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Supplementary Information

2 **Removal of calcium from water by zeolites with gravity-driven membrane**

3 **filtration for water treatment without electricity**

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20 **Table S1. Water quality of samples taken from a lake***

pH	7.2 ~7.8
Turbidity [NTU]	1.74 ~1.82
TOC [mg/L]	2.64 ~3.36
UV₂₅₄ [cm⁻¹]	0.021 ~0.027
Ca Concentration [mg/L]	8.61 ~12.72

21 *Maeji Lake, Wonju, Republic of Korea

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23 **Table S2. Debris size of B and G zeolites**

	Zeolite type	
	B	G
Diameter [μm]	1.91 (± 0.09)	7.30 (± 0.38)

24 *The size of zeolite debris was measured by a particle size analyzer.

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26 **Table S3. Cake (including zeolites) mass accumulated on the membrane surface during**

27 **GDM filtration (n = 3)**

	Zeolite type			
	P1	P2	B	G
Cake mass [g]	9.928 (±0.361)	12.367 (±0.554)	0.006 (±0.000 ₁)	0.228 (±0.011)

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29 **Table S4. SEM-EDS calcium mass percentages of zeolites before and after the adsorption**
30 **process**

Zeolite	Mass percent of calcium [%]	
	Before adsorption process	After adsorption process
P1	0.00	1.92
P2	1.14	1.87
B	0.00	4.13
G	0.86	1.80

32 **Table S5. Parameters used for evaluation of zeolites and the range corresponding to each**
 33 **score for the parameters**

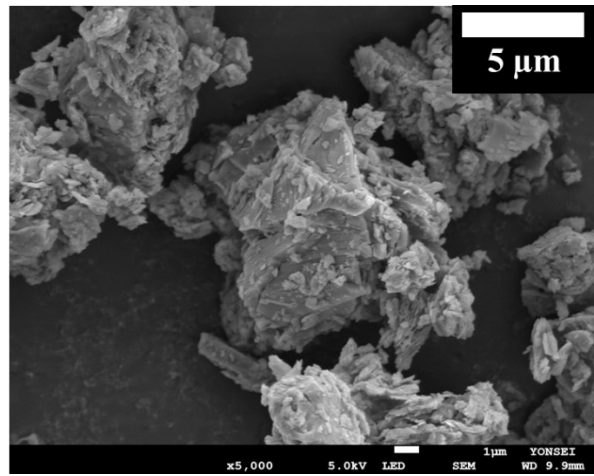
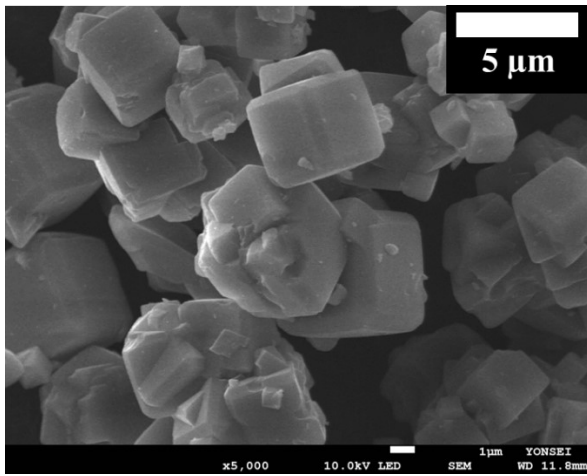
Score	Parameter (x)		
	Ca removal [%]	GDM water average Flux [LMH]	price [\$/kg]
++	$x \geq 99$	$x \geq 300$	$x < 10$
+	$70 \leq x < 99$	$150 \leq x < 300$	$10 \leq x < 40$
±	$40 \leq x < 70$	$100 \leq x < 150$	$40 \leq x < 70$
–	$x < 40$	$x < 100$	$x \geq 70$

34 * “–”, “±”, “+”, and “++” represent “Poor”, “Fair”, “Good”, and “Very Good”, respectively.

