Filtration Media for In-Home PFAS Removal from Drinking Water

Contract# 5R44ES032735-03

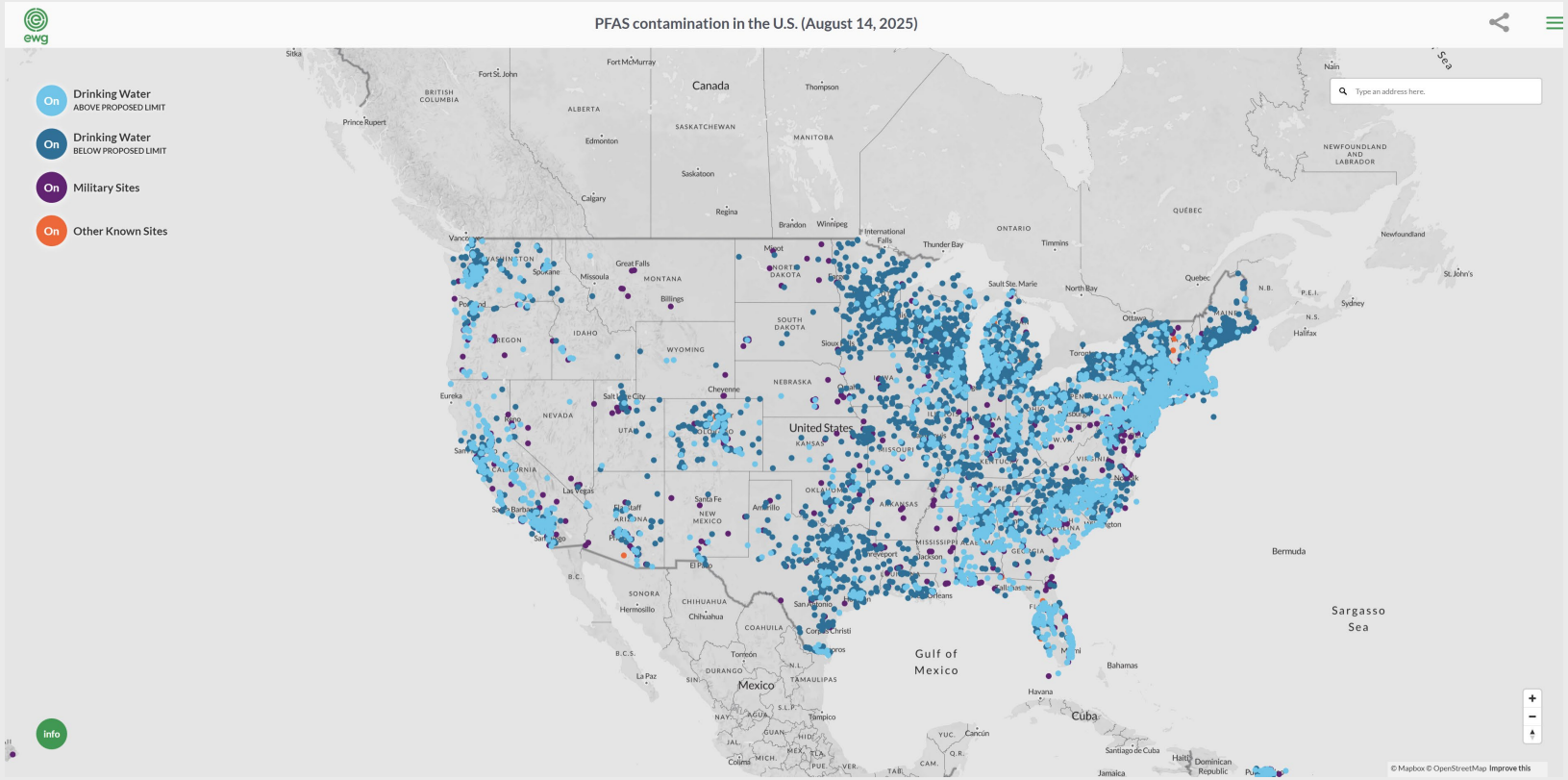
PI: Steve Dietz, Ph.D.

Virtual Technology Fair: Per- and Polyfluoroalkyl Substances

Wednesday, September 24, 2025

TDA RESEARCH

PFAS Contamination in the U.S.

