

# PREPARED FOR PFAS TESTING

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## Sigma-Aldrich®

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The Sigma-Aldrich® portfolio of Merck offers a strong and ever-expanding offering of lab and production materials. Through our technical support and scientific partnerships, we help connect our customers with a whole world of progress.

## Contents

|   |    |
|---|----|
| Introduction .....  | 4  |
| Products across the workflow .....  | 6  |
| PFAS Compounds by Method .....  | 12 |
| Products by Promulgated Methods .....   | 18 |
| Chemicals and Columns by Method .....   | 18 |
| Equipment & Sample Prep by Method .....   | 22 |
| Containers by Method .....  | 26 |
| Notable Products for PFAS Testing .....   | 30 |
| Filters .....   | 30 |
| Sample Preparation Products.....  | 31 |
| Columns.....  | 32 |
| Solvents.....   | 33 |
| Water Purification Systems .....  | 34 |
| Reference Materials .....   | 35 |
| Application Notes .....   | 36 |
| Ascentis® Express PFAS HPLC Columns LC-MS Analysis of PFAS Compounds in EPA Methods 537.1, 533 and 8327 ..... | 36 |
| Ascentis® Express PFAS HPLC Columns LC-MS Analysis of 33 PFAS Compounds in 5 minutes.....                     | 40 |
| LC-MS/MS Analysis of PFAS Extractables in Polyethersulfone (PES) Syringe Filters Using EPA 537.1 .....        | 42 |

# Introduction

Per- and polyfluoroalkyl substances (PFAS) have been in use since the 1940's. Consisting of over 4700 different compounds, PFAS substances are used in almost every facet of modern life.



The utility of these compounds resulted in rapid adoption; and PFAS compounds can now be found in food packaging, cookware, cosmetics, stain repellants, firefighting foams, and are commonly used in many manufacturing processes. While incredibly useful, these compounds also carry a risk to health that we have only recently started to understand clearly.

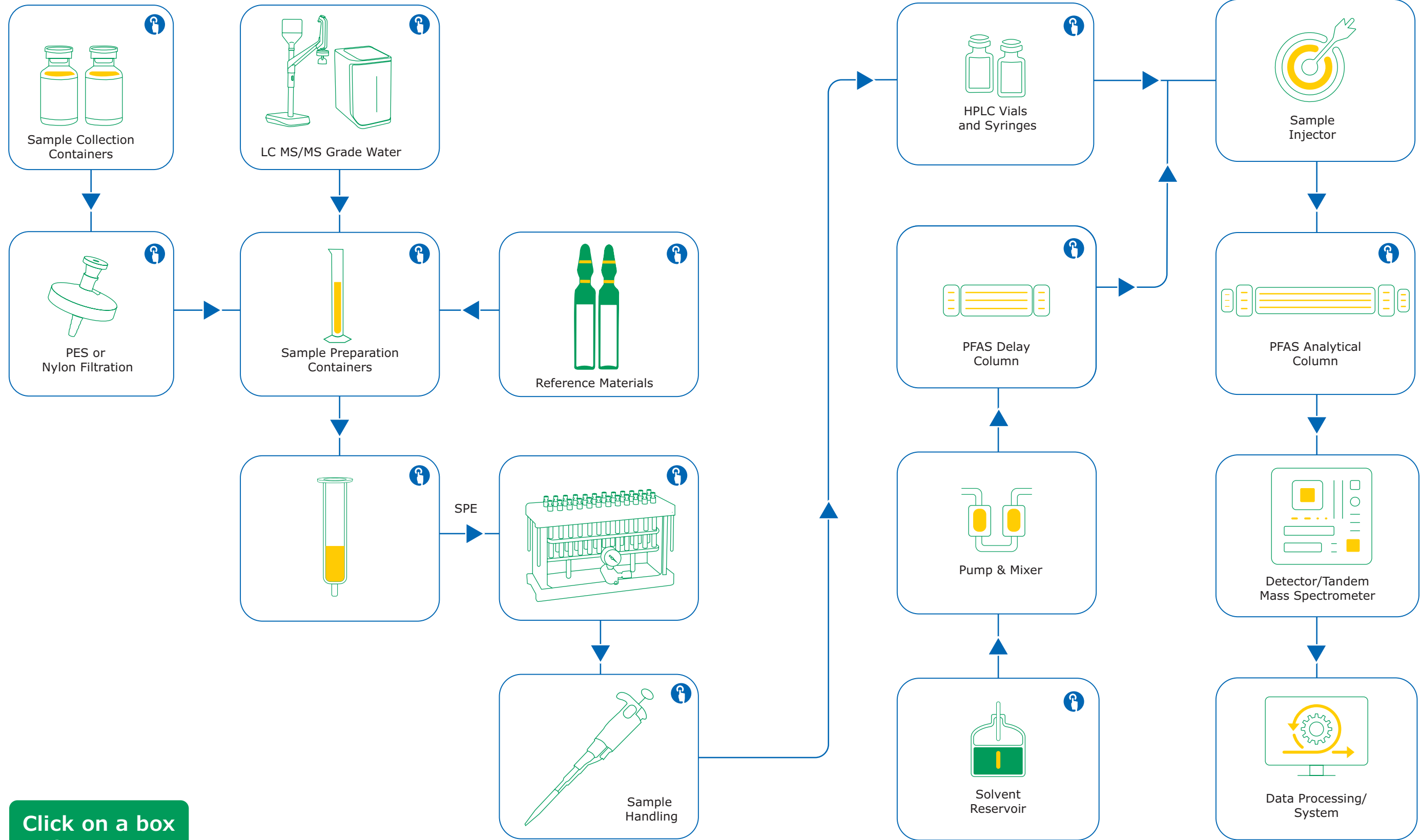
PFAS compounds are also commonly known as “forever chemicals” which means they do not break down in the environment like other chemicals. This persistence can result in the concentration of these compounds growing to levels that are unsafe for human exposure and negative health effects such as: low infant birth weights, effects on the immune system, cancer, and thyroid hormone disruption.

As part of our commitment to making a positive difference by supporting the scientific community with our products; we have focused on the need to deliver quality products, and tools that can be used to more accurately quantify PFAS compounds. Our solutions empower researchers trying to better understanding the effects of PFAS, as well as regulators and labs focused on providing ongoing exposure testing services.

This brochure is intended to provide a comprehensive list of the products that are commonly used in PFAS analysis. This includes analysis of environmental samples such as water and soil, food and beverage samples as well as serum samples. Wherever PFAS compounds can be found, we are committed to helping scientists accurately quantify these compounds to advance our knowledge and understanding of their impact on society.



# Products across the workflow



Click on a box to learn more



## Products by Method



### Chemicals & Columns



### Sample Prep and Lab Equipment



### Containers



The product categories above list ALL the products for the following methods:

- ASTM 7968
- ASTM 7979
- CDC 6304.09
- CEN TS 15968
- EPA 533
- EPA 537.1
- EPA 8327
- EPA 1633
- FDA C-010.01
- ISO 21675
- ISO 25101

### Products for PFAS Analysis by Method

## Have You Considered a Pricing Agreement with us?

Whether you are a researcher trying to develop new methods for the analysis of PFAS compounds or a contract testing lab performing thousands of tests a day; we are here to support you with quality products that ensure you achieve the best precision and accuracy possible.

In addition to delivering products of the highest quality, we also want to make sure the delivery of those products happens on time so that you don't have to worry about down time in your lab(s). The best way to avoid down time is by setting up a pricing agreement with your account manager.

**Pricing Agreements provide the following benefits:**

1. Better pricing across all products
2. Flexible delivery options for scheduled orders
3. Confidence in your supply chain
4. Online ordering profile(s) that automatically import your pricing; which simplifies placing orders.
5. Potential discounts on shipping



To set up a pricing agreement, please contact your account manager and they will work with you to get it in place.



## Are you working on a unique application not covered by the promulgated methods covered in this brochure?

Are you struggling with a difficult extraction, poor peak separation, or poor recovery?







We can help!

Our global team of experts is happy to work with you across the entire workflow of PFAS analysis. We are set up to help with both new method development as well as troubleshooting existing methods.



If a product is not available in your country, please contact customer service or your account manager to find a suitable replacement.

## Our product specific specialists can help with:

-  Membrane Filtration
-  Sample Preparation
-  Analytical U/HPLC and Delay Columns
-  Solvents
-  Water Purification Systems
-  Reference Materials

## For help with general issues we can connect you with our:

- Applications Lab
- Analytical Technology Specialists

To connect with one of our expert team members about your application, please contact us at [SigmaAldrich.com/pfas-contact](https://SigmaAldrich.com/pfas-contact) or contact your local account manager.

# PFAS Compounds by Method



Do you have a particular PFAS compound of interest but are not sure what method you should be using for the analysis?

The table below can help point you toward which of the promulgated methods have been validated for the named compounds. For any compound not included in this table,

please contact our experts at [SigmaAldrich.com/pfas-contact](https://www.sigmaaldrich.com/pfas-contact) and we can help you either adapt an existing method or develop a new method for your analysis.

| Cat. No        | Compound Name   | Abbreviation      | CASRN       | EPA 533 | EPA 537.1 | EPA 8327 | EPA 1633 | OTM 45 | ASTM D7968 | ASTM D7979 | ISO 21675 | ISO 25101 | CEN-TS-15968 | CDC 6304.09 | FDA-010.01 | DIN 38414-14 | DIN 38407-42 | DIN 23702-1 | DIN 17681-1 (Draft) | DIN 17681-2 (Draft) |
|----------------|---|-------------------|-------------|---------|-----------|----------|----------|--------|------------|------------|-----------|-----------|--------------|-------------|------------|--------------|--------------|-------------|---------------------|---------------------|
| 43809          | Perfluorohexanoic acid  | PFHxA             | 307-24-4    | x       | x         | x        | x        | x      | x          | x          | x         |           |              |             | x          | x            | x            | x           | x                   | x                   |
| 43929          | Perfluorodecanoic acid  | PFDA              | 335-76-2    | x       | x         | x        | x        | x      | x          | x          | x         |           |              |             | x          | x            | x            | x           | x                   | x                   |
| 43996          | Perfluoroheptanoic acid   | PFHpA             | 375-85-9    | x       | x         | x        | x        | x      | x          | x          | x         |           |              |             | x          | x            | x            | x           |                     |                     |
| 68542          | Perfluoropentanoic acid   | PFPeA             | 2706-90-3   | x       |           | x        | x        | x      | x          | x          | x         |           |              |             | x          | x            | x            | x           |                     |                     |
| 68706          | Pentacosfluorotridecanoic acid  |                   | 72629-94-8  |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| 68808          | Perfluorobutanoic acid  | PFBA              | 375-22-4    | x       |           | x        | x        | x      | x          | x          | x         |           |              |             | x          | x            | x            | x           |                     |                     |
| 80312          | Perfluorotetradecanoic acid   | PFTA              | 376-06-7    |         | x         |          | x        | x      |            |            | x         |           |              |             |            |              |              | x           | x                   | x                   |
| 80444          | Perfluoroundecanoic acid  | PFUnA             | 2058-94-8   | x       | x         | x        | x        | x      | x          | x          | x         |           |              | x           |            |              |              | x           | x                   | x                   |
| 89374          | Potassium heptadecafluoro-1-octanesulfonate                             |                   | 2795-39-3   |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| 91977          | Perfluorononanoic acid  | PFNA              | 375-95-1    | x       | x         | x        | x        | x      | x          | x          | x         |           |              | x           | x          | x            | x            | x           | x                   | x                   |
| 92291          | Perfluorododecanoic acid  | PFDoA             | 307-55-1    | x       | x         | x        | x        | x      | x          | x          | x         |           |              | x           |            |              |              | x           | x                   | x                   |
| 33607          | Perfluorooctanesulfonic acid  | PFOS              | 1763-23-1   | x       | x         | x        | x        | x      | x          | x          | x         | x         | x            |             | x          | x            | x            | x           | x                   | x                   |
| 33824 & 33603  | Perfluorooctanoic acid  | PFOA              | 335-67-1    | x       | x         | x        | x        | x      | x          | x          | x         | x         |              |             | x          | x            | x            | x           | x                   | x                   |
| Coming H2 2022 | Hexafluoropropylene oxide dimer acid                                    | HFPO-DA           | 13252-13-6  | x       | x         |          | x        | x      |            |            | x         |           |              |             |            |              |              |             | x                   | x                   |
| Coming H2 2022 | Perfluoro-n-octadecanoic acid   | PFocDA            | 16517-11-6  |         |           |          |          |        |            |            | x         |           |              |             |            |              |              |             |                     |                     |
| Coming H2 2022 | 1H, 1H, 2H, 2H-perfluorohexane sulfonic acid                            | 4:2 FTS           | 757124-72-4 | x       |           | x        | x        | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |
| Coming H2 2022 | 1H,1H, 2H, 2H-Perfluorodecane sulfonic acid                             | 8:2FTS            | 39108-34-4  | x       |           |          | x        |        |            |            |           |           |              |             |            |              |              |             |                     |                     |
| Coming H2 2022 | 2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy) propanoic acid | HFPO-DA           | 62037-80-3  |         |           |          |          |        |            |            |           |           |              |             | x          |              |              |             | x                   | x                   |
| Coming H2 2022 | N-Ethyl-heptafluorooctane sulphonamidoethanol                           | N-Et-FOSE alcohol | 1691-99-2   |         |           |          | x        | x      |            |            |           |           | x            |             |            |              |              |             | x                   | x                   |
| Coming H2 2022 | Nonafluoro-3,6-dioxahexanoic acid                                       | NFDHA             | 151772-58-6 | x       |           |          | x        | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |
| Coming H2 2022 | Perfluoro(2-ethoxyethane)sulfonic acid                                  | PFEESA            | 113507-82-7 | x       |           |          | x        | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |

