



Distributor  
GE Healthcare

# Filtration for Soil Testing



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# Chemical analysis

Soil sample analysis requires that chemical compounds are first extracted from their matrix using pH and heat modulation and concentrated. Filters and filtration-related products play key roles throughout this process. Quality is essential to maintain the integrity of results.

▶ What are you testing for?	▶ What testing method?	▶ Product
Nitrogen	Kjeldahl analysis	<b>Weighing boats</b> Ordering information p. 6
Pesticide detection	Soxhlet extraction	<b>Thimbles (cellulose)</b> Ordering information p. 6
Trace elements	Spectrophotometry and chromatography	<b>Syringe filters</b> Ordering information p. 7
Phosphorus	Colorimetry	<b>Cellulose filter papers</b> Ordering information p. 6
pH	pH testing	<b>Indicator papers</b> Ordering information p. 6
Retained solids and clarified solution	Gravimetric analysis. Various quantitative and qualitative analytical techniques	<b>Quantitative or qualitative cellulose filter papers</b> Ordering information p. 6

## Kjeldahl nitrogen analysis

Measuring soil nitrogen content can help refine nitrogen fertilizer addition before planting.

Nitrogen content analysis is typically done with Kjeldahl techniques, which involve the sampling of an exact amount of soil before transfer to a digestion tube. Low nitrogen content weighing paper makes the sample transfer easy and quick without loss of material and with minimal interference with the end result. The sample may need to be filtered through a Whatman brand qualitative filter paper prior to analysis.



Low nitrogen content weighing boats.

## Soxhlet extraction for chemical detection

Prior to analysis by, for example, gas chromatography (GC), soils may be prepared using Soxhlet extraction or microwave digestion. Extraction thimbles are widely used for Soxhlet techniques. Qualitative filter papers or glass fiber filters can help clear extracts after microwave extraction. Samples may then be refiltered with a 0.45  $\mu\text{m}$  filter to remove small particles and protect your GC instrument. Mini-UniPrep syringeless filter, which is an all-in-one filter and autosampler vial, allows you to process samples faster than traditional syringe filters and eliminates multiple consumables. See page 9 for Mini-UniPrep ordering information.



Extraction thimbles in Soxhlet extraction apparatus.

## Spectroscopy and chromatography for trace element analysis

Trace element analysis in soil generally involves determination of essential nutrients for plant growth (e. g., potassium, magnesium, calcium) and detection of potential heavy metal contamination (e.g., lead, chromium, arsenic, zinc, copper, cadmium, mercury, and nickel).

Most trace element tests are based on extracting soil and measuring the concentration of trace elements in the soil-free liquid phase using for example inductively coupled plasma atomic emission spectrometry (ICP-AES). Extraction methods can vary between laboratories. The sample then generally needs to be filtered through a qualitative filter paper or glass fiber filter to make sure it will not clog nebulizers or interfere with injection into the analysis instrument. If digested with aqua regia, the sample may be filtered through an ashless filter paper. If syringe filters are used as an additional sample preparation step, please see “HPLC, UHPLC, and other analytical techniques” on page 7. Fluted and 1/4 folded paper are also available for use. For more information on relevant applications and grades, please visit: [gelifesciences.com/WhatmanFilterSelector](http://gelifesciences.com/WhatmanFilterSelector).



Whatman cellulose filter paper.

## Colorimetry for phosphorus analysis

Through soil phosphorus testing, the amount of phosphorus fertilizer required to achieve maximum plant growth can be determined. Soils with low or medium phosphorus content will likely show higher yields if extra phosphorus is added. However, crops are not likely to respond with a yield increase in soils with high or very high phosphorus content.

To determine the soil phosphorus content, the soil is extracted with a chemical solution and the phosphorus content in the extract is measured by colorimetry. Filtration of the extract through a qualitative filter paper is generally needed before analysis. If an automated method is used for determining phosphorus concentration, acid-resistant filter paper may be needed.



Whatman Grade 40 ashless filter paper.

