



CASCADE 2027 NON-CONFIDENTIAL SUMMARY »

PFASPure: PFAS-Selective Water Filtration Media

COMOTION REFERENCE »

BDP 9124

Overview

Per- and polyfluoroalkyl substances (PFAS), often called “forever chemicals,” are now detectable in the blood of more than 96% of the U.S. population and are estimated to contribute to nearly 7,000 new cancer cases and over \$10 billion in health-related costs each year in the United States. Water treatment providers rely heavily on standard granular activated carbon (GAC) filtration as a cost-effective means to separate PFAS from drinking water; however, this widely used approach performs poorly against the smallest, newest PFAS compounds now detected in drinking water—compounds that are difficult to detect and even harder to remove. PFASPure modifies commercially available GAC with a targeted polymer coating that meaningfully improves capture of short- and ultra-short-chain PFAS, while preserving the cost, familiarity, and multi-contaminant performance of the carbon filtration infrastructure already used across the water industry today.

- **Problem:** Even the best available carbon filtration media struggle to remove the smallest, newest PFAS compounds now showing up in tap water, leaving utilities and consumers exposed to ongoing contamination risk.
- **Solution:** A polymer-modified carbon media is engineered with a molecularly imprinted surface coating that gives it higher capacity for the short-chain PFAS compounds that pass through standard filters largely untouched.
- **Impact:** Because the technology is built on carbon media already trusted and deployed at scale, it is designed for drop-in adoption into existing filtration systems, shortening the path to real-world use in municipal and household water treatment.

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Description

The core innovation applies molecular imprinting, a polymer chemistry technique used to create shape- and charge-selective binding sites, directly onto the surface of standard granular activated carbon. During synthesis, PFAS “template” molecules are combined with a functional monomer to form temporary complexes; a crosslinker and the carbon substrate are then added, and the mixture is polymerized to lock in molecularly shaped cavities on the carbon surface. The PFAS templates are subsequently washed out, leaving behind a polymer coating imprinted with cavities that preferentially re-bind PFAS molecules of matching size and charge. A related version of the technology immobilizes a multi-template imprinted polymer onto a biochar substrate, further improving simultaneous removal of both short- and long-chain PFAS.

- **Laboratory performance:** In side-by-side batch adsorption testing, the modified carbon media outperformed a leading commercial granular activated carbon in adsorption capacity for 7 of 8 short- and ultra-short-chain PFAS compounds tested, including PFAS not yet regulated by the U.S. EPA but increasingly detected in drinking water.

- **Adsorption kinetics:** Kinetics testing showed faster PFAS uptake within the first 24 hours for several priority compounds, particularly carboxylic acid PFAS, which are typically the hardest species to remove from water.
- **Retained functionality:** Because the technology modifies standard carbon media rather than replacing it, it is also expected to retain removal of other common contaminants such as lead, chlorine, pesticides, and pharmaceuticals.

Technology Readiness Level (TRL)

TRL 4 — System or subsystem components tested in a laboratory environment. Two prototype iterations of the modified carbon media have been produced and evaluated through controlled laboratory batch-adsorption capacity and kinetics testing using buffered water matrices designed to approximate real source-water conditions. Development to date has been supported by the UW CoMotion Innovation Gap Fund and a prior CoMotion STEP Award, with planned next steps including testing in real-world water matrices, filtration lifetime studies, and benchmarking against competing treatment media ahead of pilot-scale evaluation.

Value Proposition

- **Drop-in compatibility:** Because the technology modifies a standard, trusted carbon filtration media, it can be adopted into existing filtration infrastructure without new equipment or retraining.
- **Expanded PFAS coverage:** Laboratory testing shows improved capture of short- and ultra-short-chain PFAS that are often missed by conventional carbon filters.
- **Retained multi-contaminant performance:** Customers gain PFAS-specific removal without sacrificing existing carbon filtration performance against lead, chlorine, pesticides, and other regulated contaminants.
- **Adaptable design:** The imprinting approach can be reformulated to target new or emerging PFAS compounds as contamination profiles and regulatory requirements evolve.
- **Lower adoption barrier:** Familiarity with carbon-based filtration among water treatment customers may reduce switching hesitation compared to entirely new treatment technologies.

Intellectual Property Position

Patent application pending.

A related UW invention disclosure covering a multi-template imprinted polymer immobilized on a biochar substrate has also been submitted to UW CoMotion and is administratively grouped with the technology above for project management and licensing purposes.

Market Opportunity

- **Target customers:** Small- to mid-scale municipal drinking water utilities facing documented or elevated PFAS contamination, particularly those affected by firefighting-foam-related sources, represent an early target given their comparatively fast, lower-bureaucracy purchasing processes.
- **Market driver:** A 2024 federal drinking water regulation requires many U.S. utilities to meet strict PFAS limits by 2029 (with a possible extension to 2031), creating a defined compliance deadline expected to drive purchasing decisions.

- **Unmet need:** Carbon-based treatment is the most widely used PFAS removal method in the water industry but is well documented to underperform on the shorter-chain PFAS compounds increasingly detected in drinking water supplies.
- **Adoption pathway:** Municipal purchasing typically flows through consulting engineers and equipment representative networks rather than direct sales, making technical credibility and channel relationships important to commercial uptake.
- **Estimated market size:** Internal market analysis estimates a total addressable market of approximately \$0.5–\$4.9 billion, a serviceable addressable market of approximately \$0.5–\$1 billion, and a serviceable obtainable market of approximately \$5–\$25 million.

References

1. Steigerwald, J.M.; Peng, S.; Ray, J.R., "Novel Perfluorooctanesulfonate-Imprinted Polymer Immobilized on Spent Coffee Grounds Biochar for Selective Removal of Perfluoroalkyl Acids in Synthetic Wastewater," ACS ES&T Engineering, 2023. <https://doi.org/10.1021/acsestengg.2c00336>
2. Steigerwald, J.M.; Ray, J.R., "Adsorption Behavior of Perfluorooctanesulfonate (PFOS) onto Activated Spent Coffee Grounds Biochar in Synthetic Wastewater Effluent," Journal of Hazardous Materials Letters, 2021, 2, 100025. <https://doi.org/10.1016/j.hazl.2021.100025>
3. Steigerwald, J.M., "Development of a Novel Biochar-Molecularly Imprinted Polymer Composite for Targeted Adsorption of Perfluoroalkyl Substances in Water Treatment Applications," M.S. Thesis, University of Washington, 2022.