Supporting Information

Effects of Transition Metal ions (TMs) on the optical properties of Humic-like substances (HULIS) revealing structural preference

Juanjuan Qin[1,2], Leiming Zhang[3], Yuanyuan Qin[1], Shaoxuan Shi[1], Jingnan Li[1], Zhao Shu[1], Yuwei Gao[1], Ting Qi[4], Jihua Tan[1*], Xinming Wang[2*]

[1]College of Resources and Environment, University of Chinese Academy of Sciences, Beijing 100049, China
[2]Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, China
[3]Air Quality Research Division, Science & Technology Branch, Environment and Climate Change Canada, Toronto, Canada
[4]College of Resources and Environment, University of Chinese Academy of Sciences, Beijing 100049, China

Correspondence to: Jihua Tan (tanjh@ucas.ac.cn); Xinming Wang (wangxm@gig.ac.cn)

Summary of figures and tables

Figures S1 The ratio spectra of mass absorption efficiency (MAE) for winter humic-like substances (HULIS) with addition of four transition metal ions under acidic, weakly acidic and neutral environment.

Page S2

Figures S2 The ratio spectra of MAE for summer HULIS with addition of four transition metal ions under acidic, weakly acidic and neutral environment.

Page S2

Figures S3 The excitation-emission matrix spectra of winter HULIS with addition of 0-500 μM Cu^{2+} under three acidity conditions.

Page S3

Figures S4 The excitation-emission matrix spectra of summer HULIS with addition of 0-500 μM Cu^{2+} under three acidity conditions.

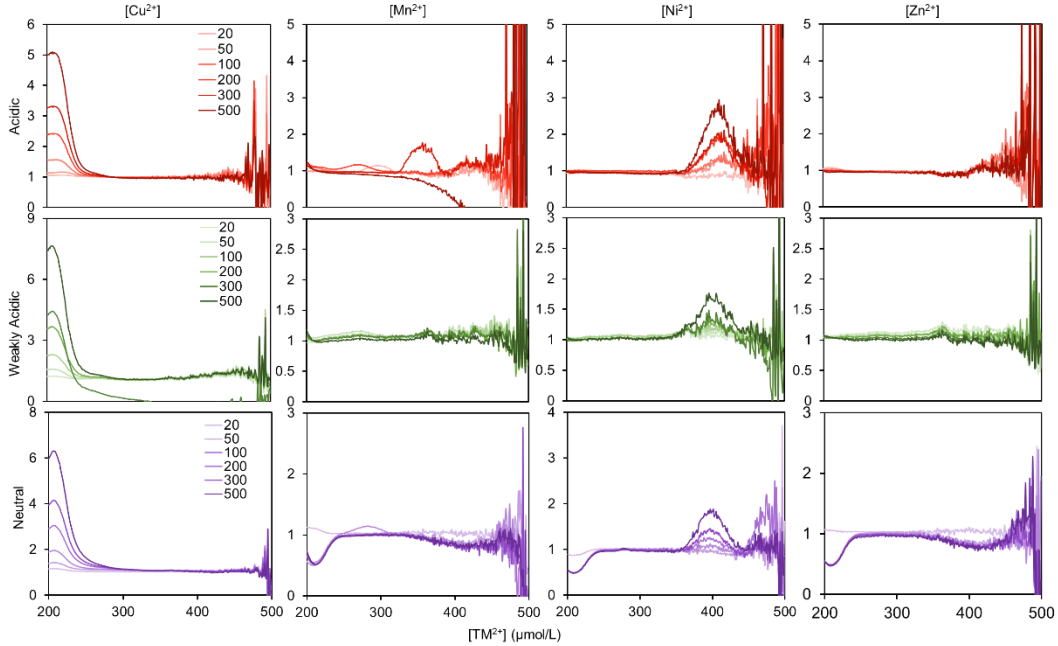
Page S3

Tables S1 The Stern-volmer results for the PARAFAC results of TMs and winter HULIS.