## PFAS Compounds by Method (continued)



| Cat. No     | Compound Name  | Abbreviation | CASRN       | EPA 533 | EPA 537.1 | EPA 8327 | EPA 1633 | OTM 45 | ASTM D7968 | ASTM D7979 | ISO 21675 | ISO 25101 | CEN-TS-15968 | CDC 6304.09 | FDA-010.01 | DIN 38414-14 | DIN 38407-42 | DIN 23702-1 | DIN 17681-1 (Draft) | DIN 17681-2 (Draft) |
|-------------|--|--------------|-------------|---------|-----------|----------|----------|--------|------------|------------|-----------|-----------|--------------|-------------|------------|--------------|--------------|-------------|---------------------|---------------------|
| Coming 2023 | 8:2 Polyfluoroalkyl phosphate diester                            | 8:2 diPAP    | 678-41-1    |         |           |          |          |        |            |            | x         |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | 8:2 Fluorotelomer unsaturated carboxylic acid                    | 8:2 FTUCA    | 70887-84-2  |         |           |          |          | x      |            |            | x         |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | N-ethylperfluorooctanesulfo-namide                               | N-EtFOSA     | 4151-50-2   |         |           |          | x        | x      |            |            | x         |           | x            |             |            |              |              |             | x                   | x                   |
| Coming 2023 | Perfluoro-1-decanesulfonic acid                                  | PFDS         | 335-77-3    |         |           | x        | x        | x      |            |            | x         |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | 2-perfluorodecyl ethanoic acid                                   | FDEA         | 53826-13-4  |         |           |          |          |        | x          | x          | x         |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | Perfluoro-3-methoxypropanoic acid                                | PFMPA        | 377-73-1    | x       |           |          | x        | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | Perfluoro-1-nonanesulfonic acid                                  | PFNS         | 68259-12-1  |         |           | x        | x        | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | Perfluoro-4-methoxybutanoic acid                                 | PFMBA        | 863090-89-5 |         |           |          | x        | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | 3-Perfluoroheptyl propanoic acid                                 | 7:3FTCA      | 812-70-4    |         |           |          | x        | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | Perfluoropentadecanoic acid                                      |              | 141074-63-7 |         |           |          |          |        | x          | x          |           |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | Decafluoro-4-(pentafluoroethyl) cyclohexane sulfonic acid-K salt | PFechS-K     | 335-24-0    |         |           |          |          |        | x          | x          |           |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | 2-Perfluorooctyl ethanoic acid                                   | FOEA         | 27854-31-5  |         |           |          |          |        | x          | x          |           |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | 2H-Perfluoro-2-octenoic acid                                     | FHUEA        | 2321-3-19   |         |           |          |          |        | x          | x          |           |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | Potassium nonafluoro-1-butanefulfonate                           | PFBS-K       | 29420-49-3  |         |           |          |          |        | x          | x          |           |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | Potassium tridecafluorohexanesulfonate                           | PFHxS-K      | 3871-99-6   |         |           |          |          |        | x          | x          |           |           |              |             |            |              |              |             |                     |                     |
| Coming 2023 | Decafluoro-4-(pentafluoroethyl) cyclohexane sulfonate            | PFechS-K     | 67584-42-3  |         |           |          |          |        | x          | x          |           |           |              |             |            |              |              |             |                     |                     |
| N/A         | Perfluorobutanesulfonic acid                                     | PFBS         | 375-73-5    | x       | x         | x        | x        | x      | x          | x          | x         |           |              |             | x          | x            | x            | x           | x                   | x                   |
| N/A         | Perfluorohexanesulfonic acid                                     | PFHxS        | 355-46-4    | x       | x         | x        | x        | x      | x          | x          | x         |           |              | x           | x          | x            | x            | x           | x                   | x                   |
| N/A         | 1H, 1H, 2H, 2H-perfluorooctane sulfonic acid                     | 6:2 FTS      | 27619-97-2  | x       |           | x        | x        | x      |            |            | x         |           |              |             |            |              |              |             |                     |                     |
| N/A         | 1H, 1H, 2H, 2H-perfluorodecane sulfonic acid                     | 8:2 FTS      | 39108-34-4  |         |           | x        |          | x      |            |            | x         |           |              |             |            |              |              |             | x                   | x                   |
| N/A         | 1H,1H,2H,2H-perfluorododecane sulfonate (10:2)                   | 10:2 FTS     | 120226-60-0 |         |           |          |          | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |
| N/A         | 9-Chlorohexadeca-fluoro-3-oxanonane-1-sulfonic acid              | 9Cl-PF3ONS   | 73606-19-6  |         |           |          |          |        |            |            | x         |           |              |             | x          |              |              |             |                     |                     |
| N/A         | 4,8-Dioxa-3H-perfluorononanoic acid                              | ADONA        | 919005-14-4 | x       | x         |          | x        | x      |            |            | x         |           |              |             |            |              |              |             |                     |                     |
| N/A         | Perfluorooctanesulfo-namide                                      | FOSA         | 754-91-6    |         |           |          |          | x      |            |            | x         |           |              |             |            |              |              | x           | x                   | x                   |
| N/A         | N-ethylperfluorooctanesulfo-amidoacetic acid                     | N-EtFOSAA    | 2991-50-6   |         | x         |          | x        | x      |            |            | x         |           |              |             |            |              |              |             |                     |                     |
| N/A         | N-methylperfluorooctanesulfo-namide                              | N-MeFOSA     | 31506-32-8  |         |           |          | x        |        |            |            | x         |           | x            |             |            |              |              |             | x                   | x                   |
| N/A         | N-methylperfluorooctanesulfo-amidoacetic acid                    | N-MeFOSAA    | 2355-31-9   |         | x         |          | x        | x      |            |            | x         |           |              |             |            |              |              |             |                     |                     |



## PFAS Compounds by Method (continued)



| Cat. No | Compound Name   | Abbreviation    | CASRN       | EPA 533 | EPA 537.1 | EPA 8327 | EPA 1633 | OTM 45 | ASTM D7968 | ASTM D7979 | ISO 21675 | ISO 25101 | CEN-TS-15968 | CDC 6304.09 | FDA-010.01 | DIN 38414-14 | DIN 38407-42 | DIN 23702-1 | DIN 17681-1 (Draft) | DIN 17681-2 (Draft) |
|---------|---|-----------------|-------------|---------|-----------|----------|----------|--------|------------|------------|-----------|-----------|--------------|-------------|------------|--------------|--------------|-------------|---------------------|---------------------|
| N/A     | Perfluoroheptanesulfonic acid   | PFHpS           | 375-92-8    | x       |           | x        | x        | x      |            |            | x         |           |              |             | x          |              |              |             |                     |                     |
| N/A     | Perfluoro-n-hexadecanoic acid   | PFHxDA          | 67905-19 -5 |         |           |          |          | x      |            |            | x         |           |              |             |            |              |              |             |                     |                     |
| N/A     | Perfluorotridecanoic acid   | PFTTrDA         | 7269-94-8   |         | x         | x        | x        | x      |            |            | x         |           |              |             |            |              |              | x           |                     |                     |
| N/A     | 11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic acid                            | 11Cl-PF3OUdS    | 763051-92-9 | x       | x         |          | x        | x      |            |            |           |           |              |             | x          |              |              |             |                     |                     |
| N/A     | Perfluoro-n-[13C8] octanoic acid  | 13C8 PFOA       | 864071-09-0 |         |           |          | x        |        |            |            |           |           |              |             | x          |              |              |             |                     |                     |
| N/A     | 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid                            | 9Cl-PF3ONS      | 756426-58-1 | x       | x         |          | x        | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |
| N/A     | N-Methyl-heptadecafluorooctane sulphonamidoethanol                            | Me-FOSE alcohol | 24448-09-7  |         |           |          | x        | x      |            |            |           |           | x            |             |            |              |              |             | x                   | x                   |
| N/A     | Sodium dodecafluoro-3H-4,8-dioxanonanoate                                     | NaDONA          | 958445-44-8 |         |           |          |          |        |            |            |           |           |              |             | x          |              |              |             |                     |                     |
| N/A     | Perfluorooctane sulphonamide  | PFOSA           | 754-91-6    |         |           |          | x        |        |            |            |           |           | x            |             |            |              |              |             |                     |                     |
| N/A     | Perfluoropentanesulfonic acid   | PFPeS           | 2706-91-4   | x       |           | x        | x        | x      |            |            |           |           |              |             | x          |              |              |             |                     |                     |
| N/A     | Perfluorododecanesulfonic acid  | PFDoS           | 79780-39-5  |         |           |          | x        | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |
| N/A     | 3-Perfluoropropyl propanoic acid  | 3:3FTCA         | 356-02-5    |         |           |          | x        | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |
| N/A     | 2H,2H,3H,3H-Perfluorooctanoic acid  | 5:3FTCA         | 914637-49-3 |         |           |          | x        | x      |            |            |           |           |              |             |            |              |              |             |                     |                     |
| N/A     | Ammonium perfluorocaprilate   |                 | 3825-26-1   |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | Sodium pentadecafluorooctanoate   |                 | 335-95-5    |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | potassium perfluorooctanoate  |                 | 2395-00-8   |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | pentadecafluoro-octanoic acid   |                 | 335-93-3    |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | METHYL PERFLUOROOCTANOATE   |                 | 376-27-2    |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | ethyl perfluorooctanoate  |                 | 3108-24-5   |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | 2,2,3,4,4,5,5,6,6,7,8,8,8-tridecafluoro-3,7-bis(trifluoromethyl)octanoic acid | pc1214          | 172155-07-6 |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | 2-aminotoluene-5-sulfonic acid  |                 | 34598-33-9  |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | heptadecafluoro-1-octanesulfonic acid lithium salt                            |                 | 29457-72-5  |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | Ammonium perfluorooctylsulfonate  |                 | 29081-56-9  |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | bis(2-hydroxyethyl)ammonium perfluorooctanesulfonate                          |                 | 70225-14-8  |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | Heptadecafluorooctanesulfonic acid tetraethylammonium salt                    |                 | 56773-42-3  |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | 2-(Perfluorooctyl)ethanol   |                 | 678-39-7    |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | 1H,1H,2H,2H-Heptadecafluorodecyl acrylate                                     |                 | 27905-45-9  |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | perfluorooctylsulfonyl fluoride/Fc-8  |                 | 307-35-7    |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | 2-(Perfluorooctyl)ethyl methacrylate  |                 | 1996-88-9   |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |
| N/A     | potassium 2,3,3,3-tetrafluoro-2-(heptafluoropropoxy)propionate                |                 | 67118-55-2  |         |           |          |          |        |            |            |           |           |              |             |            |              |              |             | x                   | x                   |

# Products by Promulgated Methods



If you are using a promulgated method, the chances are VERY high that we have everything you need for the analysis.

The following pages list all of the potential products needed for the promulgated methods listed below, sorted into 3 categories: Columns and Chemicals, Lab Equipment and Sample Prep supplies and Containers.

To find the products listed on [SigmaAldrich.com](http://SigmaAldrich.com), simply click on the catalogue number listed in the left column.

The methods covered in the tables are:

- ASTM 7968
- ASTM 7979
- CDC 6304.09
- CEN TS 15968
- EPA 533
- EPA 537.1
- EPA 8327
- EPA 1633
- FDA C-010.01
- ISO 21675
- ISO 25101

If you are using a promulgated method we have not listed here, please contact us so that we can add that method to the next version of this brochure.

## Chemicals and Columns by Method

| Cat. No | Part Description  | ASTM 7968               | ASTM 7979        | CDC 6304.09   | CEN-TS 15968-2010       | EPA 533 | EPA 537.1   | EPA 8327 / SW-846 | EPA 1633 | FDA C-010.01 | ISO 21675  | ISO 215101 |
|---------|---|-------------------------|------------------|---------------|-------------------------|---------|-------------|-------------------|----------|--------------|------------|------------|
| 900667  | Acetonitrile for UHPLC, suitable for mass spectrometry (MS)   | 8.12 & 11.1             | 7.1, 8.12 & 11.2 | 6.b.2         |                         |         |             | 7.3.1             |          | 2019.4       | 6.3        |            |
| 1.03725 | Acetonitrile for UHPLC-MS LiChrosolv®   | 8.12 & 11.1             | 7.1, 8.12 & 11.2 | 6.b.2         |                         |         |             | 7.3.1             |          | 2019.4       | 6.3        |            |
| 900688  | Methanol UHPLC, suitable for mass spectrometry (MS)   | 8.13, 11.1, 12.2 & 13.4 | 8.13 & 13.4      | 6.b.3 & 6.b.4 | 6.3.1, 6.4.5, 9.1 & 9.3 | 11.4    | 11.3 & 11.7 | 7.3.3, B7.3.1     |          | 2019.4       | 6.6        | 5.5        |
| 1.03726 | Methanol for UHPLC-MS LiChrosolv®   | 8.13, 11.1, 12.2 & 13.4 | 8.13 & 13.4      | 6.b.3 & 6.b.4 | 6.3.1, 6.4.5, 9.1 & 9.3 | 11.4    | 11.3 & 11.7 | 7.3.3, B7.3.1     |          | 2019.4       | 6.6        | 5.5        |
| AX1222  | Ammonium acetate HPLC, meets ACS specifications   | 6.2.1 & B6.1            | 7.1 & 8.14       |               | 6.4.3                   | 11.3    | 11.7        |                   |          | 2019.4       | 6.5 & 6.10 | 5.4        |
| 5.43834 | Ammonium acetate for HPLC LiChropur™  | 8.14 & 11.1             | 7.1 & 8.14       |               | 6.4.3                   | 11.3    | 11.7        |                   |          | 2019.4       | 6.5 & 6.10 | 5.4        |
| 73594   | Ammonium acetate suitable for mass spectrometry (MS), LiChropur™  | 8.14 & 11.1             | 7.1 & 8.14       |               | 6.4.3                   | 11.3    | 11.7        | 7.3.6             |          | 2019.4       | 6.5 & 6.10 | 5.4        |
| 5.33004 | Ammonium acetate for LC-MS LiChropur™   | 8.14 & 11.1             | 7.1 & 8.14       |               | 6.4.3                   | 11.3    | 11.7        | 7.3.6             |          | 2019.4       | 6.5 & 6.10 | 5.4        |
| 695092  | Acetic acid glacial, ACS reagent, ≥99.7%  | 8.15, 11.1, 12.2 & 13.4 | 8.15 & 13.6      |               |                         | 11.3    |             |                   |          |              |            |            |
| 33209   | Acetic acid glacial, puriss. p.a., ACS reagent, reagent ISO, reagent Ph. Eur., ≥99.8%                       | 8.15, 11.1, 12.2 & 13.4 | 8.15 & 13.6      |               |                         | 11.3    |             |                   |          |              |            |            |
| 45754   | Acetic acid solution suitable for HPLC  | 8.15, 11.1, 12.2 & 13.4 | 8.15 & 13.6      | 6.b.1         |                         | 11.3    |             | 7.3.7, B7.3.2     |          |              | 6.2        | 5.2        |
| 5.43808 | Acetic acid 100% for HPLC LiChropur™  | 8.15, 11.1, 12.2 & 13.4 | 8.15 & 13.6      | 6.b.1         |                         | 11.3    |             | 7.3.7, B7.3.2     |          |              | 6.2        | 5.2        |
| 650447  | 2-Propanol HPLC Plus, for HPLC, GC, and residue analysis, 99.9%   | 8.16 & 11.2             | 8.16 & 11.2      |               |                         |         |             |                   |          |              |            |            |
| 102781  | 2-Propanol hypergrade for LC-MS LiChrosolv®   | 8.16 & 11.2             | 8.16 & 11.2      |               |                         |         |             | 7.3.4             |          |              |            |            |
| AX1303  | Ammonium Hydroxide Meets ACS Specifications   | 8.17 & 13.4             | 8.17 & 13.5      |               |                         | 11.4    | 7.2         |                   |          |              | 6.4        | 5.3        |
| AX1308  | Ammonium Hydroxide OmniTrace® Ultra   | 8.17 & 13.4             | 8.17 & 13.5      | 6.b.1         |                         | 11.4    | 7.2         | 7.3.5             |          | 2019.4       | 6.4        | 5.3        |
| 1.03728 | Water for UHPLC-MS LiChrosolv®  | 11.1, 12.2 & 13.4       | 7.1              | 6.b.1 & 6.b.4 |                         |         | 11.4        | B7.2              |          | 2019.4       | 6.1        | 5.1        |
| 900682  | Water for UHPLC, suitable for mass spectrometry (MS)  | 11.1, 12.2 & 13.4       | 7.1              | 6.b.1 & 6.b.4 |                         |         | 11.4        | B7.2              |          | 2019.4       | 6.1        | 5.1        |
| 1.99001 | Buffer solution (potassium hydrogen phthalate), traceable to SRM from NIST and PTB pH 4.01 (25°C) Certipur® |                         |                  | 6.b.1         |                         |         |             |                   |          |              |            |            |
| 00940   | Formic acid for LC-MS LiChropur™, 97.5-98.5% (T)  |                         |                  | 6.b.5         | 6.4.4                   |         |             |                   |          | 2019.4       |            |            |
| RDD007  | Sodium phosphate monobasic anhydrous, free-flowing, Redi-Dri™, ≥99.0%                                       |                         |                  |               |                         | 11.4    |             |                   |          |              |            |            |
| 795410  | Sodium phosphate dibasic anhydrous, free-flowing, Redi-Dri™, ACS reagent, ≥99%                              |                         |                  |               |                         | 11.4    |             |                   |          |              |            |            |
| T7193   | Trizma® Pre-set crystals BioPerformance Certified, pH 7.0, average Mw 154.8                                 |                         |                  |               |                         |         | 11.3        |                   |          |              |            |            |

