Supplementary Information

Tertiary treatment of secondary effluent using ultrafiltration for wastewater reclamation: membrane fouling and its impact on the rejection of effluent organic matter and hydrophobic pharmaceuticals

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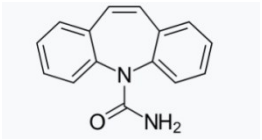
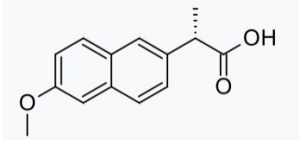
1. Other indexes for qualities of the secondary effluent

Table S1 more details in qualities of the secondary effluent

Ammonia (mg/L)	3.76-4.51
Total nitrogen (mg/L)	13.19-16.73
Total phosphorus (mg/L)	0.57-0.72
Protein (mg/L)	4.92-7.54
Polysaccharide(mg/L)	4.49-6.82

2. Detailed information on the pharmaceutical compounds (PhACs) investigated

Table S2 Physic-chemical properties of Carbamazepine and Naproxen

Pharmaceuticals	Carbamazepine	Naproxen
Molecular formula	$C_{15}H_{12}N_2O$	$C_{14}H_{14}O_3$
Structure		
Molecular weight (g mol^{-1})	236.27	230.3
pKa	13	4.15
$LogK_{ow}$	2.45	3.18
Aqueous solubility (mg L^{-1})	125.0±2	60.1±2
Charge (pH=7)	Neutral	Negative

3. Impacts of TMP on the resistances during secondary effluent treatment using UF

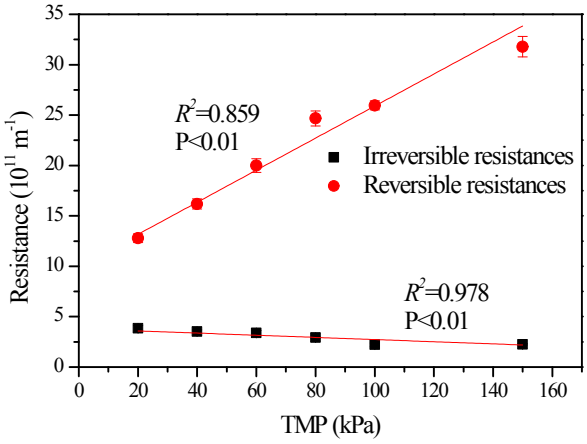


Fig. S1 Linear correlation between TMP values and resistances during filtration of secondary effluent.

