Supporting Information

Graphene oxide / polyethyleneimine modified cation exchange membrane for efficient selective recovery of ammonia nitrogen from wastewater

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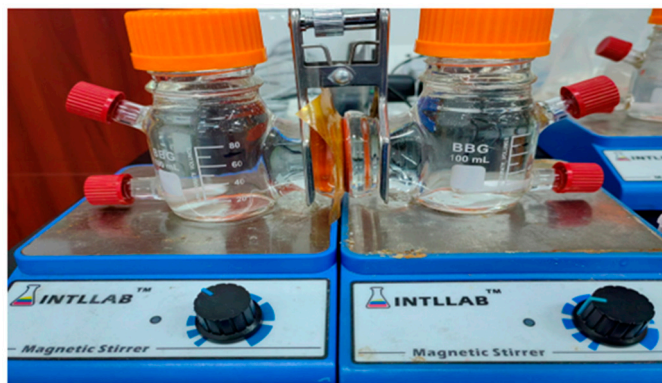
Figure S1. Photograph of the Donnan dialysis unit used.

Table S1. Design of ionic concentration investigations

Liquid^a concentration (mM)		Membrane type	Sampling interval time (h)	Running times (h)
NH$_4$Cl	NaCl			
5	10			
10	20	CEM	1	9
25	50			
50	100			

^{a} NH$_4$Cl is the feed solution and NaCl is the receiving solution.

Table S2. Design of of deposition conditions

Deposition conditions		Membrane type	Liquid type		Sampling interval time (h)	Running time (h)
Time (min)	Material		Feed	Receiving		
0						
5						
15	GO-PEI					
20			25 mM NH$_4$Cl			
30			or	50 mM NaCl		
40			2.5 mM MgCl$_2$			
5						
20	PEI					
40		CEM			1	9
0						
5						
15	GO-PEI					
20			25 mM NH$_4$Cl			
30			and	50 mM NaCl		
40			2.5 mM MgCl$_2$			
5						
20	PEI					
40						

Table S3. Exploratory design of the effect of Mg^{2+} concentration

Liquid concentration (mM)			$C[NH_4^+] : C[Mg^{2+}]$	Membrane type	Sampling interval time (h)	Running time (h)
Feed		Receiving				
NH$_4$Cl	MgCl$_2$	NaCl				
25	2.5	50	10:1	GO-PEI		
25	12.5	50	2:1	membrane/	1	9
				PEI membrane/		
25	25	50	1:1	CEM		

Table S4. EDS scan data for membrane surfaces and cross-sections

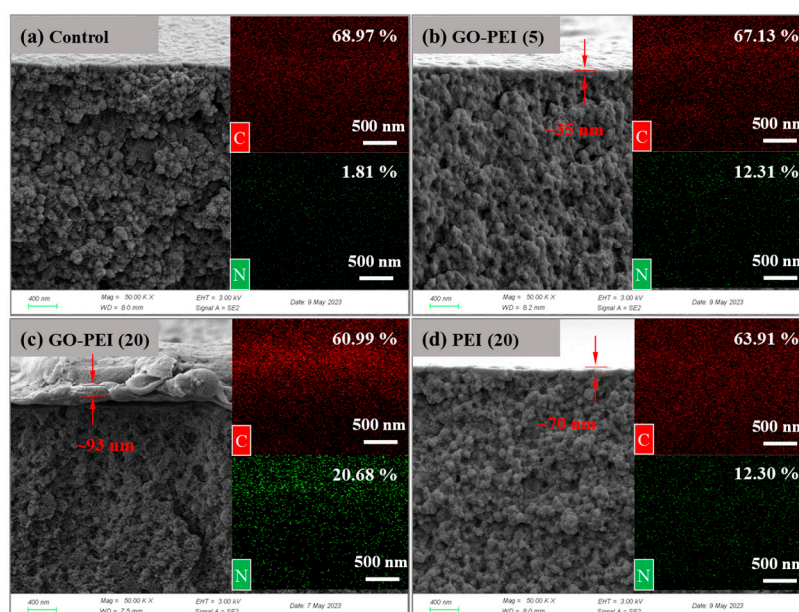| Membrane type	Elemental content (%)							
	Surface				Cross-section			
	C	O	S	N	C	O	S	N
Control	73.56	17.88	7.39	0.00	68.97	19.99	3.91	1.81
GO-PEI (5)	72.64	10.11	6.87	5.77	67.13	10.66	2.34	12.31
GO-PEI (20)	64.92	16.37	4.11	11.38	60.99	12.97	1.98	20.68
PEI (20)	66.96	14.02	5.08	9.79	63.91	16.46	3.60	12.30

Figure S2. SEM and EDS scans of C (red) and N (green) elements images of (a) control membrane, (b) GO-PEI (5) membrane, (c) GO-PEI (20) membrane and (d) PEI (20) membrane cross-section.
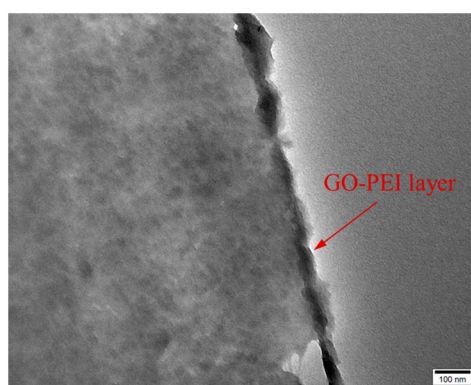

Figure S3. A TEM image of a cross-sectional section of the GO-PEI (20) membrane.