Supporting Information

Amyloid-Fibril Based Membrane for PFAS Removal from Water

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Table S1: Chemical structures of perfluoroalkyl carboxylic and sulfonic acids as well as precursors chosen as contaminants in spiked MilliQ water.

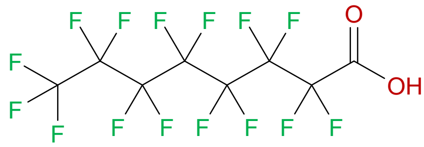
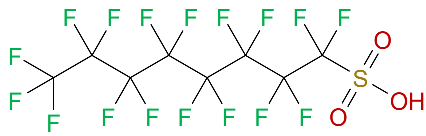
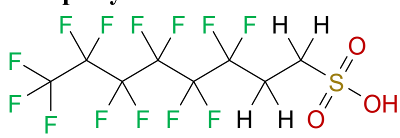
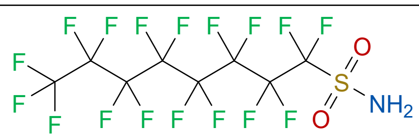
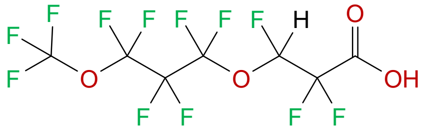
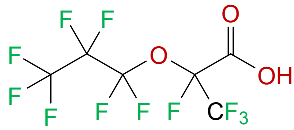
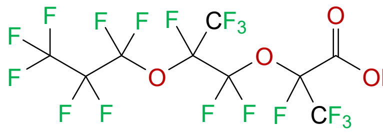
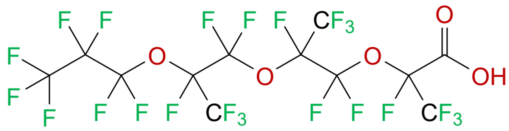
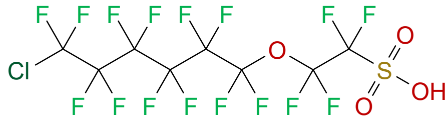
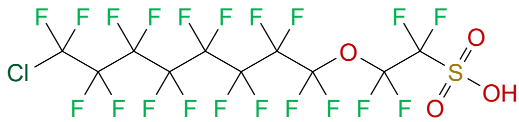
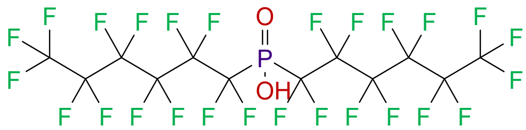
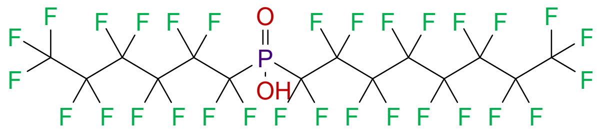
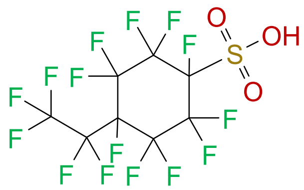
Analyte	**Acronym**	***n***	**Structure**
perfluoroalkyl carboxylic acids (PFCAs)			
perfluorobutanoic acid	PFBA	3	
perfluoropentanoic acid	PFPeA	4	
perfluorohexanoic acid	PFHxA	5	
perfluoroheptanoic acid	PFHpA	6	**general structure:** $C_nF_{2n+1}COOH$ $n < 7$: short-chain $n \geq 7$: long-chain
perfluorooctanoic acid	PFOA	7	**exemplary structure:** PFOA
perfluorononanoic acid	PFNA	8	
perfluorodecanoic acid	PFDA	9	
perfluoroundecanoic acid	PFUnDA	10	
perfluorododecanoic acid	PFDoDA	11	
perfluorotridecanoic acid	PFTrDA	12	
perfluorotetradecanoic acid	PFTeDA	13	
perfluoroalkane sulfonic acids (PFSAs)			
perfluorobutane sulfonic acid	PFBS	4	**general structure:** $C_nF_{2n+1}SO_3H$ $n < 6$: short-chain $n \geq 6$: long-chain
perfluorohexane sulfonic acid	PFHxS	6	**exemplary structure:** PFOS
perfluoroheptane sulfonic acid	PFHpS	7	
perfluorooctane sulfonic acid	PFOS	8	
perfluorodecane sulfonic acid	PFDS	10	
precursors to PFCAs and PFSAs			
4:2 fluorotelomer sulfonic acid	4:2 FTSA	4	**general structure:** $C_nF_{2n+1}CH_2CH_2SO_3H$ **exemplary structure:** 6:2 FTSA
6:2 fluorotelomer sulfonic acid	6:2 FTSA	6	
8:2 fluorotelomer sulfonic acid	8:2 FTSA	8	
perfluorooctane sulfonamide	FOSA	-	