4. Molecular weight distribution of EfOM obtained by LCOCD

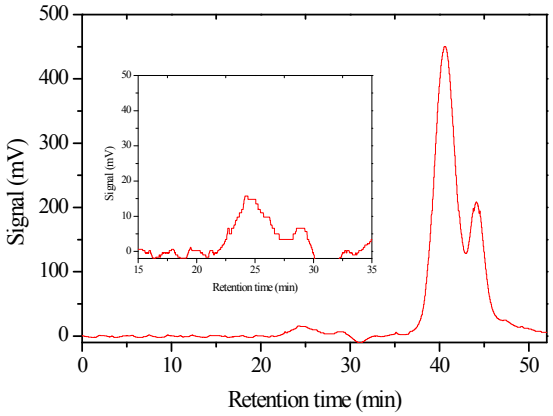


Fig.S2 Molecular weight distribution of EfOM in the secondary effluent

5. Concentration calibration curves for carbamazepine (CBZ) and naproxen (NPX)

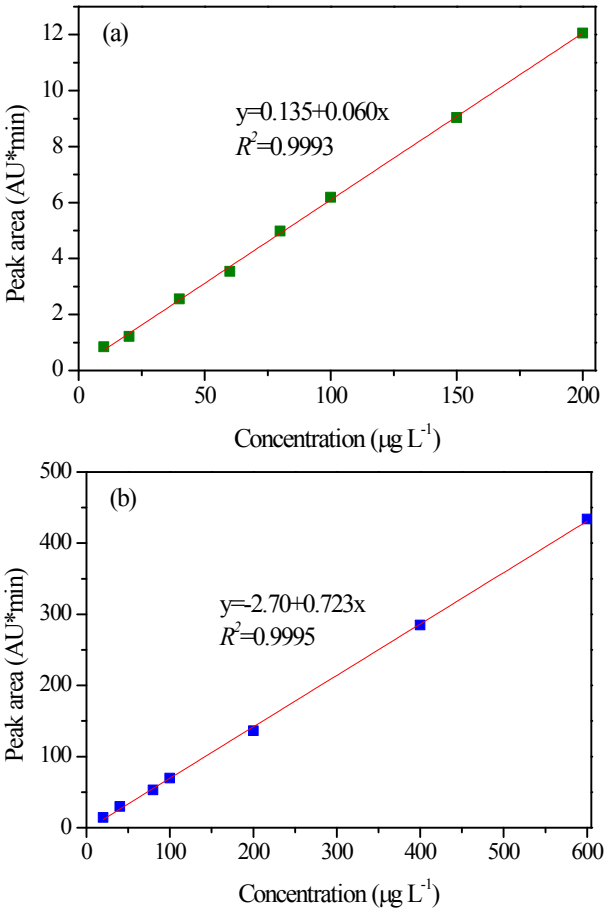


Fig. S3 Correlation results between signals and concentrations of CBZ and NPX

5. Fluorescent excitation-emission matrix (FEEM) spectra of permeate samples during secondary effluent treatment using UF

