

Phosphorus removal enhancement and mechanisms by Zn-layered double hydroxides (Zn-LDHs) modified zeolites substrates in constructed rapid infiltration system

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It includes 11 pages, 7 Figures and 3 Tables

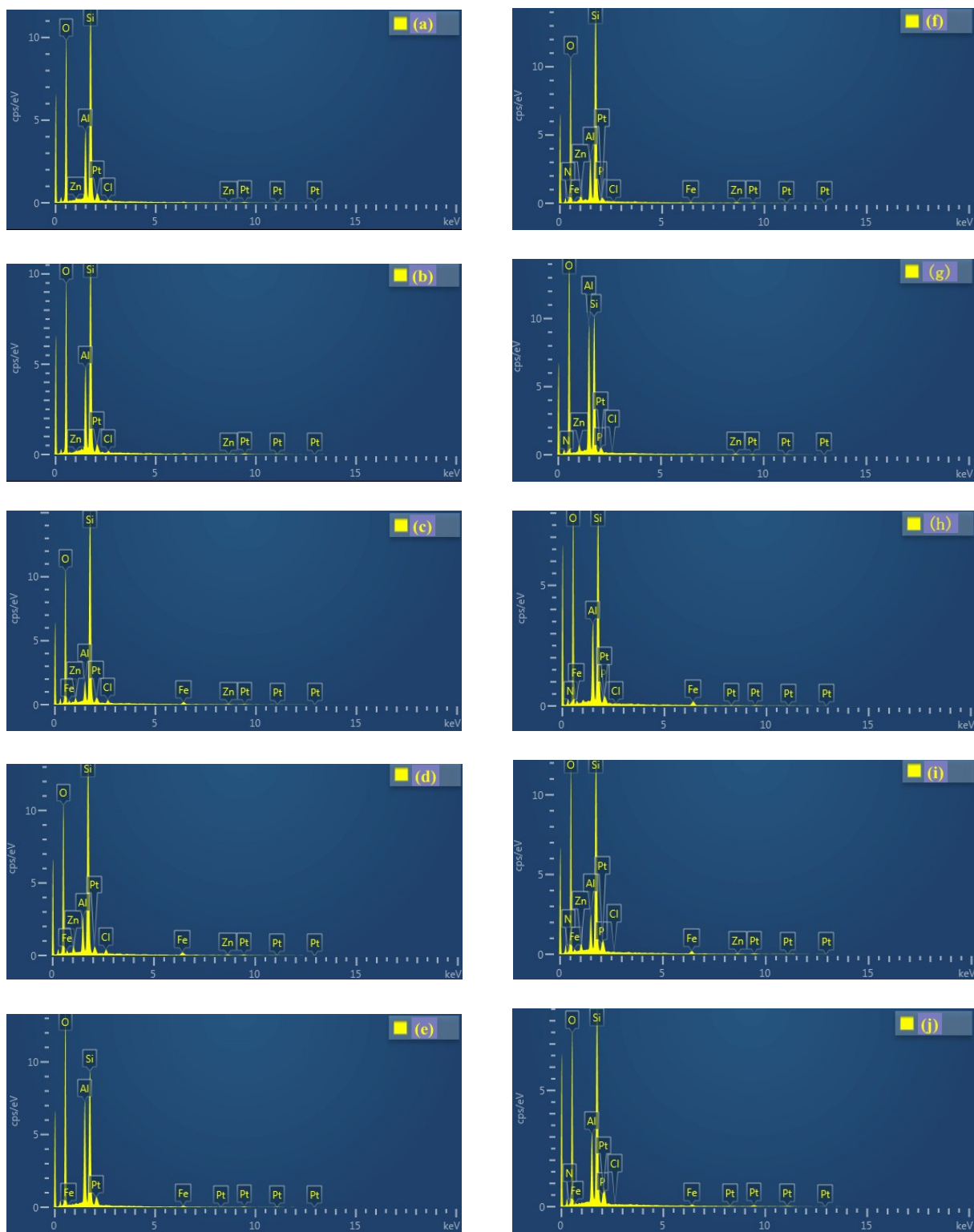


Figure S1. The EDX images of ZnAl-LDHs (2:1), ZnAl-LDHs (3:1), ZnFe-LDHs (2:1), ZnFe-LDHs (3:1) modified and original zeolites before (a, b, c, d, e) and after (f, g, h, i, j) purification experiments.

