Supporting information

Adsorption Behaviors and Mechanisms of Methyl Orange on Heat-Treated Palygorskite Clays

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It has reported in many literatures that introduction of metal ions into dye solution may be exerting an influence on the shape and position of characteristic peaks of dye in UV absorption spectrum. Taking into account the leaching of metal ions in present study, it is very important to determine whether or not leaching of these metal ions affect the shape and position of characteristic peaks of methyl orange. The thinking and discussion about this part are similar to those reported in our earlier paper [a], so their description will not be repeated again. The results show (Table S1 and Fig. S1), the introduction of these metal ions into the system has almost no impact on spectra and peak intensity of dye molecules under neutral conditions. This ensured the reliability of the results of the adsorption capacity.

Table S1 pH of 20 times dilute supernatant after adsorption

Calcination temperature (^{o}C)	25	100	200	300	400	500	600	700	800
pH	6.87	6.90	6.93	6.95	6.97	7.03	7.19	7.34	7.05

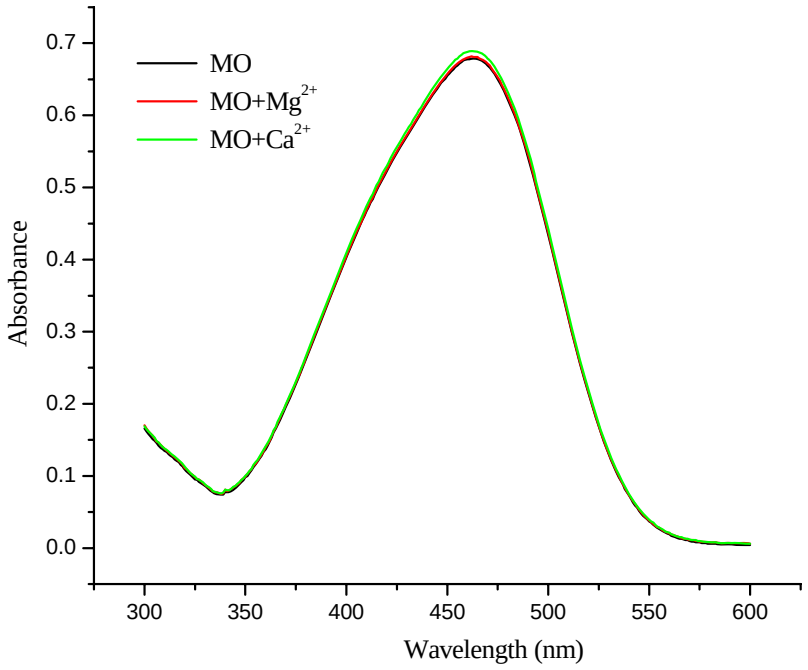

Figure S1. Effect of metal ions on UV absorption spectra of MO solution. Dye concentration is 10 mg/L.

The distributions of metal element species in the supernatants for different adsorbents were displayed in Table S2, which were drawn by Visual MINTEQ ver. 3.0 [b].

Table S2 Percentage distribution among dissolved and adsorbed species for the adsorbents calcined at different temperatures ($I = 7.64\times10^{-4}$ mol/kg)

25 ^{o}C

Component	% of total concentration	Species name
Fe+3	99.623	Fe+3
	0.377	FeOH+2
K+1	100	K+1
Mg+2	100	Mg+2
Ca+2	100	Ca+2

100 ^{o}C

Component	% of total concentration	Species name
Fe+3	8.944	Fe(OH)2+
	3.984	Fe(OH)3 (aq)
	87.072	Fe(OH)4-
K+1	99.998	K+1
Mg+2	99.654	Mg+2
	0.346	MgOH+
Ca+2	99.982	Ca+2
	0.018	CaOH+

200 ^{o}C

Component	% of total concentration	Species name
Fe+3	7.269	Fe(OH)2+
	3.633	Fe(OH)3 (aq)
	89.097	Fe(OH)4-
K+1	99.998	K+1
Mg+2	99.612	Mg+2
	0.388	MgOH+
Ca+2	99.98	Ca+2
	0.02	CaOH+

300 ^{o}C

Component	% of total concentration	Species name
Fe+3	1.314	Fe(OH)2+
	1.613	Fe(OH)3 (aq)
	97.073	Fe(OH)4-
K+1	99.996	K+1
Mg+2	99.053	Mg+2
	0.947	MgOH+
Ca+2	99.95	Ca+2
	0.05	CaOH+
Al+3	0.109	Al(OH)3 (aq)
	99.89	Al(OH)4-

400 ^{o}C

Component	% of total concentration	Species name
Fe+3	0.73	Fe(OH)2+
	1.208	Fe(OH)3 (aq)
	98.063	Fe(OH)4-
K+1	99.994	K+1
Mg+2	98.726	Mg+2
	1.274	MgOH+
Ca+2	99.933	Ca+2
	0.067	CaOH+
Al+3	0.081	Al(OH)3 (aq)
	99.919	Al(OH)4-

500 ^{o}C

Component	% of total concentration	Species name
Fe+3	0.135	Fe(OH)2+
	0.522	Fe(OH)3 (aq)
	99.344	Fe(OH)4-
K+1	99.986	K+1
	0.014	KOH (aq)
Mg+2	97.064	Mg+2
	2.936	MgOH+
Ca+2	99.842	Ca+2
	0.158	CaOH+
Al+3	0.035	Al(OH)3 (aq)
	99.965	Al(OH)4-