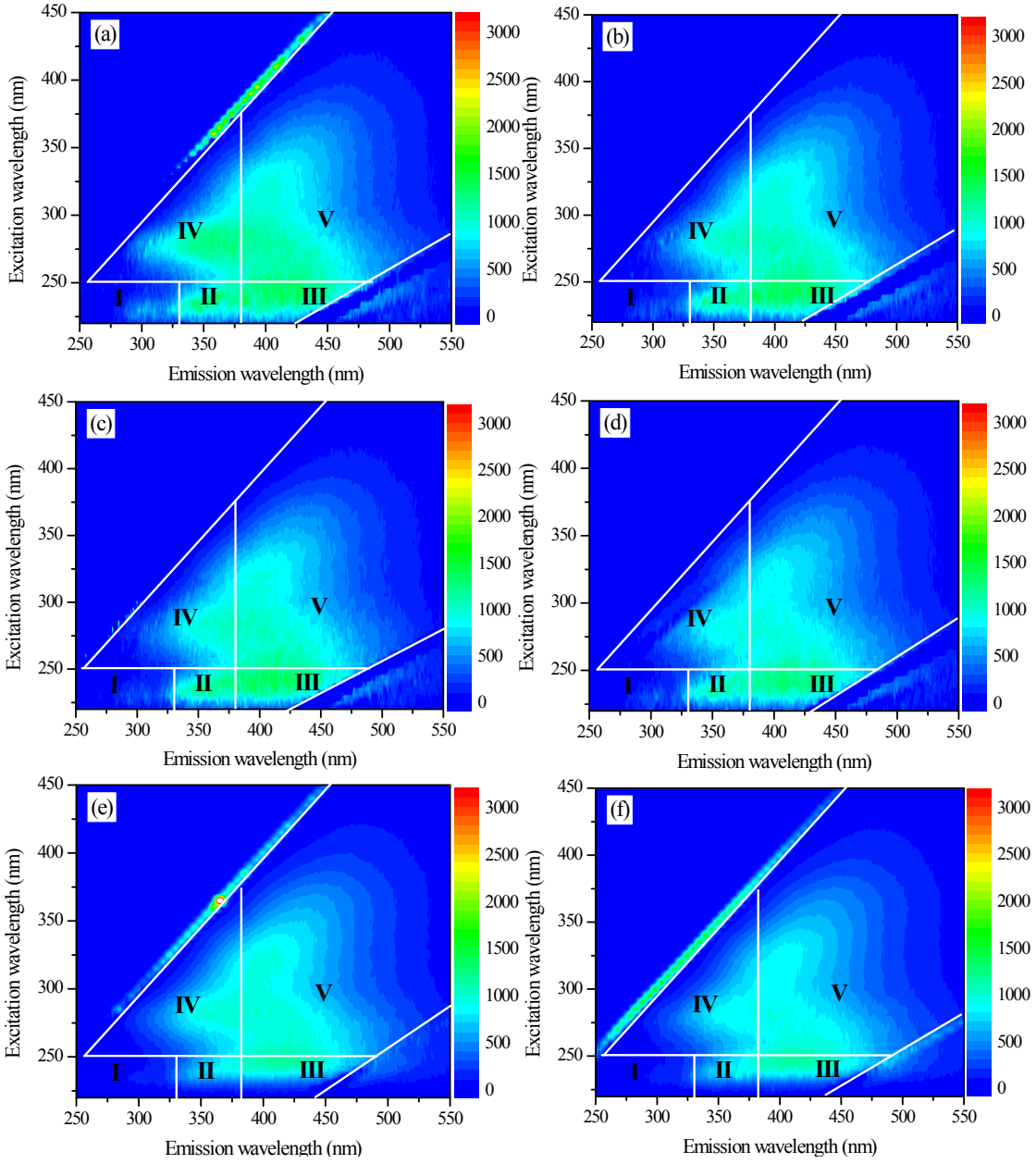


Fig. S4 Fluorescent EEM spectra of permeate during SE treatment using UF under different running pressures: (a) 20 kPa, (b) 40 kPa, (c) 60 kPa, (d) 80 kPa, (e) 100 kPa and (f) 150 kPa

6. Fluorescent excitation-emission matrix (FEEM) spectra of backwashing waste water during secondary effluent treatment using UF