## Chemicals and Columns by Method (continued)



| Cat. No         | Part Description   | ASTM 7968   | ASTM 7979 | CDC 6304.09 | CEN-TS<br>15968-2010 | EPA 533     | EPA<br>537.1 | EPA 8327 /<br>SW-846 | EPA 1633 | FDA<br>C-010.01 | ISO 21675          | ISO 215101             |
|-----------------|--|-------------|-----------|-------------|----------------------|-------------|--------------|----------------------|----------|-----------------|--------------------|------------------------|
| <b>Z273228</b>  | Alconox® detergent 0.5 oz packs  |             |           |             |                      |             |              | B6.4                 |          |                 |                    |                        |
| <b>242985</b>   | Alconox® detergent bulk packed   |             |           |             |                      |             |              | B6.4                 |          |                 |                    |                        |
| <b>217247</b>   | Sodium thiosulfate pentahydrate ACS reagent, ≥99.5%  |             |           |             |                      |             |              |                      |          |                 |                    | 5.12                   |
| <b>13479</b>    | Sodium thiosulfate pentahydrate puriss., meets analytical specification of Ph. Eur., BP, USP |             |           |             |                      |             |              |                      |          |                 |                    | 5.12                   |
| <b>31623</b>    | Silicon dioxide washed and calcined, analytical reagent                                      | 8.18 & 12.6 |           |             |                      |             |              |                      |          |                 |                    |                        |
| <b>53572-U</b>  | Ascentis® Express 90 Å PFAS Delay, 2.7 µm HPLC Column L × I.D. 5 cm × 3.0 mm                 | 11.1        | 7.1       | 6.d.x       | Annex A              | 6.12 & 11.6 | 11.7         | 6.1.2                | 6.10.3   | 2019.8          | 5.2 & 9.3          | 6.8, Annex B & Annex C |
| <b>53573-U</b>  | Ascentis® Express 90 Å PFAS Delay, 2.7 µm HPLC Column L × I.D. 5 cm × 4.6 mm                 | 11.1        | 7.1       | 6.d.x       | Annex A              | 6.12 & 11.6 | 11.7         | 6.1.2                | 6.10.3   | 2019.8          | 5.2 & 9.3          | 6.8, Annex B & Annex C |
| <b>53559-U</b>  | Ascentis® Express 90 Å PFAS, 2.7 µm HPLC Column L × I.D. 10 cm × 2.1 mm                      | 11.1        | 7.1       | 6.d.x       | Annex A              | 6.12 & 11.6 | 11.7         | 6.1.2                | 6.10.2   | 2019.8          | 5.2, 9.3 & Annex B | 6.8, Annex B & Annex C |
| <b>53560-U</b>  | Ascentis® Express 90 Å PFAS, 2.7 µm HPLC Column L × I.D. 15 cm × 2.1 mm                      | 11.1        | 7.1       | 6.d.x       | Annex A              | 6.12 & 11.6 | 11.7         | 6.1.2                | 6.10.2   | 2019.8          | 5.2, 9.3 & Annex B | 6.8, Annex B & Annex C |
| <b>53557-U</b>  | Ascentis® Express 90 Å PFAS, 2.7 µm HPLC Column L × I.D. 5 cm × 2.1 mm                       | 11.1        | 7.1       | 6.d.x       | Annex A              | 6.12 & 11.6 | 11.7         | 6.1.2                | 6.10.2   | 2019.8          | 5.2, 9.3 & Annex B | 6.8, Annex B & Annex C |
| <b>53562-U</b>  | Ascentis® Express 90 Å PFAS, 2.7 µm HPLC Column L × I.D. 25 cm × 2.1 mm                      | 11.1        | 7.1       | 6.d.x       | Annex A              | 6.12 & 11.6 | 11.7         | 6.1.2                | 6.10.2   | 2019.8          | 5.2, 9.3 & Annex B | 6.8, Annex B & Annex C |
| <b>53563-U</b>  | Ascentis® Express 90 Å PFAS, 2.7 µm HPLC Column L × I.D. 5 cm × 3.0 mm                       | 11.1        | 7.1       | 6.d.x       | Annex A              | 6.12 & 11.6 | 11.7         | 6.1.2                | 6.10.2   | 2019.8          | 5.2, 9.3 & Annex B | 6.8, Annex B & Annex C |
| <b>53564-U</b>  | Ascentis® Express 90 Å PFAS, 2.7 µm HPLC Column L × I.D. 10 cm × 3.0 mm                      | 11.1        | 7.1       | 6.d.x       | Annex A              | 6.12 & 11.6 | 11.7         | 6.1.2                | 6.10.2   | 2019.8          | 5.2, 9.3 & Annex B | 6.8, Annex B & Annex C |
| <b>53565-U</b>  | Ascentis® Express 90 Å PFAS, 2.7 µm HPLC Column L × I.D. 15 cm × 3.0 mm                      | 11.1        | 7.1       | 6.d.x       | Annex A              | 6.12 & 11.6 | 11.7         | 6.1.2                | 6.10.2   | 2019.8          | 5.2, 9.3 & Annex B | 6.8, Annex B & Annex C |
| <b>53570-U</b>  | Ascentis® Express 90 Å PFAS, 2.7 µm HPLC Column L × I.D. 25 cm × 3.0 mm                      | 11.1        | 7.1       | 6.d.x       | Annex A              | 6.12 & 11.6 | 11.7         | 6.1.2                | 6.10.2   | 2019.8          | 5.2, 9.3 & Annex B | 6.8, Annex B & Annex C |
| <b>1.52022</b>  | Chromolith® HighResolution RP-18 endcapped 100-4.6 HPLC column                               |             |           | 6.d.2       |                      |             |              |                      | 6.10.2   |                 |                    |                        |
| <b>1.52025</b>  | Chromolith® HighResolution RP-18 endcapped 5-4.6 guard cartridges (3 pieces)                 |             |           | 6.d.3       |                      |             |              |                      | 6.10.3   |                 |                    |                        |
| <b>1.52032</b>  | Chromolith® 5-4.6 guard cartridge holder   |             |           | 6.d.x       |                      |             |              |                      |          |                 |                    |                        |
| <b>1.52020</b>  | Chromolith® HighResolution RP-18 endcapped 25-4.6 HPLC column                                |             |           | 6.d.4       |                      |             |              |                      | 6.10.2   |                 |                    |                        |
| <b>1.52321</b>  | Chromolith® HighResolution RP-18 endcapped L × I.D. 50 mm × 2 mm HPLC column                 |             |           | 6.d.x       |                      |             |              |                      | 6.10.2   |                 |                    |                        |
| <b>1.52322</b>  | Chromolith® HighResolution RP-18 endcapped L × I.D. 100 mm × 2 mm HPLC column                |             |           | 6.d.x       |                      |             |              |                      | 6.10.2   |                 |                    |                        |
| <b>581300-U</b> | Ascentis® C18 HPLC Column 3 µm particle size, L × I.D. 5 cm × 2.1 mm                         |             |           |             |                      | 6.12 & 11.6 |              |                      | 6.10.2   |                 |                    |                        |
| <b>150651</b>   | Purospher® STAR RP-18 endcapped (3µm) Hibar® HR 50-2.1 suitable for UHPLC                    |             |           |             |                      | 6.12 & 11.6 |              |                      | 6.10.2   |                 |                    |                        |
| <b>581304-U</b> | Ascentis® C18 HPLC Column 5 µm particle size, L × I.D. 15 cm × 2.1 mm                        |             |           |             |                      |             | 11.7         |                      | 6.10.2   |                 |                    |                        |
| <b>53569-U</b>  | Ascentis® Express F5, 2.7 µm HPLC Column 2.7 µm particle size, L × I.D. 10 cm × 2.1 mm       |             |           |             |                      |             |              |                      | 6.10.2   |                 | Annex E            |                        |

# Equipment & Sample Prep by Method



| Cat. No        | Description   | ASTM 7968  | ASTM 7979  | CDC 6304.09 | CEN-TS 15968-2010 | EPA 533    | EPA 537.1 | EPA 8327 / SW-846 | EPA 1633 | FDA C-010.01 | ISO 21675   | ISO 215101     |
|----------------|---|------------|------------|-------------|-------------------|------------|-----------|-------------------|----------|--------------|-------------|----------------|
| 109535         | pH-indicator strips pH 0 - 14 Universal indicator. Accuracy: 1 pH unit, for use with MQuant® StripScan App                    | 8.7 & 13.4 | 8.8        |             |                   |            |           |                   | 6.3.12   |              | 7.15        |                |
| SLPBDZ5        | Millex®-PB Filter, 1.0 µm, Glass Fiber, 25 mm, nonsterile   |            |            |             |                   |            |           |                   |          |              | Annex G.3.2 |                |
| SLGP033N       | Millex®-GP Filter, 0.22 µm, PES, 33 mm, nonsterile  | 7.5 & 13.4 | 7.3 & 13.6 |             |                   |            |           | 6.2.3.3, B6.3.1   | 6.4.2    |              |             |                |
| SLGN033        | Millex®-GN Filter, 0.20 µm, Nylon, 33 mm, nonsterile  |            |            |             |                   |            |           |                   | 6.4.2    | 2019.8       |             |                |
| SLGNDZ5        | Millex®-GN Filter, 0.20 µm, Nylon, 25 mm, nonsterile  |            |            |             |                   |            |           |                   | 6.4.2    |              |             |                |
| WHA10370019    | Whatman® glass microfiber filters with inorganic binder, Grade GF 6 diam. 47 mm   |            |            |             |                   |            |           |                   | 6.4.3    |              |             |                |
| SLGNX13        | Millex®-GN Filter, 0.20 µm, Nylon, 13 mm, nonsterile  |            |            |             |                   |            |           |                   |          | 2019.8       |             |                |
| WHAUN203NPENYL | Whatman® Mini-UniPrep® syringeless filters Nylon, 0.2 µm, 100/pk  |            |            |             |                   |            |           |                   |          | 2019.8       |             |                |
| 57225-U        | Supelclean™ENVI™-Chrom P SPE Tube bed wt. 250 mg, volume 6 mL, pk of 30   |            |            |             | 6.2 & 9.3         |            |           |                   |          |              | 6.12 & 7.3  | 5.10 & Annex A |
| 57226          | Supelclean™ENVI™-Chrom P SPE Tube bed wt. 500 mg, volume 6 mL, pk of 30   |            |            |             | 6.2 & 9.3         |            | 11.4      |                   |          |              |             | 5.10 & Annex A |
| 54056-U        | Supelclean™ ENVI-WAX SPE Cartridges, bed wt. 200 mg, volume 6 mL, pk of 30  |            |            |             | 6.2 & 9.3         | 6.8 & 11.4 |           |                   | 6.7.1    | 2019.8       | 6.12 & 7.3  | 6.2 & Annex A  |
| 54057-U        | Supelclean™ ENVI-WAX SPE Cartridges, bed wt. 500 mg, volume 6 mL, pk of 30  |            |            |             | 6.2 & 9.3         | 6.8 & 11.4 |           |                   |          | 2019.8       | 6.12 & 7.3  | 6.2 & Annex A  |
| 57491-U        | Supel™ Swift HLB SPE Tubes weight 200 mg (bed), volume 6 mL, pk of 30 ea  |            |            |             | 6.2 & 9.3         |            |           |                   |          |              |             | 6.2 & Annex A  |
| 57143          | Supelclean™ENVI™-Chrom P SPE Tube bed wt. 100 mg, volume 1 mL, pk of 108  |            |            |             |                   |            |           |                   |          |              | 6.12 & 7.3  |                |
| 57062          | Supelclean™ ENVI™-18 SPE Tube bed wt. 100 mg, volume 1 mL, pk of 108  |            |            |             |                   |            |           |                   |          |              |             | 6.2 & Annex A  |
| 57064          | Supelclean™ ENVI™-18 SPE Tube bed wt. 500 mg, volume 6 mL, pkg of 30 ea   |            |            |             |                   |            |           |                   |          |              |             | 6.2 & Annex A  |
| 57224          | Supelclean™ENVI™-Chrom P SPE Tube bed wt. 250 mg, volume 3 mL, pk of 54   |            |            |             |                   |            |           |                   |          |              |             | 5.10 & Annex A |
| 54258-U        | Large Volume SPE Reservoir polypropylene body, for use with 6 mL polypropylene SPE tubes, volume 25 mL, pk of 30              |            |            |             |                   |            |           |                   |          |              | 7.4         |                |
| 57030-U        | Visiprep™ SPE Vacuum Manifold standard, 12-port model   |            |            |             |                   | 11.4       | 11.4      |                   | 6.7.2    |              | 7.5         | 6.3            |
| 57250-U        | Visiprep™ SPE Vacuum Manifold standard, 24-port model   |            |            |             |                   | 11.4       | 11.4      |                   | 6.7.2    |              | 7.5         | 6.3            |
| 55295-U        | Supel™ QuE Non-Buffered Tube 2, pk of 50  |            |            |             |                   |            |           |                   |          | 2019.4       |             |                |
| 55464-U        | Supel™ QuE PSA/ENVI-Carb Tube 2, pk of 50, suitable for EN 15662:2008 per BS, centrifuge tube volume 15 mL, Shaker Compatible |            |            |             |                   |            |           |                   |          | 2019.4       |             |                |
| Z135003        | Transfer pipette, polyethylene, general purpose, standard, bulb draw 3.2 mL, non-sterile                                      | 6.6 & 8.11 | 8.11       |             |                   |            | 11.5      | 6.2.3.3, B6.3.1   |          |              |             |                |
| Z740106        | BRAND® pipette tips, racked, TipBox, volume 2-200 µL, non-sterile, pack of 480 ea (5 boxes of 96)                             | 8.10       | 8.10       |             |                   |            |           | 6.2.3.3, B6.3.1   | 6.6.2    |              | 7.2         |                |
| Z740030        | BRAND® pipette tips, bulk, volume 2-200 µL, pack of 1000 ea (1 bag of 1000)   | 8.10       | 8.10       |             |                   |            |           |                   | 6.6.2    |              | 7.2         |                |
| CLS4863        | Corning® universal fit racked pipet tips, 1-200 µL, natural, non-sterile, 10 racks/case, 960 tips/case                        |            | 8.10       |             |                   |            |           |                   |          |              | 7.2         |                |
| CLS4844        | Corning® universal fit bulk pipet tips, 1-200 µL, natural, non-sterile, 1000 tips/bag, 10,000 tips/case                       |            | 8.10       |             |                   |            |           |                   | 6.6.2    |              | 7.2         |                |

