

Per- and polyfluoroalkyl substances (PFAS) in soil

Determination of Per- and polyfluoroalkyl substances (PFAS) in soil samples using SyncorePlus Polyvap

1. Introduction

PFAS is a class of synthetic chemicals with multiple carbon-fluorine bonds in an alkyl chain (“tail”) and a hydrophilic “head”. More than 6000 PFAS have been found, the most common ones are perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) [1]. PFAS can be present in water, soil, air, food, and materials found in homes and/or workplaces. They are used in food packaging and household items like carpets and clothing due to their grease-resistant and non-stick nature. PFAS are chemicals of concern due to their persistence and their risk of causing health issues including reproductive effects, cancer, developmental effects or delays in children, immunosuppression, and high blood pressure, among others [2].

2. Experimental

Equipment: SyncorePlus Polyvap R-24 for 50 mL Falcon tubes

Samples: Two soil samples, collected and stored in HDPE containers with linerless HDPE or PP caps. Ottawa sand, used as a clean matrix for the LCS and LLOPR fortified samples.

The soil samples were extracted with methanolic ammonium hydroxide and concentrated using SyncorePlus Polyvap. The parameters are specified in Table 1. Prior to LC-MS/MS analysis a clean-up using SPE was performed.

Table 1: Parameters for the concentration of methanolic ammonium hydroxide solution using SyncorePlus Polyvap R-24

Parameter	Step 1	Step 2	Step 3	Step 4
Vacuum start [mbar]	1000	700	200	100
Vacuum end [mbar]	700	275	100	100
Timer	2 min	10 min	7 min	30 min
Base temperature	50 °C	50 °C	50 °C	50 °C
Cover temperature	50 °C	50 °C	50 °C	50 °C
Recirculating Chiller	15 °C	15 °C	15 °C	15 °C
Rotation	60 rpm	60 rpm	250 rpm	250 rpm
Aeration	On	On	On	On

3. Results and discussion

Two soil samples, together with LLOPR (Low Level Ongoing Precision Recovery), LCS (Laboratory Control Samples) and method blank samples were run in parallel using the SyncorePlus Polyvap. All method blank values were below the Method Detection Limit (MDL) with no indication of cross-contamination caused by the SyncorePlus. Percent recoveries of the target PFAS compounds in LLOPR and LCS fell within criteria set in EPA Method 1633 [3]. Also soil samples with concentrations close to the LOQ showed low relative percent difference (n=2), indicating a repeatable procedure.

4. Conclusion

The determination of PFAS in soil samples using the SyncorePlus Polyvap provides reliable and repeatable results and should be considered as an alternative to traditional nitrogen blow-down instrumentation. The SyncorePlus Polyvap is shown to increase analyst productivity by accommodating more samples and reducing analyst oversight during the evaporation process.

5. Acknowledgements

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6. References

- [1] Poly- or perfluorinated alkylated substances (PFAS), Lenntech, [online], [17.06.2024], <https://www.lenntech.com/processes/pfas.htm>
- [2] Per- and polyfluoroalkyl substances (PFAS), European Chemicals Agency, [online], [17.06.2024], <https://echa.europa.eu/hot-topics/perfluoroalkyl-chemicals-pfas>
- [3] U.S. Environmental Protection Agency, Method 1633

For more information, please refer to Application Note 850/2024.

