectroscopic methods.
- Sulfur compounds: These can form throughout the brewing process. Some serve as antioxidants but may cause off-flavors in beer. Sulfur dioxide is a by-product of yeast, and can be detected by UV/Vis spectroscopy. Dimethyl sulfide (DMS) is formed from heating wort and is detected by head space gas chromatography.

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

Cellulose filter papers are used by passing the sample under gravity though a fluted paper filter in a funnel is a highly recommended method of clarifying and degassing wort, beer, and other samples for analysis. Whatman™ Grade 2V pre-folded fluted papers have excellent particle retention and provide a high rate of particulate removal. Whatman Grade 597½ provides a slightly lower rate of removal, but with a faster filter time. Papers are available in a variety of diameters and folded options.

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

Whatman GF/C™ glass fiber filter papers offer fine particle retention, good flow rate, loading capacity, and resistance to strongly acidic or alkaline samples.

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Vacuum membrane discs are used by passing the sample though a membrane under vacuum. The use of membrane discs is recommended in methods where the removal of gases is important.

Whatman cellulose nitrate membranes have the strength and flexibility to allow excellent filtration of aqueous solutions. The membranes are available in a range of diameters and pore sizes.

Passing a smaller volume of sample through a filtration device is an alternative method of clarifying when a shorter preparation time is important.

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

What is microbial testing in brewing quality tests, and why is it important?

Although the antibacterial qualities of hops reduce growth of most microorganisms, some bacterial strains can reproduce and spoil the flavor and appearance of beer.

The most common method to determine the presence of these bacteria is to filter samples throughout the brewing process to isolate potential bacterial contamination, plate, and then incubate in an anaerobic environment.

This method, commonly known as the membrane filter (MF) technique, allows for precise and accurate quantification of microorganisms in a liquid sample. Membrane filters can be selected based on their pore size, allowing for the isolation of specific microorganisms. The method enables the quantification of microorganisms in a sample by counting the colonies that develop on the plated membrane filter.

The MF technique is applicable to a wide range of microorganisms, including bacteria, yeast, and fungi. This versatility makes it valuable in many microbiological analyses.

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. Selection of pore size may be specifically stated in some standard methods while others suggest a suitable pore size range. In the instance where 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.

Typical spoilage organisms that may be detected in beer workflows include:

- Gram-positive bacteria such as *Lactobacillus* and *Pediococcus*.
- Gram-negative bacteria such as *Pectinatus, Megasphaera* and *Zymomonas*.
- Wild yeast such as *S Brettanomyces, Saccharomyces* and *Saccharomyces cerevisiae var. diastaticus.*
- Molds and fungi such as *Aspergillus, Fusarium, Penicillium* and *Ascomycetes*.

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. A 0.45 µm white membrane with black grid lines is the most common selection, but some light-colored organisms may show up better against a dark background, for example Lactobacillus or Pediococcus that are typically white- or cream-colored colonies.

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, dispensers, manifolds, disposable funnels, ready-to-use filter funnels, reusable funnels, pumps, and manifolds. Our products offer microbiologists the flexibility to choose their workflow based on laboratory size, number of technicians, handling preferences, and budget.

Microcheck™ beverage monitors are for suitable for busy labs that need ready-to-use disposable filter funnels. The funnels can 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.

The 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.

What is analytical HPLC and UHPLC sample preparation filtration in laboratory QA/QC tests, and why is it important?

High performance liquid chromatography (HPLC) and ultra-high performance liquid chromatography (UHPLC) are analytical chemistry techniques which use column chromatography to separate the constituents of a sample.

HPLC and UHPLC can be used in several analytical tests in beer brewing workflows. These include:

- Bitterness, which is a key taste characteristic of beer. It can be measured across the brewing process to make decisions on hops, boiling times, and other additives to achieve desired taste. This is derived from the concentration of α-acids, β acids, and isomerized versions in hops.
- Carbohydrates, specifically sugars, influence the brewing process and beer quality.
- Various dissolved minerals, ions, compounds, and trace metals can make a huge difference in the final taste of the beer.

Sample filtration is an important preventive maintenance step prior to HPLC or UHPLC analysis. This 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 of the HPLC column that can affect data quality and reduce column life.

Typically, as the 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 an 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.

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

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