cytiva

Brewing laboratory filtration applications

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Contents

Introduction

People have been brewing beer for over 6000 years. Today, beer is more popular than ever, produced around the world by micro-breweries, industrial scale breweries, and even home-based hobbyists.

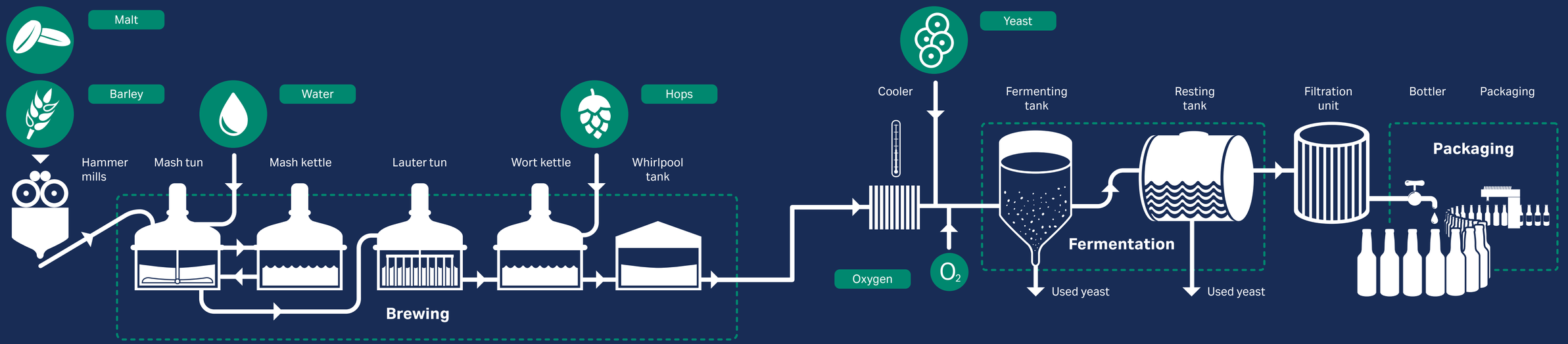
Modern brewers use a lot of science to deliver the quality and characteristics their customers expect. A large range of analytical methods are used to monitor the brewing process and to achieve consistency in the characteristics of each particular brand.

This brochure highlights the key analytical applications used throughout the brewing process, and gives recommendations for which Whatman™ filters would work best for each application.

Applications and recommended Whatman filters are based on scientific analytical methods written by key professional organizations that are associated with regulation of the brewing industry globally.

The organizations referenced in this brochure are the American Society of Brewing Chemists (ABSC) and the Mitteleuropäische Brautechnische Analysenkommission (MEBAK).

