

MACHEREY-NAGEL

# Per- and polyfluoroalkyl substances

Chromatography



## Solutions for PFAS analysis

- SPE columns and QuEChERS mixes
- HPLC columns
- Vials and caps

**MACHEREY-NAGEL**

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# Solutions for PFAS analysis

More than 4730 compounds belong to the group of PFAS (which stands for per- and polyfluoroalkyl substances), which have been produced since the 1940 s. Since these compounds do not originate in nature, global pollution is the result of human activities. PFAS are “forever chemicals”, chemicals that are very persistent in the environment and in the human body. For reliable PFAS analysis, we have developed products that are ideally suited for sample preparation, sample integrity and determination of these harmful substances by HPLC.



## The special phase for sample preparation – CHROMABOND® PFAS

CHROMABOND® PFAS is a polymer-based combination phase which contains a weak anion exchange functionality. The combination of different SPE phases makes it possible to use various interactions (dipole-dipole, ionic, hydrophobic, H-bond).



SPE column, CHROMABOND® PFAS

### CHROMABOND® PFAS provides several advantages

- Solution for various PFAS substances classes
- > 40 PFAS can be enriched
- Sorbent retention mechanisms according to DIN 38407-42, EPA 533 and FprEN 17892:2024 guidelines
- High capacity
- High recovery rates

## Ideal for PFAS enrichment – CHROMABOND® WAX

CHROMABOND® WAX was specially developed for the enrichment of short-chain PFAS from water, soil and sediments. Its properties e.g. high ion exchange capacity and very low blank value levels make this polymeric anion exchanger ideal for use in many official methods e.g. EPA 533 and 1633 as well as ISO 21675:2019, FprEN 17892:2024 or EURL POP.



SPE column, CHROMABOND® WAX

### Extensive certificate of analysis

- PFAS blank value levels
- Recovery rates for selected analytes
- Physicochemical data
- Sorbent elution test

## PFAS blank value test

(batch-based testing on the assembled cartridge)

Acceptance limits	Analytes (CAS#)
1 ng/L	PFMPA (377-73-1), PFBA (375-22-4), PFMBA (863090-89-5), PFPeA (2706-90-3), PFEESA (113507-82-7), PFBS (375-73-5), PFHxA (307-24-4), PFPeS (2706-91-4), PFHpA (375-85-9), PFHxS (355-46-4), ADONA (919005-14-4), PFHpS (375-92-8), PFOA (335-67-1), PFOS (1763-23-1), PFNA (375-95-19), 9Cl-PF3ONS (73606-19-6), PFNS (68259-12-1), PFDA (335-76-2), FOSA (754-91-6), PFDS (335-77-3), PFUnDA (2058-94-8), 11Cl-PF3OUdS (763051-92-9), PFDoDA (307-55-1), PFTrDA (72629-94-8), PFDoS (79780-39-5), NMeFOSE (24448-09-7), PFTeDA (376-06-7), NEtFOSE (1961-99-2)
2 ng/L	NFDHA (151772-58-6), HFPO-DA (13252-13-6)
10 ng/L	3:3FTCA (356-02-5), 4:2FTS (757124-72-4), 5:3FTCA (914637-49-3), 6:2FTS (27619-97-2), 7:3FTCA (812-70-4), 8:2FTS (39108-34-4), N-MeFOSAA (2355-31-9), N-EtFOSAA (2991-50-6), N-MeFOSA (31506-32-8), N-EtFOSA (4151-50-2)

Table 1: Selected PFAS analytes and their acceptance limits in quality control.

# Solutions for PFAS analysis

## The special HPLC columns: NUCLEODUR® PFAS and NUCLEODUR® PFAS Delay

NUCLEODUR® PFAS HPLC columns are a perfect choice for analyzing PFAS substances. These columns show a high batch-to-batch reproducibility, are specially batch tested for PFAS analyses and are very well suited for LC-MS due to a low bleeding characteristics.

The NUCLEODUR® PFAS Delay column provide high retention for PFAS compounds and are used to retain PFAS contaminants from the HPLC system, which could otherwise falsify the sample to be analyzed. For this purpose, the NUCLEODUR® PFAS Delay column is connected in flow direction between the mixing vessel and the sample injector.