## pH testing

The pH of soil is vital for how well it holds minerals. When the soil is too acidic, minerals will be leached out by rainwater before the plants have a chance to use them. Highly alkaline soils are often associated with mineral deficiencies due to the low solubility of minerals under alkaline conditions. Neutral or slightly alkaline soils are ideal for growing plants. However, some plants have very particular pH requirements.

There are many different ways of measuring soil pH. Litmus/pH paper is a quick and inexpensive method to test soil pH when a pH-meter is unavailable or when highly precise values are not necessary. When preparing your soil sample, use a weighing paper to weigh the soil before adding water. Filter papers can be used to remove unnecessary particles from the suspension.



Color bonded pH strips.



## Clarification and solids retention

Various test methods require that liquid components of a solution be separated from suspended solids prior to analysis. GE Healthcare Life Sciences offers a wide choice of cellulose filter papers with different levels of flow rate, loading capacity, and chemical resistance to support these applications.

Whatman quantitative filter papers are designed for gravimetric analysis and the preparation of samples for instrumental analysis. They are available in three formats: ashless, hardened low ash, and hardened ashless. Hardened low ash grade papers are acid-treated to remove trace metals, produce high wet strength, and provide chemical resistance. The tough, smooth surface of these filters makes it easy to recover precipitates, rendering them particularly suitable for Büchner filtration. Hardened ashless grade filters combine acid-hardening with extremely low ash content, making them suitable for applications requiring the filter and retained solids to be burned.

Qualitative cellulose filters are used to determine and identify the presence of materials. Two formats are available: standard filters and wet-strengthened filters. Some standard and wet-strengthened filters are available in pre-pleated forms which improves flow rate and increases loading capacity compared to equivalent flat filters. Whatman qualitative filter papers are manufactured from high-quality cotton linters, ensuring quality, reproducibility, and uniformity.











## Ordering information

For what use?	Product	Quantity	Product code
Kjeldahl analysis	Grade 609 weighing boats	100/pack	
Soxhlet extraction	Thimbles (cellulose)	25/pack	
Spectrophotometry and chromatography	Various syringe filters	N/A	
Colorimetry	Grade 5, 15 cm cellulose filter paper	100/pack	
pH testing	Indicator papers	100/pack	
Sample clarification and solids retention	Quantitative cellulose paper grade 41, 15 cm*	100/pack	
	Qualitative cellulose paper grade 4, 40 cm*	100/pack	

\*For a full list of cellulose paper grades please visit [www.gelifesciences.com/whatman](http://www.gelifesciences.com/whatman)



