Supporting information

Understanding the evolution of stratified extracellular polymeric substances in full-scale activated sludges in relation to dewaterability

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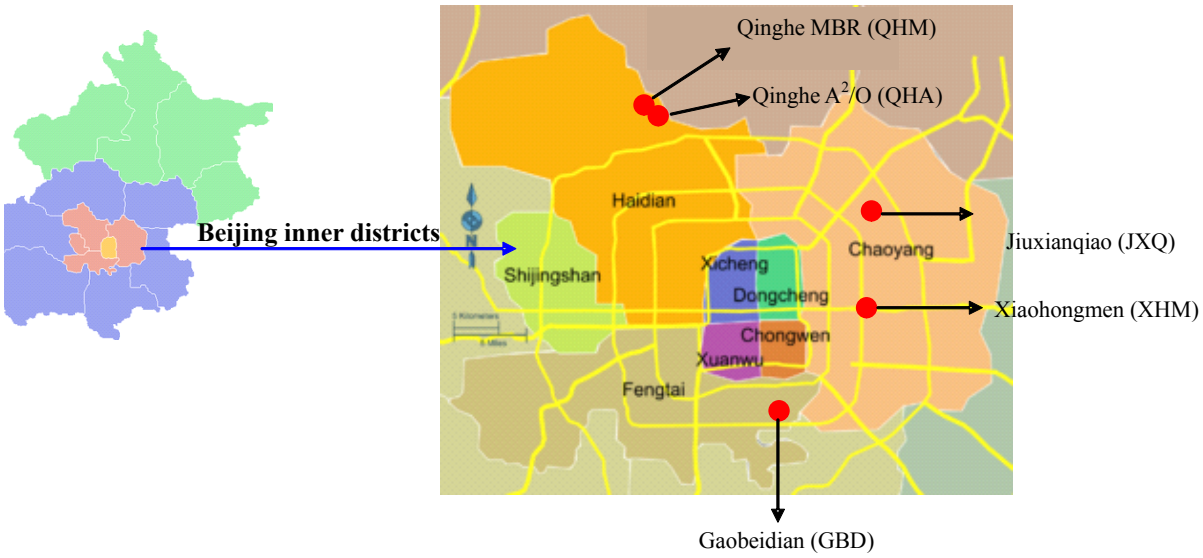

Figure S1 Locations of WWTPs investigated in Beijing city

Table S1 Coefficients of correlation (R) for linear regression between the various parameters

	CST	$d_{0.1}$	$d_{0.5}$	$d_{0.9}$	Zeta potential	pH	VSS/TSS
CST	1.00	-0.66**	-0.57	-0.39	-0.40	0.22	0.51
$d_{0.1}$	—	1.00	0.98**	0.95**	0.14	-0.63	-0.36
$d_{0.5}$	—	—	1.00	0.98**	0.20	-0.69*	-0.17
$d_{0.9}$	—	—	—	1.00	0.24	-0.68*	0.20
Zeta	—	—	—	—	1.00	0.22	0.00
pH	—	—	—	—	—	1.00	-0.75**
VSS/TSS	—	—	—	—	—	—	1.00

* Correlation is significant at the 0.05 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed).