Beer brewing workflow with key steps and ingredients highlighted



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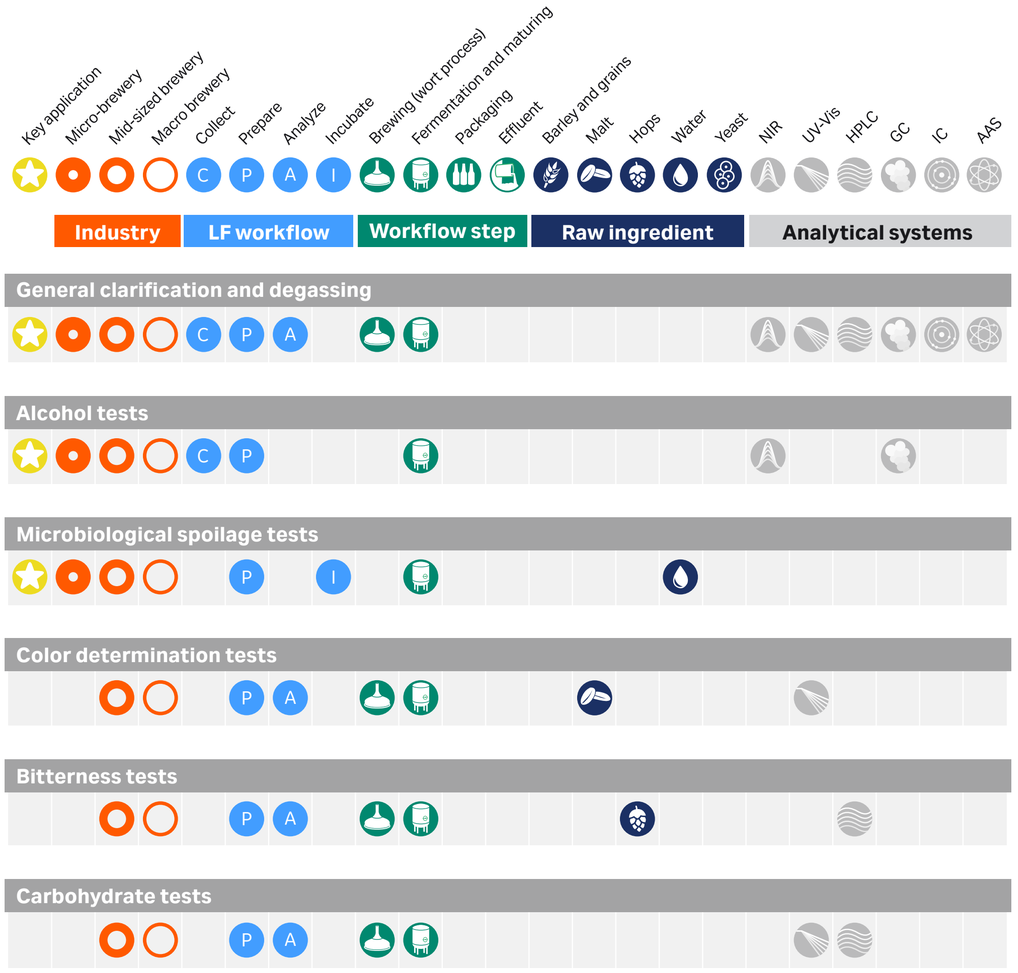
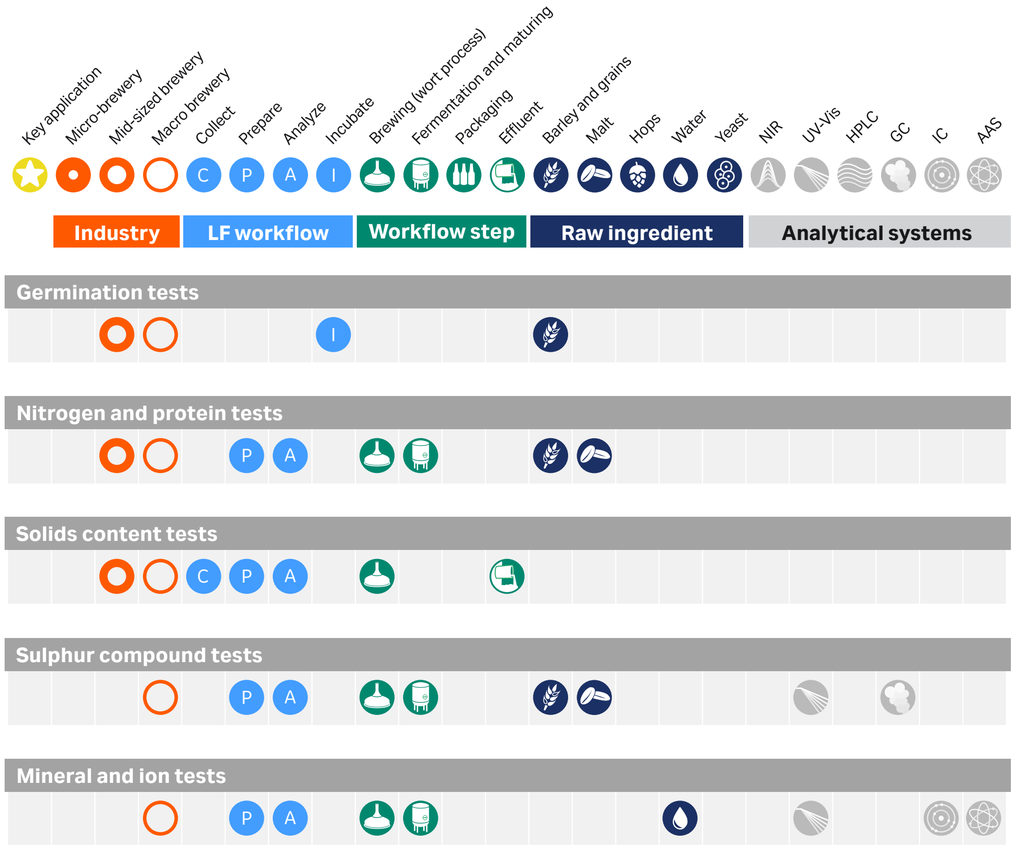




