

# LIS-doped thin-film nanocomposite membrane adsorbent with low shielding effect for effective lithium recovery from geothermal water

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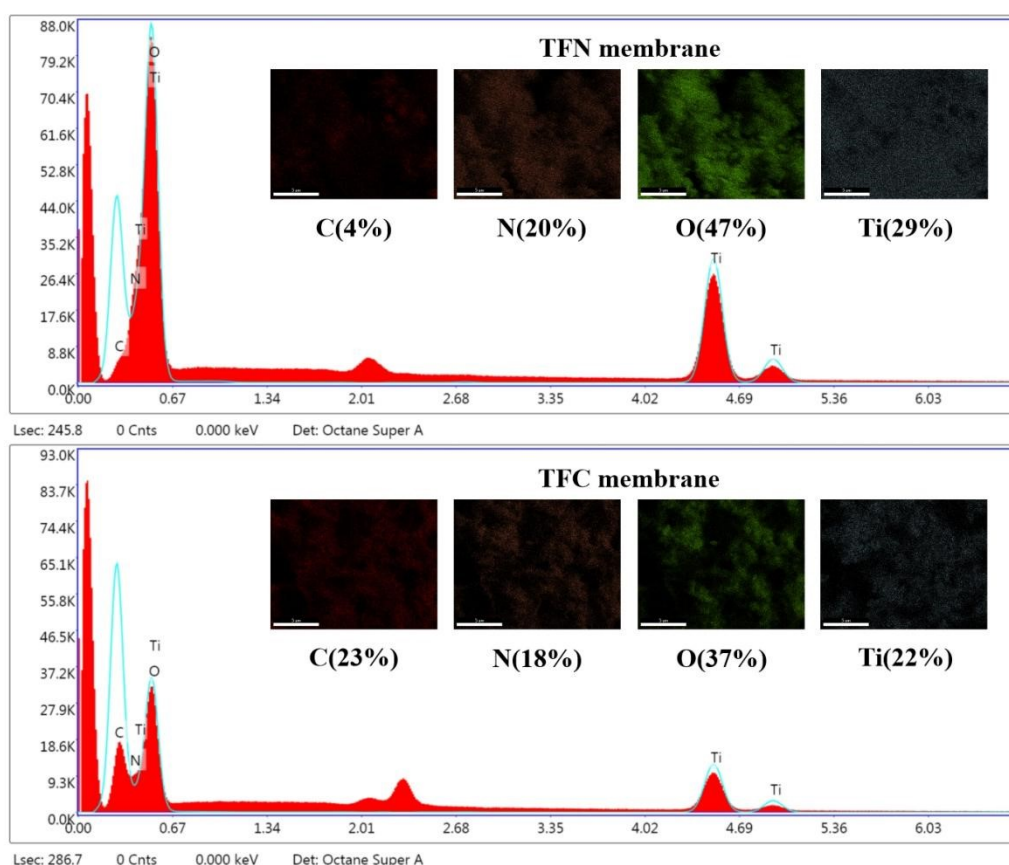
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## Supplementary Information

**Table S1** Composition of geothermal water used in this work.

Composition	pH	Na <sup>+</sup>	K <sup>+</sup>	Ca <sup>2+</sup>	Li <sup>+</sup>	Cl <sup>-</sup>	B <sub>2</sub> O <sub>3</sub>	Rb <sup>+</sup>	Cs <sup>+</sup>
Content (mg·L <sup>-1</sup> )	8.6	682.01	137.90	211.05	25.78	973.06	360.16	3.45	17.58



**Figure S1** EDS images of TFN membrane and TFC membrane adsorbent

**Table S2** Elements analyses of TFN and TFC membrane adsorbent by EDS

Component	质量分数(%)	
	TFN membrane	TFC membrane
Carbon (C)	25.52	47.54
Nitrogen (N)	15.55	11.44
Oxygen (O)	56.70	40.07
Titanium (Ti)	2.23	0.95

**Table S3** Data analysis of the effect of HTO loading amounts ( $L_a$ ) on the lithium adsorption capacity ( $Q_{Li}$ ) of TFN membrane adsorbent.

Types/ Times	Data					Data analysis		
	1	2	3	4	5	$\bar{x}^a$	$S^b$	$RSD^c$
$L_a/g \cdot m^{-2}$	18.4	18.3	18.5	18.4	18.9	18.5	0.24	1.30%
	19.6	19.7	19.6	19.5	19.6	19.6	0.07	0.357%
	24.0	23.9	23.8	24.1	24.2	24.0	0.16	0.667%
	29.5	29.4	29.5	29.5	29.6	29.5	0.07	0.237%
	32.2	32.2	32.2	32.3	32.1	32.2	0.07	0.217%
	35.0	35.1	35.0	35.1	35.3	35.1	0.12	0.342%
$Q_{Li}/mg \cdot g^{-1}$	22.18	22.18	22.17	22.19	22.18	22.18	0.01	0.045%
	13.22	13.22	13.21	13.2	13.23	13.22	0.01	0.076%
	19.84	19.85	19.82	19.81	19.83	19.83	0.02	0.101%
	24.38	24.39	24.38	24.37	24.38	24.38	0.01	0.041%
	24.33	24.34	24.35	24.34	24.34	24.34	0.01	0.041%
	24.3	24.29	24.31	24.29	24.31	24.3	0.01	0.041%

<sup>a</sup>  $\bar{x}$  means the average. <sup>b</sup>  $S$  means the standard deviation. <sup>c</sup>  $RSD$  means the relative standard deviation.

**Table S4** Data analysis of the lithium adsorption capacity ( $Q_{Li}$ ) of TFN membrane adsorbent doped with different types of LIS including lithium titanium oxides-type LIS (HTO), lithium manganese oxides-type LIS (HMnO) and lithium aluminum oxides-type LIS (HAIO).

Types of LIS/ Times		Data					Data analysis		
		1	2	3	4	5	$\bar{x}^a$	$S^b$	$RSD^c$
HTO	Powdery LIS	25.8	25.78	25.82	25.81	25.79	25.8	0.02	0.078%
	TFN membrane	24.37	24.38	24.39	24.39	24.37	24.38	0.01	0.041%
HMnO	Powdery LIS	20.83	20.83	20.84	20.8	20.8	20.82	0.02	0.096%
	TFN membrane	18.7	18.71	18.72	18.69	18.68	18.7	0.02	0.107%
HAIO	Powdery LIS	5.87	5.87	5.86	5.88	5.87	5.87	0.01	0.170%
	TFN membrane	2.29	2.29	2.3	2.31	2.26	2.29	0.02	0.873%

<sup>a</sup>  $\bar{x}$  means the average. <sup>b</sup>  $S$  means the standard deviation. <sup>c</sup>  $RSD$  means the relative standard deviation.

**Table S5** Adsorption selectivity of TFN membrane adsorbent.

Feed solution	Parameters	Li <sup>+</sup>	Na <sup>+</sup>	K <sup>+</sup>	Cs <sup>+</sup>
LiCl + NaCl	$K_d$ (mL·g <sup>-1</sup> )	1123.31	4.02	-	-
	$\alpha$	1.00	279.55	-	-
LiCl + KCl	$K_d$ (mL·g <sup>-1</sup> )	1166.97	-	1.43	-
	$\alpha$	1.00	-	816.06	-
LiCl + CsCl	$K_d$ (mL·g <sup>-1</sup> )	1431.76	-	-	0.08
	$\alpha$	1.00	-	-	17889.08