# HPLC, UHPLC, and other analytical techniques

What are you testing for?	Product	Characteristics and benefits
Low solids content	<b>Puradisc</b> Ordering information p. 9 	<ul style="list-style-type: none"> <li>Wide range of membranes, pore sizes and diameters</li> <li>Pre-filter: no</li> <li>Diameter: 4, 13, 25, or 30 mm</li> <li>Available pore sizes: 0.1, 0.2, 0.45, 0.8, 1.0, 1.2, 5 µm</li> <li>Membrane materials available: Cellulose acetate, nylon, PES, PVDF, PP, PTFE, GF</li> </ul>
	<b>SPARTAN™</b> Ordering information p. 9 	<ul style="list-style-type: none"> <li>HPLC certified</li> <li>Pre-filter: no</li> <li>Diameter: 13 or 30 mm</li> <li>Available pore sizes: 0.2 or 0.45 µm</li> <li>Membrane materials available: Regenerated cellulose</li> </ul> 
Hard-to-filter samples	<b>Whatman GD/X™</b> Ordering information p. 9 	<ul style="list-style-type: none"> <li>For hard-to-filter samples</li> <li>Pre-filter: multilayer glass filter</li> <li>Diameter: 13 or 25 mm</li> <li>Available pore sizes: 0.2, 0.45, 0.7, 1.0, 1.2, 1.5, 2.7, 5.0 µm</li> <li>Membrane materials available: Cellulose acetate, nylon, PES, PVDF, PP, PTFE, RC</li> </ul> 
	<b>GD/XP</b> Ordering information p. 9 	<ul style="list-style-type: none"> <li>For hard-to-filter samples where analytes of interest are inorganic ions</li> <li>Pre-filter: Multilayer polypropylene</li> <li>Diameter: 25 mm</li> <li>Available pore sizes: 0.45 µm</li> <li>Membrane materials available: Nylon, PES, PVDF, PP, PTFE</li> </ul>
HPLC/GC autosamplers	<b>Mini-UniPrep™</b> Ordering information p. 10 	<ul style="list-style-type: none"> <li>All-in-one filter and <b>plastic</b> autosampler vial</li> <li>Pre-filter: no</li> <li>Dimensions: Once compressed equivalent to 12 mm × 32 mm vial</li> <li>Available pore sizes: 0.2 or 0.45 µm</li> <li>Membrane materials available: PTFE, RC, Nylon, PVDF, PES, PP, GMF</li> </ul> 
	<b>Mini-UniPrep G2</b> Ordering information p. 10 	<ul style="list-style-type: none"> <li>All-in-one filter and <b>glass</b> autosampler vial</li> <li>Pre-filter: no</li> <li>Dimensions: Once compressed equivalent to 12 mm × 32 mm vial</li> <li>Available pore sizes: 0.2 or 0.45 µm</li> <li>Membrane materials available: PTFE, Nylon, PVDF, PP, GMF, RC</li> </ul> 

RC = regenerated cellulose, PVDF = polyvinylidene difluoride, PTFE = polytetrafluoroethylene, PP = polypropylene, PES = polyethersulfone, GMF = glass microfiber filter, GF = glass fiber, CA = cellulose acetate

# HPLC, UHPLC, and other analytical techniques

## Puradisc syringe filters

Membrane type/ diameter	Nylon 25 mm	PVDF 25 mm	PTFE 25 mm	PP 25 mm	PES 25 mm	CA 30 mm		
Pore size	Product code	Product code	Product code	Product code	Product code	Quantity	Product code	Quantity
0.2 µm						200/pack		100/pack
0.2 µm		-				1000/pack		500/pack
0.45 µm						200/pack		100/pack
0.45 µm						1000/pack		500/pack

## SPARTAN syringe filters

Diameter	13 mm	13 mm with mini-tip	30 mm		
<b>Membrane</b>	<b>Pore size</b>	<b>Product code</b>	<b>Product code</b>	<b>Product code</b>	<b>Quantity</b>
Regenerated cellulose	0.2 µm				100/pack
Regenerated cellulose	0.2 µm				500/pack
Regenerated cellulose	0.45 µm				100/pack
Regenerated cellulose	0.45 µm				500/pack

## GD/X syringe filters (glass fiber prefilter), 25 mm diameter

Membrane type	Nylon	PVDF	PTFE	PP	PES	CA	RC	
Pore size	Product code	Product code	Product code	Product code	Product code	Product code	Product code	Quantity
0.2 µm								150/pack
0.2 µm				-		-	-	1500/pack
0.45 µm								150/pack
0.45 µm								1500/pack

## GD/XP syringe filters (polypropylene prefilter), 25 mm diameter

Membrane type	Nylon	PVDF	PTFE	PP	PES	
Pore size	Product code	Product code	Product code	Product code	Product code	Quantity
0.45 µm						150/pack
0.45 µm			-			1500/pack

## Mini-UniPrep with polypropylene housing

Membrane type			PTFE	PVDF	Nylon	PP	RC	PES	
Pore size	Housing	Cap	Product code	Product code	Product code	Product code	Product code	Product code	Quantity
0.2 µm	Translucent	Standard							100/pack
0.45 µm	Translucent	Standard							100/pack
0.2 µm	Amber	Standard					-		100/pack
0.45 µm	Amber	Standard					-		100/pack
0.2 µm	Translucent	Slit septum					-		100/pack
0.45 µm	Translucent	Slit septum					-	-	100/pack