NIR = Near infrared spectroscopy, UV-Vis = Ultraviolet–visible spectroscopy, HPLC = High-performance liquid chromatography , GC = Gas chromatography, IC = Ion chromatography, AAS = Atomic absorption spectroscopy

General clarification and degassing tests

The degassing and clarification of wort and beer is a critical sample preparation step prior to many analytical methods. The presence of CO_2, turbidity, yeast and other particulates can damage equipment and heavily affect results.

Fluted filter paper and funnel filtration

Passing the sample gravimetrically 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.

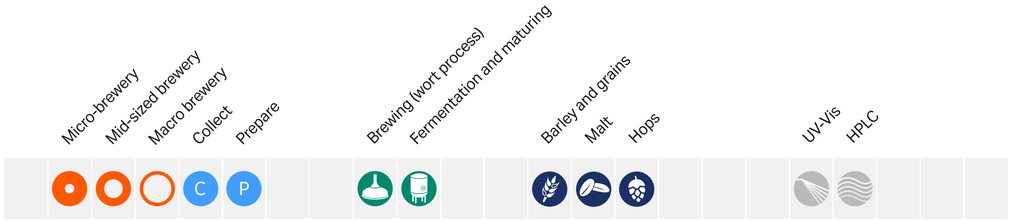
Whatman Grade 597½ provides a slightly lower rate of removal, but with a faster filter time. Papers are available in a variety of diameters and folded options.

Ordering information

Description	Quantity	Product code
Grade 2V fluted papers, 320 mm	100	1202-320
Grade 597½ fluted papers, 320 mm	100	10311853

Methods

ASBC #	Beer 1B
MEBAK #	2.9.1



Membrane vacuum filtration

Passing the sample though a membrane under vacuum is another method of clarifying and degassing wort and beer samples. It is recommended in methods where the removal of gases is important.

Whatman Cellulose Nitrate Membranes have high strength and flexibility to allow excellent filtration of aqueous solutions. The membranes are available in a range of diameters and pore sizes.

Whatman also offers a range of glass vacuum filtration devices and accessories.

Ordering information

Description	Quantity	Product code
Cellulose Nitrate Membrane Circles, 0.45 µm, 50 mm	100	10401114

Methods

ASBC #	Beer 2, Beer 3, Beer 8, Beer 9, Beer 10, Beer 32, Beer 43
MEBAK #	2.20.1, 2.20.2, 2.21.3.2, 205.16.080

Filtration devices

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

Whatman GD/X™ syringe filters include a prefilter specifically designed for filtering high particulate samples such as wort and beer. An additional option to include a specific membrane filter within the device can save time on analytical preparation.

Whatman Autovials™ syringeless filters are preassembled single-use assemblies containing the same filter capabilities as Whatman GD/X syringe filters. They can be used with hard to handle samples (such as hot wort) and positioned safely and stably.

Ordering information

Description	Membrane	Quantity	Product code
Whatman GD/X syringe filters	Glass prefilter, Glass microfiber, 0.45 µm	150	6894-1304
Autovial 12	Glass microfiber	50	AV125UGMF

Alcohol tests

In addition to knowing how strong a beer is, brewmasters rely on accurate alcohol determination to monitor fermentation rates and comply with legal regulations and alcohol taxation laws.

Degassing and clarification is an important preparation step before analysis. Common analytical systems used to measure alcohol content include near infrared Sspectroscopy and gas chromatography.

Near infrared spectroscopy sample preparation

Whatman Grade 2V pre-folded fluted papers have excellent degassing and clarification rates.

Whatman Grade 597½ provides a slightly lower rate of particulate removal, but with a faster filter time.

Papers are available in a variety of diameters and folded options.

