Supplementary Material

Mechanism of calcium hydroxide-reinforced magnesium-loaded clinoptilolite/phosphoric acid-modified biochar for NH_3-N removal from rare earth element tailings wastewater

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Table A1 Basic properties of wastewater samples

	pH	NH_3-N (mg/L)	COD (mg/L)	Sc (μg/L)	Y (μg/L)	La (μg/L)	Ce (μg/L)	Pr (μg/L)	Nd (μg/L)	Sm (μg/L)
Simulated wastewater	5.60	210.90	ND	ND	ND	ND	ND	ND	ND	ND
Wastewater 1	3.62	13.14	ND	0.33	1087	1429	579	300	898	218
Wastewater 2	4.40	55.50	ND	1.10	2400	3554	1340	736	2242	501
Wastewater 3	4.37	138.16	0.58	0.65	2841	3947	1346	854	2411	623

	Eu (μg/L)	Tb (μg/L)	Dy (μg/L)	Ho (μg/L)	Er (μg/L)	Tm (μg/L)	Yb (μg/L)	Lu (μg/L)	REEs (μg/L)
Simulated wastewater	ND	ND	ND	ND	ND	ND	ND	ND	ND
Wastewater 1	16.70	42.30	210	43.50	111	18.30	102	17.80	5287.93
Wastewater 2	38.50	95	469	92.90	234	35.30	194	30.10	12475.9
Wastewater 3	41.10	103	474	104	241	40.40	204.60	34.60	13874.35

Table A2 The content of elements in the composite

	NC-Mg	BC-PC
O	42.26	29.76
Al	5.92	0
Si	45.89	0
Ca	1.73	2.01
Mg	4.2	0.98
P	0	2.95
H	0	3.9
N	0	1.4
K	0	0.36
C	0	56.63
Na	0	2.01

Table A3 NH_3-N removal rate by the composite and equivalent adsorption materials

	Removal efficiency (%)
NC/BC/Ca	64.6 ± 1.5
NC/BC 2	10.6 ± 0.6

Table A4 The relationship between the amount of alkaline material and the pH

$Ca(OH)_2$ dosage (g)	pH	NaOH dosage (g)	pH
0	3.88	0	3.88
0.010	6.26	0.0084	6.06
0.020	8.02	0.013	8.03
0.032	9.00	0.031	8.97
0.050	10.74	0.040	9.97
0.10	12.15	0.073	11.07
0.15	12.40	0.10	11.90
0.20	12.50	0.25	12.50

Table A5 Contribution rate of NH_3-N removal of NC/BC/Ca in different ways

	Removal rate/%	Contribution rate / %			
		% Volatilization	% Adsorption	% Struvite precipitation	% Other precipitation
Volatilization experiment	2.8%	4.3%	----	----	----
Adsorption experiment (NC/BC 2)	10.6%	----	16.4%	----	----
NC/BC/Na	33.3%	4.3%	16.4%	30.8 %	----
NC/BC/Ca	64.6%	4.3%	16.4%	30.8%	48.5%

Table A6 Effects of plant yield and soil pH in farmland by application of the sediements

	Rice *(Oryza sativa L)*		Amaranth (*Amaranthus tricolor L)*	
	Grain yield (g/plant)	Soil pH	Biomass (g/plant)	Soil pH
CK	10.71	5.00	38.2	5.97
Sediments application	12.35	5.53	44.0	6.35

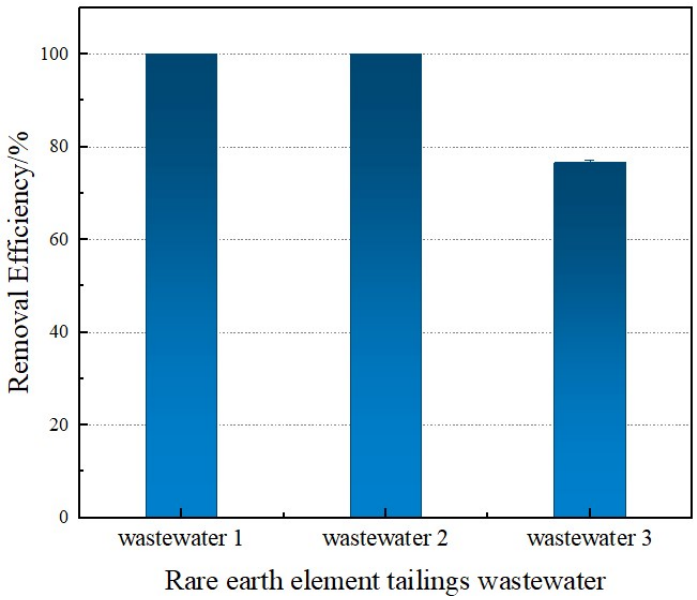

Fig. A1. NH_3-N removal efficiency with NC/BC/Ca from REEs wastewaters. Dates represent the mean ± standard error of the mean (n=3).