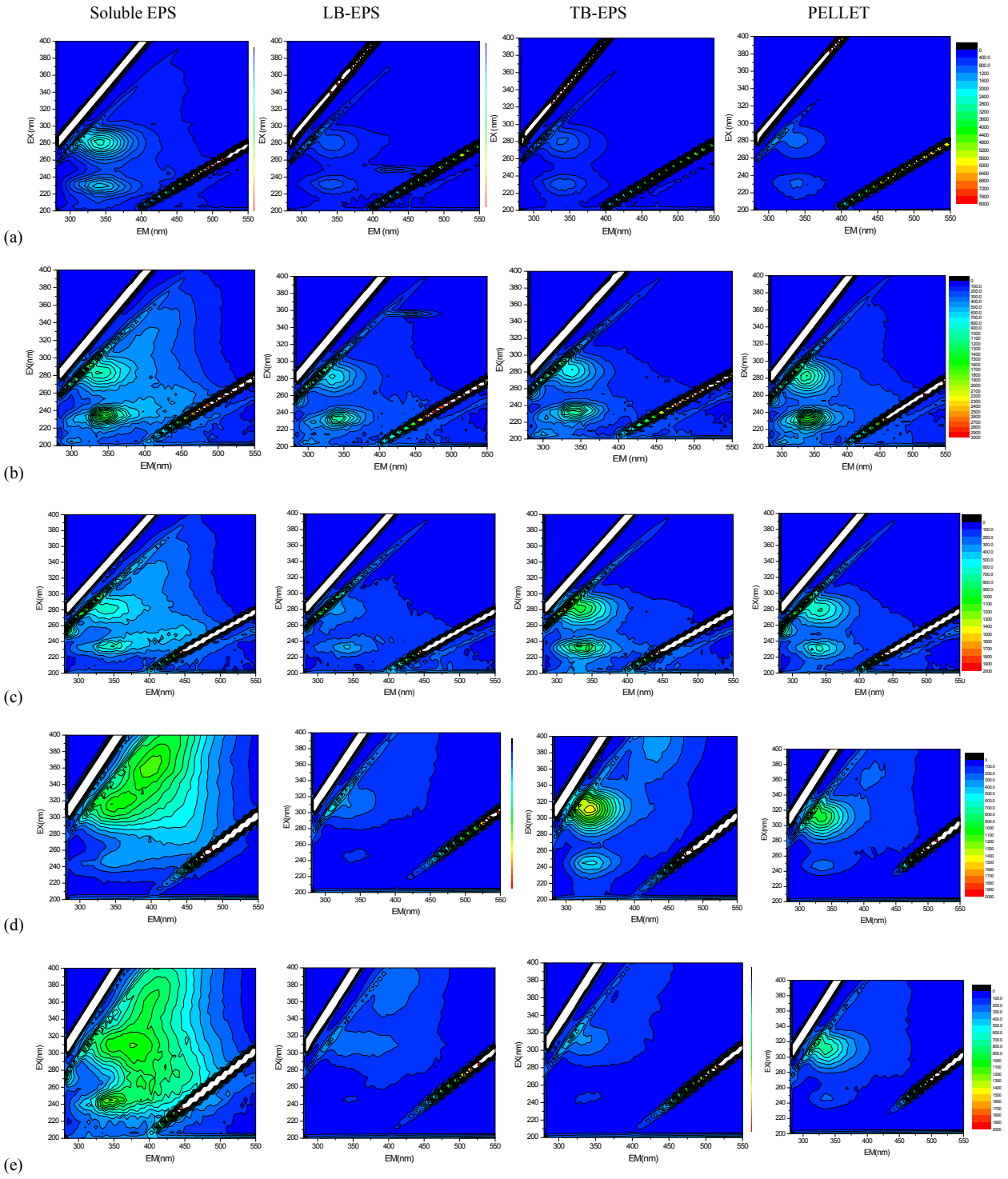

Figure S2 Change in EEM profiles of sludge from JXQ WWTP with time (a) 2013-04-16 (b) 2013-05-06 (c) 2013-05-23 (d) 2013-06-03 (e) 2013-07-10