Table S2: Chemical structures of replacement compounds and/or overlooked PFASs chosen as target analytes. The name and the structure of the free acid are given, whereas the measured form is the anion.

Common name	Acronym	Structure	Class
Per- and polyfluoroalkyl ether carboxylic acids (PFECAs)			
4,8-dioxa-3*H*-perfluorononanoic acid	DONA		replacement
hexafluoropropylene oxide dimer acid	HFPO-DA		replacement
hexafluoropropylene oxide trimer acid	HFPO-TrA		replacement
hexafluoropropylene oxide tetramer acid	HFPO-TeA		replacement
Per- and polyfluoroalkyl ether sulfonic acids (PFESAs)			
6:2 chlorinated polyfluoroalkyl ether sulfonic acid	6:2 Cl-PFESA		overlooked
8:2 chlorinated polyfluoroalkyl ether sulfonic acid	8:2 Cl-PFESA		overlooked
perfluoroalkyl phosphinic acids (PFPiAs)			
bis(perfluorohexyl) phosphinic acid	6:6 PFPiA		overlooked
perfluorohexylperfluorooctyl phosphinic acid	6:8 PFPiA		overlooked
Cyclic perfluoroalkane sulfonic acids (cyclic PFSAs)			
perfluoro-4-ethylcyclohexane sulfonic acid	PFECHS		overlooked

Replacement PFASs are structurally similar to the long-chain PFASs which are phased out by the major manufacturers. It possesses fewer fluorinated carbons (short-chain PFASs) or is less well-known PFASs [1, 2]. Overlooked PFASs, such as PFECHS, PFPiAs and 6:2 Cl-PFESA, are often neglected to be investigated chemicals [3, 4].

Table S3 Sampling locations and results of physicochemical parameters of water samples collected from Chinese rivers[5].

River	Latitude °N	Longi-tude °E	Date | time of sampling	Temp.[1] [°C]	pH	Sal.[2] [PSU]
Xiaoqing	37.066	117.892	11.11.2018 | 14:12	13.2	8.3	1.1
Xiaoqing	37.085	117.990	11.11.2018 | 13:13	14.0	8.3	1.3
Xiaoqing	37.111	118.111	11.11.2018 | 15:37	13.8	8.2	1.4

[1]temperature; [2]salinity

Table S4 Treatment efficiency of samples from Xiaoqing River Basin by AM membrane

Contaminants	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	HFPO-DA	HFPO-TrA
Removal efficiency (%)	3.5±0.03	3.91±0.02	4.28±0.02	20.62±0.05	26.29±0.03	72.29±0.1	9.81±0.14	93.51±0.08

Table S5 Technical specifications used for sorting the ranking and ranking efficiency product for the nanofiltration and amyloid fibril-based membrane considered.