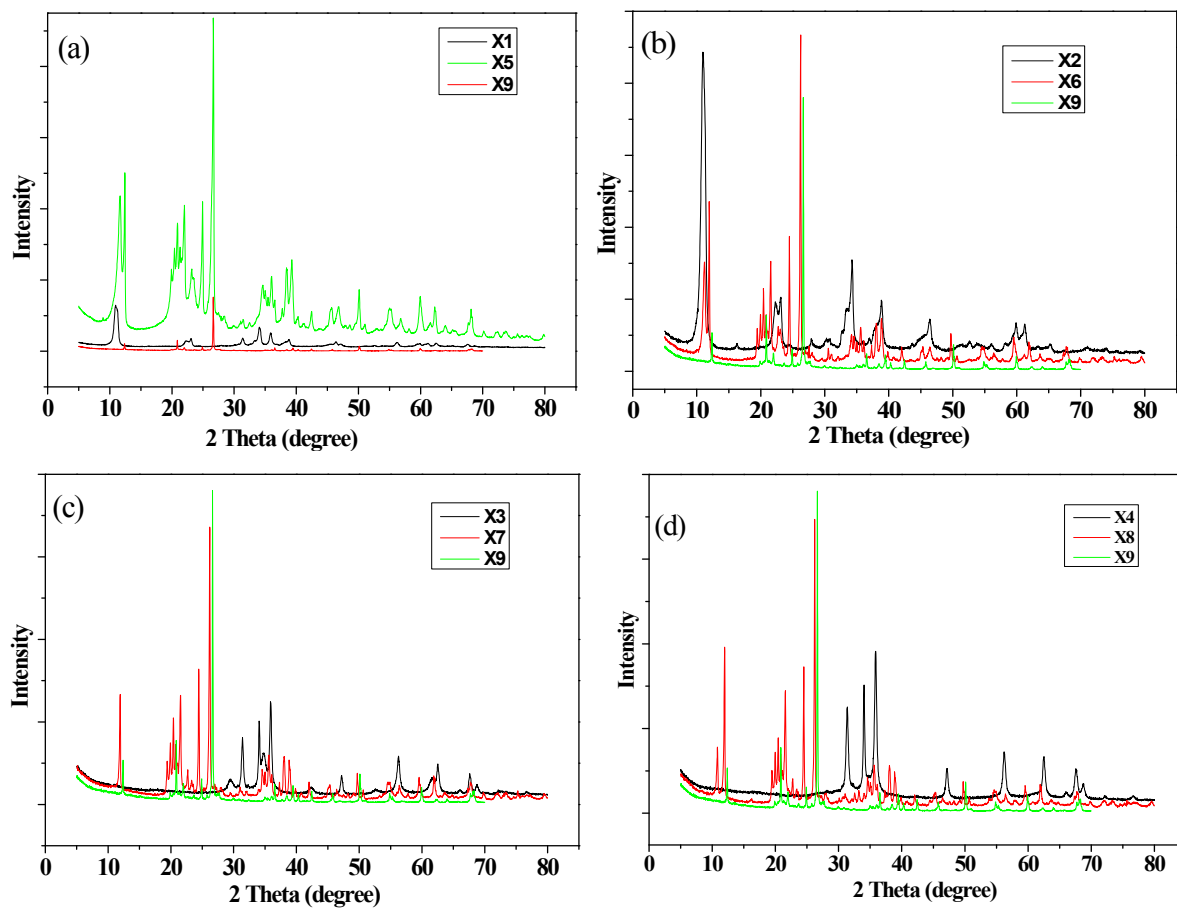


Figure S2. XRD patterns of ZnAl-LDHs-modified (2:1) (a), ZnAl-LDHs-modified (3:1) (b), ZnFe-LDHs-modified (2:1) (c) and ZnFe-LDHs-modified (3:1) (d) samples

