

Supporting Information

Zn-Ti-Al layered double hydroxides synthesized from aluminum saline slag wastes as efficient drugs adsorbents

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Fig. S1. The nitrogen adsorption-desorption isotherms of non-calcined (a) and calcined (b)
Al series and non-calcined (c) and calcined (d) Al* series of LDH.

Fig. S2. XPS spectra for the Al* calcined series.

Fig. S3. Experimental results (scatter) and isotherm adjustment to Langmuir, Freundlich and
Toth models for diclofenac adsorption on Zn₆Al*₂.

Table S1. General characteristics of the pharmaceutical drugs adsorbed.

Table S2. Pseudo-first order adjustment of the experimental results.

Table S3. Pseudo-second order adjustment of the experimental results.

Table S4. Effective diffusion coefficients of the adsorption of diclofenac and salycilic acid
by the LDH.

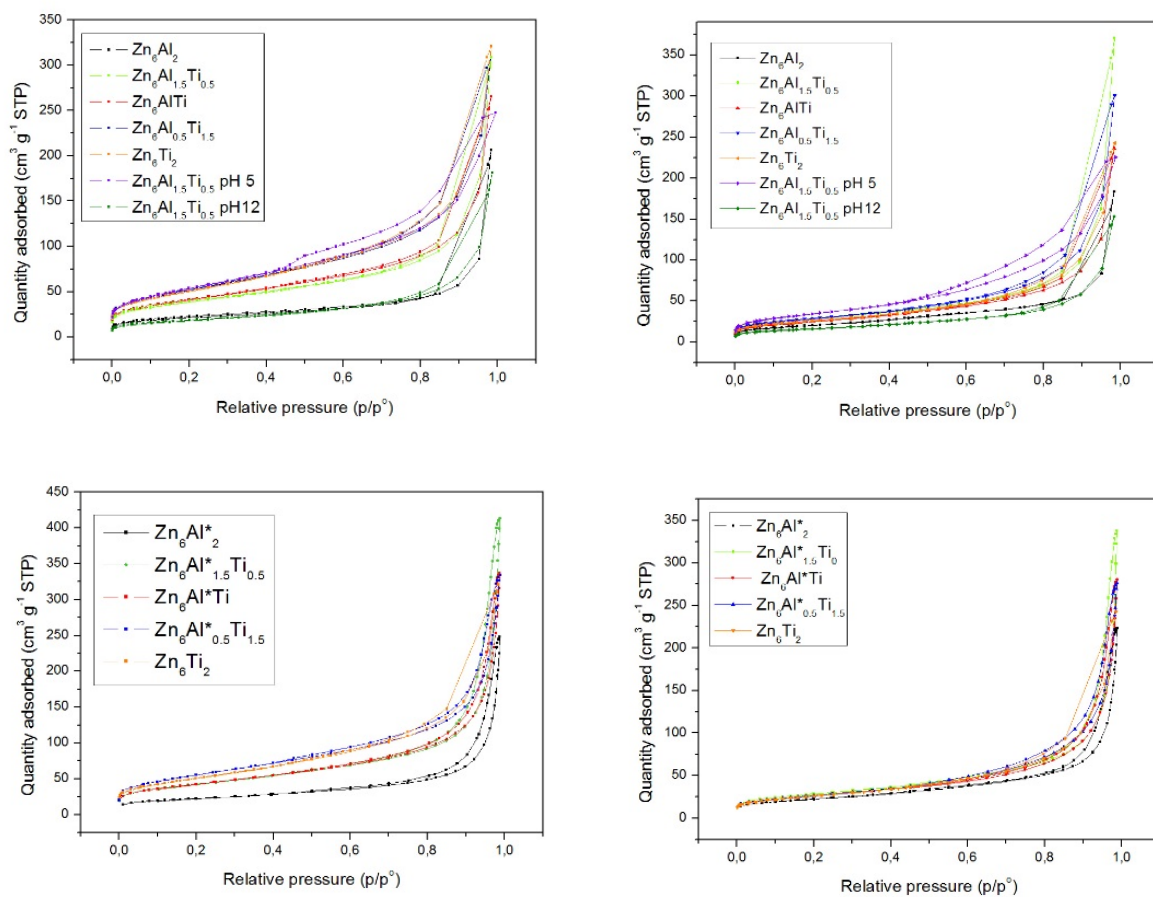


Fig. S1. The nitrogen adsorption-desorption isotherms of non-calcined (a) and calcined (b) Al series and non-calcined (c) and calcined (d) Al* series of LDH.

