

Filtration for soil testing

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01

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	Weighing boats Ordering information p. 8
Pesticide detection	Soxhlet extraction	Thimbles (cellulose) Ordering information p. 8
Trace elements	Spectrophotometry and chromatography	Syringe filters Ordering information p. 9
Phosphorus	Colorimetry	Cellulose filter papers Ordering information p. 8
pH	pH testing	Indicator papers Ordering information p. 8
Retained solids and clarified solution	Gravimetric analysis. Various quantitative and qualitative analytical techniques	Quantitative or qualitative cellulose filter papers Ordering information p. 8

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 µm 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.

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 9. Fluted and 1/4 folded paper are also available for use. For more information on relevant applications and grades, please visit: [cytiva.com/WhatmanFilterSelector](https://www.cytiva.com/WhatmanFilterSelector).



Extraction thimbles in Soxhlet extraction apparatus.



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.

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.



Whatman Grade 40 ashless filter paper.



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. Cytiva 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	10313032
Soxhlet extraction	Thimbles (cellulose)	25/pack	2800-105
Spectrophotometry and chromatography	Various syringe filters	N/A	See page 11
Colorimetry	Grade 5, 15 cm cellulose filter paper	100/pack	1005-150
pH testing	Indicator papers	100/pack	10362000
Sample clarification and solids retention	Quantitative cellulose paper grade 41, 15 cm*	100/pack	1441-150
	Qualitative cellulose paper grade 4, 40 cm*	100/pack	1004-400

* For a full list of cellulose paper grades please visit www.cytiva.com/whatman

HPLC, UHPLC, and other analytical techniques

What are you testing for?	Product	Characteristics and benefits	
Low solids content	Puradisc Ordering information p. 10 	• Wide range of membranes, pore sizes and diameters • Pre-filter: no • Diameter: 4, 13, 25, or 30 mm	• Available pore sizes: 0.1, 0.2, 0.45, 0.8, 1.0, 1.2, 5 µm • Membrane materials available: Cellulose acetate, nylon, PES, PVDF, PP, PTFE , GF
	SPARTAN™ Ordering information p. 10 	• HPLC certified • Pre-filter: no • Diameter: 13 or 30 mm	• Available pore sizes: 0.2 or 0.45 µm • Membrane materials available: Regenerated cellulose
Hard-to-filter samples	Whatman GD/X™ Ordering information p. 11 	• For hard-to-filter samples • Pre-filter: multilayer glass filter • Diameter: 13 or 25 mm	• Available pore sizes: 0.2, 0.45, 0.7, 1.0, 1.2, 1.5, 2.7, 5.0 µm • Membrane materials available: Cellulose acetate, nylon, PES, PVDF, PP, PTFE, RC
	GD/XP Ordering information p. 11 	• For hard-to-filter samples where analytes of interest are inorganic ions • Pre-filter: Multilayer polypropylene • Diameter: 25 mm	• Available pore sizes: 0.45 µm • Membrane materials available: Nylon, PES, PVDF, PP, PTFE
HPLC/GC autosamplers	Mini-UniPrep™ Ordering information p. 12 	• All-in-one filter and plastic autosampler vial • Pre-filter: no • Dimensions: Once compressed equivalent to 12 mm × 32 mm vial	• Available pore sizes: 0.2 or 0.45 µm • Membrane materials available: PTFE, RC, Nylon, PVDF, PES, PP, GMF
	Mini-UniPrep G2 Ordering information p. 12 	• All-in-one filter and glass autosampler vial • Pre-filter: no • Dimensions: Once compressed equivalent to 12 mm × 32 mm vial	• Available pore sizes: 0.2 or 0.45 µm • Membrane materials available: PTFE, Nylon, PVDF, PP, GMF, RC

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	6751-2502	6747-2502	6785-2502	6788-2502	6781-2502	200/pack	10462710	100/pack
0.2 µm	6753-2502	–	6798-2502	6790-2502	6794-2502	1000/pack	10462700	500/pack
0.45 µm	6751-2504	6747-2504	6785-2504	6788-2504	6781-2504	200/pack	10462610	100/pack
0.45 µm	6753-2504	6749-2504	6798-2504	6790-2504	6794-2504	1000/pack	10462600	500/pack

