Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Graphene Oxide Membranes on a Hierarchical Elemental Carbon-based Support

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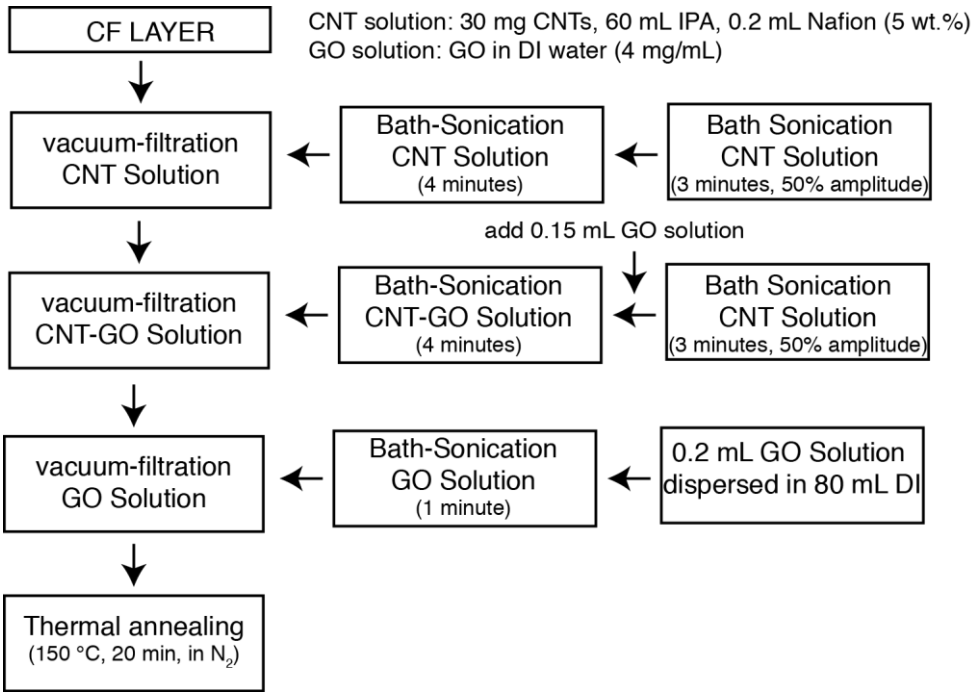

Figure S1: FCM fabrication process.

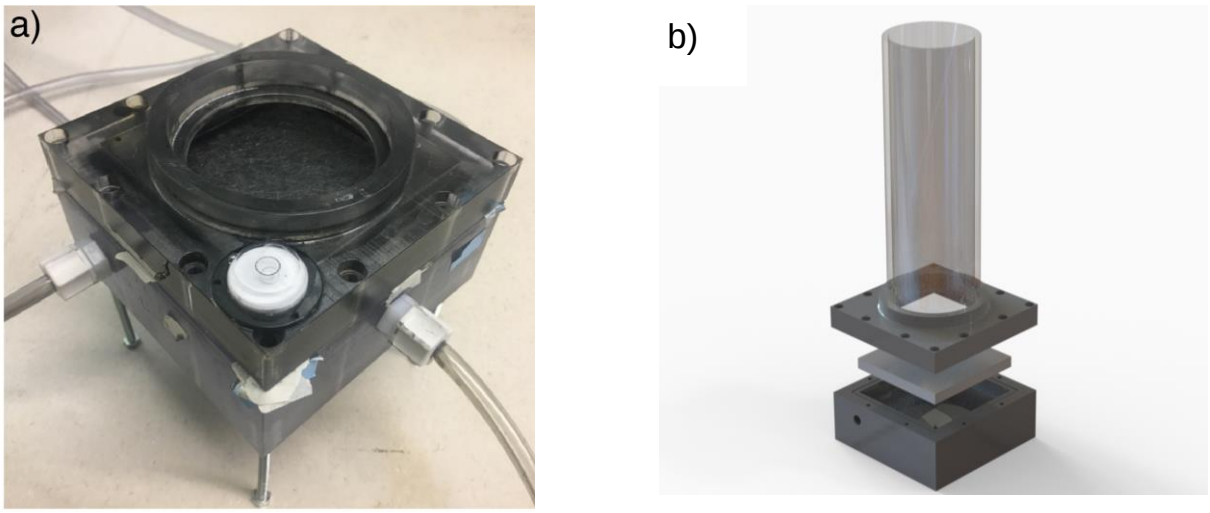

Figure S2: Custom-made vacuum filtration device for FCM fabrication. a) Photo of the 3D-printed vacuum filtration device. **b)** *SolidWorks* representation of the 3D-printed vacuum filtration device.