## Equipment & Sample Prep by Method (continued)



| Cat. No      | Description  | ASTM 7968 | ASTM 7979 | CDC 6304.09 | CEN-TS 15968-2010 | EPA 533 | EPA 537.1 | EPA 8327 / SW-846 | EPA 1633     | FDA C-010.01 | ISO 21675 | ISO 215101 |
|--------------|--|-----------|-----------|-------------|-------------------|---------|-----------|-------------------|--------------|--------------|-----------|------------|
| Z709972      | Sartorius pipette tips, volume range 10-1000 µL, standard, refill, non-sterile   |           | 8.10      |             |                   |         |           |                   |              |              | 7.2       |            |
| CLS4867      | Corning® universal fit racket pipet tips, 100-1000 µL, blue, non-sterile, 10 racks/case, 1000 tips/case  |           | 8.10      |             |                   |         |           |                   |              |              | 7.2       |            |
| CLS4868      | Corning® universal fit bulk pipet tips, 100-1000 µL, blue, non-sterile, 1000 tips/bag, 1000 tips/case  |           | 8.10      |             |                   |         |           |                   | 6.6.2        |              | 7.2       |            |
| Z741648      | Sartorius pipette tips, volume range 100-5000 µL, Standard, rack, non-sterile  |           | 8.10      |             |                   |         |           |                   | 6.6.2        |              | 7.2       |            |
| Z741650      | Sartorius pipette tips, volume range 100-5000 µL, Standard, bulk, non-sterile  |           | 8.10      |             |                   |         |           |                   | 6.6.2        |              | 7.2       |            |
| Z740447      | Eppendorf® Reference® 2 Variable Volume Pipettor, 0.1-2.5 µL, 0.5-10 µL, 10-100 µL, 100-1,000 µL, pack of 4 ea                                       |           |           | 6.d.6       |                   |         |           | 6.2.1, B6.1       | 6.6.2, 6.6.4 |              |           |            |
| CLS4071      | Corning® Lambda® plus single channel pipettor, volume 0.5-10 µL  |           |           | 6.d.6       |                   |         |           | 6.2.1, B6.1       | 6.6.2, 6.6.4 |              |           |            |
| CLS4072      | Corning® Lambda® plus single channel pipettor, volume 2-20 µL  |           |           | 6.d.6       |                   |         |           | 6.2.1, B6.1       | 6.6.2, 6.6.4 |              |           |            |
| CLS4073      | Corning® Lambda® plus single channel pipettor, volume 10-100 µL  |           |           | 6.d.6       |                   |         |           | 6.2.1, B6.1       | 6.6.2, 6.6.4 |              |           |            |
| CLS4074      | Corning® Lambda® plus single channel pipettor, volume 20-200 µL  |           |           | 6.d.6       |                   |         |           | 6.2.1, B6.1       | 6.6.2, 6.6.4 |              |           |            |
| CLS4075      | Corning® Lambda® plus single channel pipettor, volume 100-1000 µL  |           |           | 6.d.6       |                   |         |           | 6.2.1, B6.1       | 6.6.2, 6.6.4 |              |           |            |
| Z740099      | BRAND® pipette tips, racked, TipBox, volume 0.1-20 µL, non-sterile, pack of 480 ea (5 boxes of 96)   |           |           | 6.d.6       |                   |         |           | 6.2.3.3, B6.3.1   | 6.6.2        |              |           |            |
| Z740108      | BRAND® pipette tips, racked, TipBox, volume 50-1000 µL, non-sterile, pack of 480 ea (5 boxes of 96)  |           |           | 6.d.6       |                   |         |           | 6.2.3.3, B6.3.1   | 6.6.2        |              |           |            |
| AXYAP5000ALT | Corning® Axygen® Axypet® Single Channel Pipettor, volume (1-5 mL), ISO17025, Calibration 3x4   |           |           |             |                   |         |           |                   | 6.6.2, 6.6.4 |              |           |            |
| Z627992      | Pasteur pipettes, short capillary tip, approx 2 mL withdraw volume, soda-lime glass  |           |           |             |                   |         |           |                   | 6.6.3        |              |           |            |
| CLS7095B5X   | Corning® Pasteur pipettes, non-sterile, L 5 3/4 in. (146 mm), standard tip, soda lime  |           |           |             |                   |         |           |                   | 6.6.3        |              |           |            |
| Z683620      | Syringe PP/PE without needle, luer lock tip, centered, capacity 20 mL, graduated, 1 mL, non-sterile  |           |           |             |                   |         |           | 6.2.3.3, B6.3.1   |              |              |           |            |
| Z760293      | Ohaus® MB-23 and MB-25 moisture analyzers, model MB23, AC/DC input 110 V AC  |           |           |             |                   |         |           |                   | 6.3.6.1      |              |           |            |
| Z743924      | Ohaus® Explorer® semi-micro analytical balance, model EX125D, weighing capacity 51 or 120 g, Precision 0.01 0.1 mg, AC/DC input 110 V, US 3-pin plug |           |           |             |                   |         |           |                   | 6.3.7.1      |              |           |            |
| Z760420      | Ohaus® Explorer® analytical balance, model EX124, weighing capacity 120 g, precision: 0.1 mg, AC/DC input 110 V AC                                   |           |           |             |                   |         |           |                   | 6.3.7.2      |              |           |            |
| Z185159      | Aluminum foil W x L 18 in. x 500 ft, thickness 0.001 in.   |           |           |             |                   |         |           |                   | 6.3.8        |              |           |            |
| Z561762      | Disposable smartSpatula®, L 140 mm, white, anti-static, micro  |           |           |             |                   |         |           |                   | 6.3.9        |              |           |            |
| Z560057      | Disposable smartSpatula®, L 310 mm, green, macro   |           |           |             |                   |         |           |                   | 6.3.9        |              |           |            |
| Z742705      | BenchMixer™ XLQ QuEChERs Shaker/Vortexer, AC/DC input 115 V AC, US 2-pin plug  |           |           |             |                   |         |           |                   | 6.3.13       |              |           |            |
| Z742300      | RotoBot™ Programmable Rotator, AC/DC input 115 V AC (US plug)  |           |           |             |                   |         |           |                   | 6.3.16       |              |           |            |
| 20411        | Glass Wool, Silanized, pkg of 50 g   |           |           |             |                   |         |           |                   | 6.4.1        |              |           |            |
| Z683582      | Syringe PP/PE without needle, luer lock tip, centered, capacity 5 mL, graduated, 0.2 mL, non-sterile   |           |           |             |                   |         |           |                   | 6.6.1        | 2019.8       |           |            |



## Equipment & Sample Prep by Method (continued)



| Cat. No | Description   | ASTM 7968 | ASTM 7979 | CDC 6304.09 | CEN-TS 15968-2010 | EPA 533 | EPA 537.1 | EPA 8327 / SW-846 | EPA 1633 | FDA C-010.01 | ISO 21675 | ISO 215101 |
|---------|---|-----------|-----------|-------------|-------------------|---------|-----------|-------------------|----------|--------------|-----------|------------|
| 22971   | Six Port Mini-Vap Evaporator/Concentrator, Mini-Vap L x W 7 1/2 in. (19 cm) x 1 1/2 in. (4 cm), for use with 1-250 mL containers, pkg of 1 ea |           |           |             |                   |         |           |                   | 6.8.1    |              | 7.9       | 6.6        |
| 23029-U | Replacement needles for 6 port Mini-Vap, stainless steel, pkg of 6 ea   |           |           |             |                   |         |           |                   | 6.8.1    |              | 7.9       | 6.6        |
| Z765503 | Benchmixer™ XL multi-tube vortexer, AC/DC input 115 V AC  |           |           |             |                   |         |           |                   |          | 2019.8       |           |            |
| 57100-U | Visidry™ Drying Attachment for use with Visiprep 12-port model  |           |           |             |                   |         |           |                   |          |              | 7.9       |            |
| 57124   | Visidry™ Drying Attachment for use with Visiprep 24-port model  |           |           |             |                   |         |           |                   |          |              | 7.9       |            |

## Containers by Method

| Cat. No     | Description   | ASTM 7968        | ASTM 7979  | CDC 6304.09 | CEN-TS 15968-2010 | EPA 533 | EPA 537.1 | EPA 8327 / SW-846 | EPA 1633 | FDA C-010.01 | ISO 21675 | ISO 215101 |
|-------------|---|------------------|------------|-------------|-------------------|---------|-----------|-------------------|----------|--------------|-----------|------------|
| 29654-U     | Certified Vial Kit, Low Adsorption (LA), 2 mL, pk of 100, volume 2 mL, amber glass vial (with marking spot), natural PTFE/silicone septa (with slit), thread for 9 mm | 8.4, 12.2 & 13.4 | 8.4        |             |                   |         |           |                   |          |              |           |            |
| B9532       | Nalgene® bottles, style 2105, capacity 30 mL  | 10.1             | 4.2 & 10.1 |             |                   |         |           |                   |          |              |           |            |
| Z376795     | Disposable culture tubes, polypropylene tube  |                  |            |             |                   |         |           |                   | 6.3.15   |              |           |            |
| T2318       | Greiner centrifuge tubes, 50 mL, 30 x 115 mm, conical (V) bottom, w/ graduations, I.D. field  | 8.8              | 8.7        |             |                   |         |           | 6.2.3.3, B6.3.1   | 6.5.2    | 2019.8       |           |            |
| CLS430829   | Corning® 50 mL centrifuge tubes, polypropylene, conical bottom w/ CentriStar cap, bulk packed, sterile, natural, 500/cs   | 8.8              | 8          |             |                   |         |           | 6.2.3.3, B6.3.1   | 6.5.2    | 2019.8       |           |            |
| T1943       | Greiner centrifuge tubes, 15 mL, 17x120 mm, conical (V) bottom, w/ graduation, I.D. field   | 8.8, 12.6 & 13.3 | 8.7 & 13.3 |             |                   | 11.4    | 11.5      | 6.2.3.3, B6.3.1   |          | 2019.8       | 7.6       |            |
| CLS430791   | Corning® 15 mL centrifuge tubes, polypropylene, conical bottom w/ CentriStar cap, sterile, natural, 500/cs  | 8.8, 12.6 & 13.3 | 8.7 & 13.3 |             |                   | 11.4    | 11.5      | 6.2.3.3, B6.3.1   |          | 2019.8       | 7.6       |            |
| Z511501     | Kimax® heavy-duty wide-mouth, large numbers volumetric flasks - CLASS A, capacity 10 mL   | 8.9              | 8.9        |             |                   |         |           |                   |          |              |           |            |
| CLS563110   | Pyrex® certified and serialized micro volumetric flask, with Pyrex® stopper, capacity 10 mL   | 8.9              | 8.9        |             |                   |         |           |                   |          |              |           |            |
| B9532       | Nalgene® bottles, style 2105, capacity 30 mL  | 10.1             | 4.2 & 10.1 |             |                   |         |           |                   |          |              |           |            |
| CLS56405    | Pyrex® volumetric flask, class A with Pyrex® ST stopper, capacity 5 mL  |                  | 8.9        |             |                   |         |           |                   |          |              |           |            |
| CLS564010   | Pyrex® volumetric flask, class A with Pyrex® ST stopper, capacity 10 mL   |                  | 8.9        |             |                   |         |           |                   |          |              |           |            |
| DWK92812G-5 | KIMBLE® KIMAX® Heavy duty volumetric wide-mouth flask with glass stopper, glass flask, flask capacity (5 mL), class A   |                  | 8.9        |             |                   |         |           |                   |          |              |           |            |
| CLS5641P10  | Corning® reusable volumetric flask, Class B, polypropylene, size 10 mL, with 10/19 tapered PP stopper   |                  |            |             | 6.2               |         |           |                   |          |              | 7.7       | 6.4        |
| CLS5641P50  | Corning® reusable volumetric flask, Class B, polypropylene, size 50 mL, with 12/21 tapered PP stopper   |                  |            |             | 6.2               |         |           |                   |          |              | 7.7       | 6.4        |
| CLS5641P100 | Corning® reusable volumetric flask, Class B, polypropylene, size 100 mL, with 14/23 tapered PP stopper  |                  |            |             | 6.2               |         |           |                   |          |              | 7.7       | 6.4        |
| CLS5641P500 | Corning® reusable volumetric flask, Class B, polypropylene, size 500 mL, with 19/26 tapered PP stopper  |                  |            |             | 6.2               |         |           |                   |          |              | 7.7       | 6.4        |
| B9907       | Nalgene® bottles, style 2105, capacity 250 mL   |                  |            |             |                   | 11.1    | 11.3      |                   |          |              |           |            |
| B0158       | Nalgene® bottles, style 2105, capacity 500 mL   |                  |            |             |                   | 11.1    | 11.3      |                   |          |              |           |            |
| B0283       | Nalgene® bottles, style 2105, capacity 1,000 mL   |                  |            |             |                   | 11.1    | 11.3      |                   |          |              |           |            |
| Z327549     | BRAND® graduated cylinder, PP, with blue printed scale or embossed scale, volume 25 mL, blue graduations  |                  |            |             |                   |         | 11.3      |                   |          |              |           |            |