36 **Table S6. Price of zeolites**

Zeolite	Price [\$/kg]
P1	94.19
P2	2.37
B	86.61
G	3.38

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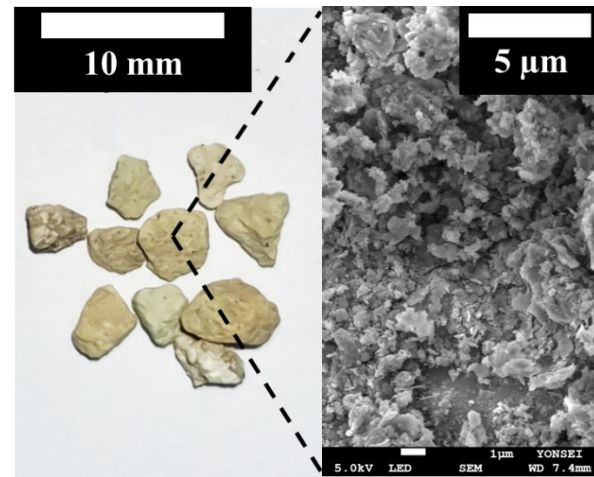
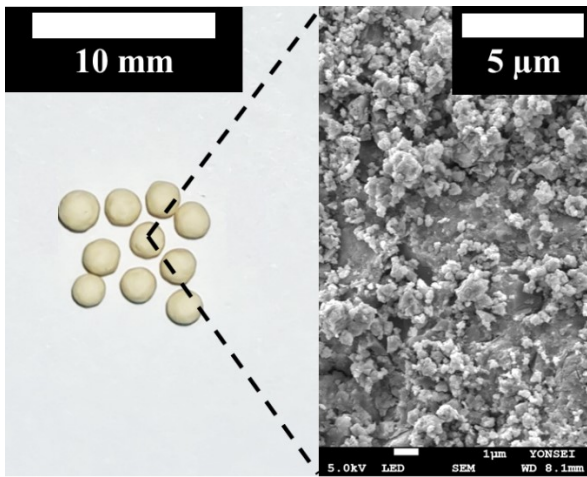


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(a)

(b)



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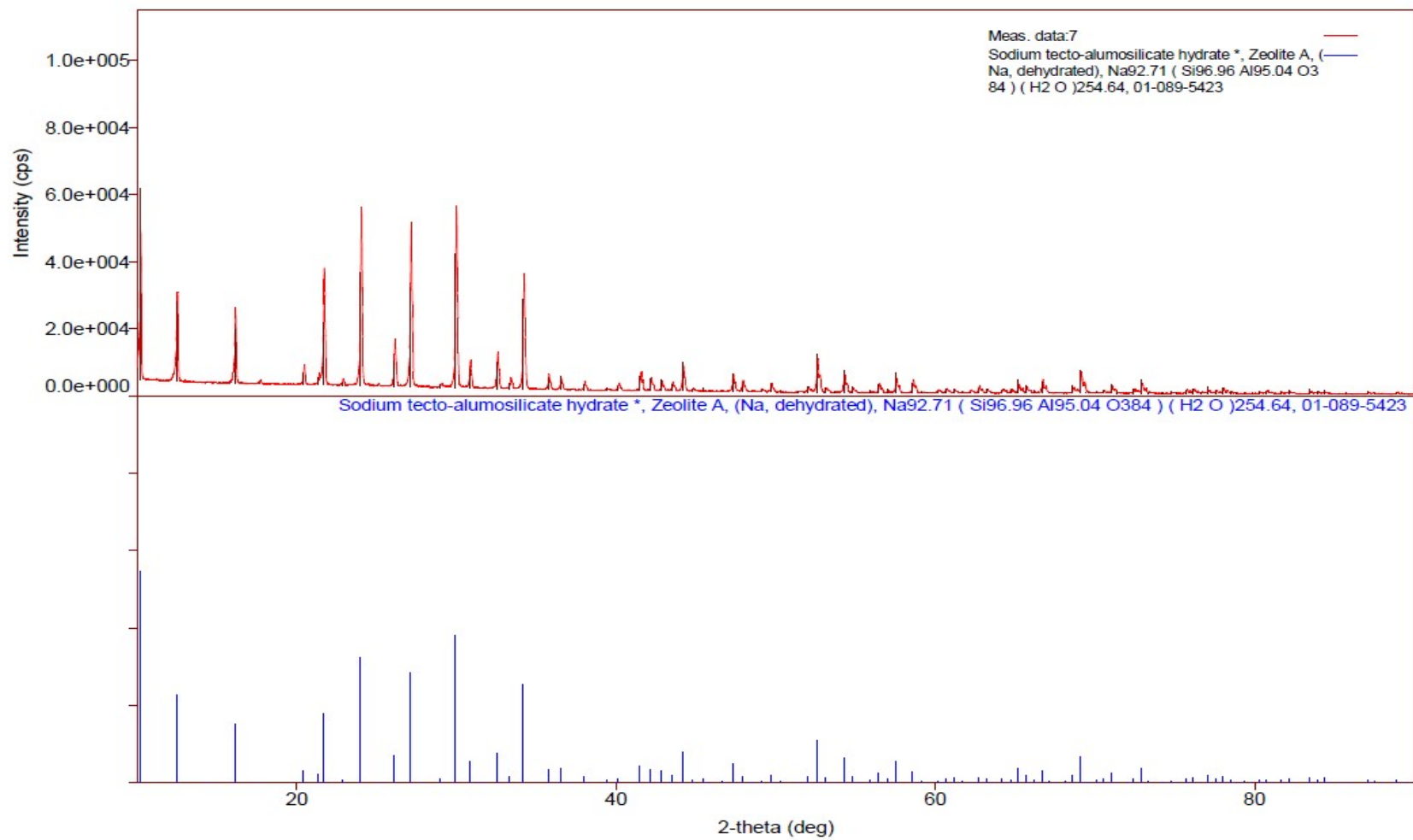
(c)