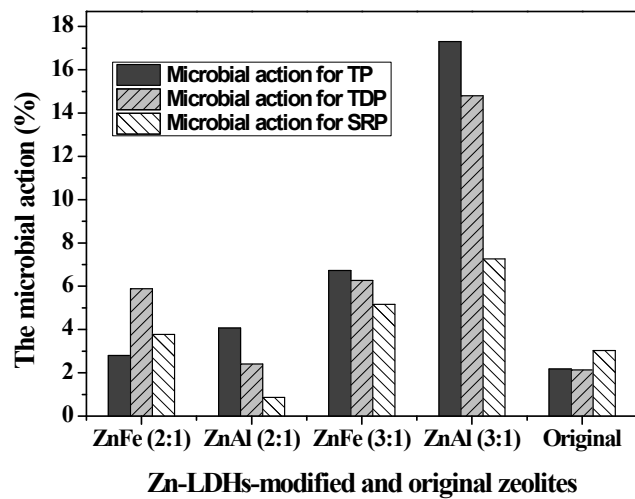


Figure S3. The microbial action for TP, TDP and SRP removal with Zn-LDHs-modified and original zeolites

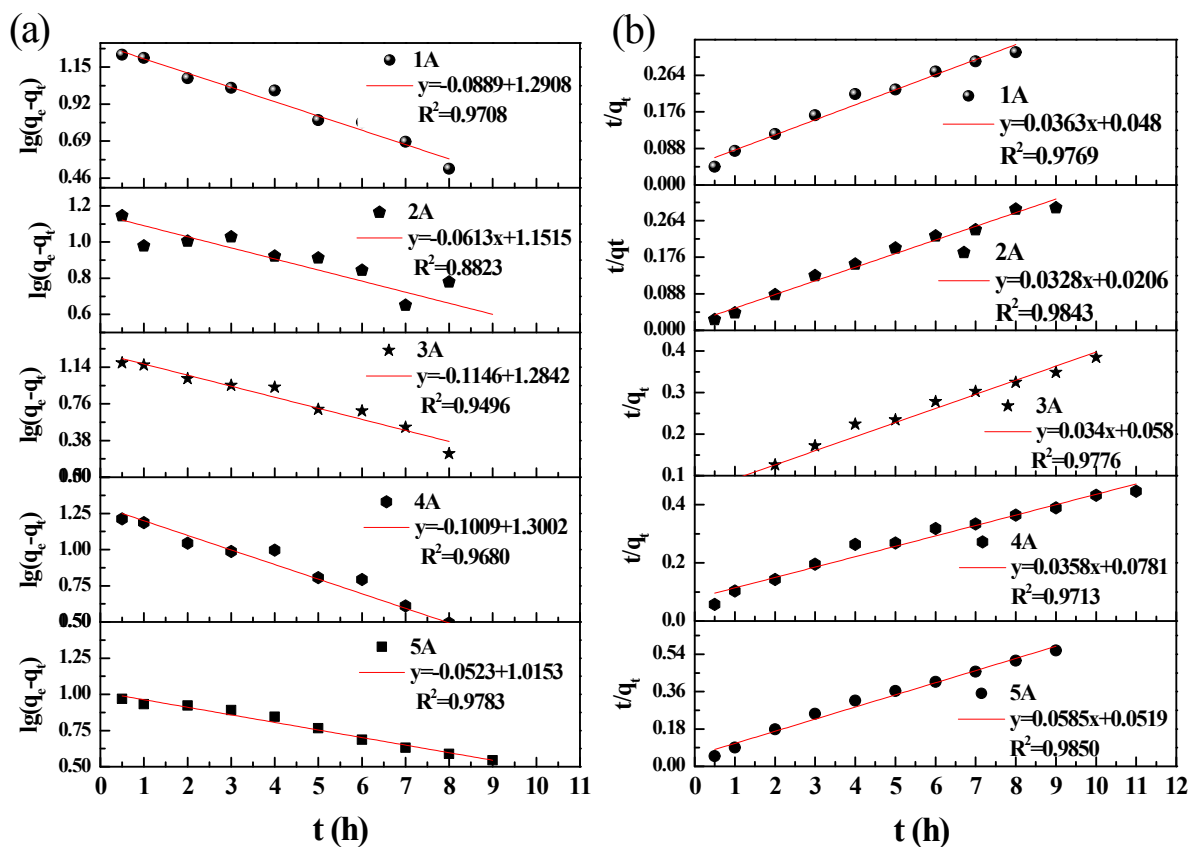


Figure S4. Pseudo-first-order (a) and pseudo-second-order (b) kinetic for adsorption of phosphate for Zn-LDHs-modified and original zeolites