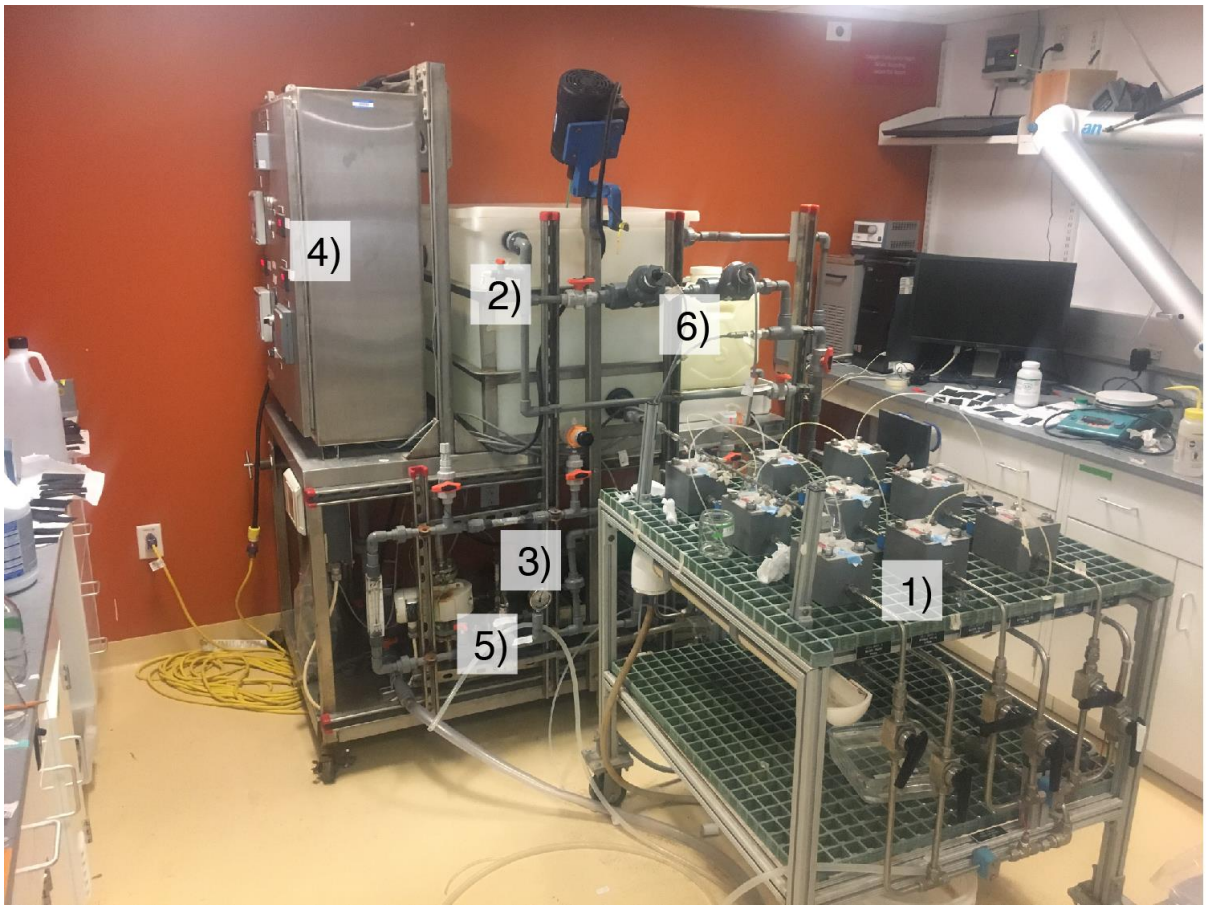

Figure S3: Multi-cell cross-flow apparatus used for filtration tests. (1) Membrane cell lines; **(2)** feed tank; **(3)** circulation pump; **(4)** control panel to adjust flow and pressure flow control valves; **(5)** flow-meter; **(6)** pH and conductivity sensor.