SPARTAN syringe filters

Diameter	13 mm		13 mm with mini-tip	30 mm	
Membrane	Pore size	Product code	Product code	Product code	Quantity
Regenerated cellulose	0.2 µm	10463100	10463040	10463060	100/pack
Regenerated cellulose	0.2 µm	10463102	10463042	10463062	500/pack
Regenerated cellulose	0.45 µm	10463110	10463030	10463050	100/pack
Regenerated cellulose	0.45 µm	10463112	10463032	10463052	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	6870-2502	6872-2502	6874-2502	6878-2502	6876-2502	6880-2502	6887-2502	150/pack
0.2 μm	6871-2502	6873-2502	6875-2502	–	6905-2502	–	–	1500/pack
0.45 μm	6870-2504	6872-2504	6874-2504	6878-2504	6876-2504	6880-2504	6882-2504	150/pack
0.45 μm	6871-2504	6873-2504	6875-2504	6879-2504	6905-2504	6881-2504	6883-2504	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	6970-2504	6972-2504	6974-2504	6978-2504	6994-2504	150/pack
0.45 μm	6971-2504	6973-2504	-	6993-2504	6995-2504	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	UN203NPEORG	UN203NPEAQU	UN203NPENYL	UN203NPEPP	UN203NPERC	UN203NPEPES	100/pack
0.45 µm	Translucent	Standard	UN203NPUORG	UN203NPUAQU	UN203NPUNYL	UN203NPUPP	UN203NPURC	UN203NPUPES	100/pack
0.2 µm	Amber	Standard	UN203APEORG	UN203APEAQU	UN203APENYL	UN203APEPP	–	UN203APEPES	100/pack
0.45 µm	Amber	Standard	UN203APUORG	UN203APUAQU	UN203APUNYL	UN203APUPP	–	UN203APUPES	100/pack
0.2 µm	Translucent	Slit septum	US203NPEORG	US203NPEAQU	US203NPENYL	US203NPEPP	–	US203NPEPES	100/pack
0.45 µm	Translucent	Slit septum	US203NPUORG	US203NPUAQU	US203NPUNYL	US203NPUPP	–	–	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	GN203NPEORGSP	GN203NPEAQUSP	GN203NPENYLSP	GN203NPEPPSP	–	GN203NPERCSP	100 + 1 HC
0.2 µm	Translucent	Standard	GN203NPEORG	GN203NPEAQU	–	GN203NPEPP	–	GN203NPERC	100/pack
0.45 µm	Translucent	Standard	GN203NPUORGSP	GN203NPUAQUSP	–	–	GN203NPUGMFSP	GN203NPURCSP	100 + 1 HC
0.45 µm	Translucent	Standard	GN203NPUORG	GN203NPUAQU	–	–	GN203NPUGMF	GN203NPURC	100/pack
0.2 µm	Amber	Standard	GN203APEORGSP	GN203APEAQUSP	–	–	–	–	100 + 1 HC
0.2 µm	Translucent	Slit septum	GS203NPEORGSP	–	–	–	–	–	100 + 1 HC
0.45 µm	Translucent	Slit septum	GS203NPUORGSP	–	–	–	GS203NPUGMFSP	–	100 + 1 HC
0.45 µm	Translucent	Slit septum	–	–	–	–	GS203NPUGMF	–	100/pack

HC = Hand compressor

Filtration for soil testing

Compressors for Mini-UniPrep

Compressor suitable for	Description	Product code	Quantity
Mini-UniPrep G2 (glass vial)	Hand compressor - 1 position	MUPG2PWC1	1/pack
	Multi Compressor - 8 positions (includes 1 tray)	MUPG2MCPWC8	1/pack
Mini-UniPrep (plastic vial)	Multi Compressor - 6 positions	CR0000006	1/pack