NUCLEODUR® PFAS analytical HPLC column

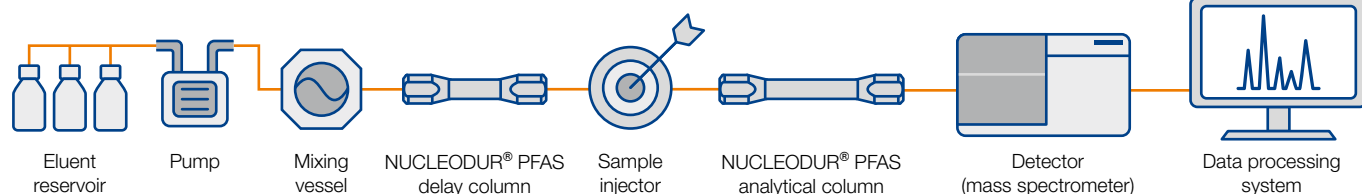
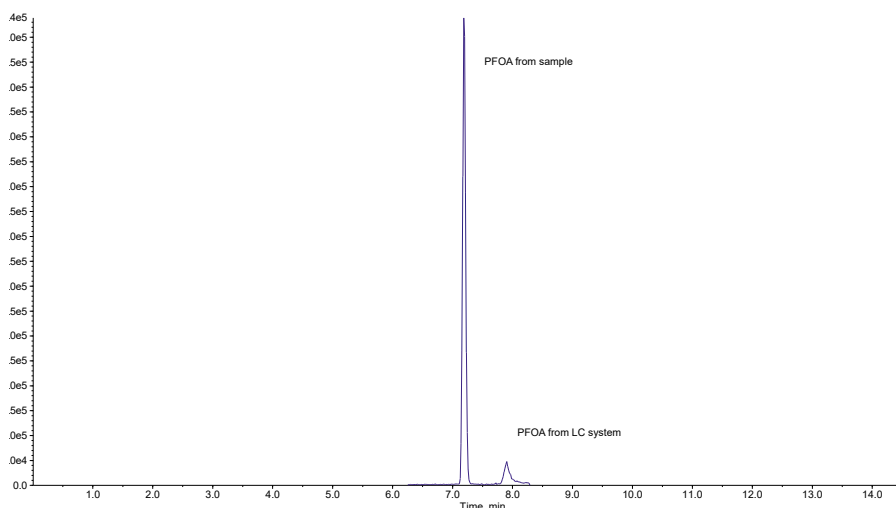


Illustration of installation and usage of NUCLEODUR® PFAS Delay column



### Good to know

The prevalence of PFOA is commonly observed as an instrument materials contaminant.

The following figure shows the benefits of using a delay column 50 × 2 mm NUCLEODUR® PFAS Delay in combination with a 100 × 2 mm NUCLEODUR® PFAS analytical column.

## Product selection according to several official guidelines

Type	Product	EPA 533	EPA 537.1	EPA 1633
■ SPE column	CHROMABOND® PFAS	✓		
■ SPE column	CHROMABOND® WAX	✓		✓
■ SPE column	CHROMABOND® HR-XAW	✓		✓
■ SPE column	CHROMABOND® HR-X		✓	
■ dSPE centrifuge tubes	QuEChERS Mix XII			
■ dSPE centrifuge tubes	QuEChERS Mix L			
■ dSPE centrifuge tubes	QuEChERS Mix XX			
■ dSPE centrifuge tubes	QuEChERS Mix LVII			
■ Delay column	NUCLEODUR® PFAS Delay	✓	✓	✓
■ HPLC column	NUCLEODUR® PFAS, 3 µm	✓	✓	✓
■ Vials and caps	N 9 screw neck vial, PP transparent	✓	✓	✓
■ Vials and caps	N 9 screw neck vial, PP amber	✓	✓	✓
■ Vials and caps	N 11 snap ring/crimp neck vial, PP transparent	✓	✓	✓
■ Vials and caps	N 11 snap ring/crimp neck vial, PP amber	✓	✓	✓
■ Vials and caps	N 9 screw closure, PP, blue, silicone white / polyimide orange	✓	✓	✓
■ Vials and caps	N 9 screw closure, PP, blue, silicone white / polyimide orange, slit	✓	✓	✓
■ Vials and caps	N 9 screw closure, PP, blue, silicone white / polypropylene colorless	✓	✓	✓
■ Vials and caps	N 11 snap ring closure, PE (soft), light blue, silicone white / polyimide orange	✓	✓	✓



# Solutions for PFAS analysis

## SPE product solutions – CHROMABOND® HR-X and HR-XAW

According to DIN 38407-42, EPA 537.1 and 533 guidelines, MACHEREY-NAGEL also offers further SPE product solutions for the enrichment of PFAS:

- CHROMABOND® HR-X: hydrophobic PS/DVB copolymer
- CHROMABOND® HR-XAW: weak mixed mode anion exchanger (WAX) PS/DVB copolymer

These allow outstanding recovery rates and high reproducibility.

## PFAS in food using QuEChERS extraction and clean-up method

QuEChERS ("Quick, Easy, Cheap, Effective, Rugged and Safe") sample preparation products from MACHEREY-NAGEL ensure a time efficient and simple extraction of PFAS from food and a subsequent solid phase extraction for further sample clean-up according to procedure C-010.02 developed by the US Food and Drug Administration (FDA) for the measurement of 16 PFAS in food.



dSPE columns, CHROMABOND® QuEChERS Mix XII, 15 mL centrifuge tubes, CHROMABOND® QuEChERS Mix XX, 2 mL centrifuge tubes

### Good to know

There are CHROMABOND® QuEChERS mixes available that are especially suitable for sample preparation of PFAS in:

- Dairy products
- Bread
- Lettuce
- Fish

## Plastic vials and fluorine-free closures for PFAS analysis

When you are doing PFAS analysis, it is crucial to select the right vials and closures for this application. Adsorption effects of glass as well as possible contaminations of the sample by particles from the septa, especially from the PTFE lamination, may put your analysis results at risk.