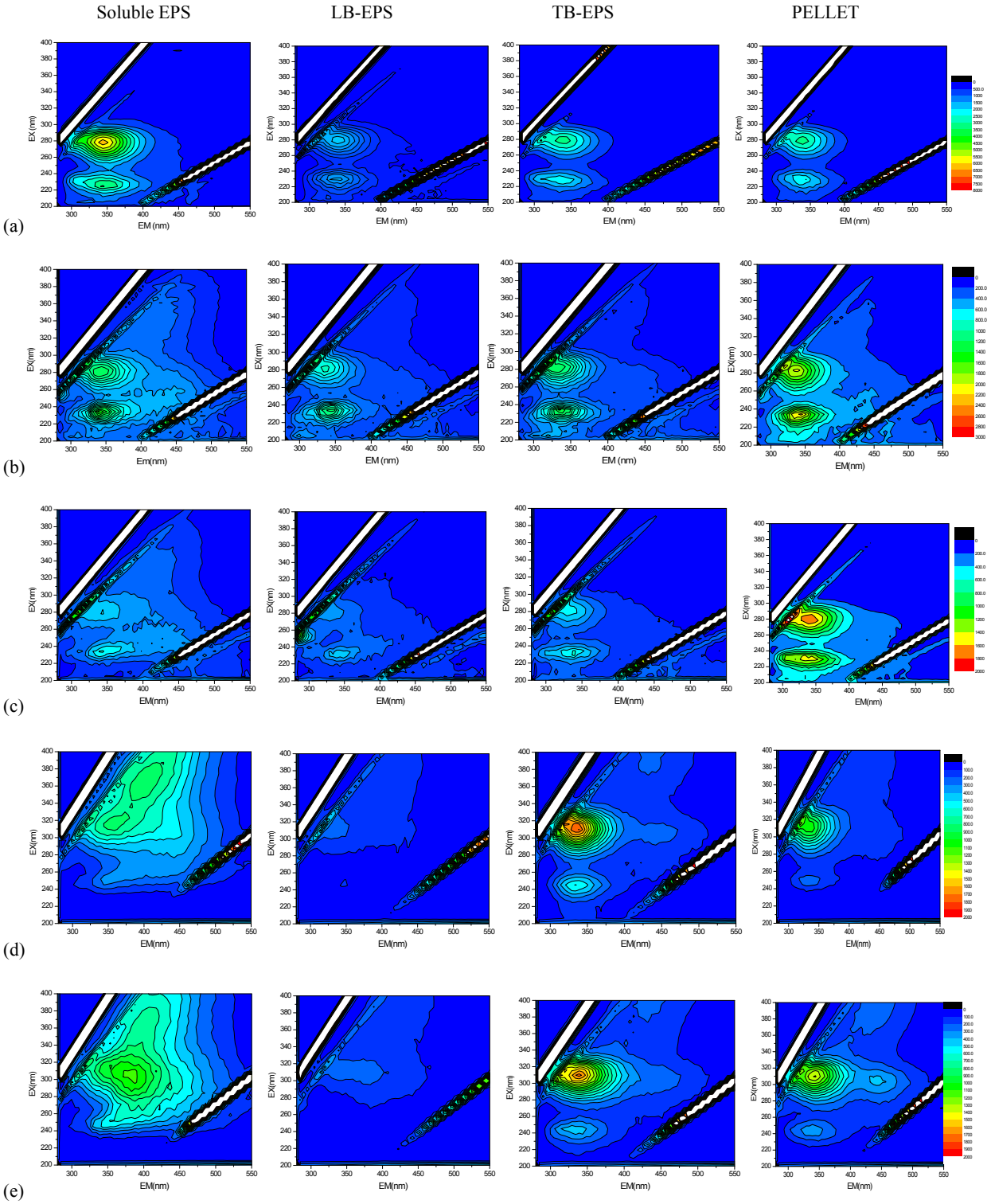

Figure S3 Change in EEM profiles of sludge from QHA WWTP with time (a) 2013-04-16 (b) 2013-05-06 (c) 2013-05-23 (d) 2013-06-03 (e) 2013-07-10