02

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



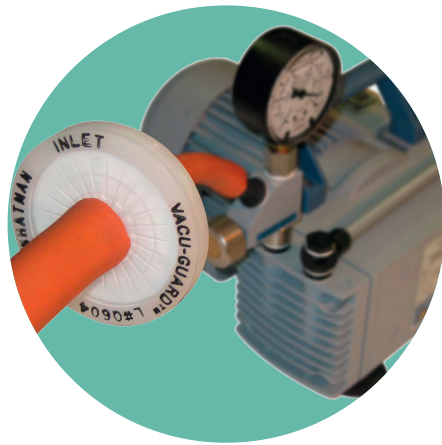
Grade 105 lens cleaning tissue



Benchkote™ protection paper



pH paper



Vacu-Guard Pump protection filter

Description	Product name	Dimension	Quantity	Product code
Phase separation paper • Separatory funnel replacement: Automatic cut-off • Ease of use: No special training required	1PS Phase separator paper	Diam. 125 mm	100/pack	2200-125
		Diam. 150 mm	100/pack	2200-150
Optical lens cleaning tissue • Soft tissue for removing surface moisture and grease from lenses and other optical surfaces	Grade 105	100 × 150 mm	25 wallets of 25 sheets	2105-841
		200 × 300 mm	100/pack	2105-862
Benchkote bench protection papers • High-quality, smooth, absorbent Whatman paper • Quickly absorbs liquid spills and protects the working surface • Benchkote Plus is thicker and more absorbent	Benchkote	460 × 570 mm	50/pack	2300-916
		460 mm × 50 m	1/pack	2300-731
	Benchkote Plus	500 × 600 mm	50/pack	2301-6150
		600 mm × 50 m	1/pack	2301-6160
pH indicator paper • Range of pH indicator and test papers for rapid results	Color Bonded, 0.0 to 14.0 range	6 × 80 mm	100 strips, 1/pack	2613-991
	Standard Full Range, Reel, 1.0 to 14.0 range	7 mm × 5 m	1/pack	2600-100A
	Standard Narrow Range, Reel, 4.0 to 7.0 range	7 mm × 5 m	1/pack	2600-102A
Pump protection filters • Protects vacuum pump systems from aqueous aerosols. Hydrophobic PTFE membranes retain 99.99% of airborne particles > 0.1 µm.	Vacu-Guard	50 mm	10/pack	6722-5000

Description	Product name	Dimension	Quantity	Product code
Filtration flask for batch filtration - Consists of a 250 mL glass filtration funnel and 1000 mL flask, funnel base, top, and clamp - Good choice for use with Whatman filtration membranes	Whatman GV050/2 vacuum filtration unit	–	–	10442200
Pressure filtration apparatus - Stainless steel - Infusion vessel 2200 mL	MD142/5/3	142 mm	1	10451610
Pressure filter holder - PTFE - Infusion vessel 1500 mL	MD142/7/3	142 mm	1	10451710
In-line filtration degasser Connects directly into an HPLC line to simultaneously filter and degas the mobile phase as it is being used - Flexibility: available with either nylon or polypropylene membranes - Polypropylene housing with security ring sealing - No need for preliminary mobile phase separation	Inline Filtration Degasser (IFD)	–	–	
3-piece filter funnel - For quick and easy filtration - Choice of 3 plates	Filter funnel	47 mm	1	1950-004
	Filter funnel	90 mm	1	1950-009
	Filter funnel	70 mm	1	1950-017
Membrane holder - Produced from borosilicate glass - Suitable for aqueous and organic solvent filtration	Vacuum-type glass membrane holder	47 mm	1	1960-004
	Vacuum-type glass membrane holder	90 mm	1	1960-009
Manual dispenser for membranes	Membrane-Butler	–	1	10477103

03

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 [‡]	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 [†]	R	R	R	NR	R	R	LR	NR	NR	R	R	R	R
Benzyl alcohol [†]	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 [†]						R	NR	NR	NR		R	R	
Carbon tetrachloride [†]	R	NR	R	LR	R	R	LR	NR	NR	NR	R	R	R
Chloroform [†]	R	NR	R	NR	R	R	NR	LR	LR	NR	R	R	R
Chlorobenzene [†]	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

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.

[†] Short Term Resistance of Housing.

[‡] 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.

Solvent	ANP	CA	CN	PC	PE	GMF	NYL	PP	DpPP	PES	PTFE [‡]	PVDF	RC
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
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 [†]	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

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Solvent	ANP	CA	CN	PC	PE	GMF	NYL	PP	DpPP	PES	PTFE [‡]	PVDF	RC
Nitric acid, 6 N		LR	LR			R	NR	LR	LR	LR	R	R	LR
Nitrobenzene [†]	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	Rw	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 [†]	R	LR	R	NR	R	R	LR	LR	LR	NR	R	R	R
Trichloroethane [†]	R	NR	LR	NR	R	R	LR	LR	LR	NR	R	R	R
Trichloroethylene [†]	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 [†]	R	R	R			R	LR	LR	LR	LR	R	R	R
Xylene [†]	R	R	R			R	LR	LR	LR	LR	R	R	R

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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 Cytiva distributors.
A list of these distributors can be found at [cytiva.com/distributors](https://www.cytiva.com/distributors).

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