

Removal of Perfluorinated Chemicals by Epic Nano® Filter Media

Date: December 2016

Setting: School of Engineering - Accredited American University

Goal: The goal of this project was to perform a continuous flow adsorption test. This project is an experimental investigation of PFC removal from the same source water by filter material Epic Nano Filter Media by Epic Water Filters, Inc. In this project, Epic Nano® Filter Media with powdered activated carbon was investigated in a flow-through filtration set-up to simulate its standard operation.

Results: The results demonstrated 95% removal of total PFCs by the filter media and development of breakthrough curves in approximately two hour filtration experiments.

Filter Media: Epic Nano used in Epic Nano Water Pitcher & Epic Outdoor Bottle Filter

Experimental Details: Raw Water: Table 1 present the concentration of 13 perfluorinated chemical species. The total PFC concentration is 556 ng/L.

Table 1. Concentration of PFC Species in the influent water

PFC Species	Full Name	Concentration (ng/L)
PFOA	Perfluorooctanoic acid	50
PFOS	Perfluorooctanesulfonic acid	237
PFBA	Perfluorobutanoic acid	20
PFPeA	Perfluoro-n-pentanoic acid	66
PFHxA	Perfluorohexanoic acid	61
PFHpA	Perfluoroheptanoic acid	30
PFNA	Perfluorononanoic acid	3.4
PFBS	Perfluorobutanesulfonic acid	14
PFHxS	Perfluorohexane sulfonic acid	74
PFDA	Perfluorodecanoic acid	ND
PFUnA	Perfluoroundecanoic acid	ND
PFDoA	Perfluorododecanoic acid	ND
PFOSA	Perfluorooctanesulfonic acid	ND

ND: Compound is not detected at the reporting limit i.e., 1.7 ng/L

Data Quality. All PFCs were analyzed by an external analytical lab (AXYS Analytical Services, Canada) and the data quality was traced by spiking samples with isotopically labeled PFC standards at known concentrations (i.e., 20-40 ng/L). The average recoveries of these isotopically labeled PFC standards reported by the AXYS Analytical Services are listed in Table 2. The percent recoveries range between 88 –100% and the coefficient of variations are less than 11%.

Table 2. Average recoveries of PFC species

PFC Species	Recovery (%)*
PFOA	88 ± 4
PFOS	95 ± 10
PFBA	95 ± 8
PFHxA	86 ± 8
PFNA	95 ± 9
PFHxS	98 ± 11

*Recoveries are reported as arithmetic mean ± standard deviation for all twelve samples analyzed by the lab

Filtration Apparatus and Operational Conditions: The experimental set-up of the flowthrough filtration experiments. The flowrate was adjusted to ~150-170 mL/min (aiming ~ 1gpm/ft²) interactively during the experiment. The pressure at the feed line to the filter was 6-8 psi as presented in Figure 3. A total of eight samples were collected and shipped to AXYS Analytical Services Ltd. for PFC analysis. The sampling times and average removal rates are presented in Table 3.

Table 3. Collected composite samples and their sampling times during the filtration experiments

Sample	Start Time (min)	End Time (min)	Avg PFC % Removal
Sample 1	0	3	94%
Sample 2	10	13	80.30%
Sample 3	20	23	72.40%
Sample 4	30	33	65.50%
Sample 5	40	43	55.70%
Sample 6	60	63	57.20%
Sample 7	80	83	45.50%
Sample 8	110	113	46.60%