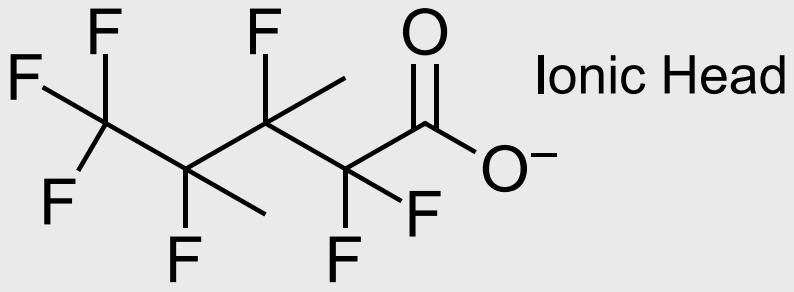


- As of August 2025, the total number of known PFAS-contaminated sites in the U.S. was 9,552, indicating that at least 172 million people have drinking water that has tested positive for PFAS contamination.
- To meet increasing stringent federal and state regulations for PFAS pollution, we are developing FluorTrap™ sorbents for in-house, municipal, industrial and other applications.

TDA RESEARCH

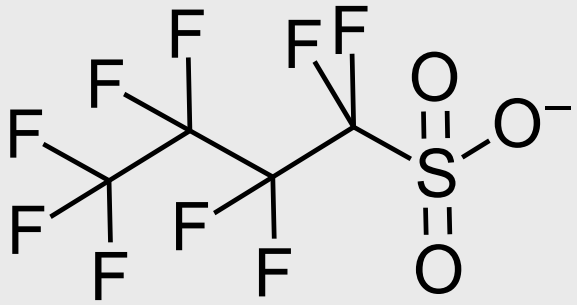
Main Treatment Options

- **Granulated activated carbon (GAC)** is the dominant treatment technology for removing per- and polyfluoroalkyl substances (PFAS) from water sources. The process works by adsorption, where PFAS compounds adhere to the highly porous surface of the carbon. GAC is particularly effective for longer-chain PFAS but is less so for shorter-chain variants.
  - Multi-contaminant removal: GAC can also remove other compounds, such as volatile organic compounds (VOCs) and substances that cause unpleasant tastes and odors.
  - Regenerable: The activated carbon can be thermally reactivated off-site to destroy the adsorbed PFAS, allowing the carbon to be reused
- **Ion Exchange (IX)** Uses synthetic resins to electrostatically attract and remove negatively charged PFAS ions. IX can be more effective for short-chain PFAS than GAC, but the media is often single-use and is much more expensive.



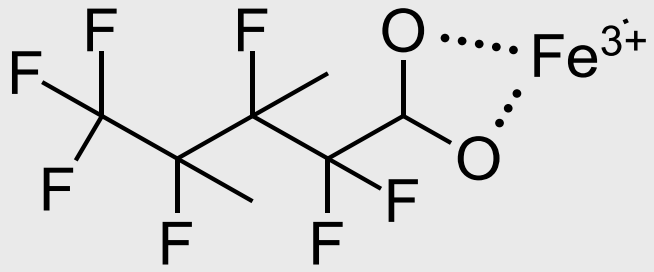
Ionic Head

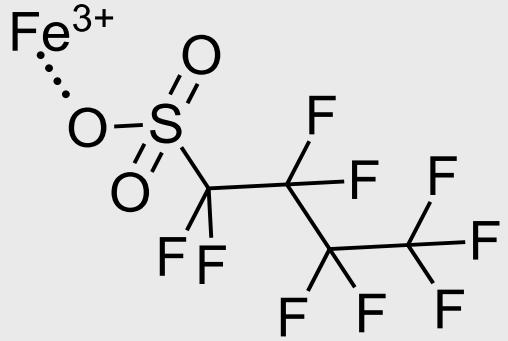
Hydrophobic tail



TDA Innovation

- To improve the removal of low molecular weight PFAS compounds, we prepared activated carbons modified with metals such as iron, magnesium, aluminum, zirconium, zinc and the like
- TDA's PFAS removal sorbent (FluorTrap™) comprises a mesoporous carbon structure modified with Lewis acid-base functional groups incorporated into the porous carbon structure to be able to efficiently remove PFAS, and other anionic contaminants from water through a combination of adsorption, electrostatic, and ion exchange interactions





Batch Screening PFAS Removal

- Batch screening tests at realistic concentrations found at contaminated sites were done at TDA using a total of 12 ppb of PFAS in tap water, split into equal amounts of perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA, commonly known as GenX), perfluorohexane sulfonic acid (PFHxS), and perfluorobutane sulfonic acid (PFBS).

