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## **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 Zn<sub>6</sub>Al\*<sub>2</sub>.

**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<sub>6</sub>Al\*<sub>2</sub>.

	Diclofenac sodium	Salicylic acid
Molecular structure		
IUPAC name	Sodium; 2-(2-(2,6-Dichloranilino) phenyl)acetate	2-Hydroxybenzoic acid
Chemical formula	$C_{14}H_{10}Cl_2NNaO_2$	C7H6O3
Molecular mass	318.13	138.12
pKa	4.15	2.97; 13.6
$\lambda_{max}$	276	297

 Table S1. General characteristics of the pharmaceutical drugs adsorbed.

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

Sample			Diclofenac			Salicylic acid				
		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 μΜ	75 μΜ	25 μΜ	50 µM	75 μΜ	75 μΜ	75 μΜ	25 μΜ	50 µM
<i>k</i> <sub>1</sub> (1/min)	0.033	0.034	0.012	0.0065	0.010	0.015	0.0071	0.012	0.030	0.011
χ²	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
<i>k</i> 1 (1/min)	0.024	0.017	0.0055	0.013	0.017	0.16	0.11	0.053	0.033	0.15
χ²	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
<i>kı</i> (1/min)	0.016	0.024	0.012	0.088	0.019	0.12	0.11	0.021	0.030	0.019
χ²	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
<i>k</i> <sub>1</sub> (1/min)	0.0088	0.0085	0.0032	0.17	0.011	0.031	0.15	0.14	0.027	
χ²	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	
	ble $k_{l} (1/\min)$ $\chi^{2}$ R $k_{l} (1/\min)$ $\chi^{2}$ R $k_{l} (1/\min)$ $\chi^{2}$ R $k_{l} (1/\min)$ $\chi^{2}$ R	ble $ \begin{array}{c c} 100 \text{ mg/L} \\ 75 \ \mu\text{M} \\ \hline k_{l} (1/\text{min}) & 0.033 \\ \chi^{2} & 371 \\ R & 0.99 \\ \hline k_{l} (1/\text{min}) & 0.024 \\ \chi^{2} & 65 \\ R & 0.99 \\ \hline k_{l} (1/\text{min}) & 0.016 \\ \chi^{2} & 83 \\ R & 0.99 \\ \hline k_{l} (1/\text{min}) & 0.0088 \\ \chi^{2} & 50 \\ R & 0.99 \\ \end{array} $	Jee         100 mg/L         200 mg/L $75 \ \mu M$ $75 \ \mu M$ $75 \ \mu M$ $k_l (1/\min)$ $0.033$ $0.034$ $\chi^2$ $371$ $42$ R $0.99$ $0.99$ $k_l (1/\min)$ $0.024$ $0.017$ $\chi^2$ $65$ $55$ R $0.99$ $0.99$ $k_l (1/\min)$ $0.016$ $0.024$ $\chi^2$ $83$ $7.2$ R $0.99$ $0.99$ $k_l (1/\min)$ $0.0088$ $0.0085$ $\chi^2$ $50$ $94$ R $0.99$ $0.96$	Diclofenac           Johe         100 mg/L         200 mg/L         400 mg/L $75 \mu$ M $75 \mu$ M $75 \mu$ M $75 \mu$ M $k_l$ (1/min)         0.033         0.034         0.012 $\chi^2$ $371$ 42         184.74           R         0.99         0.99         0.97 $k_l$ (1/min)         0.024         0.017         0.0055 $\chi^2$ 65         55         102           R         0.99         0.99         0.97 $k_l$ (1/min)         0.016         0.024         0.012 $\chi^2$ 83         7.2         39           R         0.99         0.99         0.93 $k_l$ (1/min)         0.0088         0.0085         0.0032 $\chi^2$ 50         94         2.5           R         0.99         0.96         0.99	Diclofenac         Diclofenac           100 mg/L         200 mg/L         400 mg/L         200 mg/L $75 \mu M$ $75 \mu M$ $75 \mu M$ $25 \mu M$ $k_l$ (1/min)         0.033         0.034         0.012         0.0065 $\chi^2$ $371$ $42$ 184.74 $4.9$ R         0.99         0.99         0.97 $0.97$ $k_l$ (1/min)         0.024         0.017         0.0055 $0.013$ $\chi^2$ 65         55         102 $4.9$ R         0.99         0.99 $0.97$ $0.98$ $k_l$ (1/min)         0.016         0.024 $0.012$ $0.088$ $\chi^2$ 83 $7.2$ $39$ $1.2$ R $0.99$ $0.99$ $0.93$ $0.94$ $k_l$ (1/min) $0.0088$ $0.0085$ $0.0032$ $0.17$ $\chi^2$ 50         94 $2.5$ $2.0$ $R$ $R$ $0.99$ $0.96$ $0.99$ $0.94$	Diclofenac           Jole         100 mg/L         200 mg/L         400 mg/L         200 mg/L         200 mg/L         200 mg/L $75 \mu\text{M}$ $75 \mu\text{M}$ $75 \mu\text{M}$ $75 \mu\text{M}$ $25 \mu\text{M}$ $50 \mu\text{M}$ $k_l$ (1/min) $0.033$ $0.034$ $0.012$ $0.0065$ $0.010$ $\chi^2$ $371$ $42$ $184.74$ $4.9$ $74$ R $0.99$ $0.99$ $0.97$ $0.97$ $0.99$ $k_l$ (1/min) $0.024$ $0.017$ $0.0055$ $0.013$ $0.017$ $\chi^2$ $65$ $55$ $102$ $4.9$ $165$ R $0.99$ $0.99$ $0.97$ $0.98$ $0.97$ $k_l$ (1/min) $0.016$ $0.024$ $0.012$ $0.088$ $0.019$ $\chi^2$ $83$ $7.2$ $39$ $1.2$ $3.6$ R $0.99$ $0.99$ $0.93$ $0.94$ $0.99$ $k_l$ (1/min) $0.0088$ $0.0085$ $0.0032$	Diclofenac           jbr         100 mg/L         200 mg/L         400 mg/L         200 mg/L         200 mg/L         100 mg/L         100 mg/L $75 \mu M$ $75 \mu M$ $75 \mu M$ $75 \mu M$ $25 \mu M$ $50 \mu M$ $75 \mu M$ $k_l$ (1/min)         0.033         0.034         0.012         0.0065         0.010         0.015 $\chi^2$ $371$ 42         184.74         4.9         74         166           R         0.99         0.99         0.97         0.97         0.99         0.94 $k_l$ (1/min)         0.024         0.017         0.0055         0.013         0.017         0.16 $\chi^2$ 65         55         102         4.9         165         2.1           R         0.99         0.99         0.97         0.98         0.97         0.98 $k_l$ (1/min)         0.016         0.024         0.012         0.088         0.019         0.12 $\chi^2$ 83         7.2         39         1.2         3.6         0.14           R         0.99         0.99         0.93         0.94         0.99	Diclofenac           ole         100 mg/L         200 mg/L         400 mg/L         200 mg/L	Jec         Diclofenac         Saticylic 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           75 µM         75 µM         75 µM         75 µM         75 µM         50 µM         50 µM         75 µM         75 µM         75 µM           kr (1/min)         0.033         0.034         0.012         0.0065         0.010         0.015         0.0071         0.012           x²         371         42         184.74         4.9         74         166         5.8         3.3           R         0.99         0.97         0.97         0.99         0.94         0.98         0.99           kr (1/min)         0.024         0.017         0.0055         0.013         0.017         0.16         0.11         0.053           x²         65         55         102         4.9         165         2.1         1.2         3.2           R         0.99         0.97         0.98         0.97         0.98         0.98         0.94           kr (1/min)         0.016         0.024         0.012         0.088         0.019         0.12         0.11	Dictoreme         Dictoreme         Salicylic acid           100 mg/L         200 mg/L         400 mg/L         200 mg/L

