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Scalable fabrication of LDHs based Adsorbent for the Removal of Nitrate with Enhanced Performance

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Table S1. The level of factors of NO_3^-–N orthogonal experiment on LDHs material adsorption

factors / levels	A	B	C
	pH	alkali source	metal composition
1	11	NaOH	Mg–Al
2	12	NaOH+Na_2CO_3	Mg–Fe
3	13	Na_2CO_3	Ca–Fe

Table S1 shows a 3–factor 3–level L9 (3^3) orthogonal experiment. The three factors are pH (A), alkali source (B) and metal composition (C) and each factor included three levels as A: 11, 12, and 13; B: NaOH, Na_2CO_3, and NaOH+Na_2CO_3; C: Mg–Al, Mg–Fe, and Ca–Fe.

Table S2. Orthogonal experimental scheme and experimental results

number	factor			RE of NO_3^-–N
	A	B	C	（%）
1	3	3	1	10.91
2	1	2	3	8.73
3	3	1	3	18.10
4	1	3	2	5.04
5	2	3	3	5.13
6	3	2	2	13.39
7	2	2	1	38.40
8	2	1	2	39.00
9	1	1	1	55.10
K_1	22.96	37.40	34.80	
K_2	27.51	20.17	19.14	
K_3	14.13	7.03	10.65	
R	13.38	30.37	24.15	

A: pH B: alkali source C: metal components

Table. S2 exhibits the orthogonal experimental results and the influences degree of different factors on the NO_3^- removal rate can be reflected by the corresponding value of K and the variance R.

Table S3. Table of variance analysis of orthogonal experiment

factor	R^2	freedom	standard deviation	F	$F_{0.05}$	significance level
A	277.52	2	138.76	6.59	19.00	
B	1392.13	2	696.07	33.08	19.00	significant
C	900.54	2	450.27	21.40	19.00	significant
EE	42.08	2	21.04			
sum	2612.27	8				

EE: experimental error

Table. S3 reveals the degree of effect on the removal rate of NO_3^- of three factors: pH(A), alkali source (B), and metal components (C).

Table S4. Crystallite size of Mg_3Al–LDHs

Sample	*2θ* (°)		*FWHM* (nm)				
	(003)	(110)	(003)	(110)	D_a (nm)	D_c (nm)	D_a/D_c
(Na_2CO_3)	11.34	60.46	0.835	0.566	0.284	0.167	1.699
(NaOH+ Na_2CO_3)	11.14	60.22	0.509	0.379	0.423	0.274	1.545
(NaOH)	11.44	60.58	0.421	0.402	0.399	0.331	1.207

Table. S4 illustrates the calculation result of the lattice parameters of LDHs. And Da and Dc represents the crystal grain size of material on the a–axis and c–axis, respectively.

Table S5. XRD characteristic parameters of LDHs synthesized by different alkali sources

Sample	$d_{(003)}$ (Å)	$d_{(110)}$ (Å)	c (Å)	a (Å)	Layer space (Å)
(Na_2CO_3)	7.80	1.53	23.39	3.06	3.00
(NaOH+ Na_2CO_3)	7.94	1.54	23.81	3.07	3.14
(NaOH)	7.73	1.53	23.19	3.05	2.93

Table. S5 displays characteristic parameters from XRD patterns which indicates the degree of effect by different alkali sources on layer composition of LDHs.

Table S6. XRD characteristic parameters before and after adsorption

Sample	$d_{(003)}$ (Å)	$d_{(110)}$ (Å)	c (Å)	a (Å)	Layer space (Å)
Before	7.73	1.53	23.19	3.05	2.93
After	8.01	1.53	24.03	3.08	3.21

$a=2d_{(110)}$, $c=3d_{(003)}$, layer spacing=$d_{(003)}$–4.8Å

Table. S6 shows XRD the characteristic parameters of the Mg_3Al–LDHs (NaOH) before and after nitrate adsorption, respectively.