Ordering information

Description	Quantity	Product code
Grade 2V, 320 mm	100	1202-320
Grade 597½, 320 mm	100	10311853

Methods

ASBC #	Beer 4G
MEBAK #	2.9.6.3

Gas chromatography sample preparation

Whatman Grade 4V pre-folded fluted papers have excellent degassing and filtration speed which is ideal for gas chromatography.

Papers are available in a variety of diameters and folded options.

Ordering information

Description	Quantity	Product code
Grade 4V, 320 mm	100	1204-320

Methods

ASBC #	Beer 4D, Beer 29

Microbiological spoilage tests

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

One method of determining the presence of these bacteria is to filter samples throughout the brewing process to isolate the bacteria, plate, then incubate in an anaerobic environment.

Whatman has a broad range of filters and hardware for use in microbiological quality control.

Membrane filtration

Whatman sterile WME membranes are specifically designed for the aqueous vacuum filtration of microorganisms with a high contrast grid.

As the key brewery microorganism colonies (lactobacillus and pediococcus) appear white and cream colored, black membranes with white grid lines are recommended.

WME membranes are specifically designed to be used with the Whatman MBS-1 microbiological filtration system.

Ordering information

Description	Membrane	Quantity	Product code
ME25 Sterile Membranes	Mixed cellulose ester sterile membrane circles, black with 3.1 mm white grid, 47 mm 0.45 µm	400	10407332

Methods

ASBC #	Microbiology 1D, 2B, 2C, 5

MBS-1 microbiological filtration system

The Whatman MBS-1 system consists of an electric membrane dispenser, a funnel dispenser and vacuum manifold.

The combined filtration system reduces the overall procedure time to a minimum, is safe, simple and leads to more reproducible results.

Ordering information

Description	Product code
Electric butler for dispensing filtration membranes	10477103
2-place vacuum filtration manifold	10445890
Steel frit with ring	10445863
Dispenser for 100 mL and 350 mL funnels	10445871
Autoclavable plastic funnel of polypropylene	10445861
Autoclaving bags for plastic funnels	10445868

Color determination

Color is an important measurement to monitor the brewing process, as well as to obtain a quality final beer of the desired color. The removal of all particulates is a crucial sample preparation step prior to analysis either visually or by UV/Vis spectroscopic methods. Recommended methods involve passing beer and wort samples though a membrane under vacuum or glass fiber filter gravimetrically to obtain a brilliantly clear filtrate and true color.

Membrane vacuum filtration

Whatman Cellulose Nitrate Membranes are designed for routine applications including the filtration of large amounts of aqueous solutions under vacuum. Membrane circles are available in a variety of diameters.

Whatman also offers a range of vacuum filtration hardware.

(MEBAK recommended method)

Ordering information

Description	Quantity	Product code
Cellulose Nitrate Membrane Circles, 0.45 µm, 50 mm	100	10401114

Methods

ASBC #	2.12.1, 2.12.2

Glass fiber filtration

Whatman 934-AH Glass Microfiber Filters are designed for fast and effective clarification of a large amount of aqueous solutions gravimetrically. The filter circles are available in a variety of diameters.

(ASBC recommended method)

Ordering information

Description	Quantity	Product code
934-AH Glass Microfiber Filters, 320 mm	100	1827-320

Methods

ASBC #	Wort 9B

Bitterness tests

Bitterness 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 the desired taste.

The International Bitterness Units (IBU) measurement is derived from the concentration of α-acids, β-acids and isomerized versions in hops. These are measured by the use of a high-performance liquid chromatography (HPLC) system. Whatman offers a variety of preparatory and analytical filter devices.

Depending on nature of the mobile phase, different membranes are recommended.

Whatman Nylon Membranes are used for pre-filters prior to HPLC of polar (hydrophilic) solvents.

Methods

ASBC #	Hops 9, Hops 14, Hops 15, Hops 16, Wort 23C
MEBAK #	2.17.3, 2.17.4

Whatman PTFE Membranes are used for pre-filters prior to HPLC of non-polar (hydrophobic) solvents.

Methods

ASBC #	Beer 23E
MEBAK #	300.04, 311.02, 321.02, 321.03

Mid-sized brewery
Macro brewery
Prepare
Analyze
Brewing (wort process)
Fermentation and maturing
Hops
HPLC
P
A

HPLC sample preparation

Syringe device filters

Passing the clarified sample through a syringe filter prior to HPLC analysis is a highly recommended step. Whatman Puradisc syringe filters combine quality and economy for the quick and efficient filtration of samples.