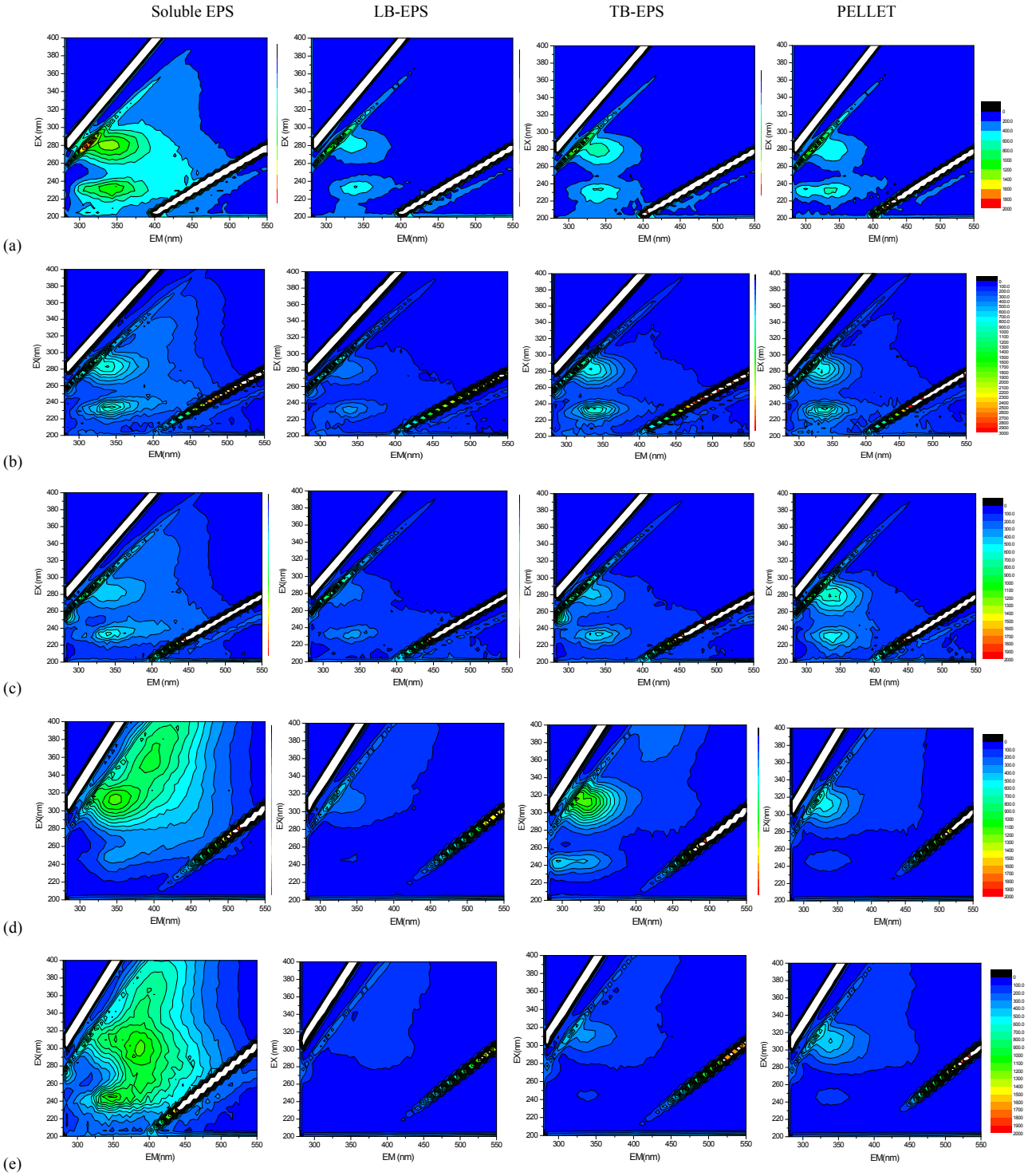

Figure S4 Change in EEM profiles of sludge from GBD WWTP with time (a) 2013-04-16 (b) 2013-05-06 (c) 2013-05-23 (d) 2013-06-03 (e) 2013-07-10