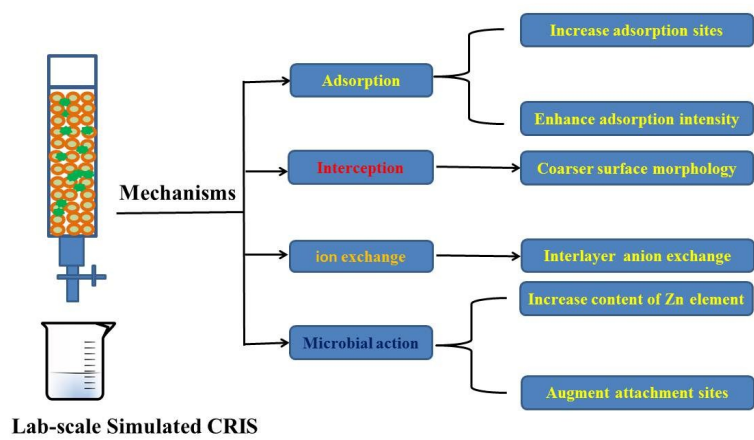


Figure S5. The main mechanisms for phosphorus removal in CRIS

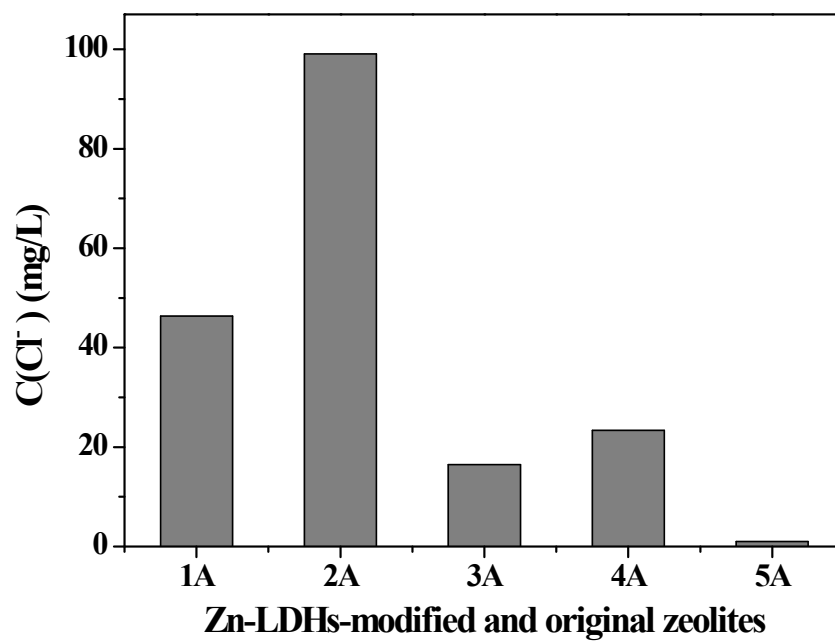


Figure S6. The Cl^- concentration in filtrates (mg/L)