Ordering information

Description	Membrane	Quantity	Product code
Puradisc 25	PTFE 0.45 µm	50	6750-2504
Puradisc 25	Nylon 0.45 µm	50	6784-2504

Syringeless filters

The Whatman Mini-UniPrep™ is a preassembled filtration device combining filtration membranes along with an autosampler vial.

This all-in-one filtration process enables processing samples in one-third of the time and reducing consumable costs by up to 40%.

Ordering information

Description	Membrane	Quantity	Product code
Mini-UniPrep syringeless filter	Nylon 0.45 µm	100	UN203NPUNYL
Puradisc 25	PTFE 0.45 µm	100	UN203NPUORG

High particulate filter devices

Whatman high particulate filtration devices combine the clarification of high particulate samples along with HPLC pre-filtering for a faster sample preparation time.

Whatman GD/X syringe filters include a prefilter specifically designed for filtering high particulate samples, along with the relevant solvent-compatible membrane.

Whatman Autovials syringeless filters are preassembled single use devices containing the same filter capabilities as Whatman GD/X syringe filters. They can be used with hard-to-handle samples (such as hot wort) and positioned safely and stably.

Ordering information

Description	Membrane	Quantity	Product code
Whatman GD/X syringe filters	Nylon 0.45 µm	150	6870-1304
Whatman GD/X syringe filters	PTFE 0.45 µm	150	6874-1304
Autovial 12	Nylon 0.45 µm	50	AV125UNAO
Autovial 12	PTFE 0.45 µm	50	AV125UORG

Carbohydrate tests

Various carbohydrates influence the brewing process, and sugars in particular are very important. Its fermentation by yeast substantially influences the final beer quality.

Sugars and other carbohydrates can be analyzed by UV/Vis spectroscopy and high-performance liquid chromatography (HPLC) methods. Clarification, degassing and HPLC pre-filtering are all important sample preparation steps where Whatman filters are used.

Clarification and degassing by filter paper

Passing the sample gravimetrically 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.

Ordering information

Description	Quantity	Product code
Grade 2V fluted papers, 320 mm	100	1202-320

Methods

ASBC #	Wort 22
MEBAK #	2.7.4, 2.10.3, 205.19, 205.20

Clarification and degassing by vacuum membrane filtration

Passing the sample though a membrane under vacuum is another method of clarifying and degassing wort and beer samples. It is recommended in methods where the degassing is important.

Whatman Cellulose Nitrate Membranes have high strength and flexibility to allow excellent filtration of aqueous solutions. The membranes are available in a range of diameters and pore sizes.

Whatman also offers a range of glass vacuum filtration devices and accessories.

Ordering information

Description	Quantity	Product code
Cellulose Nitrate Membrane Circles, 0.45 µm, 50 mm	100	10401114

Methods

ASBC #	Wort 41B, Wort 19, Beer 41B, Sugars and Syrups 18
MEBAK #	2.7.2, 205.20

HPLC pre-filtration and sample preparation

Whatman Nylon Membrane are recommended for use in carbohydrate HPLC tests for filtering prior to analysis to HPLC (for Polar/hydrophilic solvents).

Whatman Puradisc syringe filters combine quality and economy for the quick and efficient filtration of samples.

Whatman GD/X syringe filters include a specifically designed prefilter for filtering high particulate samples along with a nylon membrane.

Whatman Mini-UniPrep is a preassembled filtration device, combining filtration membranes along with an autosampler vial.

Ordering information

Description	Membrane	Quantity	Product code
Puradisc 25	Nylon 0.45 µm	50	6750-2504
Whatman GD/X syringe filters	Nylon 0.45 µm	150	6870-1304
Mini-UniPrep syringeless filter	Nylon 0.45 µm	100	UN203NPUNYL