## Containers by Method (continued)



| Cat. No        | Description   | ASTM 7968 | ASTM 7979 | CDC 6304.09 | CEN-TS 15968-2010 | EPA 533 | EPA 537.1 | EPA 8327 / SW-846 | EPA 1633          | FDA C-010.01 | ISO 21675 | ISO 215101 |
|----------------|---|-----------|-----------|-------------|-------------------|---------|-----------|-------------------|-------------------|--------------|-----------|------------|
| Z327565        | BRAND® graduated cylinder, PP, with blue printed scale or embossed scale, volume 50 mL, blue graduations            |           |           |             |                   |         | 11.3      |                   |                   |              |           |            |
| Z327581        | BRAND® graduated cylinder, PP, with blue printed scale or embossed scale, volume 100 mL, blue graduations           |           |           |             |                   |         | 11.3      |                   |                   |              |           |            |
| Z327670        | BRAND® graduated cylinder, PP, with blue printed scale or embossed scale, volume 1,000 mL, blue graduations         |           |           |             |                   |         | 11.3      |                   |                   |              |           |            |
| TMO312006-9125 | Nalgene® diagnostic bottle, natural polypropylene copolymer, volume 4 mL, case of 2000 ea                           |           |           |             |                   |         | 11.4      |                   |                   |              |           |            |
| B7657          | Nalgene® bottles, style 2002, capacity 125 mL   |           |           |             |                   |         |           |                   | 6.1.1.1           |              |           |            |
| B6660          | Nalgene® bottles, style 2114, capacity 500 mL   |           |           |             |                   |         |           |                   | 6.1.1.1 & 6.1.1.2 |              |           |            |
| B6535          | Nalgene® bottles, style 2114, capacity 250 mL   |           |           |             |                   |         |           |                   | 6.1.1.1           |              |           |            |
| B9282          | Nalgene® bottles, style 2104, capacity 500 mL   |           |           |             |                   |         |           |                   | 6.1.1.2           |              |           |            |
| B9032          | Nalgene® bottles, style 2104, capacity 125 mL   |           |           |             |                   |         |           |                   | 6.1.1.3           |              |           |            |
| Z261076        | Nalgene® PassPort™ IP2 bottles, Narrow-mouth, capacity 60 mL  |           |           |             |                   |         |           |                   | 6.3.11            |              |           |            |
| B6285          | Nalgene® bottles, style 2114, capacity 60 mL  |           |           |             |                   |         |           |                   | 6.3.11            |              |           |            |
| CLS568010      | Pyrex® volumetric flask, certified and serialized, with Pyrex® ST stopper, capacity 10 mL                           |           |           |             |                   |         |           |                   | 6.3.14            |              |           |            |
| CLS568025      | Pyrex® volumetric flask, certified and serialized, with Pyrex® ST stopper, capacity 25 mL                           |           |           |             |                   |         |           |                   | 6.3.14            |              |           |            |
| CLS568050      | Pyrex® volumetric flask, certified and serialized, with Pyrex® ST stopper, capacity 50 mL                           |           |           |             |                   |         |           |                   | 6.3.14            |              |           |            |
| CLS5680100     | Pyrex® volumetric flask, certified and serialized, with Pyrex® ST stopper, capacity 100 mL                          |           |           |             |                   |         |           |                   | 6.3.14            |              |           |            |
| CLS5680200     | Pyrex® volumetric flask, certified and serialized, with Pyrex® ST stopper, capacity 200 mL                          |           |           |             |                   |         |           |                   | 6.3.14            |              |           |            |
| Z376795        | Disposable culture tubes, polypropylene tube  |           |           |             |                   |         |           |                   | 6.3.15            |              |           |            |
| B8157          | Nalgene® bottles, style 2006, capacity 60 mL  |           |           |             |                   |         |           |                   |                   | 7.1          |           |            |
| B8282          | Nalgene® bottles, style 2006, capacity 125 mL   |           |           |             |                   |         |           |                   |                   | 7.1          |           |            |
| B8407          | Nalgene® bottles, style 2006, capacity 250 mL   |           |           |             |                   |         |           |                   |                   | 7.1          |           |            |
| B8532          | Nalgene® bottles, style 2006, capacity 500 mL   |           |           |             |                   |         |           |                   |                   | 7.1          |           |            |
| B8657          | Nalgene® bottles, style 2006, capacity 1,000 mL   |           |           |             |                   |         |           |                   |                   | 7.1          |           |            |
| CLS3022P50     | Corning® reusable graduated cylinder, single metric scale with funnel top, polypropylene, "to contain", size 50 mL  |           |           |             |                   |         |           |                   |                   | 7.8          |           |            |
| Z327557        | BRAND® graduated cylinder, PP, with blue printed scale or embossed scale, volume 50 mL                              |           |           |             |                   |         |           |                   |                   | 7.8          |           |            |
| CLS3022P100    | Corning® reusable graduated cylinder, single metric scale with funnel top, polypropylene, "to contain", size 100 mL |           |           |             |                   |         |           |                   |                   | 7.8          |           |            |
| Z327573        | BRAND® graduated cylinder, PP, with blue printed scale or embossed scale, volume 100 mL                             |           |           |             |                   |         |           |                   |                   | 7.8          |           |            |
| CLS3022P500    | Corning® reusable graduated cylinder, single metric scale with funnel top, polypropylene, "to contain", size 500 mL |           |           |             |                   |         |           |                   |                   | 7.8          |           | 6.5        |
| Z327638        | BRAND® graduated cylinder, PP, with blue printed scale or embossed scale, volume 500 mL                             |           |           |             |                   |         |           |                   |                   | 7.8          |           | 6.5        |
| CLS1500P1L     | Corning® narrow mouth reagent bottle, reusable, capacity 1 L, polypropylene, with GL-63 PP screw cap                |           |           |             |                   |         |           |                   |                   |              |           | 6.1        |

# Notable Products for PFAS Testing



The following pages provide technical information on the products that have been specifically evaluated for use in PFAS testing.

## Filters

Higher particulate samples, such as wastewater, may require a filtration step before analysis. Millipore EXPRESS Polyethersulfone (PES) membranes, in either a Millex® syringe filter or cut disc format, can enable testing of these more complex matrices. Three lots of nonsterile PES Millex syringe filters were tested for

PFAS extractables (Table 1). For all compounds tested, PFAS extractables were not detected (Table 2). The analytes tested include all analytes in EPA 537.1 and SW-846 Method 8327 and the majority of analytes in ASTM D7979-19 and ISO 21675.

**Table 1. Nonsterile PES Millex syringe filters included in PFAS extractable analysis. Note, larger pack sizes are available.**

| Cat. No.  | Diameter | Pore Size | # Lots Analyzed |
|-----------|----------|-----------|-----------------|
| SLGP033NS | 33mm     | 0.22 µm   | 3               |
| SLHP033NS | 33mm     | 0.45 µm   | 3               |

**Table 2. PFAS Compounds Analyzed in Nonsterile PES Millex syringe filter extractable study. All compounds were below the minimum detection limit (MDL) of the study.**

| Compound  | Abbreviation                | MDL (ppb) | EPA 537.1 | ASTM D7979-19 | SW-846 Method 8327 | ISO 21675 |
|---|-----------------------------|-----------|-----------|---------------|--------------------|-----------|
| Perfluoro-n-butanoic acid                           | PFBA                        | 0.0020    |           | x             | x                  | x         |
| Perfluoro-n-pentanoic acid                          | PFPeA                       | 0.0010    |           | x             | x                  | x         |
| Perfluoro-n-hexanoic acid                           | PFHxA                       | 0.0010    | x         | x             | x                  | x         |
| Perfluoro-n-heptanoic acid                          | PFHpA                       | 0.0010    | x         | x             | x                  | x         |
| Perfluoro-n-octanoic acid                           | PFOA                        | 0.0010    | x         | x             | x                  | x         |
| Perfluoro-n-nonanoic acid                           | PFNA                        | 0.0010    | x         | x             | x                  | x         |
| Perfluoro-n-decanoic acid                           | PFDA                        | 0.0010    | x         | x             | x                  | x         |
| Perfluoro-n-undecanoic acid                         | PFUnDA                      | 0.0010    | x         | x             | x                  | x         |
| Perfluoro-n-dodecanoic acid                         | PFDoDA                      | 0.0010    | x         | x             | x                  | x         |
| Perfluoro-n-tridecanoic acid                        | PFTTrDA                     | 0.0010    | x         | x             | x                  | x         |
| Perfluoro-n-tetradecanoic acid                      | PFTeDA                      | 0.0010    | x         | x             | x                  | x         |
| Perfluoro-n-butanesulfonic acid                     | PFBS                        | 0.0020    | x         | x             | x                  | x         |
| Perfluoro-n-pentanesulfonic acid                    | PFPeS                       | 0.0020    |           |               | x                  |           |
| Perfluoro-n-hexanesulfonic acid                     | PFHxS                       | 0.0020    | x         | x             | x                  | x         |
| Perfluoro-n-heptanesulfonic acid                    | PFHpS                       | 0.0020    |           |               | x                  | x         |
| Perfluoro-n-octanesulfonic acid                     | PFOS                        | 0.0020    | x         | x             | x                  | x         |
| Perfluoro-n-nonanesulfonic acid                     | PFNS                        | 0.0020    |           |               | x                  |           |
| Perfluoro-n-decanesulfonic acid                     | PFDS                        | 0.0020    |           |               | x                  | x         |
| 4:2 Fluorotelomer sulfonic acid                     | 4:2 FTS<br>4:2 FTSA         | 0.0020    |           | x             |                    |           |
| 6:2 Fluorotelomer sulfonic acid                     | 6:2 FTS<br>6:2 FTSA         | 0.0020    |           | x             | x                  |           |
| 8:2 Fluorotelomer sulfonic acid                     | 8:2 FTS<br>8:2 FTSA         | 0.0020    |           |               |                    |           |
| Perfluorooctanesulfonamide                          | PFOSA/FOSA                  | 0.0020    |           |               | x                  | x         |
| N-methyl Perfluorooctanesulfonamidoacetic acid      | N-MeFOSAA                   | 0.0040    |           |               | x                  | x         |
| N-ethyl Perfluorooctanesulfonamidoacetic acid       | N-EtFOSAA                   | 0.0040    |           |               | x                  | x         |
| Hexafluoropropylene oxide dimer acid                | Gen-X<br>HFPO-DA            | 0.0020    |           | x             |                    |           |
| 4,8-Dioxa-3H-perfluorononanoic acid                 | ADONA<br>DONA               | 0.0020    |           |               | x                  |           |
| 9-Chlorohexadecafluoro-3-oxanone-1-sulfonic acid    | 9CI-PF3ONS<br>F-53B Major   | 0.0020    |           |               | x                  |           |
| 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid | 11CI-PF3OUdS<br>F-53B Minor | 0.0020    |           |               |                    |           |

**Millipore®**

Preparation, Separation,  
Filtration & Monitoring Products

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application note here

## Sample Preparation Products

Optimized sample cleanup and concentration is vital to achieve accurate and precise results. We offer vacuum manifolds, solid phase extraction (SPE) cartridges, and large volume samplers manufactured to high quality specifications to support your PFAS sample preparation needs (Figure 1).



**Figure 1.** Visiprep™ large volume samplers, Supelclean™ SPE cartridges, and Visiprep™ vacuum manifolds provide a complete sample preparation solution for PFAS analysis.

### Supelclean™ SPE Cartridges

| Cat. No | Description  |
|---------|--|
| 57226   | Supelclean™ ENVI™ Chrom P SPE Cartridges, 500 mg                           |
| 57239-U | Supelclean™ ENVI™ Chrom P SPE Cartridges, 500 mg for use with Gerstel® MPS |
| 54057-U | Supelclean™ ENVI™ WAX™ SPE Cartridges, 500 mg                              |
| 54056-U | Supelclean™ ENVI™ WAX™ SPE Cartridges, 200 mg                              |

### Visiprep™ Vacuum Manifolds

| Cat. No | Description             |
|---------|-------------------------|
| 57030-U | Standard, 12-port model |
| 57250-U | Standard, 24-port model |

### Large Volume SPE Reservoir

| Cat. No | Description   |
|---------|---|
| 54258-U | Large Volume SPE Reservoir, polypropylene body, for use with 6 mL polypropylene SPE tubes, volume 25 mL, pk of 30 |

### Visiprep™ Vacuum Manifolds

The Visiprep™ system contains a patented valve system that allows for precise flow control through each SPE tube via rotating, independent, screw-type valves situated in each port within the manifold cover. Visiprep™ vacuum manifolds allow you to process up to 12 (12-port version) or 24 (24-port version) PFAS samples simultaneously.

### Supelclean™ SPE Cartridges

Multiple regulatory methods, such as EPA 537 and 533, detail the extraction of PFAS analytes from drinking water using SPE cartridges followed by analysis by LC/TQ. Most commonly, weak anion exchange (WAX) cartridges, such as Supelclean™ ENVI-WAX SPE cartridges, are used due to their ability to extract

both short and long-chain PFAS analytes with good recoveries as seen in EPA 533 and ISO methods. EPA 537 uses a polystyrene divinylbenzene (PS-DVB) cartridge, such as a Supelclean™ ENVI™-Chrom P SPE cartridge, which offers high recoveries for medium and long-chain PFAS analytes.

### Large Volume SPE Reservoirs

Large volume SPE reservoirs are designed to increase the headspace volume of standard polypropylene SPE tubes. Because these reservoirs are designed to connect directly to the mouth of the SPE tube, they are ideal for gravity applications where increased headspace volume is required.

The reservoirs are designed for use with 6 mL polypropylene SPE tubes and add an additional headspace volume of 25 mL.

**Supelco®**  
Analytical Products

## Columns

The HPLC column of choice for PFAS analysis by LC-MS/(MS) is a C18 column based on fully porous silica particles (FPP) such as Ascentis® C18 and Purospher™ STAR RP-18 endcapped, monolithic Chromolith® columns for every matrix-rich samples, or on superficially porous silica particles (SPP) such as Ascentis® Express.