	Nanofiltration	Amyloid-carbon hybrid membrane
Environmental friendliness	Organic material dominated Organic solvent-based preparation Hard to be degraded	Dairy industry by product Water phase preparation Biodegradable
Public acceptability	Material dependent potential risk Plastic waste	Low risk for health Biodegradable Disposable
Long-chain PFASs removal efficiency (%)	85 to 99[6]	≈100
Short-chain PFASs removal efficiency (%)	20-70[6]	> 96
OPEX: operating cost per volume of treated water (€ per m^3)	0.155[7]	0.04[8]
CAPEX: capital investment normalized by operating flux [€ per (day^{-1})]	530[8]	50[8]
water recovery efficiency (%)	60-70[7]	100[8]
required energy per volume ($kWhm^{-3}$)	0.528[8]	0.2[8]

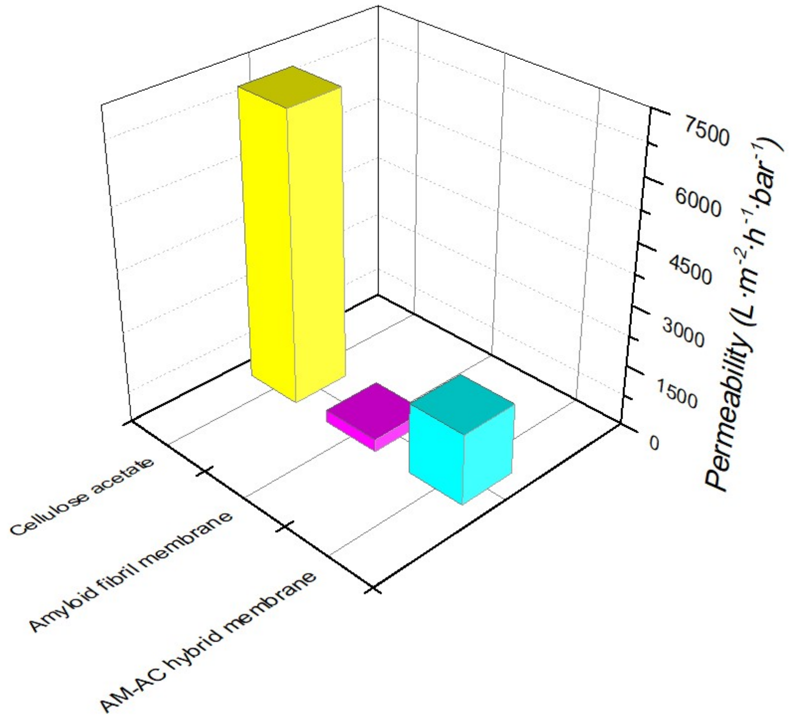


Figure S1 Comparison of permeability of amyloid-based membranes.