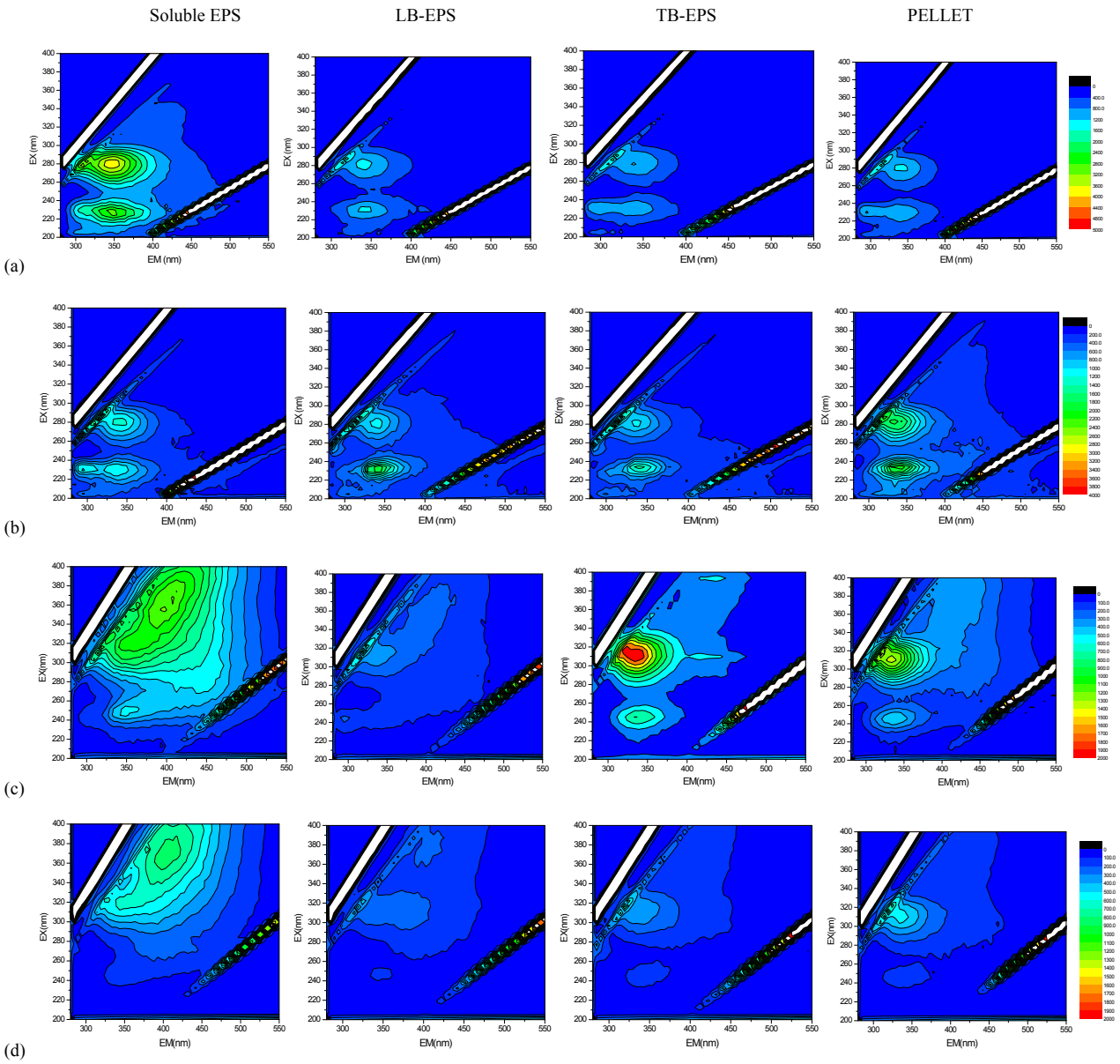

Figure S5 Change in EEM profiles of sludge from XHM WWTP with time (a) 2013-04-16 (b) 2013-05-06 (c) 2013-06-03 (d) 2013-07-10

TEXT 1

The According to the study of Chen et al [1], the EEM spectra could be divided into five regions. Peaks at shorter wavelengths (<250 nm) and shorter emission wavelengths (<350 nm) are associated with simple aromatic proteins such as tyrosine and tryptophan (Regions I and II). Peaks at intermediate excitation wavelengths (250 - 280 nm) and shorter emission wavelengths (<380 nm) are related to soluble microbial byproducts which are actually protein-like substances (Region IV) while peaks located at the excitation wavelengths (200 - 250 nm) and the emission wavelengths (>380 nm) represent fulvic acid-like substances (Region III). The beneath EEMs within selected regions could represent the cumulative fluorescence response of DOM with similar properties. Therefore, quantification of the EEM spectra could be achieved by the fluorescence regional integration (FRI) method. The spectral subtraction has been performed to remove blank spectra mainly caused by water Raman scattering before FRI.