Metal Additive	%PFOA Removal	%PFNA Removal	%PFBS Removal	%PFHxS Removal	%HFPO-DA Removal	%PFOS Removal
None	83	76	86	82	79	78
Aluminum	95	96	96	96	92	99
Zirconium	94	94	95	96	89	95
Iron	86	82	84	90	86	86

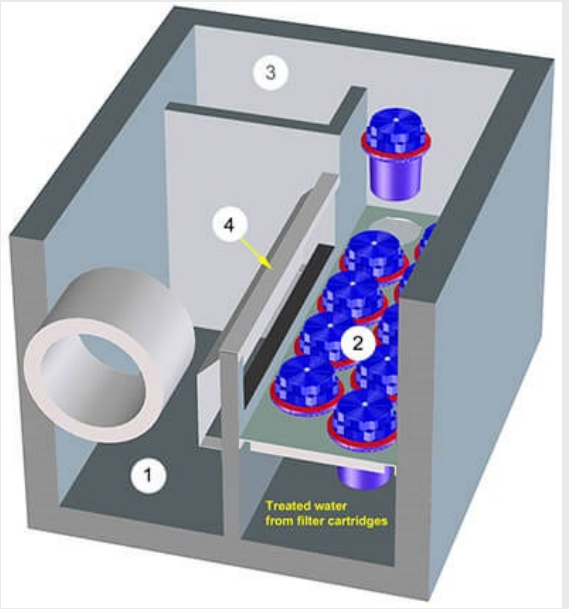
TDA RESEARCH

Commercialization

fabco® Industries Inc

Storm Safe Filter Cartridge

Multi-Chamber Filter Cartridge Vault System



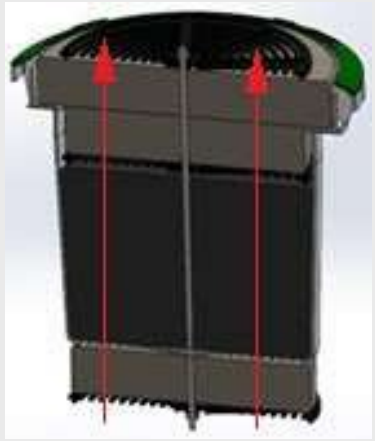
TDA RESEARCH

Fabco Independent Testing for PFAS Removal from Stormwater

Lab Number	3052248-03	3052248-05
Sampled Name	FluorTrap™ Outlet	PFAS Stock Solution
Parameter	Value	Value
EPA 533 (ng/L)		
11-CESF-3-oxaundecane-1-sulfonate (11Cl-PF3OUdS)	2.43	171
2,3,3,3-Tetrafluoro-2-propanoic acid (HFPO-DA)	<2.00	410
4:2 FTS	<2.00	427
6:2 FTS	<2.00	399
8:2 FTS	3.09	472
9-CHDF-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	<2.00	256
Dodecafluoro-3H-4,8-dioxanonaoate (ADONA)	<2.00	305
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	<2.00	335
Perfluoro-3-6,dioxaheptanoic acid (NFDHA)	<2.00	375
Perfluoro-4-oxapentanoic acid (PFMPA)	<2.00	378
Perfluoro-5-oxahexanoic acid (PFMBA)	<2.00	372
Perfluorobutanesulfonic Acid (PFBS)	<2.00	391
Perfluorobutanoic Acid (PFBA)	<20.0	296
Perfluorodecanoic Acid (PFDA)	<2.00	239
Perfluorododecanoic Acid (PFDoA)	2.28	161
Perfluoroheptanesulfonic Acid (PFHpS)	<2.00	278
Perfluoroheptanoic Acid (PFHpA)	<2.00	342
Perfluorohexanesulfonic Acid (PFHxS)	<2.00	309
Perfluorohexanoic Acid (PFHxA)	<2.00	363
Perfluorononanoic Acid (PFNA)	<2.00	266
Perfluorooctanesulfonic Acid (PFOS)	<2.00	255
Perfluorooctanoic Acid (PFOA)	<2.00	294
Perfluoropentanesulfonic Acid (PFPeS)	<2.00	362
Perfluoropentanoic Acid (PFPeA)	<20.0	322
Perfluoroundecanoic Acid (PFUnA)	2.03	266