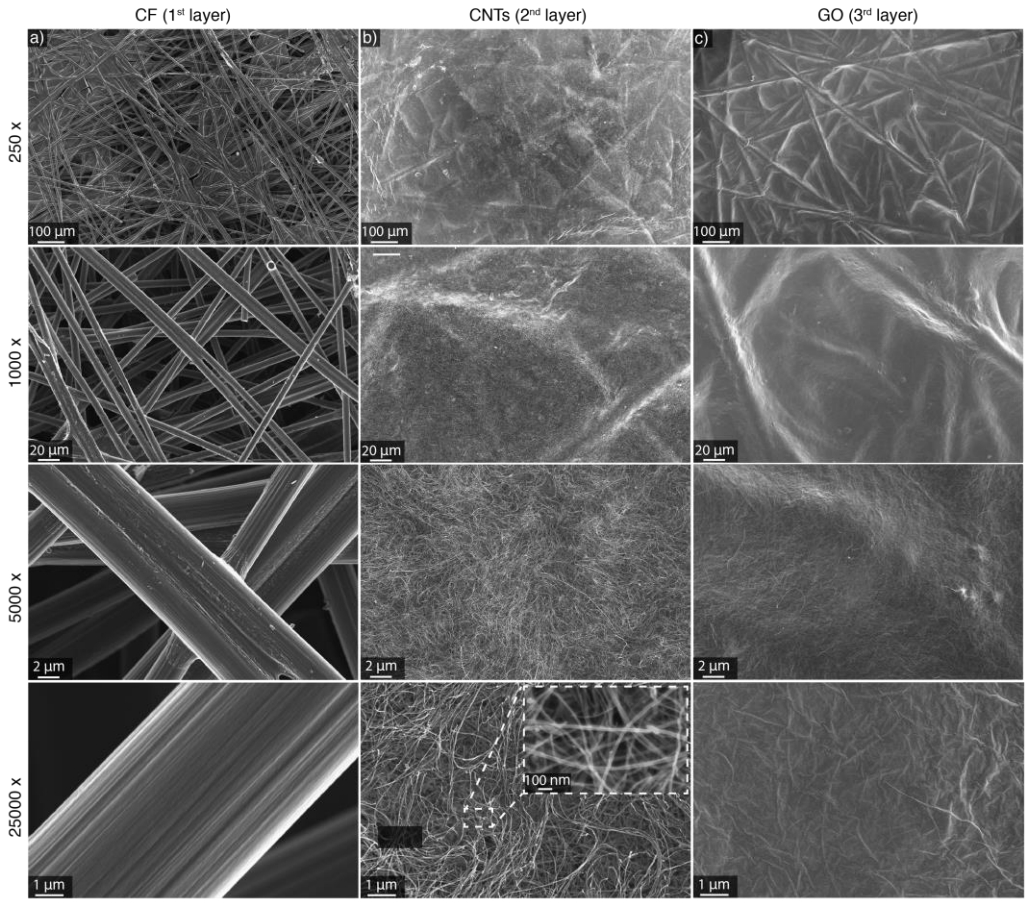

Figure S4: SEM analysis of the hierarchical structure of FCMs. SEM surface images of **a)** CF paper (1st layer, substrate of the FCM), **b)** intermediate CNT support layer (2nd layer) and **c)** GO selective layer (3rd layer) at different magnifications.