## Mini-UniPrep G2 with inner glass storage vial (hand or multicompressor required for use)

Membrane type			PTFE	PVDF	Nylon	PP	GMF	RC	
Pore size	Housing	Cap	Product code	Product code	Product code	Product code	Product code	Product code	Quantity
0.2 µm	Translucent	Standard					-		100 + 1 HC
0.2 µm	Translucent	Standard					-		100/pack
0.45 µm	Translucent	Standard					-		100 + 1 HC
0.45 µm	Translucent	Standard					-		100/pack
0.2 µm	Amber	Standard					-	-	100 + 1 HC
0.2 µm	Translucent	Slit septum		-			-	-	100 + 1 HC
0.45 µm	Translucent	Slit septum		-			-	-	100 + 1 HC
0.45 µm	Translucent	Slit septum	-	-			-	-	100/pack

HC = Hand compressor

## Compressors for Mini-UniPrep

Compressor suitable for	Description	Product code	Quantity
Mini-UniPrep G2 (glass vial)	Hand compressor - 1 position		1/pack
	Multi Compressor - 8 positions (includes 1 tray)		1/pack
Mini-UniPrep (plastic vial)	Multi Compressor - 6 positions		1/pack



# Whatman laboratory accessories

In addition to the filtration consumable range, we provide a comprehensive range of accessories for routine work in your laboratory.



1PS phase separator



Grade 105 lens cleaning tissue



Benchkote™ protection paper



pH paper



Vacu-Guard Pump protection filter

Description	Product name	Dimension	Quantity	Product code
<b>Phase separation paper</b>	1PS Phase separator paper	Diam. 125 mm	100/pack	
<ul style="list-style-type: none"> <li>Separatory funnel replacement: Automatic cut-off</li> <li>Ease of use: No special training required</li> </ul>		Diam. 150 mm	100/pack	
<b>Optical lens cleaning tissue</b>	Grade 105	100 × 150 mm	25 wallets of 25 sheets	
<ul style="list-style-type: none"> <li>Soft tissue for removing surface moisture and grease from lenses and other optical surfaces</li> </ul>		200 × 300 mm	100/pack	
<b>Benchkote bench protection papers</b>	Benchkote	460 × 570 mm	50/pack	
<ul style="list-style-type: none"> <li>High-quality, smooth, absorbent Whatman paper</li> <li>Quickly absorbs liquid spills and protect the working surface</li> <li>Benchkote Plus is thicker and more absorbent</li> </ul>		460 mm × 50 m	1/pack	
	Benchkote Plus	500 × 600 mm	50/pack	
		600 mm × 50 m	1/pack	
<b>pH indicator paper</b>	Color Bonded, 0.0 to 14.0 range	6 × 80 mm	100 strips, 1/pack	
<ul style="list-style-type: none"> <li>Range of pH indicator and test papers for rapid results</li> </ul>	Standard Full Range, Reel, 1.0 to 14.0 range	7 mm × 5 m	1/pack	
	Standard Narrow Range, Reel, 4.0 to 7.0 range	7 mm × 5 m	1/pack	
<b>Pump protection filters</b>	Vacu-Guard	50 mm	10/pack	
<ul style="list-style-type: none"> <li>Protects vacuum pump systems from aqueous aerosols. Hydrophobic PTFE membranes retain 99,99% of airborne particles &gt; 0.1 µm</li> </ul>				
<b>Filtration flask for batch filtration</b>	Whatman GV050/2 vacuum filtration unit	–	–	
<ul style="list-style-type: none"> <li>Consists of a 250 mL glass filtration funnel and 1000 mL flask, funnel base, top, and clamp</li> <li>Good choice for use with Whatman filtration membranes</li> </ul>				
<b>Pressure filtration apparatus</b>	MD142/5/3	142 mm	1	
<ul style="list-style-type: none"> <li>Stainless steel</li> <li>Infusion vessel 2200 mL</li> </ul>				
<b>Pressure filter holder</b>	MD142/7/3	142 mm	1	
<ul style="list-style-type: none"> <li>PTFE</li> <li>Infusion vessel 1500 mL</li> </ul>				
<b>In-line filtration degasser</b>	Inline Filtration Degasser (IFD)	–	–	
<p>Connects directly into an HPLC line to simultaneously filter and degas the mobile phase as it is being used</p> <ul style="list-style-type: none"> <li>Flexibility: available with either nylon or polypropylene membranes</li> <li>Polypropylene housing with security ring sealing</li> <li>No need for preliminary mobile phase separation</li> </ul>				
<b>3-piece filter funnel</b>	Filter funnel	47 mm	1	
<ul style="list-style-type: none"> <li>For quick and easy filtration</li> <li>Choice of 3 plates</li> </ul>	Filter funnel	90 mm	1	
	Filter funnel	70 mm	1	
<b>Membrane holder</b>	Vacuum-type glass membrane holder	47 mm	1	
<ul style="list-style-type: none"> <li>Produced from borosilicate glass</li> <li>Suitable for aqueous and organic solvent filtration</li> </ul>	Vacuum-type glass membrane holder	90 mm	1	
<b>Manual dispenser for membranes</b>	Membrane-Butler	–	1	