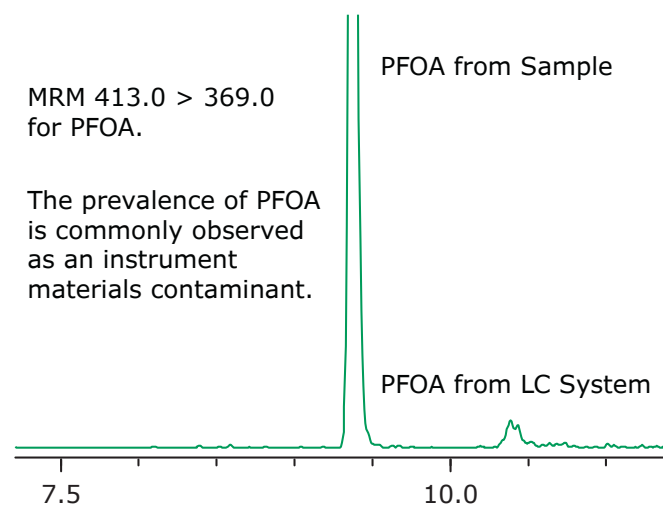
In contrast to ordinary FPP C18 columns Ascentis® Express PFAS columns are tested using a PFAS compound mixture. This ensures the full suitability of the column for PFAS analysis.

The contamination of PFAS compounds from the HPLC system and materials used in analytics is a concern. Therefore, it is recommended to use a delay column, which is placed before injection in the system set-up

The highly retentive endcapped silane of the Ascentis® Express PFAS Delay column provides high retention of PFAS compounds across various mobile phase conditions and is used to delay background instrument PFAS contamination from interference with analyzed samples. For this reason, the Ascentis® Express PFAS Delay column is placed upstream of the sample injector and after the mixer.

The new Ascentis® Express PFAS HPLC column is designed for the separation of novel and legacy short chain and long chain PFAS compounds containing branched and linear isomers, whilst adhering to EPA methodology requirements. The Ascentis® Express PFAS HPLC column, with its Fused-Core® technology and a particle size of 2.7 µm, delivers fast and high-resolution separations with excellent selectivity, peak shape, and necessary retention to perform in EPA methods 537.1, 533 and 8327.

Furthermore, a specific PFAS delay column prevents background PFAS contamination from interfering with the sample results in quantitative LC-MS methods.



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

| Cat. No  | Description             | Cat. No  | Description            |
|--|-------------------------|--|------------------------|
| <b>Analytical Column</b>                               |                         | <b>Corresponding Delay Column</b>                            |                        |
| <b>Ascentis® Express 90 Å PFAS, 2.7 µm HPLC Column</b> |                         | <b>Ascentis® Express 90 Å PFAS Delay, 2.7 µm HPLC Column</b> |                        |
| 53557-U  | L × I.D. 5 cm × 2.1 mm  | 53572-U  | L × I.D. 5 cm × 3.0 mm |
| 53559-U  | L × I.D. 10 cm × 2.1 mm | 53572-U  | L × I.D. 5 cm × 3.0 mm |
| 53560-U  | L × I.D. 15 cm × 2.1 mm | 53572-U  | L × I.D. 5 cm × 3.0 mm |
| 53562-U  | L × I.D. 25 cm × 2.1 mm | 53572-U  | L × I.D. 5 cm × 3.0 mm |
| 53563-U  | L × I.D. 5 cm × 3.0 mm  | 53573-U  | L × I.D. 5 cm × 4.6 mm |
| 53564-U  | L × I.D. 10 cm × 3.0 mm | 53573-U  | L × I.D. 5 cm × 4.6 mm |
| 53565-U  | L × I.D. 15 cm × 3.0 mm | 53573-U  | L × I.D. 5 cm × 4.6 mm |
| 53570-U  | L × I.D. 25 cm × 3.0 mm | 53573-U  | L × I.D. 5 cm × 4.6 mm |

Read the related application note

**Supelco®** Analytical Products **Sigma-Aldrich®** Lab & Production Materials

## Solvents



We are committed to providing our customers with the widest selection of high purity solvents, specifically designed to deliver the ultimate performance for UHPLC-MS, LC-MS, and HPLC Analysis. For solvents that are ready to be used for PFAS analysis; we have products available from both the Supelco® and Sigma-Aldrich® product lines.

Our advanced UHPLC-MS LiChrosolv® solvents have been designed to meet the highest requirements of UHPLC-MS in quality control for environmental, clinical, food or industrial testing applications.

Our Sigma-Aldrich® solvents were designed originally for academic and research applications but maintain an excellent level of quality control and in both internal as well as 3rd party testing have been found to have very low levels of background PFAS.

Regardless of which brand you choose from; our solvents enable the highest sensitivity and reliable results due to the low baseline noise and clean mass spectra. Both brands have been tested and shown to contain less than 4ppt PFAS when analyzed using EPA methods 533 and 537.1.

| Cat. No | Description                                 |
|---------|---|
| 900688  | methanol (LC-MS grade, verified)            |
| 1.03726 | methanol (LC-MS grade, verified)            |
| 45754   | acetic acid (HPLC grade)                    |
| 5.43808 | acetic acid (HPLC grade)                    |
| AX1308  | ammonium hydroxide (OmniTrace Ultra)        |
| 5.43834 | ammonium acetate, solid (HPLC grade)        |
| 900667  | acetonitrile (LC-MS grade, verified)        |
| 1.03725 | acetonitrile (LC-MS grade, verified)        |
| AX1222  | ammonium acetate, solid (HPLC & ACS grades) |
| 650447  | isopropyl alcohol (HPLC+ grade)             |
| 900682  | water (LC-MS grade, verified)               |
| 1.03728 | water (LC-MS grade, verified)               |





# Water Purification Systems

Purified water is an important solvent in the laboratory, and is used for sample and standard preparation, as blank and in LC-MS mobile phase. To achieve and maintain good chromatographic performance, it is recommended to use freshly produced ultrapure water at each step of the PFAS testing process.

Discover the Milli-Q® IQ 7003/7005/7010/7015 ultrapure and pure water system, designed to improve your productivity, reduce environmental impact, and provide unparalleled convenience and versatility in the lab.

- **Tailor water quality to your needs**

An optimized combination of purification technologies reliably delivers pure and ultrapure water, ascertained by highly accurate, continuous water quality monitoring. The LC-Pak® polisher, when connected to the Q-POD® dispenser, delivers the optimal water quality for sensitive LC-MS analyses.

- **Work more efficiently**

Intuitive and easy to use touch screens enable rapid and precise dispensing.

- **Save bench space**

Only the POD is needed for daily use. The system can be conveniently placed under the bench or wall-mounted.

- **Reach your sustainability targets**

Look for the Greener Alternative Product label on some of our Milli-Q® systems, as they are certified to consume less water and electricity, decrease plastic waste and eliminate mercury waste handling.



| Cat. No    | Description   |
|------------|---|
| ZIQ7005T0C | Milli-Q® IQ 7003/05/10/15 pure and ultrapure water purification systems |
| ZIQ7000T0C | Milli-Q® IQ 7000 ultrapure water purification system                    |
| LCPAK00A1  | LC-Pak® Polisher for trace and ultra-trace organic analyses             |



# Reference Materials



Reference materials are a critical component of the analytical testing workflow.

Our reference material portfolio comprises neat material and solutions in analytical grade standard quality as well as certified reference materials. Our analytical standard grade products come with a certificate of analysis including a purity and identity as well as a chromatogram and the expiration date. These materials can be used for identity/screening analysis and content/assay determination if the product is qualified.

The certified reference materials are produced and certified according to ISO/IEC 17025 and ISO 17034 and provide the highest level of confidence to get accurate results. They come with a certificate including the certified content plus the expanded combined uncertainty having contributions from the certification process itself, stability and homogeneity studies and all requirements according to the ISO Guide 31.

| Cat. No. | Description                                       | Format   | Concentration / matrix | Quality grade       | Pack Size |
|----------|---|----------|------------------------|---------------------|-----------|
| 68808    | Perfluorobutanoic acid                            | neat     |                        | Analytical standard | 25 mg     |
| 68542    | Perfluoropentanoic acid                           | neat     |                        | Analytical standard | 25 mg     |
| 43809    | Perfluorohexanoic acid                            | neat     |                        | Analytical standard | 25 mg     |
| 93899    | Perfluorohexanoic acid                            | neat     |                        | CRM                 | 25 mg     |
| 43996    | Perfluoroheptanoic acid                           | neat     |                        | Analytical standard | 25 mg     |
| 93983    | Perfluoroheptanoic acid                           | neat     |                        | CRM                 | 25 mg     |
| 33824    | Perfluorooctanoic acid                            | neat     |                        | Analytical standard | 100 mg    |
| 91977    | Perfluorononanoic acid                            | neat     |                        | Analytical standard | 50 mg     |
| 05167    | Perfluorononanoic acid                            | neat     |                        | CRM                 | 25 mg     |
| 43929    | Perfluorodecanoic acid                            | neat     |                        | Analytical standard | 25 mg     |
| 91367    | Perfluorodecanoic acid                            | neat     |                        | CRM                 | 10 mg     |
| 89988    | Perfluoroundecanoic acid                          | neat     |                        | CRM                 | 10 mg     |
| 92291    | Perfluorododecanoic acid                          | neat     |                        | Analytical standard | 50 mg     |
| 76705    | Perfluorotridecanoic acid                         | neat     |                        | CRM                 | 10 mg     |
| 80312    | Perfluorotetradecanoic acid                       | neat     |                        | Analytical standard | 50 mg     |
| 38400    | Perfluorotetradecanoic acid                       | neat     |                        | CRM                 | 10 mg     |
| 76467    | Tricosafuorododecanoic acid                       | neat     |                        | CRM                 | 10 mg     |
| 93973    | Pentadecafluorooctanoic acid                      | neat     |                        | CRM                 | 25 mg     |
| 33603    | Pentadecafluorooctanoic acid                      | solution | 100 µg/mL in methanol  | Analytical standard | 1 mL      |
| 33607    | Heptadecafluorooctanoic acid                      | solution | 100 µg/mL in methanol  | Analytical standard | 1 mL      |
| 33829    | Perfluorooctane sulfonic acid                     | neat     |                        | Analytical standard | 10 mg     |
| 80444    | Perfluoroundecanoic acid                          | neat     |                        | Analytical standard | 50 mg     |
| 89374    | Heptadecafluorooctanesulfonic acid potassium salt | neat     |                        | Analytical standard | 100 mg    |
| 93899    | Heptadecafluorooctanesulfonic acid potassium salt | neat     |                        | CRM                 | 25 mg     |

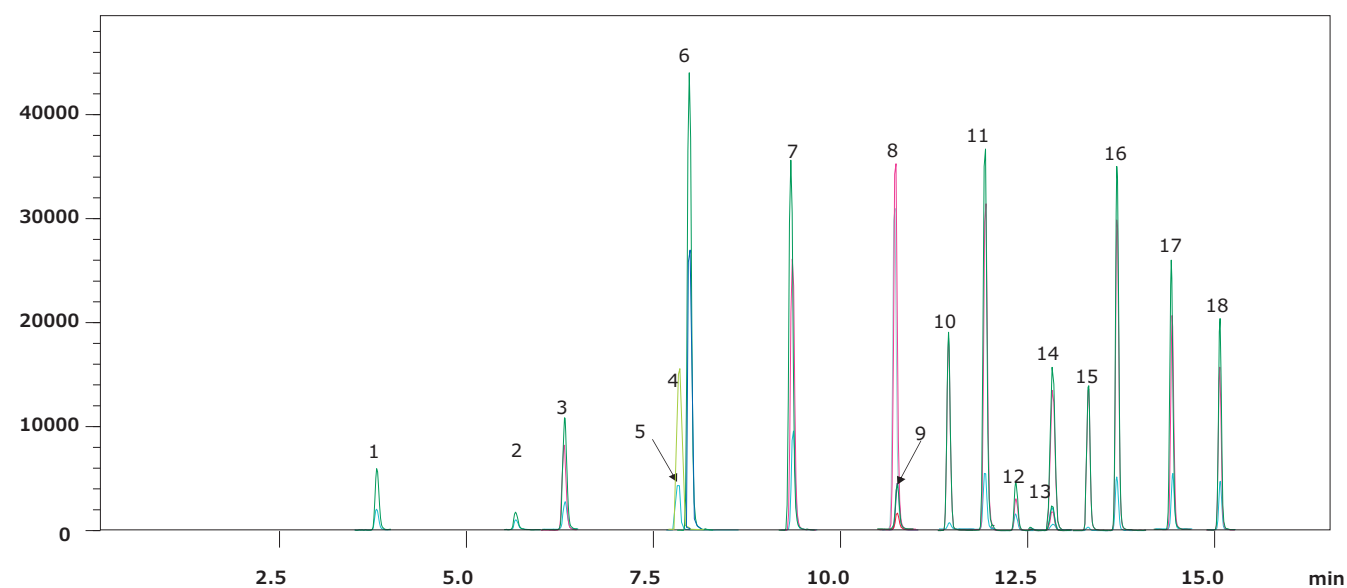




## EPA Method 533

| LC Conditions:            |  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
|---------------------------|--|------|----|-----|------|------|------|------|-------|------|-------|------|------|------|-----|
| <b>Analytical Column:</b> | Ascentis® Express PFAS, 2.7 µm, 10 cm x 2.1 mm, 90 Å (53559-U)   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Delay Column:</b>      | Ascentis® Express PFAS Delay, 2.7 µm, 5 cm x 3 mm (53572-U)  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Gradient:</b>          | <table border="1"> <thead> <tr> <th>Time</th> <th>%B</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>33.0</td></tr> <tr><td>18.0</td><td>98.0</td></tr> <tr><td>18.1</td><td>100.0</td></tr> <tr><td>21.0</td><td>100.0</td></tr> <tr><td>21.1</td><td>33.0</td></tr> <tr><td>26.0</td><td>End</td></tr> </tbody> </table> | Time | %B | 0.0 | 33.0 | 18.0 | 98.0 | 18.1 | 100.0 | 21.0 | 100.0 | 21.1 | 33.0 | 26.0 | End |
| Time                      | %B   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 0.0                       | 33.0   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 18.0                      | 98.0   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 18.1                      | 100.0  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 21.0                      | 100.0  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 21.1                      | 33.0   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 26.0                      | End  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Mobile Phase A:</b>    | 10 mM Ammonium Acetate   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Mobile Phase B:</b>    | Methanol   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Flow Rate:</b>         | 0.4 mL/min   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Pressure:</b>          | 485 bar  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Temperature:</b>       | 35 °C  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Injection Volume:</b>  | 2.0 µL   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Sample Solvent:</b>    | Methanol (96%) Water (4%)  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |

| MS Conditions:          |                    |
|-------------------------|--------------------|
| <b>Detection:</b>       | -ESI MS/MS         |
| <b>LC System:</b>       | Shimadzu Nexera X2 |
| <b>ESI LCMS system:</b> | Shimadzu LCMS-8040 |
| <b>Spray Voltage:</b>   | -2.0 kV            |
| <b>Nebulizing gas:</b>  | 2 L/min            |
| <b>Drying gas:</b>      | 15 L/min           |
| <b>DL temp:</b>         | 250 °C             |
| <b>Heat Block:</b>      | 400 °C             |