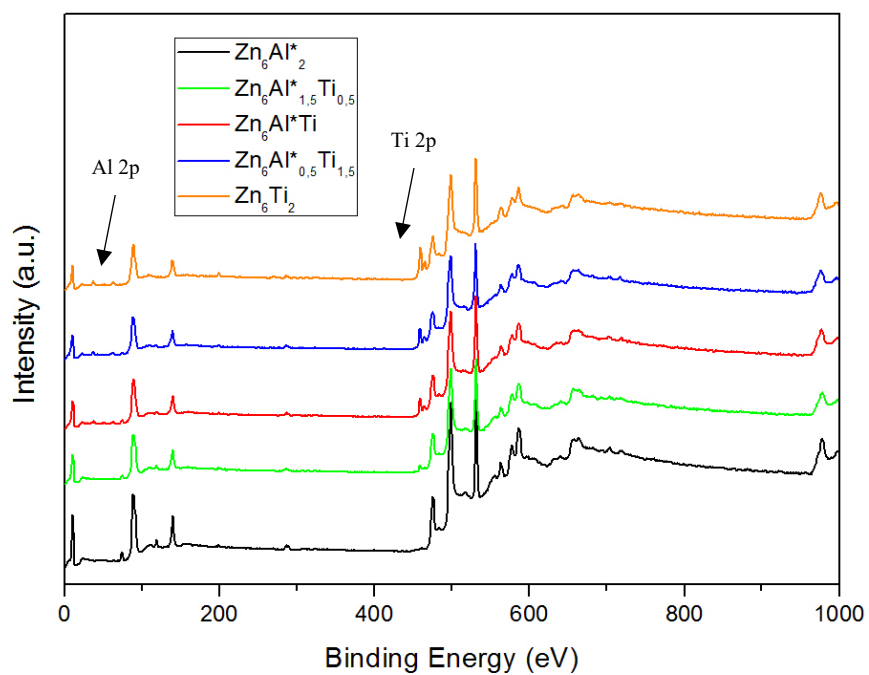


Fig. S2. XPS spectra for the Al* calcined series.

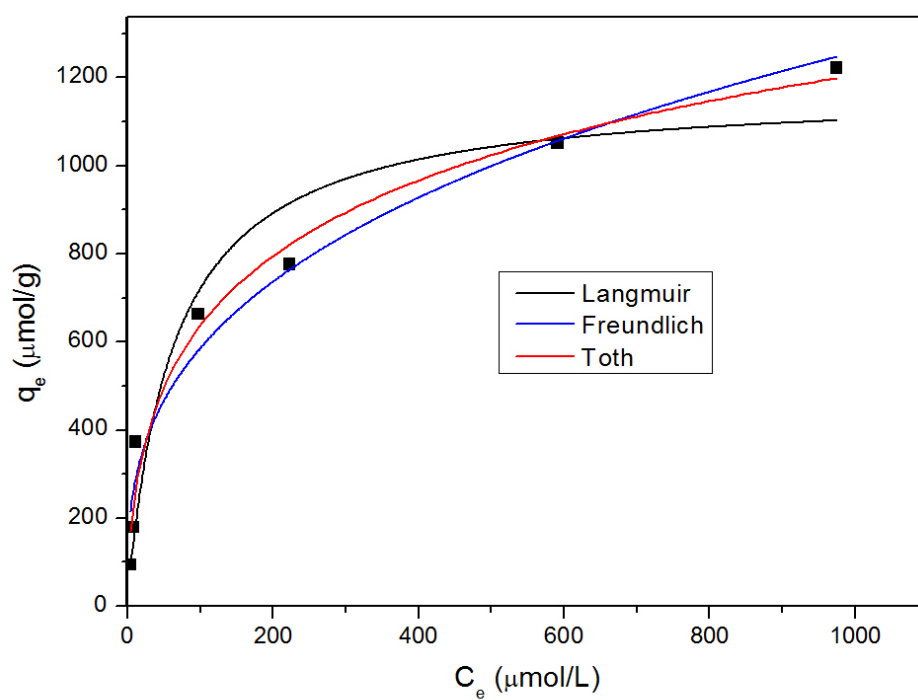


Fig. S3. Experimental results (scatter) and isotherm adjustment to Langmuir, Freundlich and Toth models for diclofenac adsorption on Zn_6Al^*_2 .