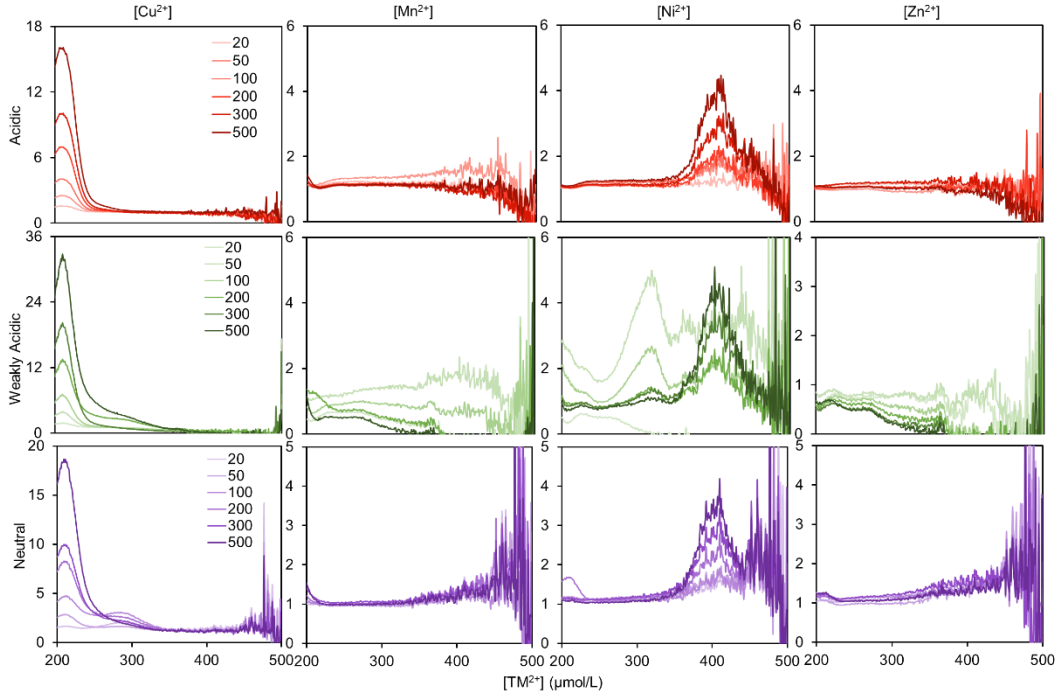
Page S4

Tables S2 The Stern-volmer results for the PARAFAC results of TMs and summer HULIS.