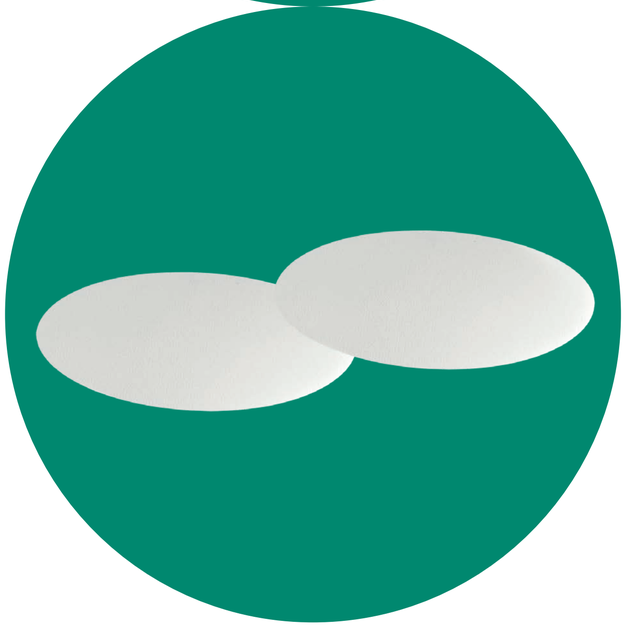
Methods

ASBC #	Wort 19, Wort 22, Wort 41B, Sugars and Syrups 18
MEBAK #	2.7.2, 2.7.5, 205.19, 205.20

Barley germination tests

A barley sample's ability to germinate, or germinative energy, will affect the quality of malt and the final beer in the brewing process.

Germinative energy tests involve incubating barley seeds on paper with constant water absorption. Whatman has a range of pure cellulose papers options with no additives that can be used for seed testing.



Seed testing papers

Whatman seed testing papers are specially designed for seed germination with a constant absorption of water and without any additives that could influence germination.

Seed testing papers are available in a variety of options including sizes, absorption grades, pleated strips, petri dish circles, sheets and colors, depending on your needs.

Ordering information

Description	Quantity	Product code
Grade 1 filter paper circle, 85 mm, white	100	1001-085
Seed testing paper, grade 3621, 140 × 200 mm sheet, white	1000	10342580
Seed testing paper, grade 3644, 380 × 340 mm sheet, white	100	10342582
Seed testing paper, grade 3014, 110 × 20 mm pleated, white	1000	10344672

Methods

ASBC #	Barley 3
MEBAK #	110.27, 110.29, 110.30, 110.32, 110.33, 110.34, 110.35

Nitrogen and protein tests

Nitrogen compound and protein levels throughout the brewing process are significant factors for yeast metabolism, final beer shelf life, mouth feel and foam stability. A recommended test method is by Kjeldahl analysis, always taking care to use specialty filter papers and weighing boats with low nitrogen content to avoid influencing the test results.

Filter paper filtration

Whatman Grade 589/2 quantitative ashless papers are designed for the preparatory filtration of wort and beer samples prior to analysis. With a low nitrogen content, it will not influence the analytical results in any way. The papers are available in a variety of diameters and pre-folded options.

Ordering information

Description	Quantity	Product code
Grade 589/2, 320 mm	100	10300120

Methods

ASBC #	Wort 10 A&B, Beer 11A
MEBAK #	2.6.2, 2.6.3.1, 2.6.3.2, 205.13.030

Weighing boats

Whatman Kjeldahl weighing boats are an easy way to transfer barley and malt samples safely and reliably by dropping the entire boat and contents loss-free into the acid solution. Made from a very low nitrogen parchment paper, it will not influence the analytical result in any way. The boats are available in a variety of sizes and sheet options.

Ordering information

Description	Quantity	Product code
Weighing Boats, 55 × 10 × 10 mm	100	10313032

Methods

ASBC #	Barley 7A, Malt 8, Cereals 6
MEBAK #	2.6.1.1, 110.41.030, 205.11.030

Suspended solids content tests

The brewing process often generates large amounts of wastewater effluent which must either be treated or disposed off according to regulations set by government bodies.

Total suspended solids (TSS) is measured by mass loss to calculate the total solids (TS) content of wastewater.

There are various global standards that outline the method and specified filter features. Although most countries have their own testing methods, they are likely based on existing standards by either the European Committee for Standardization (CEN) or the United States Environmental Protection Agency (EPA).

Whatman offers various glass fiber filter grades designed for TSS testing to follow parameters set out in these standards.