# Chemical compatibility of membranes and housings\*

Selecting the right filter depends on the solvent that you are using for your application. This table will help ensure that you get it right the first time.

Solvent	ANP	CA	CN	PC	PE	GMF	NYL	PP	DpPP	PES	PTFE <sup>†</sup>	PVDF	RC
Acetic acid, 5%	R	LR	R	R		R	R	R	R	R	R	R	R
Acetic acid, glacial	R	NR	NR			R	LR	R	R	R	R	R	NR
Acetone	R	NR	NR	NR	R	R	R	R	R	NR	R	NR	R
Acetonitrile	R	NR	NR			R	R	R	R	NR	R	R	R
Ammonia, 6 N	NR		NR	NR	LR	LR	R	R	R	R	R	LR	LR
Amyl acetate	LR	NR	NR	NR	R	R	R	R	R	LR	R	LR	R
Amyl alcohol	R	LR	LR			R	R	R	R	NR	R	R	R
Benzene <sup>†</sup>	R	R	R	NR	R	R	LR	NR	NR	R	R	R	R
Benzyl alcohol <sup>†</sup>	R	LR	LR	LR	R	R	LR	R	R	NR	R	R	R
Boric acid	R	R	R	R	R	R	LR	R	R		R	R	R
Butyl alcohol	R	R	R	R	R	R	R	R	R	R	R	R	R
Butyl chloride <sup>†</sup>						R	NR	NR	NR		R	R	
Carbon tetrachloride <sup>†</sup>	R	NR	R	LR	R	R	LR	NR	NR	NR	R	R	R
Chloroform <sup>†</sup>	R	NR	R	NR	R	R	NR	LR	LR	NR	R	R	R
Chlorobenzene <sup>†</sup>	R		LR	NR		R	NR	LR		NR	R	R	R
Citric acid						R	LR	R		R	R	R	R
Cresol		NR	R			R	NR	NR	NR	NR	R	NR	R
Cyclohexane	R	NR	NR	R	R	R	NR	NR	NR	NR	R	R	R
Cyclohexanone	R	NR	NR			R	NR	R	R	NR	R	R	R
Diethylacetamide		NR	NR			R	R	R	R		R	NR	R
Dimethylformamide	LR	NR	NR			R	R	R	R	NR	R	NR	LR
Dioxane	R	NR	NR	NR	R	R	R	R	R	LR	R	LR	R
DMSO	LR	NR	NR	NR	R	R	R	R	R	NR	R	LR	LR
Ethanol	R	R	NR	R	R	R	R	R	R	R	R	R	R
Ethers	R	LR	LR	R	R	R	R	NR	NR	R	R	LR	R
Ethyl acetate	R	NR	NR	NR	R	R	R	R	R	NR	R	NR	R
Ethylene glycol	R	LR	LR	R	R	R	R	R	R	R	R	R	R
Formaldehyde	LR	LR	R	R	R	R	R	LR	LR	R	R	R	LR
Freon TF	R	R	R	R	R	R	NR	NR	NR	R	R	R	
Formic acid		LR	LR			R	NR	R	R	R	R	R	LR
Hexane	R	R	R	R	R	R	R	R	R	R	R	R	R
Hydrochloric acid, conc.	NR	NR	NR	NR	NR	R	NR	LR	LR	R	R	R	NR
Hydrofluoric acid		NR	NR			NR	NR	LR	LR		R	R	NR