(d)

43 **Figure S1. SEM images of zeolites (a) P1, (b) P2, (c) B, and (d) G.**

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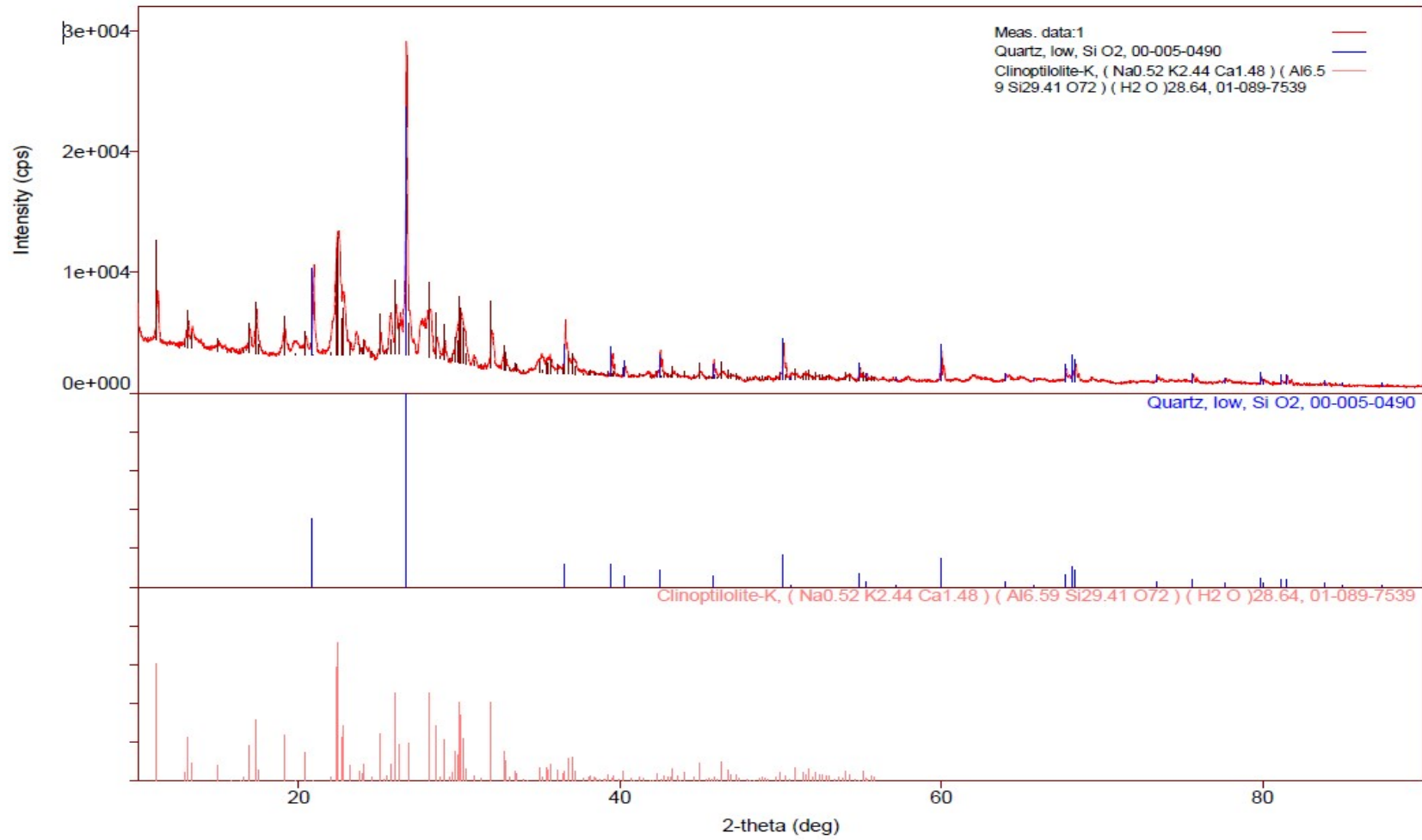
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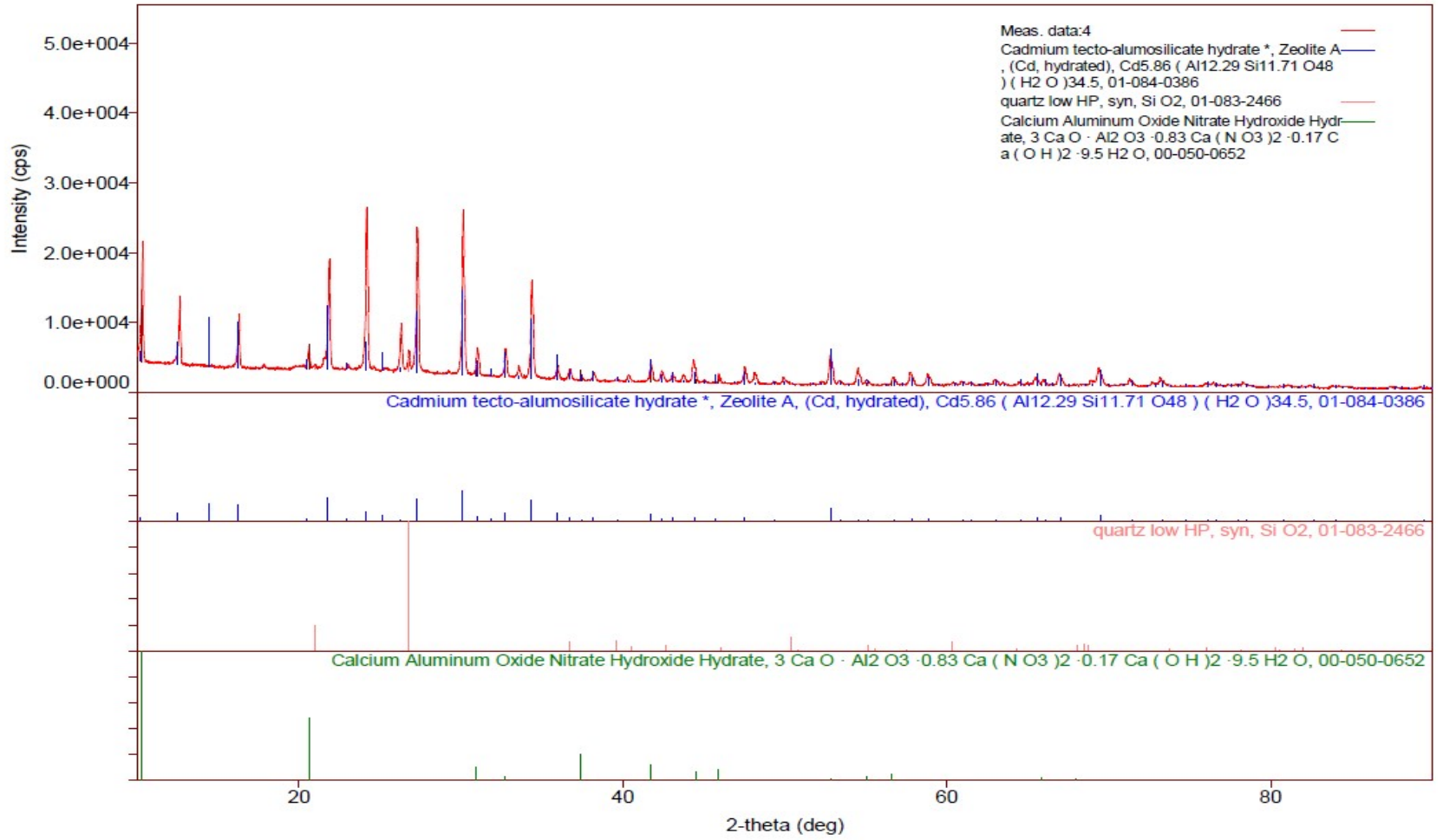
(a)