The volume (ϕ_i) beneath region "i" of the EEM could be calculated with

$$\varphi_i = \int_{ex}\int_{em} I(\lambda_{ex}\lambda_{em})d\lambda_{ex}\lambda_{em} \quad (2)$$

For discrete data, the volume ϕ_i also can be expressed as

$$\varphi_i = \sum_{ex}\sum_{em} I(\lambda_{ex}\lambda_{em})\Delta\lambda_{ex}\Delta\lambda_{em} \quad (3)$$

where $\Delta\lambda_{ex}$ and $\Delta\lambda_{em}$ were the excitation and emission wavelength interval (taken as 5 nm), and $I(\lambda_{ex}\lambda_{em})$ was the fluorescence intensity at each excitation-emission wavelength pair. And the cumulative volume beneath the EEM (ϕ_T) was calculated as $\phi_T = \sum \phi_i$. All ϕ_T and ϕ_i were normalized to its DOC concentration of 1 mg/L for comparison. The percent of fluorescence response in a specific region (P_i) was calculated as $\phi_i / \phi_T \times 100\%$.

In order to reduce the effect of dominance by shoulders in different regions, it normalized ϕ_i to relative regional areas (nm^2). A multiplication factor for each region (MFi) which equal to the inverse of fractional projected excitation-emission area, was calculated to account for these secondary or tertiary responses at longer wavelength. Therefore, the normalized excitation-emission are volumes ($\phi_{i,n}$, $\phi_{T,n}$) and percent fluorescence (P_i) can be obtained as follows:

$$\varphi_{i,n} = MF_i\varphi_i \quad (4)$$

$$\varphi_{T,n} = \sum_{i=1}^{3}\varphi_{i,n} \quad (5)$$

$$P_{i,n} = \varphi_{i,n} / \varphi_{T,n} \times 100\% \quad (6)$$”

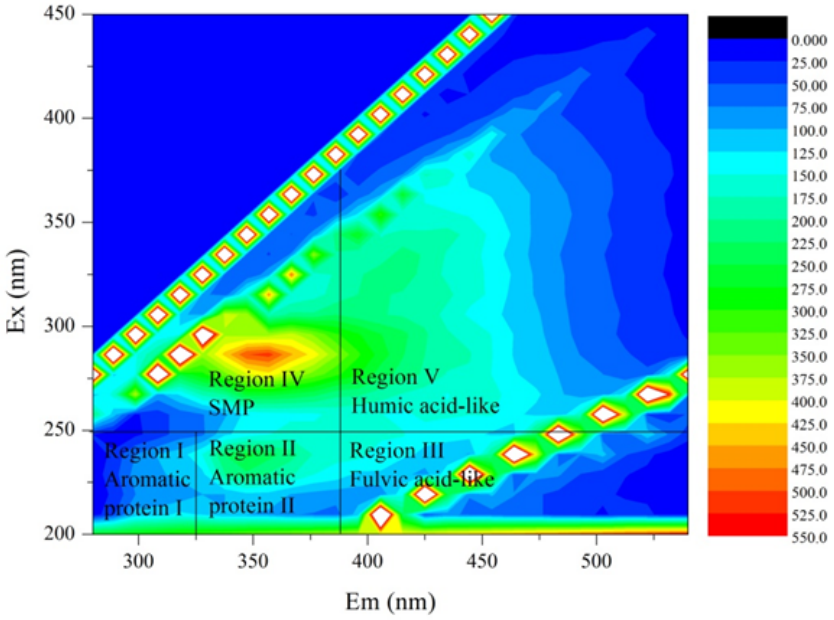

Fig. S6 Fluorescence spectrum regional division

References

[1] W. Chen, P. Westerhoff, J.A. Leenheer, K. Booksh, Fluorescence excitation-emission matrix regional integration to quantify spectra for dissolved organic matter, Environmental science & technology, 37 (2003) 5701-5710.