Table S1. General characteristics of the pharmaceutical drugs adsorbed.

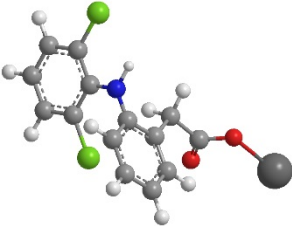
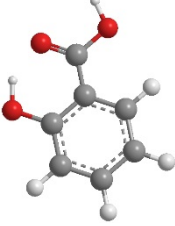
	Diclofenac sodium	Salicylic acid
Molecular structure		
IUPAC name	Sodium; 2-(2-(2,6-Dichloranilino) phenyl)acetate	2-Hydroxybenzoic acid
Chemical formula	$C_{14}H_{10}Cl_2NNaO_2$	$C_7H_6O_3$
Molecular mass	318.13	138.12
pK_a	4.15	2.97; 13.6
λ_{max}	276	297

Table S2. Pseudo-first-order adjustment of the experimental results.

Sample		Diclofenac					Salicylic acid				
		100 mg/L	200 mg/L	400 mg/L	200 mg/L	200 mg/L	100 mg/L	200 mg/L	400 mg/L	200 mg/L	200 mg/L
		75 μ M	75 μ M	75 μ M	25 μ M	50 μ M	75 μ M	75 μ M	75 μ M	25 μ M	50 μ M
Zn₆Al₂	k_T (1/min)	0.033	0.034	0.012	0.0065	0.010	0.015	0.0071	0.012	0.030	0.011
	χ^2	371	42	184.74	4.9	74	166	5.8	3.3	1.8	3.1
	R	0.99	0.99	0.97	0.97	0.99	0.94	0.98	0.99	0.99	0.99
Zn₆Al_{1.5}Ti_{0.5}	k_T (1/min)	0.024	0.017	0.0055	0.013	0.017	0.16	0.11	0.053	0.033	0.15
	χ^2	65	55	102	4.9	165	2.1	1.2	3.2	1.1	0.87
	R	0.99	0.99	0.97	0.98	0.97	0.98	0.98	0.94	0.94	0.95
Zn₆AlTi	k_T (1/min)	0.016	0.024	0.012	0.088	0.019	0.12	0.11	0.021	0.030	0.019
	χ^2	83	7.2	39	1.2	3.6	0.14	1.1	3.5	0.36	3.6
	R	0.99	0.99	0.93	0.94	0.99	0.99	0.95	0.94	0.57	0.82
Zn₆Al_{0.5}Ti_{1.5}	k_T (1/min)	0.0088	0.0085	0.0032	0.17	0.011	0.031	0.15	0.14	0.027	
	χ^2	50	94	2.5	2.0	4.5	0.10	0.044	0.049	0.055	
	R	0.99	0.96	0.99	0.94	0.96	0.97	0.99	0.97	0.98	

Table S3. Pseudo-second-order adjustment of the experimental results.