MACHEREY-NAGEL offers polypropylene screw neck vials N 9 and snap ring vials N 11 as well as appropriate closures with a silicone/polyimide and silicone/polypropylene septa respectively, that – in contrast to PTFE laminated liners – are fluorine-free.

### Get more details

If you want to learn more, read the detailed [PFAS test report](#) showing the performance of different MN vials and fluorine-free closures in PFAS analysis.



Polypropylene vials and fluorine-free closures for PFAS analysis

# Solutions for PFAS analysis

## Ordering information

Product description	REF	Pack of
<b>SPE columns and dSPE centrifuge tubes</b>		
■ CHROMABOND® PFAS, 85 µm, 6 mL/300 mg	730283	30
■ CHROMABOND® PFAS, 3 mL/120 mg	7300009	30
■ CHROMABOND® WAX, 30 µm, 6 mL/150 mg	7300011	30
■ CHROMABOND® WAX, 30 µm, 6 mL/500 mg	7300012	30
■ CHROMABOND® WAX, 30 µm, 3 mL/60 mg	7300014	30
■ CHROMABOND® WAX, 30 µm, 3 mL/200 mg	7300015	30
■ CHROMABOND® HR-XAW, 85 µm, 6 mL/500 mg	730745	30
■ CHROMABOND® HR-XAW, 85 µm, 3 mL/60 mg	730747	30
■ CHROMABOND® HR-X, 45 µm, 3 mL/200 mg	730931P45	30
■ CHROMABOND® HR-X, 85 µm, 6 mL/500 mg	730939	30
■ CHROMABOND® QuEChERS Mix XII, extraction mix consisting of: 4000 mg MgSO <sub>4</sub> , 1000 mg NaCl, individually weighed and filled into 15 mL centrifuge tubes (PP) with screw cap (PE)	730648	50
■ CHROMABOND® QuEChERS Mix L Diamino/Carbon clean-up mix consisting of: 900 mg MgSO <sub>4</sub> , 300 mg CHROMABOND® Diamino, 150 mg CHROMABOND® Carbon, individually weighed and filled into 15 mL centrifuge tubes (PP) with screw cap (PE)	7300008	50
■ CHROMABOND® QuEChERS Mix XX Diamino clean-up mix (acc. to AOAC) consisting of: 150 mg MgSO <sub>4</sub> , 50 mg CHROMABOND® Diamino individually weighed and filled into 2 mL centrifuge tubes (PP) with snap cap (PP)	730670.2	50
■ CHROMABOND® QuEChERS Mix LVII Diamino/Carbon clean-up mix consisting of: 2000 mg MgSO <sub>4</sub> , 500 mg NaCl, 100 mg CHROMABOND® C18 ec, 100 mg CHROMABOND® Carbon individually weighed and filled into 15 mL centrifuge tubes (PP) with screw cap (PE)	7300026	50
<b>HPLC columns</b>		
■ EC 100/2 NUCLEODUR® PFAS, 3 µm	760666.20	1
■ EC 50/2 NUCLEODUR® PFAS, 3 µm	760663.20	1
■ EC 50/2 NUCLEODUR® PFAS Delay, 5 µm	760673.20	1
<b>Vials and caps</b>		
■ 0.3 mL N 9 screw neck vial, PP transparent, 11.6 × 32.0 mm, inner cone	702009	100
■ 0.7 mL N 9 screw neck vial, PP transparent, 11.6 × 32.0 mm, round bottom insert	702010	100
■ 1.5 mL N 9 screw neck vial, PP transparent, 11.6 × 32.0 mm, flat bottom	702500	100
■ 0.3 mL N 9 screw neck vial, PP amber, 11.6 × 32.0 mm inner cone	702172	100
■ 0.3 mL N 11 snap ring/crimp neck vial PP transparent, 11.6 × 32.0 mm inner cone	702809	100
■ 0.7 mL N 11 snap ring/crimp neck vial, PP transparent, 11.6 × 32.0 mm round bottom insert	702174	100
■ 0.3 mL N 11 snap ring/crimp neck vial, PP amber, 11.6 × 32.0 mm inner cone	702173	100
■ N 9 screw closure, PP, blue, center hole, silicone white/polyimide orange, 1.0 mm	702402	100
■ N 9 screw closure, PP, blue, silicone white/polypropylene colorless	702406	100
■ N 9 screw closure, PP, blue, center hole, silicone white/polyimide orange, slit, 1.0 mm	702405	100
■ N 11 snap ring closure, PE (soft), light blue, center hole, silicone white/polyimide orange, 1.0 mm	702403	100
■ 0.1 mL N 9 N 10 N 11 micro-insert, 5.7 × 29.0 mm, 0.1 mL, conical, PP, spring	702819	100

### Registered trademarks

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 CHROMABOND® MACHERY-NAGEL GmbH & Co. KG (Germany)



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