Key standards

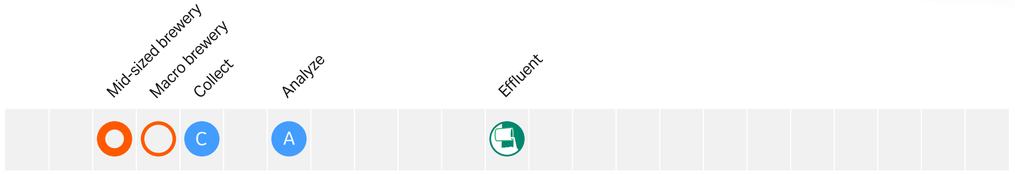
Description	Quantity	Product code
Committee	EN 872	GF/C™
EPA	2540 D	934-AH™

Glass fiber paper filters

Whatman glass fiber paper circles feature a high flow rate, fine retention capacity and stability up to 550°C. They are designed for the TSS analysis of wastewater and effluent by the mass loss method.

Ordering information

Description	Quantity	Product code
GF/C Glass Microfiber Circles, 47 mm	100	1822-047
934-AH™ Glass Microfiber Circles, 47 mm	100	1827-047



RTU (Ready-to-use) glass fiber filters

Whatman glass 934-AH Ready to Use (RTU) filters are delivered pre-washed and pre-weighed, eliminating the preparatory steps prior to filtration of the wastewater sample.

The filters are in full compliance with Method 2540 (USA), EN872 (EU), and save time by eliminating five steps from the filtration process.

RTU filters are available in additional grades, including GF/C.

Ordering information

Description	Quantity	Product code
GF/C RTU Glass Microfiber Circles, 47 mm	100	9907-042
934-AH RTU Glass Microfiber Circles, 47 mm	100	3822-047

Sulphur compound tests

Several sulphur compounds can form throughout the brewing process. These can serves as antioxidants, but also can cause off-flavors in beer.

Sulphur dioxide is a by-product from yeast, often when it is stressed. It can be detected by UV/Vis spectroscopy and preparatory filtration is required.

Dimethyl sulfide (DMS) is formed from heating wort. It is detected by head space gas chromatography and preparatory filtration is required.

Near infrared spectroscopy sample preparation

Whatman Grade 2V pre-folded fluted papers have excellent degassing and clarification rates.

Papers are available in a variety of diameters and folded options.

Ordering information

Description	Quantity	Product code
Grade 2V, 320 mm	100	1202-320

Methods

ASBC #	Malt 11, Beer 23B
MEBAK #	2.21.8.1, 2.21.8.3

Dimethyl sulfide test filtration

Whatman Grade 1V pre-folded fluted papers have excellent degassing and clarification rates.

Papers are available in a variety of diameters and folded options.

Ordering information

Description	Quantity	Product code
Grade 1V, 320 mm	100	1201-320

Methods

ASBC #	Malt 11, Beer 23B
MEBAK #	00.29.153, 2.23.11

Mineral and ion tests

The makeup of the water has a significant impact throughout the brewing process. Various dissolved minerals, ions, compounds and trace metals can make a huge difference in the final taste of the beer.

The content and concentration of these trace elements can be tested and measured throughout the brewing process by ion chromatography (IC) and atomic absorption spectroscopy (AAS).

Whatman offers a range of specialized filter paper and devices to use in the filtering prior to analysis of samples.

Ion chromatography analytical filtration

The minerals and ion content of brewing water can be detected by the use of ion chromatography.

Whatman Anotop™ IC syringe filters are specially designed for the analytical prefiltering of clarified ion chromatography samples with very low levels of anion leaching.

Ordering information

Description	Membrane	Quantity	Product code
Anotop 25 IC syringe filters, 0.2 µm	Anopore	200	6809-9244

Ion chromatography anion membrane vacuum filtration

The clarification of wort and beer samples is an important preparatory filtration step prior to ion chromatography.

Whatman nylon membranes are suitable for preparatory vacuum filtration for the testing of chloride, sulphate, nitrate and phosphate content.

Whatman also offers a range of glass vacuum filtration devices and accessories.

Ordering information

Description	Quantity	Product code
Nylon Membrane Circles, 0.45 µm, 50 mm	100	7404-002

Methods

ASBC #	Beer 43
MEBAK #	2.22.1

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