 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 μΜ	75 μΜ	75 μΜ	25 μΜ	50 µM	75 μΜ	75 μΜ	75 μΜ	25 μΜ	50 µM
Zn <sub>6</sub> Al <sub>2</sub>	k₂ (g/mg·min)	0.00050	0.00084	1.79	0.0016	0.00025	0.0025	0.0012	0.0022	0.0093	0.0017
	χ²	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
Zn6Al1.5Ti0.5	k₂ (g/mg·min)	0.00051	0.00041	0.00032	0.0028	0.00059	0.10	0.039	0.019	0.017	0.17
	$\chi^2$	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
Zn <sub>6</sub> AlTi	k₂ (g/mg·min)	0.00057	0.0016	0.0015	0.079	0.0033	0.11	0.062	0.0086	0.040	0.011
	χ²	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
Zn6 Al0.5Ti1.5	k₂ (g/mg·min)	0.00039	0.00051	0.00036	0.099	0.0036	0.043	0.46	0.37	0.037	
	$\chi^2$	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 salycilic 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 μΜ	75 μΜ	75 μΜ	25 μΜ	50 µM	75 μΜ	75 μΜ	75 μΜ	25 μΜ	50 µM	
Zn <sub>6</sub> Al <sub>2</sub>	D/r <sup>2</sup> (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	
	χ²	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	
Zn6Al1.5Ti0.5	$D/r^{2}(1/s)$	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	
	χ²	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	
Zn <sub>6</sub> AlTi	$D/r^{2}(1/s)$	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	
	χ²	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	
Zn6 Al0.5Ti1.5	$D/r^{2}(1/s)$	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		
	χ²	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		