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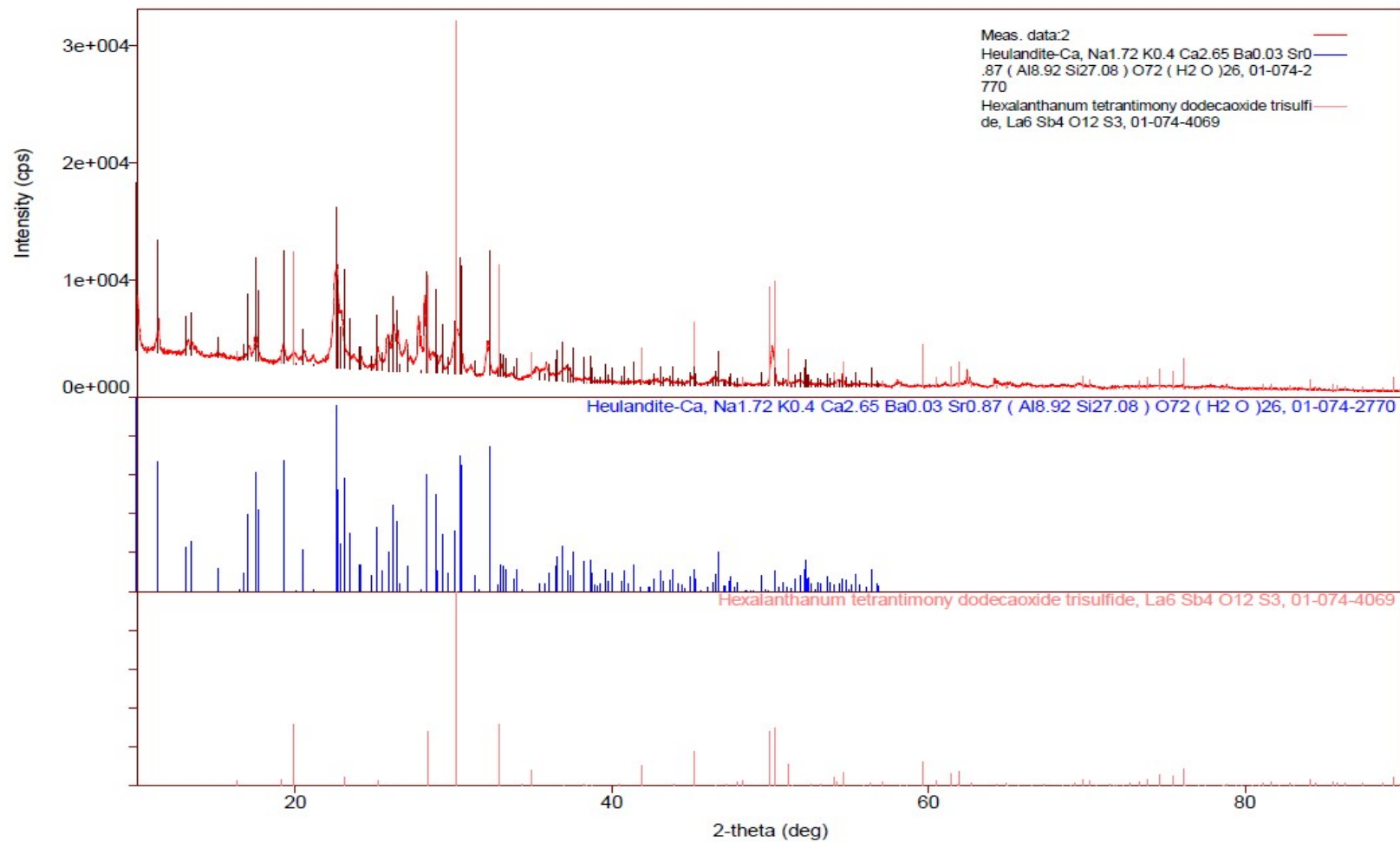
(b)



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(c)