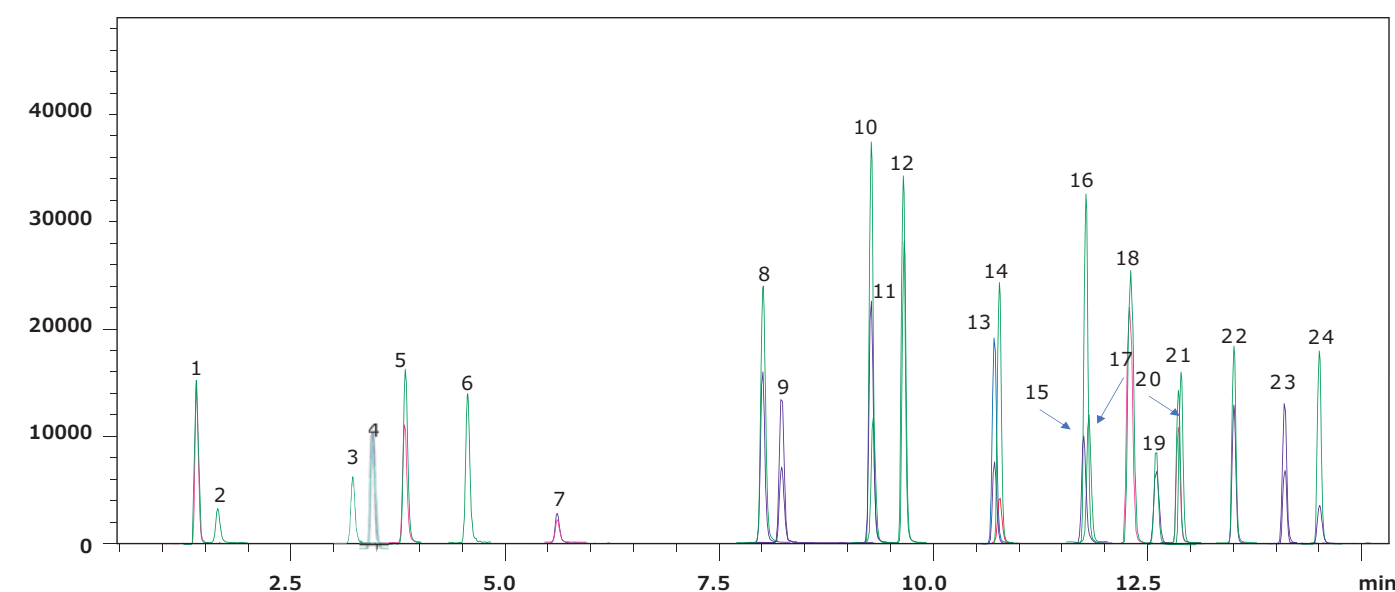
| Peak # | Compound | Transition        | tR (min) |
|--------|----------|-------------------|----------|
| 1      | PFBA     | 213.0000>169.0000 | 1.358    |
| 2      | 4:2FTS   | 229.0000>85.0000  | 1.890    |
| 3      | PFPeA    | 263.0000>219.0000 | 3.219    |
| 4      | PFBS     | 299.0000>80.0000  | 3.810    |
| 5      | PFHpS    | 279.0000>85.0000  | 3.967    |
| 6      | PFPeS    | 315.0000>135.0000 | 4.791    |
| 7      | PFMPA    | 327.0000>307.0000 | 5.431    |
| 8      | PFHxA    | 313.0000>269.0000 | 5.684    |
| 9      | PFEESA   | 349.0000>80.0000  | 6.099    |
| 10     | HFPO-DA  | 285.0000>169.0000 | 6.335    |
| 11     | PFHpA    | 363.0000>319.0000 | 7.763    |
| 12     | PFHxS    | 399.0000>80.0000  | 7.985    |
| 13     | ADONA    | 377.0000>250.9000 | 8.012    |

| Peak # | Compound     | Transition        | tR (min) |
|--------|--------------|-------------------|----------|
| 14     | PFOA         | 413.0000>369.0000 | 9.398    |
| 15     | PFMBA        | 449.0000>80.0000  | 9.512    |
| 16     | PFNA         | 463.0000>419.0000 | 10.751   |
| 17     | PFOS         | 499.0000>80.0000  | 10.793   |
| 18     | 9Cl-PF3ONS   | 530.9000>351.0000 | 11.459   |
| 19     | PFDA         | 513.0000>469.0000 | 11.885   |
| 20     | 8:2FTS       | 549.0000>80.0000  | 11.897   |
| 21     | 6:2FTS       | 498.0000>78.0000  | 12.680   |
| 22     | NFDHA        | 599.0000>80.0000  | 12.847   |
| 23     | PFUnA        | 563.0000>519.0000 | 12.862   |
| 24     | 11Cl-PF3OUdS | 630.7000>451.0000 | 13.329   |
| 25     | PFDoA        | 613.0000>569.0000 | 13.708   |

## EPA Method 8327

| LC Conditions:            |  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
|---------------------------|--|------|----|-----|------|------|------|------|-------|------|-------|------|------|------|-----|
| <b>Analytical Column:</b> | Ascentis® Express PFAS, 2.7 µm, 10 cm x 2.1 mm, 90 Å (53559-U)   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Delay Column:</b>      | Ascentis® Express PFAS Delay, 2.7 µm, 5 cm x 3 mm (53572-U)  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Gradient:</b>          | <table border="1"> <thead> <tr> <th>Time</th> <th>%B</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>33.0</td></tr> <tr><td>18.0</td><td>98.0</td></tr> <tr><td>18.1</td><td>100.0</td></tr> <tr><td>21.0</td><td>100.0</td></tr> <tr><td>21.1</td><td>33.0</td></tr> <tr><td>26.0</td><td>End</td></tr> </tbody> </table> | Time | %B | 0.0 | 33.0 | 18.0 | 98.0 | 18.1 | 100.0 | 21.0 | 100.0 | 21.1 | 33.0 | 26.0 | End |
| Time                      | %B   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 0.0                       | 33.0   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 18.0                      | 98.0   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 18.1                      | 100.0  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 21.0                      | 100.0  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 21.1                      | 33.0   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| 26.0                      | End  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Mobile Phase A:</b>    | 10 mM Ammonium Acetate   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Mobile Phase B:</b>    | Methanol   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Flow Rate:</b>         | 0.4 mL/min   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Pressure:</b>          | 485 bar  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Temperature:</b>       | 35 °C  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Injection Volume:</b>  | 2.0 µL   |      |    |     |      |      |      |      |       |      |       |      |      |      |     |
| <b>Sample Solvent:</b>    | Methanol (96%) Water (4%)  |      |    |     |      |      |      |      |       |      |       |      |      |      |     |

| MS Conditions:          |                    |
|-------------------------|--------------------|
| <b>Detection:</b>       | -ESI MS/MS         |
| <b>LC System:</b>       | Shimadzu Nexera X2 |
| <b>ESI LCMS system:</b> | Shimadzu LCMS-8040 |
| <b>Spray Voltage:</b>   | -2.0 kV            |
| <b>Nebulizing gas:</b>  | 2 L/min            |
| <b>Drying gas:</b>      | 15 L/min           |
| <b>DL temp:</b>         | 250 °C             |
| <b>Heat Block:</b>      | 400 °C             |



| Peak # | Compound | Transition        | tR (min) |
|--------|----------|-------------------|----------|
| 1      | PFBA     | 213.0000>169.0000 | 1.358    |
| 2      | 4:2FTS   | 229.0000>85.0000  | 1.890    |
| 3      | PFPeA    | 263.0000>219.0000 | 3.219    |
| 4      | PFBS     | 299.0000>80.0000  | 3.810    |
| 5      | PFHpS    | 279.0000>85.0000  | 3.967    |
| 6      | PFPeS    | 315.0000>135.0000 | 4.791    |
| 7      | PFHxA    | 313.0000>269.0000 | 5.684    |
| 8      | PFHpA    | 363.0000>319.0000 | 7.763    |
| 9      | PFHxS    | 399.0000>80.0000  | 7.985    |
| 10     | FOSA     | 427.0000>407.0000 | 9.304    |
| 11     | PFOA     | 413.0000>369.0000 | 9.398    |
| 12     | PFDS     | 295.0000>201.0000 | 9.695    |

| Peak # | Compound  | Transition        | tR (min) |
|--------|-----------|-------------------|----------|
| 13     | PFNA      | 463.0000>419.0000 | 10.751   |
| 14     | PFOS      | 499.0000>80.0000  | 10.793   |
| 15     | PFNS      | 527.0000>507.0000 | 11.843   |
| 16     | PFDA      | 513.0000>469.0000 | 11.885   |
| 17     | 8:2FTS    | 549.0000>80.0000  | 11.897   |
| 18     | N-MeFOSAA | 570.0000>419.0000 | 12.366   |
| 19     | 6:2FTS    | 498.0000>78.0000  | 12.680   |
| 20     | PFUnA     | 563.0000>519.0000 | 12.862   |
| 21     | N-EtFOSAA | 584.0000>419.0000 | 12.865   |
| 22     | PFDoA     | 613.0000>569.0000 | 13.708   |
| 23     | PFTTrDA   | 663.0000>619.0000 | 14.446   |
| 24     | PFTeDA    | 713.0000>669.0000 | 15.103   |

| Product list  |  | Cat. No.        |
|---|--|-----------------|
| Ascentis® Express PFAS, 2.7 µm, 10 cm x 2.1 mm, 90 Å  |  | 53559-U         |
| Ascentis® Express PFAS Delay, 2.7 µm, 5 cm x 3 mm   |  | 53572-U         |
| Methanol for chromatography (LC-MS grade) LiChrosolv®                                       |  | 1.06035         |
| Water for chromatography (LC-MS grade) LiChrosolv®  |  | 1.15333         |
| or<br>Ultrapure water from a Milli-Q® IQ 7 series water purification system                 |  | or<br>ZI7005TOC |
| Ammonium acetate suitable for mass spectrometry (MS), LiChropur™, eluent additive for LC-MS |  | 73594           |



# Ascentis® Express PFAS HPLC Columns LC-MS Analysis of 33 PFAS Compounds in 5 minutes

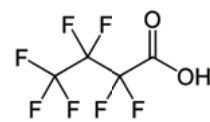
## Introduction

The EPA has developed, validated, and published three methods to support the analysis of 29 PFAS in drinking water, Method 533, 537 and 537.1. EPA 8327 covers the analysis of selected PFAS compounds in prepared extracts of various matrices (e.g., waters and solids) by liquid chromatography/tandem mass spectrometry (LC/MS/MS) analysis.

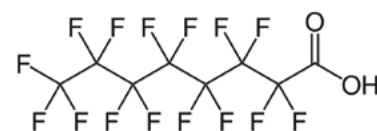
As technological advancements continue to progress, mass spectrometers will continue to be improved regarding their level of sensitivity, mass resolution, and scanning speed. This will impact future developments in PFAS analysis, and column performance must be able to handle these advancements. With this in mind, we developed a method for separation at maximum speed to test the suitability of the columns for use in these advanced conditions. The higher scanning speed of the MS instruments will lead to a decrease in the resolution therefore causing coelutions. The rapid separation of 33 PFAS compounds found in EPA 537.1, EPA 533, and EPA 8327 was completed in 5 minutes in this application note.

The HPLC column of choice for PFAS analysis by LC-MS/(MS) is a C18 column based on fully porous silica particles (FPP) or on superficially porous silica particles (SPP). In contrast to ordinary C18 columns, Ascentis® Express PFAS columns are tested using a PFAS compound mixture. This ensures the full suitability of the column for PFAS analysis.

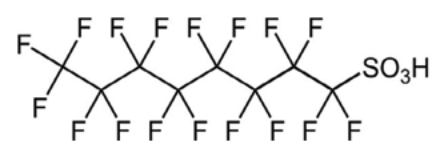
The contamination of PFAS compounds from the HPLC system and materials used in analytics is a concern. Therefore, it is recommended to use a delay column, which is placed before injection in the system set-up.



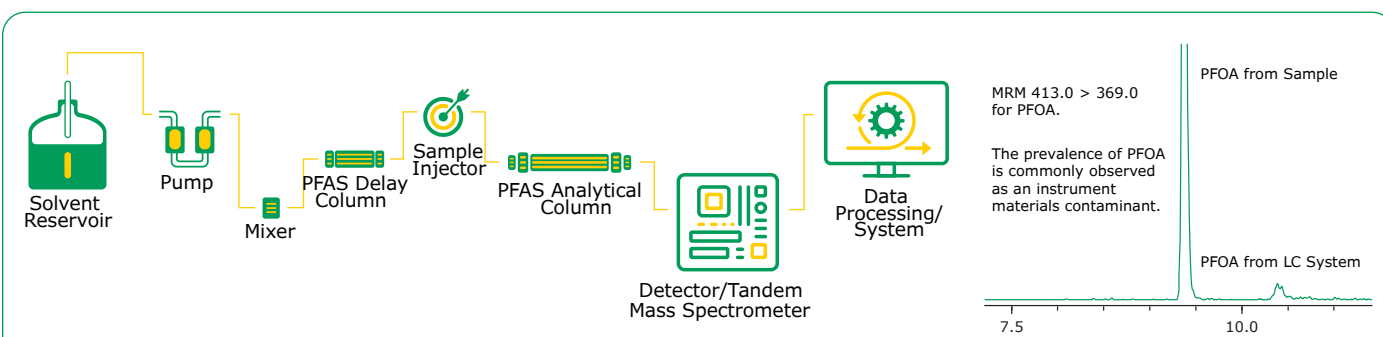
PFBA



PFOA



PFOS

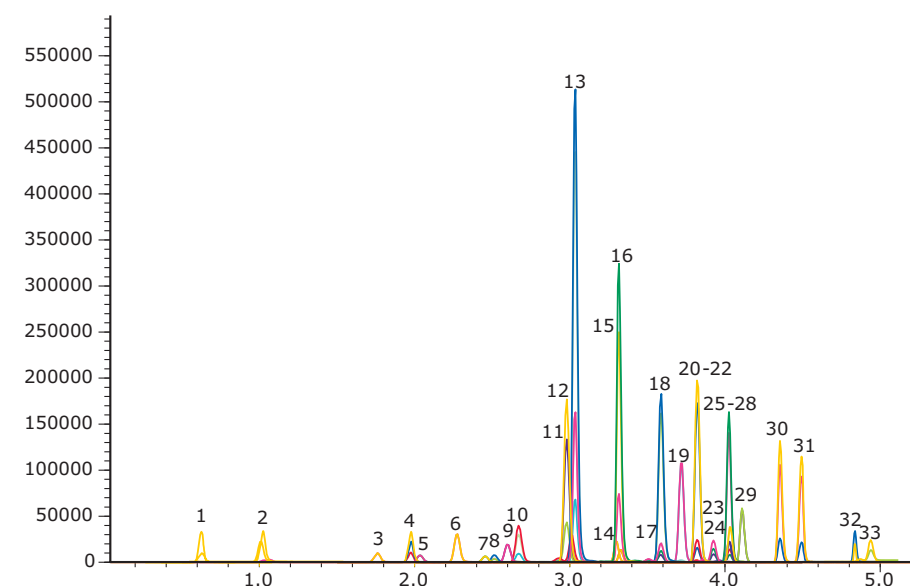


The highly retentive endcapped silane of the Ascentis® Express PFAS Delay column provides high retention of PFAS compounds across various mobile phase conditions and is used to delay background instrument PFAS contamination from interference with analyzed samples. For this reason, the Ascentis® Express PFAS Delay column is placed upstream of the sample injector and after the mixer.