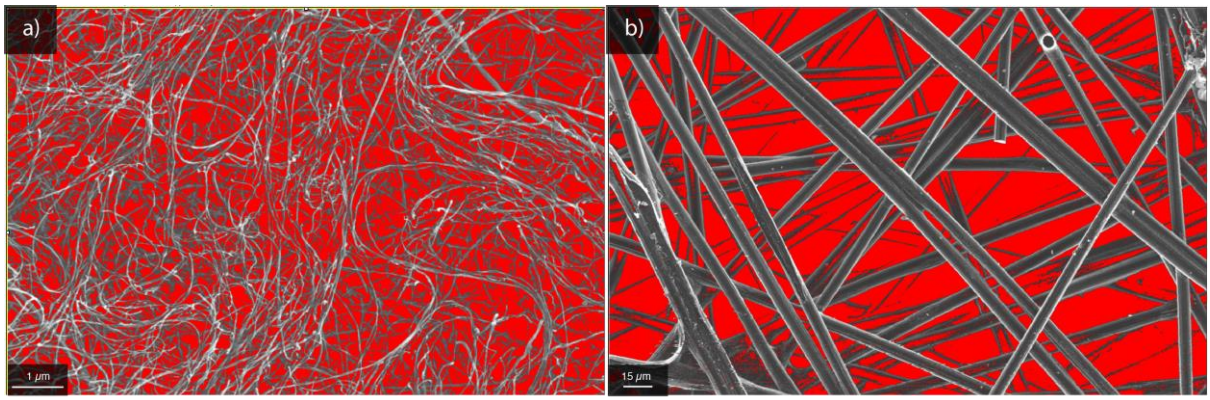

Figure S5: Evaluation of the superficial mean pore size of the layers constituting the FCMs. SEM image under analysis of the **a)** CNT layer and **b)** CF layer. *Image J* software allows to recognized the superficial pores (in red) and calculate their areas.

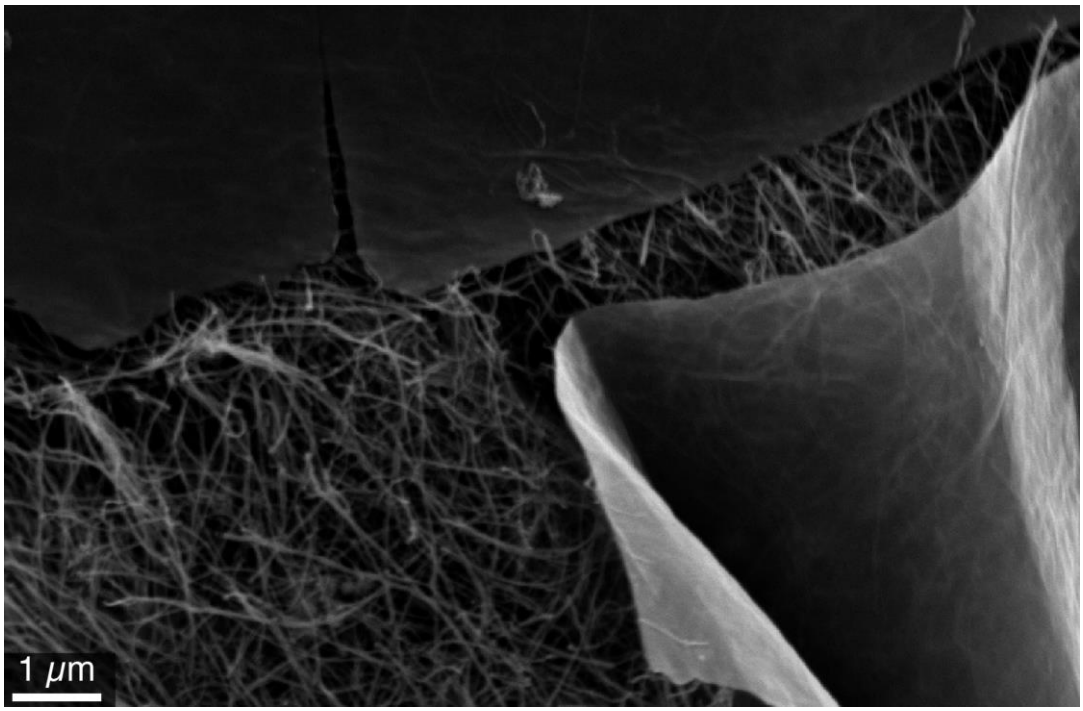

Figure S6: Example of a mechanically-damaged FCM. The FCM has a crack that reveals the underneath CNT layer.

Table S1: Benchmarking of GO membranes for ions rejection.