Solvent	ANP	CA	CN	PC	PE	GMF	NYL	PP	DpPP	PES	PTFE <sup>†</sup>	PVDF	RC
Isobutyl alcohol	R	LR	LR	R	R	R	R	R	R		R	R	R
Isopropyl alcohol	R	R	LR			R	R	R	R		R	R	R
Methanol	R	R	NR	R	R	R	R	R	R	R	R	R	R
Methyl ethyl ketone	R	LR	NR	NR	R	R	R	R	R	NR	R	NR	R
Methylene chloride <sup>†</sup>	R	NR	LR			R	NR	LR	LR	NR	R	R	R
Nitric acid, conc.		NR	NR	LR	NR	R	NR	NR	NR	NR	R	R	NR
Nitric acid, 6 N		LR	LR			R	NR	LR	LR	LR	R	R	LR
Nitrobenzene <sup>†</sup>	LR	NR	NR	NR	R	R	LR	R	R	NR	R	R	R
Pentane	R	R	R	R	R	R	R	NR	NR	R	R	R	R
Perchloroethylene	R	R	R			R	LR	NR	NR	NR	R	R	R
Phenol 0.5%	LR	LR	R			R	NR	R	R	NR	R	R	R
Pyridine	R	NR	NR	NR	R	R	LR	R	R	NR	R	NR	R
Sodium hydroxide, 6N	NR	NR	NR	NR	NR	NR	LR	R	R	R	R	NR	NR
Sulfuric acid, conc.	NR	NR	NR	NR	NR	R	NR	NR	NR	NR	R	NR	NR
Tetrahydrofuran	R	NR	NR			R	R	LR	LR	NR	R	R	R
Toluene <sup>†</sup>	R	LR	R	NR	R	R	LR	LR	LR	NR	R	R	R
Trichloroethane <sup>†</sup>	R	NR	LR	NR	R	R	LR	LR	LR	NR	R	R	R
Trichloroethylene <sup>†</sup>	R		R			R	NR	LR	LR	NR	R	R	R
Water	R	R	R	R	R	R	R	R	R	R	R	R	R
Xylene <sup>†</sup>	R	R	R			R	LR	LR	LR	LR	R	R	R
Xylene <sup>†</sup>	R	R	R			R	LR	LR	LR	LR	R	R	R

\* ANP = Anopore™; CA = Cellulose acetate; CN = Cellulose nitrate; DpPP = Polypropylene depth filter; GMF = Glass microfiber; NYL = Nylon; PC = Polycarbonate; PE = Polyester; PES = Polyethersulfone; PP = Polypropylene; PTFE = Polytetrafluoroethylene; PVDF = Polyvinylidene difluoride; RC = Regenerated cellulose R = Resistant; LR = Limited Resistance; NR = Not Recommended.

<sup>†</sup> Short Term Resistance of Housing.

<sup>‡</sup> Membrane may need pre-wetting with isopropanol/methanol if filtering a polar liquid.

The above data is to be used as a guide only. Testing prior to application is recommended.

The majority of products presented in this brochure are available from GE Healthcare's Life Sciences distributors.

A list of these distributors can be found at [gelifesciences.com/distributors](http://gelifesciences.com/distributors).



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GE Healthcare

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