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Pending PFAS Regulations and Testing for Fluorotelomer Alcohols (FTOHs) in Water

Fluorotelomer alcohols (FTOHs) represent a major class of per- and polyfluoroalkyl substances (PFAS) and include some of the most well-known precursors of perfluorocarboxylic acids (PFCAs), including perfluorooctanoic acid (PFOA) and perfluorohexanoic acid (PFHxA). Their presence in surface water, groundwater, and drinking water supplies represents a potential risk to human health and the environment. The ALS R&D team has recently validated a sensitive, robust, and selective analytical method to quantify FTOHs to ultra-trace levels using gas chromatography with triple quadrupole tandem mass spectrometry with positive ion chemical ionization (GC-MS/MS-PCI).

Uses of FTOHs

The widespread use of fluorotelomer-based commercial products has resulted in extensive occurrence of FTOHs in the environment. Recent studies have focused on FTOH sources, fate, transport, and distribution in environmental media, along with human health risks and exposure.

FTOHs are used in the synthesis of various surfactants and as intermediates in the manufacture of a variety of products with a wide range of applications, including textiles, polymers, paints, adhesives, waxes, and cleaning agents. FTOHs function as surfactants, lubricants, and intermediate products in manufacturing processes and can be emitted into the atmosphere during the production of fluoropolymers.

FTOHs are a constituent in many aqueous film-forming foam (AFFF) formulations and are a byproduct in fluorotelomer-based AFFF. 8:2 FTOH concentrations in some AFFFs have been found to range from 8 to 26.5 mg/L[5]. The detection of FTOHs at AFFF-impacted sites is therefore likely to increase as testing for these substances becomes more common, and as analytical methods improve.

Fate and Transport

FTOHs have been found to be ubiquitous in water[1,4]. Numerous studies in the literature have also shown that FTOHs can transform into other persistent, bioaccumulative PFCAs in water through various biotransformation mechanisms. FTOHs may therefore be considered an indirect source of PFCAs in the environment.

Due to their high volatility, FTOHs can undergo long-range environmental transport. Landfill leachate[8] and wastewater treatment works are potential sources of FTOHs.

Relevance and Pending Regulations

Being a major precursor of common PFCAs, FTOHs may indirectly cause adverse effects to human and environmental health. Human exposure to FTOHs occurs mainly through ingestion pathways such as diet and drinking water[2]. Because they are widely used, FTOHs have been found in

various types of water sources including drinking water[1,2], wastewaters[4,6], industrial wastewater influents and effluents[1,3,6], surface water[2,7], and rainwater.

New European regulations are currently pending for 6:2 and 8:2 FTOH which propose their inclusion within a regulated sum of twenty-four per- and polyfluorinated alkyl substances (PFAS) of primary concern[9]. Incorporation of these substances into the regulatory regimes of other regions may follow.

Laboratory Analysis Method

ALS Canada offers testing of 6:2 and 8:2 FTOHs through our specialty PFAS laboratory in the UK. The test method uses GC-MS/MS with positive ion chemical ionization (PCI) to provide optimal sensitivity, selectivity, and reliability, with detection limits of 5 parts per trillion (ng/L) per substance, as shown in Table 1. ALS Coventry has applied for ISO 17025 accreditation for this test through UKAS. Please refer to the ALS Coventry's scope of accreditation for current status.

Sampling Requirements

Samples for analysis of FTOH are collected in 40 mL VOC vials with Teflon septa, containing 2 mL of methanol preservative. When collecting a sample, vials should be filled completely with zero-headspace, but not over-filled to cause methanol spillage. Because the 6:2 and 8:2 FTOHs are volatile, sealed VOC vials are necessary to prevent evaporative losses. ALS has conducted extensive validations to confirm that the Teflon-lined septa of these vials are suitable for these analytes. Our studies have determined that a maximum holding time of 5 days protects against significant FTOH losses, which can occur with longer storage periods.

Because of the short hold time of this test, sample collection and submission must be pre-arranged with your ALS Canada Project Manager. This is necessary to permit expediting of samples to the UK for prompt analysis. Sample collection should generally occur on a Monday or possibly Tuesday to ensure receipt at one of our hub lab locations (Waterloo, Calgary, or Vancouver) before Tuesday at noon.

Please contact your ALS Project Manager with any questions, or to arrange for sampling supplies.

Table 1. FTOH Analyte Reporting

Fluorotelomer Alcohol	Abbreviation	CAS Number	Limit of Reporting
6:2 Fluorotelomer Alcohol	6:2 FTOH	647-42-7	5 ng/L
8:2 Fluorotelomer Alcohol	8:2 FTOH	678-39-7	5 ng/L

Table 2. Sampling and Analysis Requirements

Test Method Instrumentation	GC-MS/MS-PCI
ALS Canada Method Code	FTOH
Sample Containers and Preservative	2 x 40 mL clear VOC vials pre-charged with 2 mL methanol preservative (fill with zero-headspace)
Storage Temperature	2 – 8°C
Holding Time	5 days

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