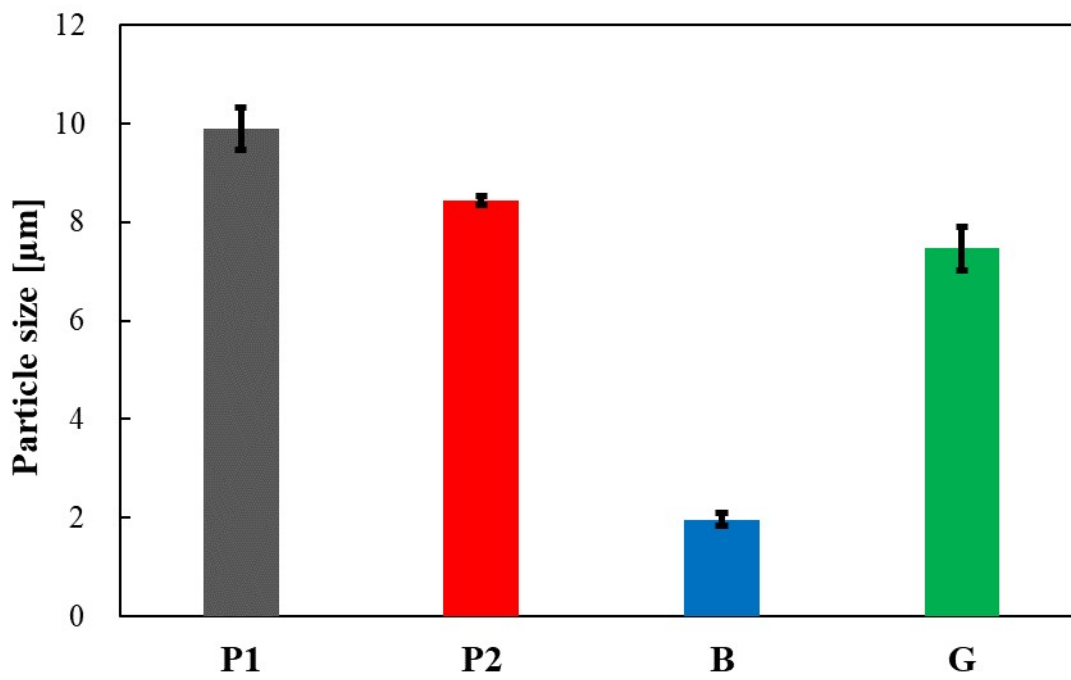
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(d)

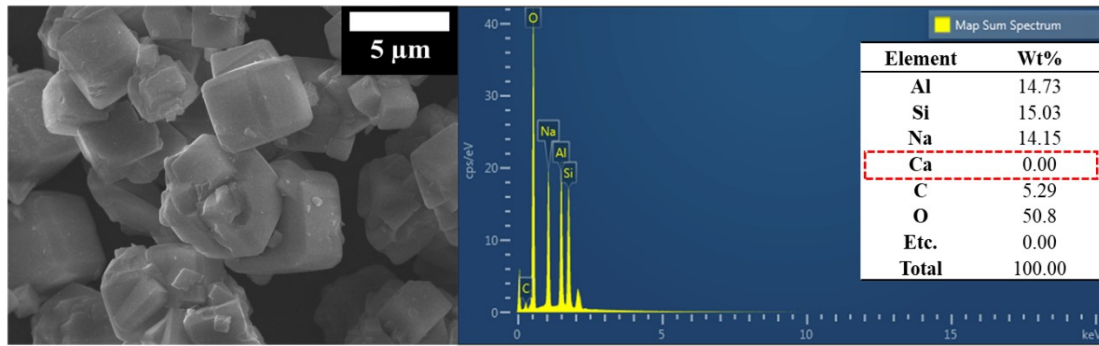
Figure S2. XRD pattern of zeolites (a) P1, (b) P2, (c) B, and (d) G.