600 ^{o}C

Component	% of total concentration	Species name
Fe+3	0.03	Fe(OH)2+
	0.245	Fe(OH)3 (aq)
	99.725	Fe(OH)4-
K+1	99.971	K+1
	0.029	KOH (aq)
Mg+2	93.927	Mg+2
	6.073	MgOH+
Ca+2	99.663	Ca+2
	0.337	CaOH+
Al+3	0.016	Al(OH)3 (aq)
	99.984	Al(OH)4-

700 ^{o}C

Component	% of total concentration	Species name
Fe+3	0.015	Fe(OH)2+
	0.174	Fe(OH)3 (aq)
	99.812	Fe(OH)4-
K+1	99.959	K+1
	0.041	KOH (aq)
Mg+2	91.631	Mg+2
	8.369	MgOH+
Ca+2	99.525	Ca+2
	0.475	CaOH+
Al+3	0.011	Al(OH)3 (aq)
	99.989	Al(OH)4-

800 ^{o}C

Component	% of total concentration	Species name
Fe+3	0.036	Fe(OH)2+
	0.269	Fe(OH)3 (aq)
	99.696	Fe(OH)4-
K+1	99.973	K+1
	0.027	KOH (aq)
Mg+2	94.431	Mg+2
	5.569	MgOH+
Ca+2	99.693	Ca+2
	0.307	CaOH+
Al+3	0.018	Al(OH)3 (aq)
	99.982	Al(OH)4-

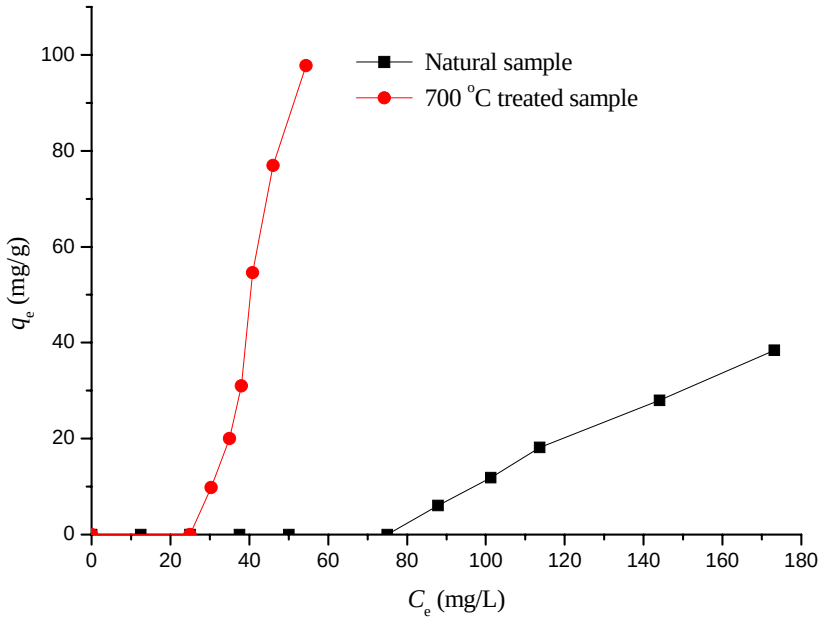

Figure S2. Adsorption isotherms of MO on natural and 700 °C treated palygorskite clays.

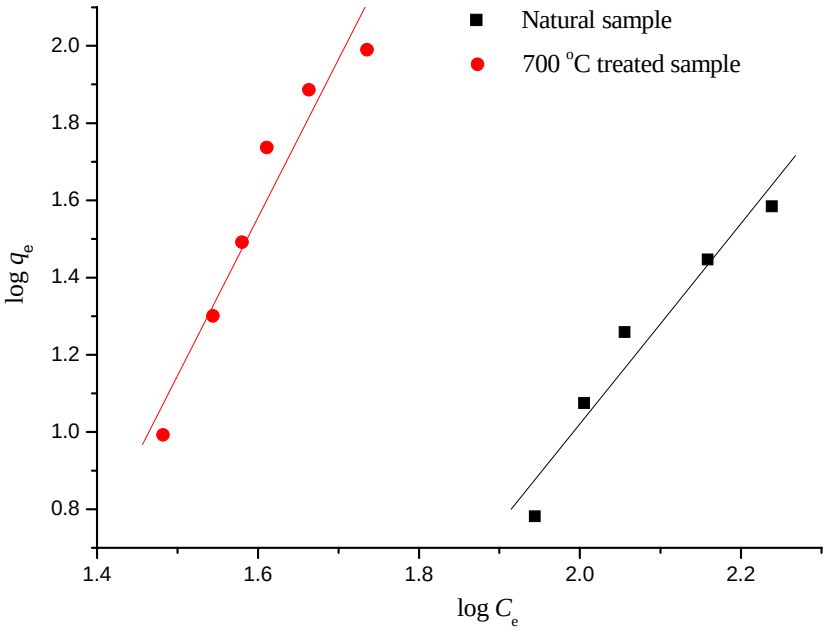

Figure S3. Freundlich plots for the adsorption of MO on natural and 700 °C treated palygorskite clays in the specific dye concentration range.

Reference

[a] Chen, H.; Zhao, J.; Zhong, A.; Jin, Y. Removal capacity and adsorption mechanism of heat-treated palygorskite clay for methylene blue. *Chem. Eng. J.* 2011, *174*, Appendix A. Supplementary data.

[b] J.P. Gustafasson, visual MINTEQ ver. 3.0, <http://www2.lwr.kth.se/English/OurSoftware/vminteq>.