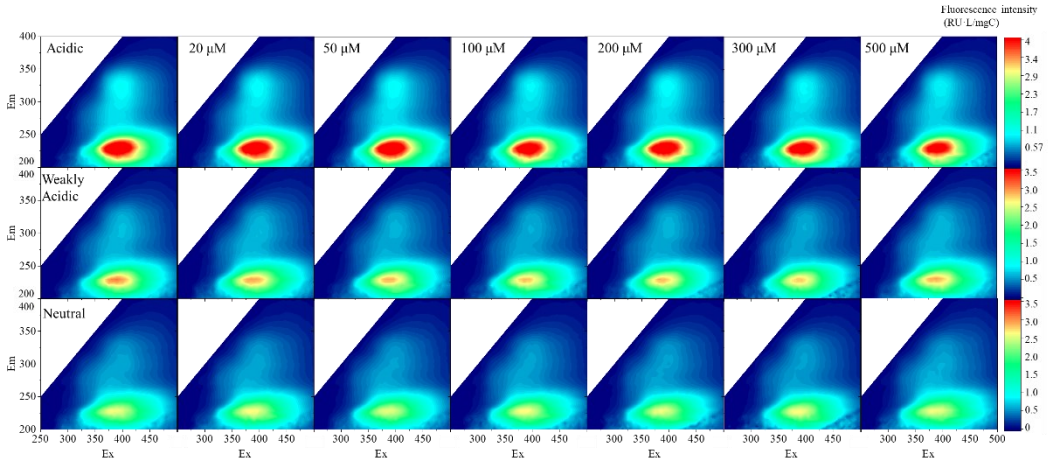
Page S4



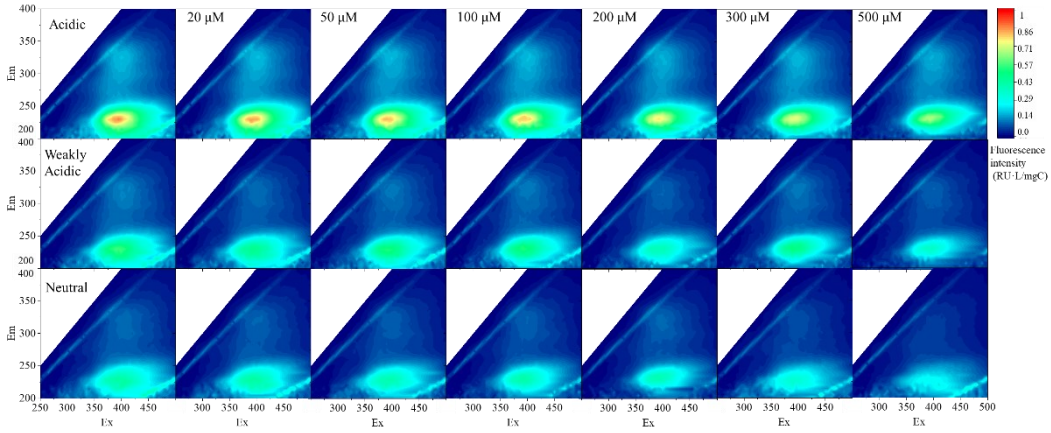
Figures S3 The ratio spectra of mass absorption efficiency (MAE) for winter humic-like substances (HULIS) with addition of four transition metal ions under acidic, weakly acidic and neutral conditions.



Figures S4 The ratio spectra of MAE for summer HULIS with addition of four transition metal ions under acidic, weakly acidic and neutral conditions.



Figures S3 The excitation-emission matrix spectra of winter HULIS with addition of 0-500 μM Cu^{2+} under three acidity conditions.



Figures S4 The excitation-emission matrix spectra of summer HULIS with addition of 0-500 μM Cu^{2+} under three acidity conditions.

Tables S3 The Stern-volmer results for the PARAFAC results of TMs and winter HULIS.

		Cu^{2+}		Mn^{2+}		Ni^{2+}		Zn^{2+}	
Acidity	Components	$k \cdot 10^3$	R^2	$k \cdot 10^3$	R^2	$k \cdot 10^3$	R^2	$k \cdot 10^3$	R^2
Acidic	C1	0.60	0.98	0.08	0.94	0.09	0.97	0.10	0.87
	C2	-0.04	0.11	0.10	0.72	0.07	0.63	0.04	0.47
	C3	-0.30	0.99	0.09	0.88	0.10	0.97	0.03	0.52
	C4	1.90	0.97	0.10	0.43	0.10	0.33	0.40	0.69
Weakly Acidic	C1	0.04	0.12	-0.05	0.15	0.03	0.05	0.01	0.02
	C2	0.20	0.84	0.20	0.93	0.10	0.98	0.05	0.73
	C3	0.30	0.83	0.10	0.96	0.20	0.98	0.07	0.68
	C4	0.20	0.27	0.03	0.05	0.09	0.48	0.10	0.64
Neutral	C1	0.50	0.99	0.10	0.58	0.20	0.48	0.10	0.64
	C2	0.30	0.94	0.08	0.55	0.09	0.55	0.08	0.36
	C3	0.01	0.01	0.10	0.73	0.20	0.88	0.06	0.44
	C4	1.50	0.97	0.10	0.62	0.20	0.57	0.09	0.76

Tables S4 The Stern-volmer results for the PARAFAC results of TMs and summer HULIS.

		Cu^{2+}		Mn^{2+}		Ni^{2+}		Zn^{2+}	
Acidity	Components	$k \cdot 10^3$	R^2	$k \cdot 10^3$	R^2	$k \cdot 10^3$	R^2	$k \cdot 10^3$	R^2
Acidic	C1	0.60	0.98	0.10	0.38	0.01	0.01	-0.20	0.09
	C2	1.30	0.98	0.20	0.18	0.50	0.16	-0.40	0.58
	C3	0.70	0.99	0.10	0.73	0.09	0.15	-0.06	0.01
	C4	-0.90	0.95	0.05	0.00	1.60	0.81	0.10	0.04
Weakly Acidic	C1	1.00	0.72	0.10	0.01	-0.8	0.58	-0.40	0.07
	C2	1.20	0.92	0.06	0.13	0.05	0.03	-0.10	0.65
	C3	0.60	0.73	0.10	0.04	-0.10	0.29	-0.20	0.11
	C4	-0.30	0.56	0.05	0.08	0.20	0.71	0.04	0.23
Neutral	C1	0.40	0.33	0.03	0.01	-0.10	0.05	-0.60	0.12
	C2	1.20	0.95	0.10	0.49	-0.01	0.01	0.20	0.19
	C3	0.30	0.61	-0.02	0.01	0.20	0.68	-0.40	0.39
	C4	-0.50	0.97	-0.05	0.00	0.10	0.43	-0.20	0.36