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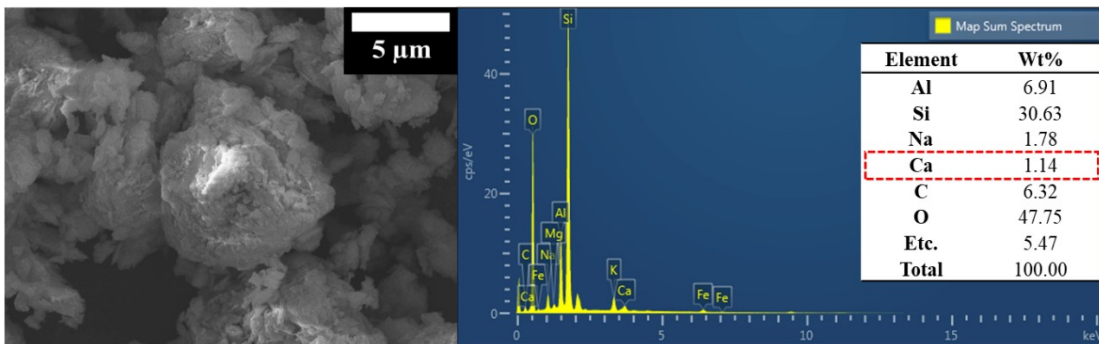
56 **Figure S3. Average size of particles deposited on the membrane surface during GDM**
57 **filtration (n = 3).**

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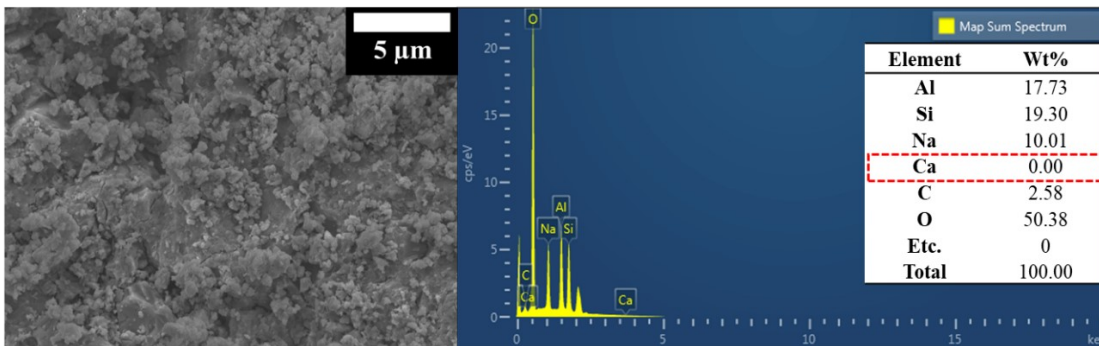
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(a)



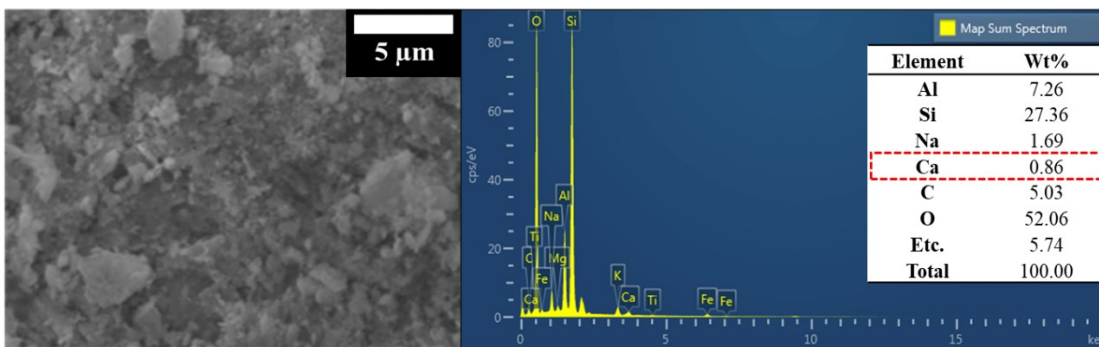
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(b)