Ref.	NaCl rejection (%)	$MgSO_4$/Na_2SO_4 rejection(%)	Permeability (LMH-bar)	Notes
[3]	40%	75%	2.5	Feed Na_2SO_4
[3]	20%	55%	2.5	Feed Na_2SO_4
[1]	20%	60%	20	Feed $MgSO_4$
[2]	45%	80%	22	Feed Na_2SO_4
[4]	38%	62%	11	Feed $MgSO_4$
[5]	25%	55%	3.5	Feed $MgSO_4$
[7]	27%	79%	2.7	Feed Na_2SO_4

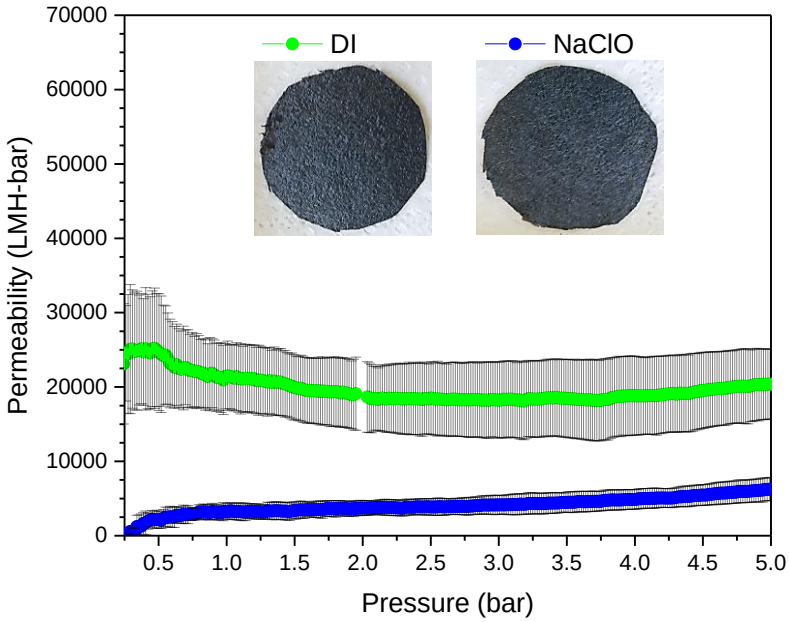

Figure S7: Permeability of the FCMs measured by CFP method. Permeability data of the FCM after DI filtration (in green) and after 9 hours of NaClO filtration at 1000 ppm and 5 bar of applied pressure (in blue). The figure includes photos of the FCMs used in the analysis.