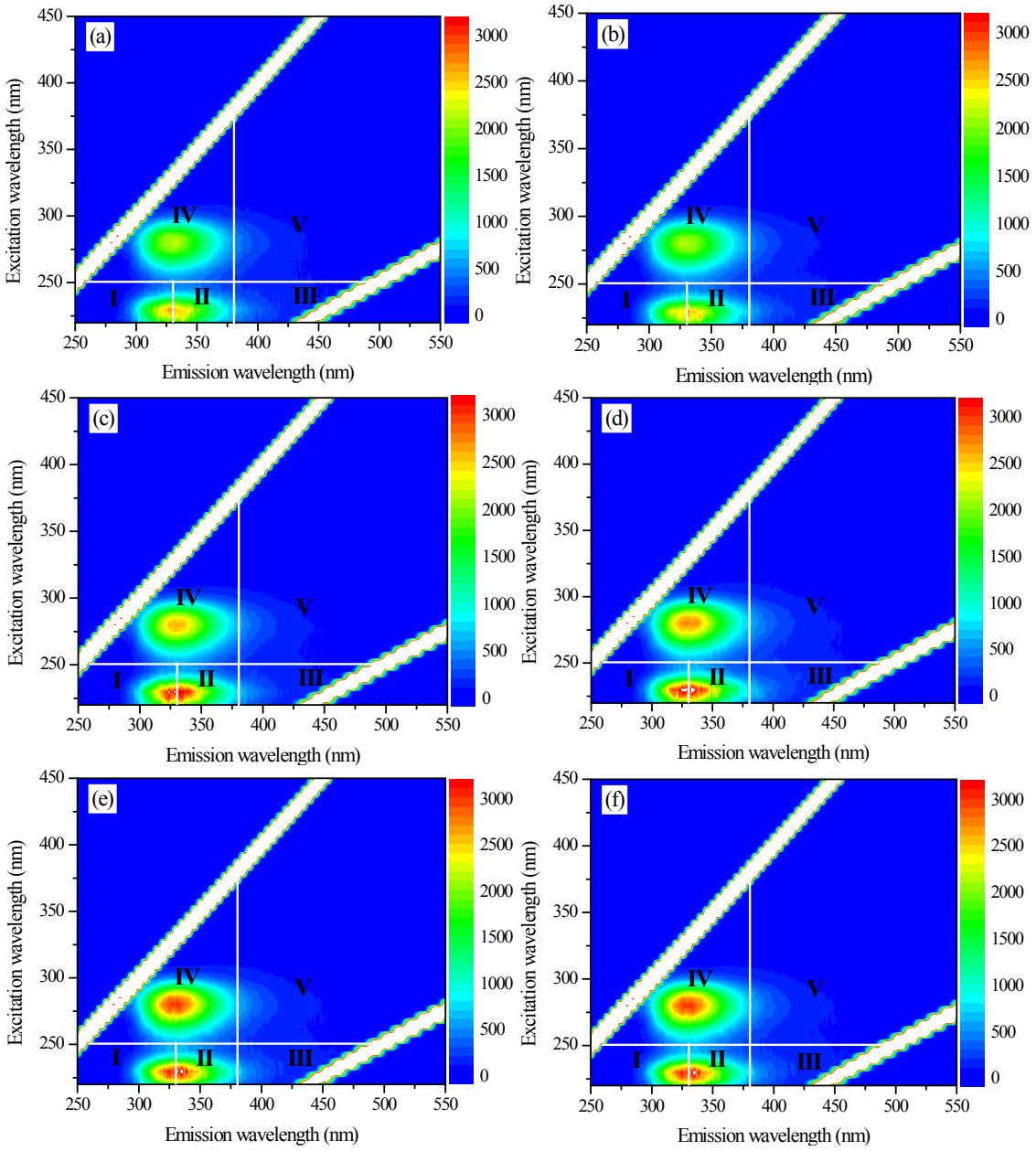


Fig. S5 FEEM spectra of backwashing wastewater during SE treatment using UF under different running pressures: (a) 20 kPa, (b) 40 kPa, (c) 60 kPa, (d) 80 kPa, (e) 100 kPa and (f) 150 kPa

7. Analyzing the FEEM data using PARAFAC modling

PARAFAC modeling procedures conducted were similar to that described by Stedmon and Bro (2008). Briefly, a dataset of 44 EEM fluorescence data were modeled using the DOMFluor Toolbox in Matlab® according to the recommended procedures (Stedmon and Bro, 2008). With the PARAFAC analysis, spectrally overlapping EEM data can be mathematically separated into chemically independent fluorescence components. A series of PARAFAC models consisting of between 3 and 7 components were generated. The number of fluorescence components was identified by a validation method including residual analysis, split half analysis and random initialization analysis. three components were identified in this work as shown in Fig. SX. Component 2 is in the region of protein-like fluorophores, whereas Component 1 and Component 3 are indicated to be humic-like fluorophores (Murphy et al., 2011). The maximum fluorescence intensity (F_{max}) of each component in each sample generated from PARAFAC model has been used to estimate the relative concentration of the corresponding component in a sample, and excitation and emission loadings indicated their characteristics excitation and emission spectra (Murphy et al., 2011; Sanchez et al., 2013; Baghoth et al., 2011).

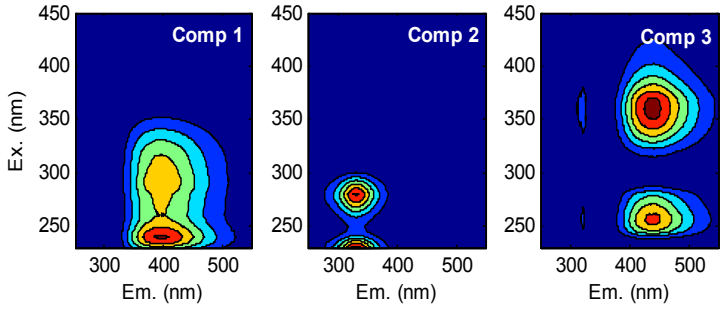


Fig. S6 Contour plots of three Components in EfOM extractedby the PARAFAC model.

(Ex.= excitation wavelength; Em.= emission wavelength)