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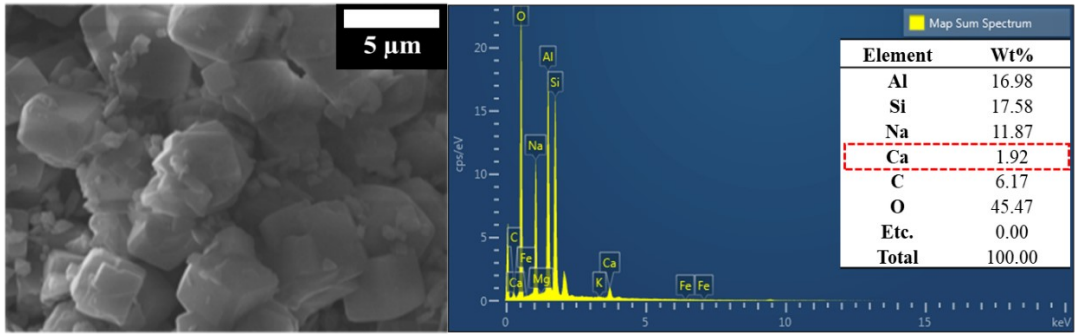
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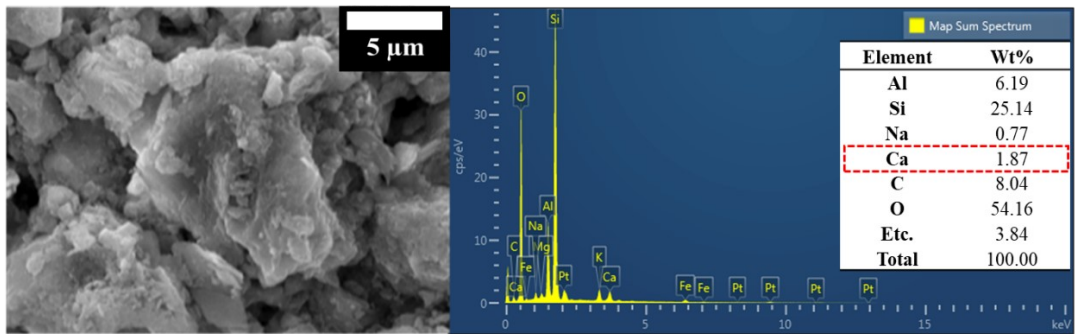
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(d)

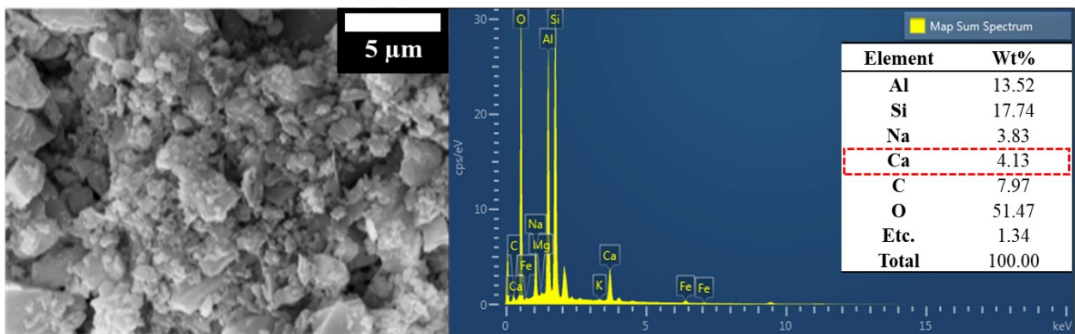
67 **Figure S4. SEM-EDS data of zeolite (a) P1, (b) P2, (c) B, and (d) G.**



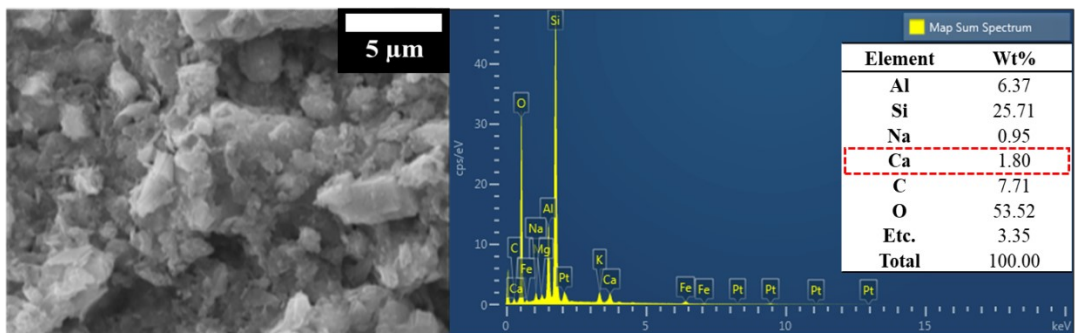
(a)



(b)



(c)



(d)

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76 **Figure S5. SEM-EDS data of zeolite fouling cakes for (a) P1, (b) P2, (c) B, and (d) G**
77 **accumulated on the membrane surface after GDM filtration.**

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