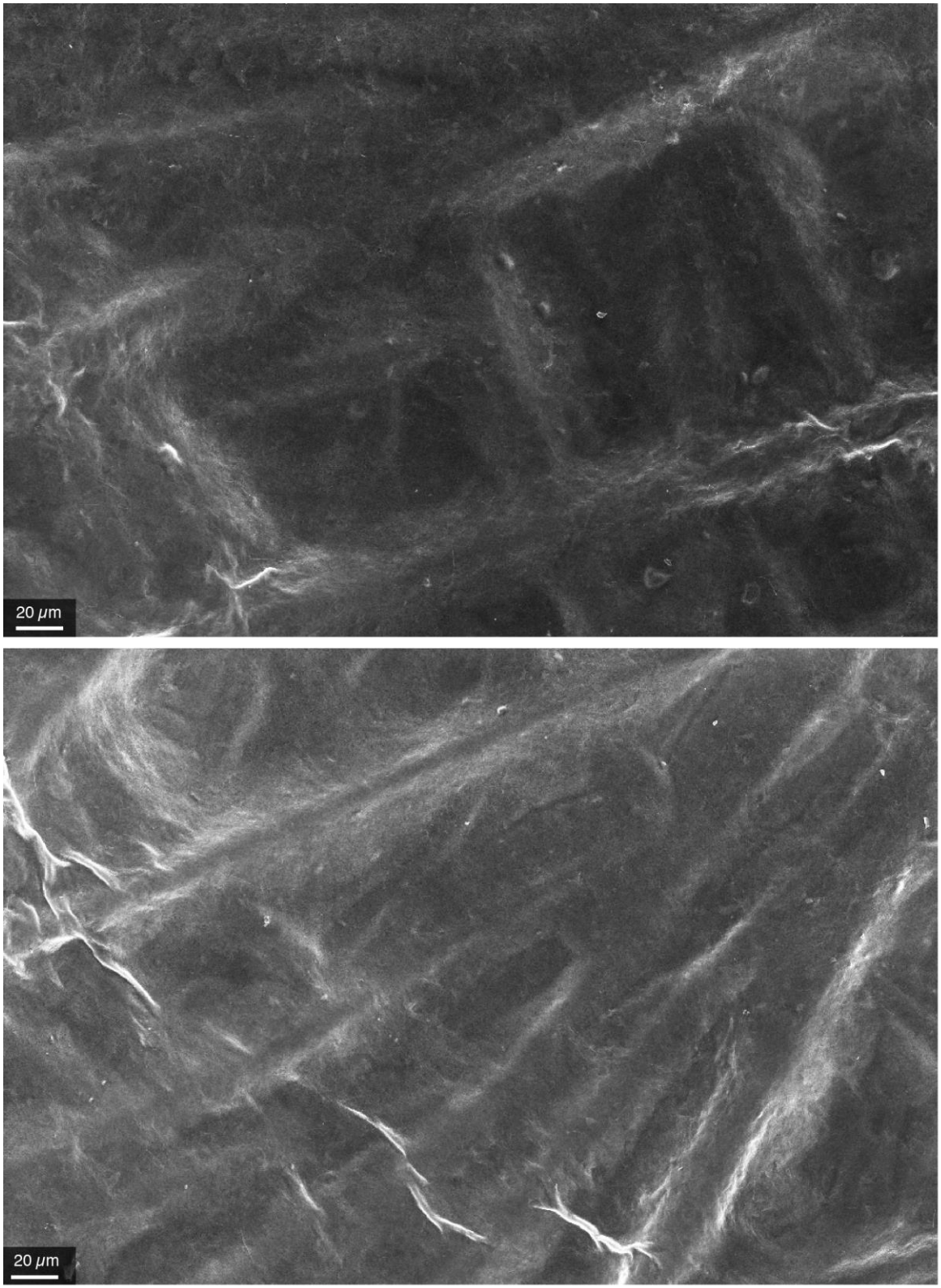

Figure S8: FCM chemical stability to organic solvents. FCM after being immersed in acetone (top) or water (bottom) reveals the same morphology.

Table S2: Decomposition of the C1s peak of the FCM after each thermal annealing cycle.

	Wavelength (eV)	1st cycle	2nd cycle	3rd cycle	4th cycle
C-C C=C	≈285	64.5±1	66.3±1	65.0±1	64.3±1
C-OH; C-O-C	≈287	14.1±1	10.2±1	16.0±1	16.5±1
O=C-OH	≈289	21.4±1	23.5±1	19.0±1	20.2±1