TDA RESEARCH

Nutrient Removal from Stormwater



Fabco
Standard Up flow Cartridge

Influent (mg/L)		Effluent (mg/L)	
Pollutant	Concentration (mg/L)	Concentration (mg/L)	Percent Change
Phosphorus	16.7	3.9	-76.9
Total Nitrogen	45.6	12.8	-71.9
Total Organic Nitrogen	24.6	4.9	-80.1
Nitrate as N	12.2	5.3	-56.7
Ammonia as N	8.8	2.6	-70.5
Total Kjeldahl Nitrogen	33.4	7.5	-77.5

- Nutrient pollution from fertilizer runoff is a growing problem in the U.S., particularly in the Northeast and Florida. Fabco has an urgent need for products that can remove these pollutants from water runoff.

- Conventional AC does not adsorb phosphate, whereas TDA's metal modified sorbents are very effective for nitrate and phosphate removal from water

TDA RESEARCH

Key Outcomes/Next Steps

- We developed activated carbons with metals such as iron, magnesium, aluminum, zirconium, zinc and the like. The metal doped carbons exceed the PFAS removal efficiency of commercial carbons.
- We scaled-up production of our best performing sorbents and these sorbents are being tested by our commercialization partner FABCO Industries in their stormwater cartridges for the removal of PFAS and other contaminants.
- We filed a U.S. Patent application claiming the composition of matter and the use of our metal doped carbons for water treatment.

TDA Overview

Main Point of Contact: Steve Dietz
sdietz@tda.com,
(303) 887-9510

- **In Business for over 30 years**
  - Privately held—7 partners.
  - 130 employees, 33 Ph.D.'s chemistry/engineering.
  - Over $30 million in annual revenue.
- **Facilities**
  - Combined 75,000 ft^2 laboratory and office space near Denver, Colorado.
  - Catalyst testing: Continuous PFR, CSTR, batch, large scale, high P&T systems.
  - Sorbents: Sulfur removal from natural gas; post-combustion CO_2 capture; heavy-metals removal.
  - Materials processing and testing.
  - Battery materials development and testing
- **Business Model**
  - Identify opportunities with industry.
  - Perform R&D.
  - Secure intellectual property.
  - Commercialize technology via spin-offs licensing, joint ventures, internal business units.

TDA RESEARCH

Grant Information	**Steve Dietz, Ph.D., Filtration Media for In-Home PFAS Removal from Drinking Water, TDA Research, Inc., 5R44ES032735-03**
Presenter	Steve Dietz, Principal Scientist
Technology Name and Description	TDA's PFAS removal sorbent (FluorTrap™) is an advanced filtration media for PFAS removal from water comprises a mesoporous carbon structure modified with Lewis acid-base functional groups incorporated into the porous carbon structure for in-home, municipal, industrial and other applications.
Innovation	Conventional activated carbon sorbents remove contaminants by physical adsorption only and are not as effective for removal of low molecular weight PFAS species. TDA's patent pending sorbents are effective for difficult to remove low molecular weight PFAS compounds and other soluble ions from water.
Contaminant and Media	**Contaminants:** PFAS, nitrate, phosphate, ammonia **Media:** groundwater, drinking water, stormwater, wastewater **Target contaminant level:** Reduce PFAS from ppm level to <4 ppt
Technology Readiness Level	TRL 5-6 anticipated market availability – 2026
Site Work	Sorbent production scale-up in-house. Multiple ton scale in 2026
Main Point of Contact and Social Media	**Main Point of Contact:** Steve Dietz, sdietz@tda.com, (303) 887-9510 **Website:** www.TDA.com **LinkedIn:** www.linkedin.com/company/tda-research/posts/?feedView=all

TDA RESEARCH