| LC Conditions:     |   |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
|--------------------|---|------|----|-----|------|-----|------|-----|-------|-----|-------|-----|------|-----|-----|
| Analytical Column: | Ascentis® Express PFAS, 2.7 µm, 10 cm x 2.1 mm, 90 Å (53559-U)  |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| Delay Column:      | Ascentis® Express PFAS Delay, 2.7 µm, 5 cm x 3 mm (53572-U)   |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| Gradient:          | <table border="1"> <thead> <tr> <th>Time</th> <th>%B</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>33.0</td></tr> <tr><td>4.0</td><td>98.0</td></tr> <tr><td>4.1</td><td>100.0</td></tr> <tr><td>6.0</td><td>100.0</td></tr> <tr><td>6.1</td><td>33.0</td></tr> <tr><td>7.5</td><td>End</td></tr> </tbody> </table> | Time | %B | 0.0 | 33.0 | 4.0 | 98.0 | 4.1 | 100.0 | 6.0 | 100.0 | 6.1 | 33.0 | 7.5 | End |
| Time               | %B  |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| 0.0                | 33.0  |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| 4.0                | 98.0  |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| 4.1                | 100.0   |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| 6.0                | 100.0   |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| 6.1                | 33.0  |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| 7.5                | End   |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| Mobile Phase A:    | 10 mM Ammonium Acetate  |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| Mobile Phase B:    | Methanol  |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| Flow Rate:         | 0.4 mL/min  |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| Pressure:          | 485 bar   |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| Temperature:       | 35 °C   |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| Injection Volume:  | 2.0 µL  |      |    |     |      |     |      |     |       |     |       |     |      |     |     |
| Sample Solvent:    | Methanol (96%) Water (4%)   |      |    |     |      |     |      |     |       |     |       |     |      |     |     |

| MS Conditions:   |                    |
|------------------|--------------------|
| Detection:       | -ESI MS/MS         |
| LC System:       | Shimadzu Nexera X2 |
| ESI LCMS system: | Shimadzu LCMS-8040 |
| Spray Voltage:   | -2.0 kV            |
| Nebulizing gas:  | 2 L/min            |
| Drying gas:      | 15 L/min           |
| DL temp:         | 250 °C             |
| Heat Block:      | 400 °C             |

Analysis of 33 PFAS Compounds in Under 5 Minutes



| Peak # | Compound     | Transition        | tR (min) |
|--------|--------------|-------------------|----------|
| 1      | PFBA         | 213.0000>169.0000 | 0.755    |
| 2      | 4:2FTS       | 229.0000>85.0000  | 1.031    |
| 3      | PFPeA        | 263.0000>219.0000 | 1.762    |
| 4      | PFBS         | 299.0000>80.0000  | 1.979    |
| 5      | PFHpS        | 279.0000>85.0000  | 2.035    |
| 6      | PFPeS        | 315.0000>135.0000 | 2.273    |
| 7      | PFMPA        | 327.0000>307.0000 | 2.454    |
| 8      | PFHxA        | 313.0000>269.0000 | 2.514    |
| 9      | PFEEA        | 349.0000>80.0000  | 2.599    |
| 10     | HFPO-DA      | 285.0000>169.0000 | 2.670    |
| 11     | PFHxS        | 399.0000>80.0000  | 3.013    |
| 12     | NaDONA       | 377.0000>251.0000 | 3.033    |
| 13     | ADONA        | 377.0000>250.9000 | 3.034    |
| 14     | FOSA         | 427.0000>407.0000 | 3.299    |
| 15     | PFOA         | 413.0000>369.0000 | 3.316    |
| 16     | PFMBA        | 449.0000>80.0000  | 3.328    |
| 17     | PFHpA        | 363.0000>319.0000 | 3.388    |
| 18     | PFOS         | 499.0000>80.0000  | 3.588    |
| 19     | 9Cl-PF3ONS   | 530.9000>351.0000 | 3.719    |
| 20     | 8:2FTS       | 549.0000>80.0000  | 3.816    |
| 21     | PFNS         | 527.0000>507.0000 | 3.820    |
| 22     | PFDA         | 513.0000>469.0000 | 3.822    |
| 23     | N-MeFOSAA    | 570.0000>419.0000 | 3.925    |
| 24     | PFNA         | 463.0000>419.0000 | 3.942    |
| 25     | NFDHA        | 599.0000>80.0000  | 4.015    |
| 26     | PFUnA        | 563.0000>519.0000 | 4.025    |
| 27     | N-EtFOSAA    | 584.0000>419.0000 | 4.029    |
| 28     | 6:2FTS       | 498.0000>78.0000  | 4.033    |
| 29     | 11Cl-PF3OUdS | 630.7000>451.0000 | 4.110    |
| 30     | PFTrDA       | 663.0000>619.0000 | 4.355    |
| 31     | PFDoA        | 613.0000>569.0000 | 4.496    |
| 32     | PFTeDA       | 713.0000>669.0000 | 4.745    |
| 33     | PFDS         | 295.0000>201.0000 | 4.921    |

## Conclusion

The new Ascentis® Express PFAS HPLC column allows the highly efficient separation of 33 PFAS compounds in 5 minutes, and it is equally adept at delaying PFAS contamination originating from the instrument by using the Ascentis® Express PFAS Delay column.

This application note demonstrates that the Fused-Core® technology of Ascentis® Express PFAS HPLC columns benefits PFAS analysis for fast, efficient, and rugged separations which are paramount to environmental analysis.

| Product list  | Cat. No               |
|---|-----------------------|
| Ascentis® Express PFAS, 2.7 µm, 10 cm x 2.1 mm, 90 Å  | 53559-U               |
| Ascentis® Express PFAS Delay, 2.7 µm, 5 cm x 3 mm   | 53572-U               |
| Methanol for chromatography (LC-MS grade) LiChrosolv®   | 1.06035               |
| Water for chromatography (LC-MS grade) LiChrosolv® or ultrapure water from a Milli-Q® IQ 7 series water purification system | 1.15333 or ZIQ7005T0C |
| Ammonium acetate suitable for mass spectrometry (MS), LiChropur™, eluent additive for LC-MS                                 | 73594                 |



# LC-MS/MS Analysis of PFAS Extractables in Polyethersulfone (PES) Syringe Filters Using EPA 537.1

## Introduction

A key consideration for any PFAS method is to avoid contamination that can impact the accuracy of data, including those coming from sample preparation techniques such as filtration. Currently, most of the analytical methods are for “clean” matrices, such as drinking water, and often do not require filtration as a part of sample preparation. However, methods such as SW-846 Method 8327, ASTM D7968, ASTM D797 and ISO 21675 involve matrices that could have a higher degree of particulates, such as wastewater. Particulates in solution must be removed prior to LC/MS/MS, as they can be detrimental to sample analysis, column longevity and overall instrument function. These methods identify the need for filtration using membranes in a syringe filter format.

In this application note, EPA Method 537.1 was used to demonstrate that the Millex® syringe filters with

PES (polyethersulfone) Millipore Express® membranes did not give any detectable levels of PFAS contamination. **Figure 1** is the schematic of the experimental procedure.

## Results

No PFAS contaminants were detected even with the very low reporting limits (RL) of the method (**Table 1**). These results suggest that nonsterile Millex® syringe filters with PES membranes are reliable and appropriate to utilize in the filtration of samples for the analysis of PFAS compounds in environmental matrices that require filtration prior to further clean-up, by solid phase extraction for example, and/or LC-MS/MS analysis.

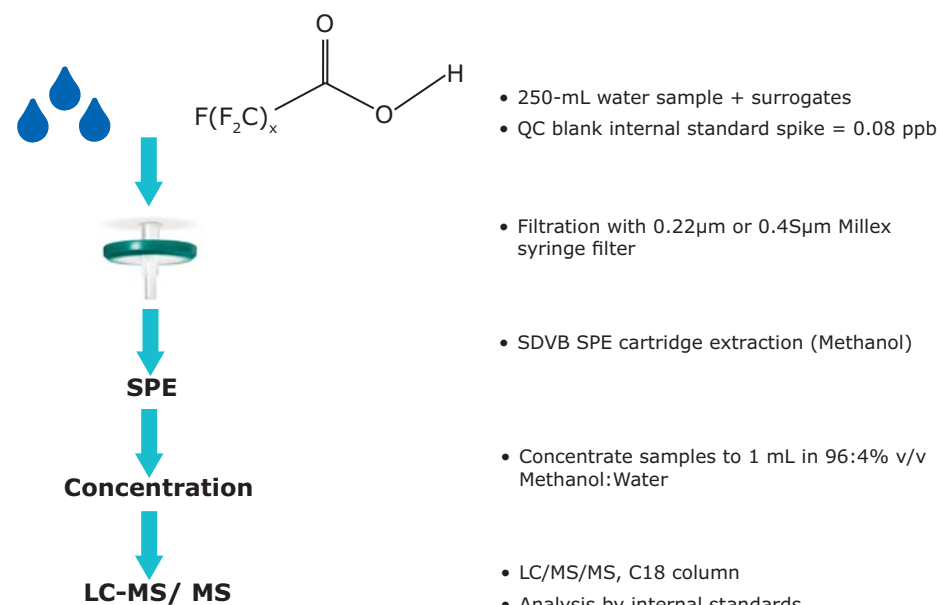


Figure 1. Schematic outline for testing Millex® syringe filters for PFAS contamination

Table 1 Detection of PFAS after filtration with nonsterile Millex® filters with PES membranes using LC/MS/MS according to EPA 537.1

| Compound   | Abbreviation | RL (ppb) | MDL (ppb) | Millex® PES |      |      |        |      |              |
|--|--------------|----------|-----------|-------------|------|------|--------|------|--------------|
|  |              |          |           | 0.22µm      |      |      | 0.45µm |      |              |
|  |              |          |           | Lot1        | Lot2 | Lot3 | Lot1   | Lot2 | Lot3         |
| <b>Perfluoroalkylcarboxylic Acids</b>  |              |          |           |             |      |      |        |      |              |
| Perfluorobutanoic acid   | PFBA         | 0.0040   | 0.0020    |             |      |      |        |      |              |
| Perfluoropentanoic acid  | PFPeA        | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluorohexanoic acid   | PFHxA        | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluoroheptanoic acid  | PFHpA        | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluorooctanoic acid   | PFOA         | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluorononanoic acid   | PFNA         | 0.0020   | 0.0010    |             |      |      |        |      | Not detected |
| Perfluorodecanoic acid   | PFDA         | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluoroundecanoic acid   | PFUnDA       | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluorododecanoic acid   | PFDoDA       | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluorotridecanoic acid  | PFTTrDA      | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluorotetradecanoic acid  | PFTeDA       | 0.0020   | 0.0010    |             |      |      |        |      |              |
| <b>Perfluoroalkylsulfonic Acids, Perfluorooctanesulfonamides, and Perfluorooctanesulfonamidoacetic Acids</b> |              |          |           |             |      |      |        |      |              |
| Perfluorobutanesulfonic acid   | PFBS         | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluoropentanesulfonic acid  | PFPeS        | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluorohexanesulfonic acid   | PFHxS        | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluoroheptanesulfonic acid  | PFHpS        | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluorooctanesulfonic acid   | PFOS         | 0.0020   | 0.0010    |             |      |      |        |      |              |
| Perfluorononanesulfonic acid   | PFNS         | 0.0020   | 0.0010    |             |      |      |        |      | Not detected |
| Perfluorodecanesulfonic acid   | PFDS         | 0.0020   | 0.0010    |             |      |      |        |      |              |
| PFOSA  | PFOSA        | 0.0040   | 0.0020    |             |      |      |        |      |              |
| N-MeFOSAA  | MeFOSAA      | 0.0040   | 0.0020    |             |      |      |        |      |              |
| N-EtFOSAA  | EtFOSAA      | 0.0040   | 0.0020    |             |      |      |        |      |              |
| <b>Fluorotelomer Sulfonates and Next Generation PFAS Analytes</b>  |              |          |           |             |      |      |        |      |              |
| 4:2 Fluorotelomer sulfonate  | 8:2 FTS      | 0.0080   | 0.0020    |             |      |      |        |      |              |
| 6:2 Fluorotelomer sulfonate  | 6:2 FTS      | 0.0080   | 0.0020    |             |      |      |        |      |              |
| 8:2 Fluorotelomer sulfonate  | 8:2 FTS      | 0.0080   | 0.0020    |             |      |      |        |      |              |
| HFPO-DA  | GenX         | 0.0040   | 0.0020    |             |      |      |        |      | Not detected |
| ADONA  | ADONA        | 0.0080   | 0.0020    |             |      |      |        |      |              |
| 9Cl-PF3ONS (F-53B Major)   | --           | 0.0080   | 0.0020    |             |      |      |        |      |              |
| 11Cl-PF3OUdS (F-53B Minor)   | --           | 0.0080   | 0.0020    |             |      |      |        |      |              |

Abbreviations: RL = reporting limit (ppb); MDL = minimum detection limit (ppb).

| Product list                         | Cat. No.  |
|--------------------------------------|-----------|
| <b>Syringe Filters</b>               |           |
| Millex-GP Syringe Filter, PES 0.22µm | SLGP033NS |
|                                      | SLGP033NB |
|                                      | SLGP033NK |
| Millex-GP Syringe Filter, PES 0.45µm | SLHP033NS |
|                                      | SLHP033NB |
|                                      | SLHP033NK |



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