Sample		Diclofenac					Salicylic acid				
		100 mg/L	200 mg/L	400 mg/L	200 mg/L	200 mg/L	100 mg/L	200 mg/L	400 mg/L	200 mg/L	200 mg/L
		75 μ M	75 μ M	75 μ M	25 μ M	50 μ M	75 μ M	75 μ M	75 μ M	25 μ M	50 μ M
Zn₆Al₂	k_2 (g/mg·min)	0.00050	0.00084	1.79	0.0016	0.00025	0.0025	0.0012	0.0022	0.0093	0.0017
	χ^2	1152	272	185	11.2	559	7.7	20.8	12.1	8.8	17.7
	R	0.97	0.98	0.97	0.94	0.96	0.97	0.94	0.95	0.94	0.95
Zn₆Al_{1.5}Ti_{0.5}	k_2 (g/mg·min)	0.00051	0.00041	0.00032	0.0028	0.00059	0.10	0.039	0.019	0.017	0.17
	χ^2	310	309	102	5.4	76	2.9	0.25	1.02	0.64	1.26
	R	0.98	0.98	0.97	0.98	0.99	0.97	0.99	0.98	0.97	0.92
Zn₆AlTi	k_2 (g/mg·min)	0.00057	0.0016	0.0015	0.079	0.0033	0.11	0.062	0.0086	0.040	0.011
	χ^2	362	25.4	11.3	1.85	14.1	2.10	0.54	4.31	0.54	1.95
	R	0.94	0.99	0.98	0.91	0.95	0.92	0.98	0.92	0.91	0.90
Zn₆Al_{0.5}Ti_{1.5}	k_2 (g/mg·min)	0.00039	0.00051	0.00036	0.099	0.0036	0.043	0.46	0.37	0.037	
	χ^2	205	228	24.2	1.36	6.6	0.27	0.10	0.050	0.08	
	R	0.97	0.90	0.97	0.96	0.94	0.92	0.97	0.97	0.98	

Table S4. Effective diffusion coefficients of the adsorption of diclofenac and salicylic acid by the LDH.

Sample		Diclofenac					Salicylic acid				
		100 mg/L	200 mg/L	400 mg/L	200 mg/L	200 mg/L	100 mg/L	200 mg/L	400 mg/L	200 mg/L	200 mg/L
		75 μ M	75 μ M	75 μ M	25 μ M	50 μ M	75 μ M	75 μ M	75 μ M	25 μ M	50 μ M
Zn₆Al₂	D/r ² (1/s)	3.02 10 ⁻⁵	3.03 10 ⁻⁵	5.95 10 ⁻⁶	4.3 10 ⁻⁶	8.21 10 ⁻⁶	9.11 10 ⁻⁶	5.91 10 ⁻⁶	1.12 10 ⁻⁵	6.75 10 ⁻⁵	9.43 10 ⁻⁶
	χ^2	0.050	0.024	0.025	0.57	0.13	0.064	0.20	0.28	0.028	0.15
	R	0.993	0.997	0.98	0.85	0.96	0.96	0.94	0.92	0.99	0.95
Zn₆Al_{1.5}Ti_{0.5}	D/r ² (1/s)	2.05 10 ⁻⁵	1.33 10 ⁻⁵	4.56 10 ⁻⁶	8.85 10 ⁻⁶	1.35 10 ⁻⁵	2.84 10 ⁻⁴	6.61 10 ⁻⁴	3.1 10 ⁻⁵	3.12 10 ⁻⁵	1.77 10 ⁻⁴
	χ^2	0.021	0.042	0.034	0.062	4.7 10 ⁻³	0.048	0.053	0.067	0.103	0.43
	R	0.997	0.993	0.99	0.98	0.998	0.98	0.98	0.98	0.96	0.84
Zn₆AlTi	D/r ² (1/s)	8.4 10 ⁻⁶	2.02 10 ⁻⁶	5.30 10 ⁻⁴	9.50 10 ⁻⁴	1.73 10 ⁻⁵	1.38 10 ⁻⁴	1.26 10 ⁻⁵	2.52 10 ⁻⁵	3.80 10 ⁻⁵	1.46 10 ⁻⁵
	χ^2	0.055	0.021	0.036	5.75 10 ⁻³	0.15	0.018	0.20	0.21	0.53	0.17
	R	0.92	0.997	0.98	0.93	0.97	0.99	0.94	0.94	0.84	0.91
Zn₆Al_{0.5}Ti_{1.5}	D/r ² (1/s)	6.51 10 ⁻⁶	601 10 ⁻⁵	2.31 10 ⁻⁶	3.82 10 ⁻⁵	9.91 10 ⁻⁶	8.50 10 ⁻⁵		8.50 10 ⁻⁴	2.05 10 ⁻⁵	
	χ^2	0.146	0.41	0.13	0.45	0.14	0.52		0.13	0.024	
	R	0.97	0.90	0.97	0.86	0.94	0.89		0.94	0.99	

