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The Analysis of Perfluorinated Compounds – Beyond UCMR3

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UCMR3

"**Purpose:** To collect occurrence data for contaminants suspected to be present in drinking water, but that do not have health based standards set under the Safe Drinking Water Act (SDWA). Assessment monitoring target contaminants that are analyzed with methods that utilize existing and widely used technology."

USEPA Fact Sheet
EPA 815-F-12-003

UCMR3

Perfluorinated Compounds (PFCs): EPA Method 537 included as UCMR3 List 1 Contaminants;

Compound	MRL ug/l
Perfluorooctanesulfonic acid	0.04
Perfluoroctanoic acid	0.02
Perfluorononanoic acid	0.02
Perfluorohexanesulfonic acid	0.03
Perfluoroheptanoic acid	0.01
Perfluorobutanesulfonic acid	0.09

Perfluorinated Compounds

Solicitations for capabilities for analysis of PFCs often request a “UCMR3” certified lab.

“UCMR3” certified lab would have been certified for EPA Method 537, Version 1.1.

EPA Method 537, as written, has some limitations as to it’s application

EPA Method 537 - Limitations

- Limited list of compounds/chemistries covered
- Poor SPE recoveries for shorter chain acids using listed column
- Poor performance of several sulfonamides
- Poor chromatographic peak shape due in part to high organic content of extracts
- Telomer sulfonates, for example, not addressed

Per and Polyfluorinated Compounds

There are several chemistries that are being looked at;

- perfluorinated carboxylic acids
- perfluorinated sulfonic acids/sulfonates
- perfluorinated telomer sulfonates (polyfluorinated)
- perfluorinated sulfonamides
- fluorotelomer alcohols

EPA Method 537 - Limitations

- Written for drinking water, what about surface or ground waters with sediment?
- How do we address solids, soils, sediments?
- How do we address tissues?
- Larger list of compounds

What does the commercial, contract services lab do?

Options

ISO 25101:2009

- Also limited in scope of compounds
- Greater flexibility in SPE sorbents and analytical conditions
- Not as prescriptive as EPA 537

ASTM D7979-15 (water)

- Broad range of per and polyfluorinated chemistries
- Avoids SPE
- Potentially instrument limited

Options

ASTM D7968-14 (soil)

- Broad range of per and polyfluorinated chemistries
- Only requires filtration of extract
- Potentially instrument limited

ICES Techniques in Marine Sciences, No. 48, August 2010

- Broad range of per and polyfluorinated chemistries
- Addresses waters, soils and tissues
- Readily adaptable to commercial laboratory already doing waters

Options

EPA 537 Modified

- What many laboratories have adopted in lieu of a standard EPA methodology
- Potentially greater acceptance by regulators
- Often done in attempt to try to meet client needs.
- Leads to substantially greater variability in results delivered by laboratories

Variations

Waters

- Polymeric (styrene divinylbenzene) SPE
- Weak Anion Exchange SPE
- C18 SPE
- Presence of a concentration and whether or not taken to dryness a factor
- Extent of use of isotopically labeled internal standards

Variations

Soils

- Sonication with ACN/Water
- Methanol/Acetic Acid shake or tumble
- Methanol water tumble
- Pressurized fluid extraction
- Amount of soil extracted (0.1 g to 10 grams)

Variations

Tissues

- Sonication with ACN/Water
- Ion pair extraction
- Alkaline digestion
- All use some form of SPE for clean-up
- Lipid removal addressed differently

Variations

Instrumental

- Number of isotopically labeled compounds varies
- Matrix matched calibration standards
- Instruments vary; MS/MS, TOF, Ion Trap
- Calibration model (external vs internal vs isotopic internal)
- How are branched chain isomers dealt with?

Summary

Several studies and reviews have verified variability in the results from the analysis of perfluorinated compounds.

Result is that there is potential for greater variability in results generated between different laboratories.

Where isotopically labeled standards are heavily used, variability minimized.

Points to the need for a method(s) validated by many laboratories for general purpose use.

Questions