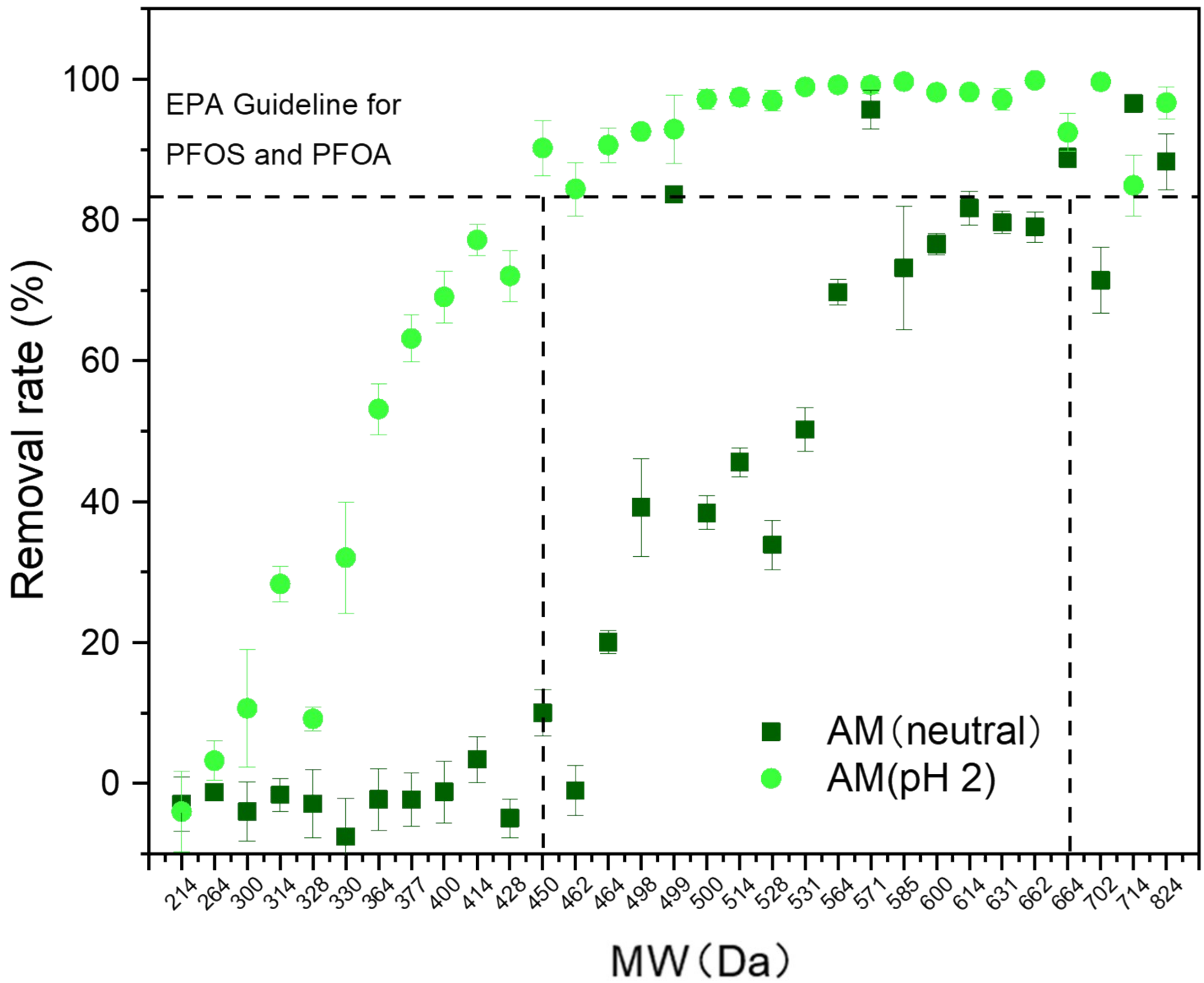


Figure S2 Removal rate as a function of Molecular Weight. Since the feed concentration of each PFASs compounds is 400 ng/L, the concentration of permeate can be reached to the EPA guideline of PFOA and PFOS when the removal rate is higher than 82.5 %. The detailed compounds are PFBA (214.04), PFPeA (264.05), PFBS (300.10), PFHxA (314.05), 4:2 FTSA (328.15), HFPO-DA (330.05), PFHpA (364.06), DONA (377.50), PFHxS (400.12), PFOA (414.07), 6:2 FTSA (428.17), PFHpS (450.12), PFECHS (462.13), PFNA (464.08), HFPO-TrA (498.06), FOSA (499.14), PFOS (500.13), PFDA (514.08), 8:2 FTSA (528.18), 6:2 Cl-PFESA (531.90), PFUnDA (564.09), N-EtFOSE (571.25), N-EtFOSAA (585.24), PFDS (600.15), PFDoDA (614.10),8:2 Cl-PFESA (631.90), HFPO-TeA (662.09), PFTrDA (664.10), 6:6 PFPiA (702.07), PFTeDA (714.11), and 6:8 PFPiA (824.06).

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