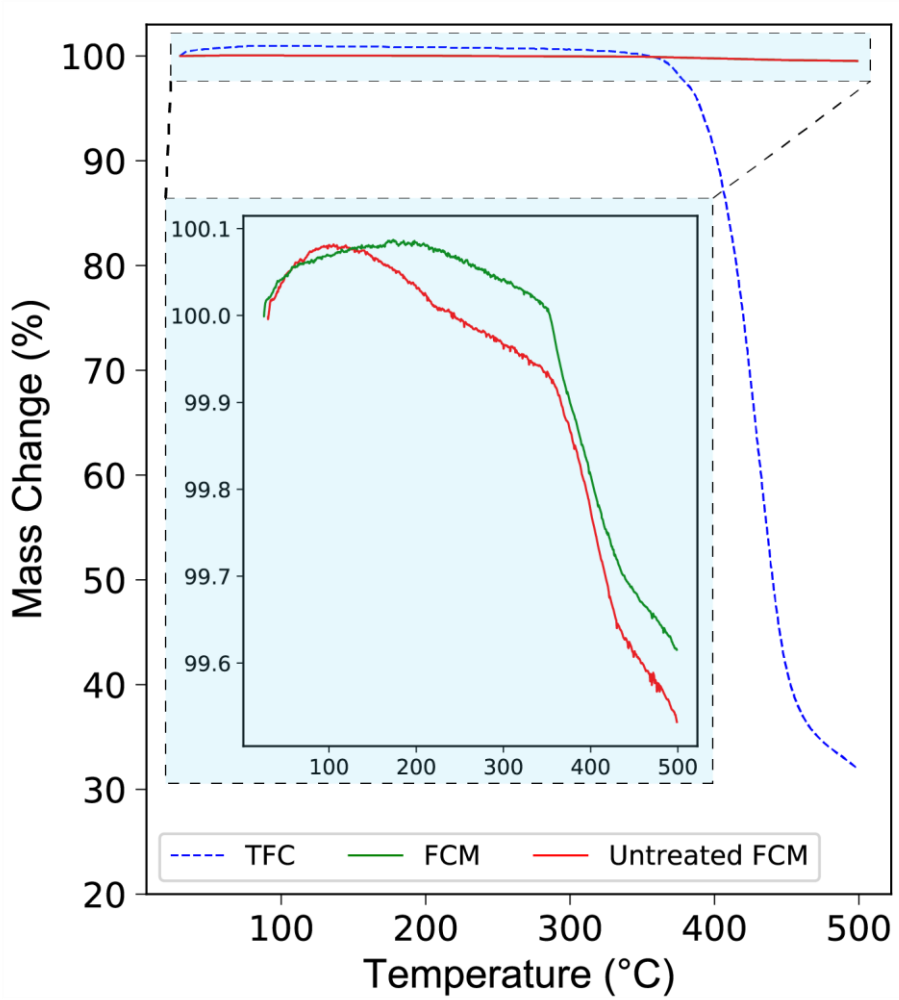

Figure S9: Mass change over temperature of an untreated FCM (red line), a thermally treated FCM (green line) and a polyamide thin film composite (TFC) membrane (dashed blue line). The untreated FCMs were not subjected to any annealing at 150 °C during the fabrication process whereas, the thermally treated FCMs were thermally reduced at 150 °C for 20 min during the fabrication process and then subjected to four sequential thermal annealing cycles of 15 min at 150 °C. TFC it was not treated before the annealing.

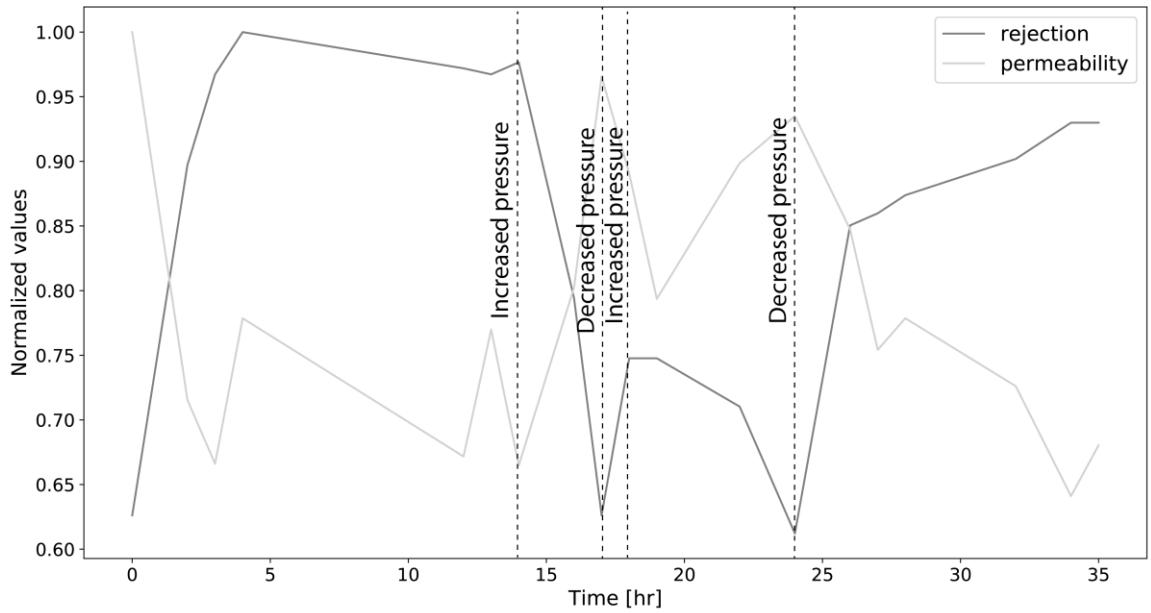

Figure S10: Permeability (light grey) and rejection (dark grey) performance of a FCM over time under different applied pressures. The dashed line indicates the times when the pressure was changed.

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