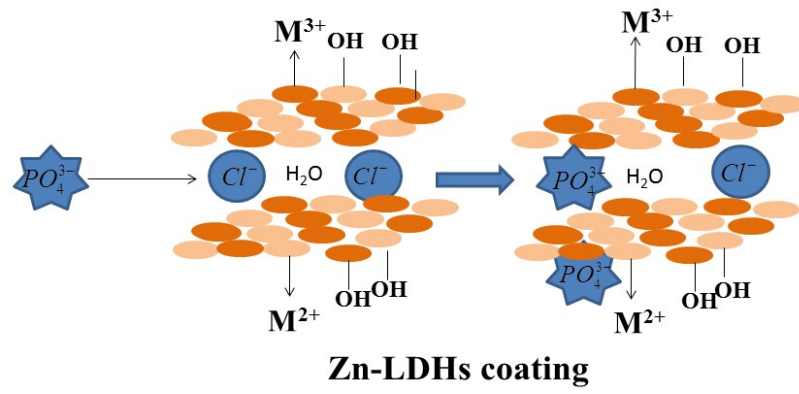


Figure S7. The adsorption and ion exchange mechanisms of Zn-LDHs coating

Table S1. The relative content of elements of all kinds of Zn-LDHs-modified and original zeolites before and after purification experiments

Elements		Before purification experiments				
		1A	2A	3A	4A	5A
O	Wt%	61.05	61.58	60.71	59.94	63.58
	At%	73.22	73.59	74.05	73.30	75.36
Si	Wt%	29.50	24.75	25.84	30.59	26.14
	At%	20.15	16.85	17.95	21.31	17.65
Al	Wt%	9.04	13.13	8.40	5.12	9.65
	At%	6.43	9.30	6.07	3.71	6.78
Fe	Wt%	-	-	3.28	2.21	-
	At%	-	-	1.15	0.77	-
Zn	Wt%	0.11	0.14	0.77	1.11	-
	At%	0.03	0.04	0.23	0.33	-
P	Wt%	-	-	-	-	-
	At%	-	-	-	-	-
Cl	Wt%	0.30	0.39	1.01	2.21	-
	At%	0.16	0.21	0.56	0.58	-
Elements		After purification experiments				
		1A	2A	3A	4A	5A
O	Wt%	59.60	59.46	61.40	63.06	63.27
	At%	72.05	72.17	73.13	74.87	75.06
Si	Wt%	31.08	23.06	24.31	27.44	32.39
	At%	21.40	15.95	16.49	18.56	21.89
Al	Wt%	5.96	12.48	9.54	4.60	4.34
	At%	4.27	8.98	6.73	3.24	3.05
Fe	Wt%	-	-	2.40	2.23	-
	At%	-	-	0.82	0.76	-
Zn	Wt%	1.52	3.58	0.46	0.90	-
	At%	0.45	1.06	0.29	0.26	-
P	Wt%	0.08	0.05	0.28	0.08	0.01
	At%	0.05	0.05	0.17	0.08	0.01
Cl	Wt%	0.04	0.14	0.21	0.10	-
	At%	0.02	0.08	0.11	0.05	-

Table S2. Intra-particle diffusion model constants and correlation coefficients for adsorption of phosphate on LDHs-modified and original zeolites

Adsorbents	C_0 (mg/L)	Intra-particle diffusion model								
		K_{d1} (mg/h ^{1/2} g)	C_1	$(R_1)^2$	K_{d2} (mg/h ^{1/2} g)	C_2	$(R_2)^2$	K_{d3} (mg/h ^{1/2} g)	C_3	$(R_3)^2$
1A		6.9068	0	1	6.9068	5.8473	0.9707	-34.458	131.01	1
2A		27.46	0	1	4.3998	16.140	0.924	-32.709	136.83	1
3A	4	15.652	0	1	6.1059	6.6904	0.9832	-13.727	74.35	1
4A		12.357	0	1	6.0798	4.3921	0.9849	-13.727	72.602	1
5A		14.554	0	1	3.2492	6.9957	0.9551	-32.813	137.92	1

Table S3. The corresponding sequences, OTUs, Chao 1 and Shannon indexes in lab-scale simulated CRIS

Samples	Effective sequences	High-quality sequences	OTUs	Chao 1	ACE	Shannon	Simpson
1A	30327	26013	788	545.0	676.16	5.97	0.935
2A	27446	24978	949	662.0	662.00	7.07	0.978
3A	42471	39095	961	662.0	924.73	6.78	0.973
4A	42069	39362	1033	711.0	978.07	6.99	0.979
5A	41436	35472	1407	1179.0	1427.65	7.62	0.969
Total	183749	164920	-	-	-	-	-