

Algae-laden water treatment with ultrafiltration: effects of moderate oxidation by
Fe(II)/permanganate on hydraulically irreversible fouling and deposition of iron and
manganese oxides

Supplementary information

Fangshu Qu^{a,b}, Zhimeng Yang^a, Huarong Yu^{a,b,*}, Hong Zhou^a, Gongduan Fan^c, Junguo He^{a,b}, Hongwei Rong^{a,b,**}

^a Key Laboratory for Water Quality and Conservation of the Pearl River Delta, Guangzhou University, Guangzhou,
510006 , P.R. China

^b College of Civil Engineering, Guangzhou University, Guangzhou, 510006 , P.R. China

^c College of Civil Engineering, Fuzhou University, Fuzhou, 350116, China

1. Composition of the BG11 medium

Table S1 Ingredients of BG-11 medium

Chemicals	Concentration (mg/L)
NaNO ₃	1500.00
K ₂ HPO ₄	40.00
MgSO ₄ .7H ₂ O	75.00
CaCl ₂ . 2H ₂ O	36.00
Citric acid	6.00
Ammonium ferric citrate	6.00
EDTANa ₂	1.00
Na ₂ CO ₃	20.00
H ₃ BO ₃	2.86
MnCl ₂ .4H ₂ O	1.86
Na ₂ MoO ₄ .2H ₂ O	0.22
CuSO ₄ .5H ₂ O	0.08
Co(NO ₃) ₂ .6H ₂ O	0.05

2. Preparation of algae-laden water

The algae-laden water was prepared via four steps. Firstly, the concentration of the harvested algae suspension was determined using a blood counting chamber. Secondly, the absorbance of algae suspension was measured in a visible spectrum range (400-700 nm) and a characteristic absorbance peak was found at a wavelength of 685 nm. Thirdly, a calibration between cell concentration and optical density at 685 nm (OD_{685}) was established (Fig. R1(a)). Finally, the dilution factor can be calculated with the initial algae solution and the objective algae solution (2.0×10^6 cells mL^{-1}).

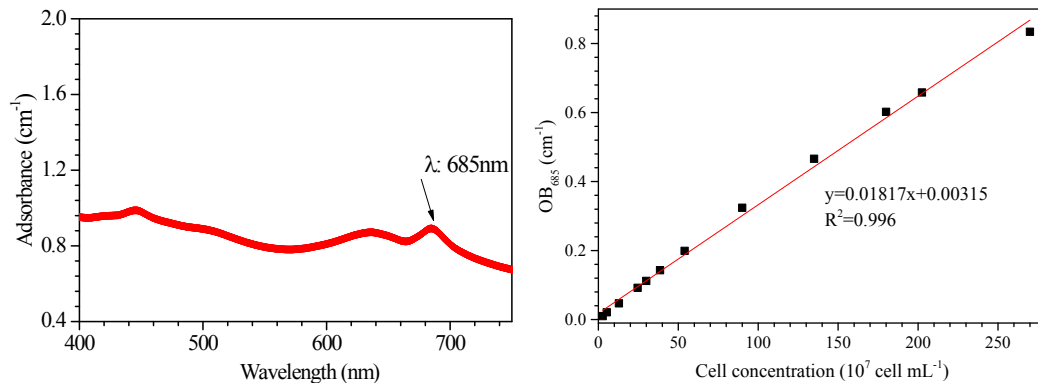


Fig. S1 Absorbance spectrum of algae suspension (a) and calibration of algae concentration and OD_{685} (b)

3. Effects of permanganate doses on the membrane fouling during filtration of the algae-laden water

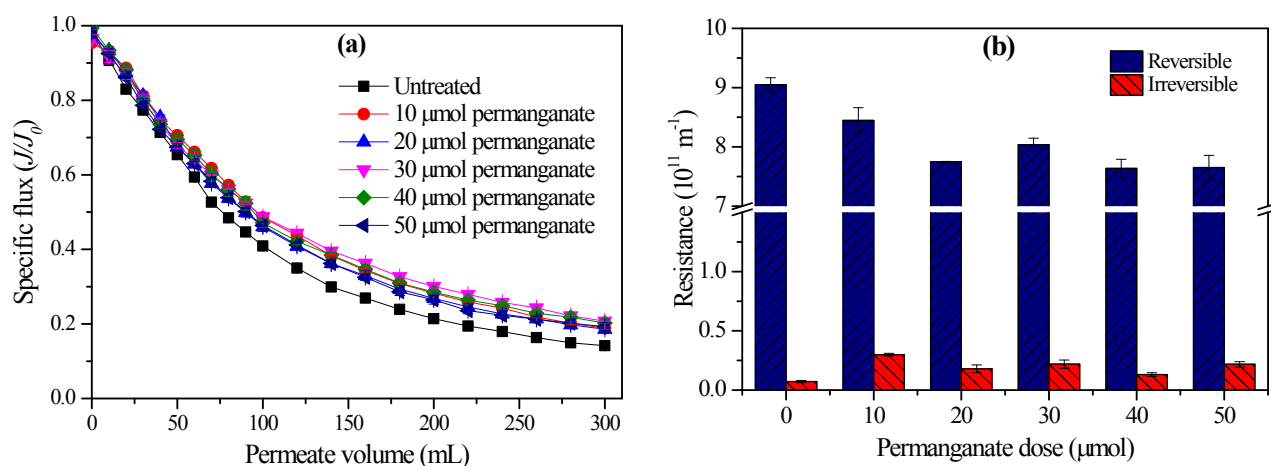


Fig.S2 Effects of permanganate doses on the membrane fouling during filtration of the algae-laden water: Flux decline (a) and fouling resistances (b)

4. Effects of Fe(II) doses on the membrane fouling during filtration of the algae-laden water:

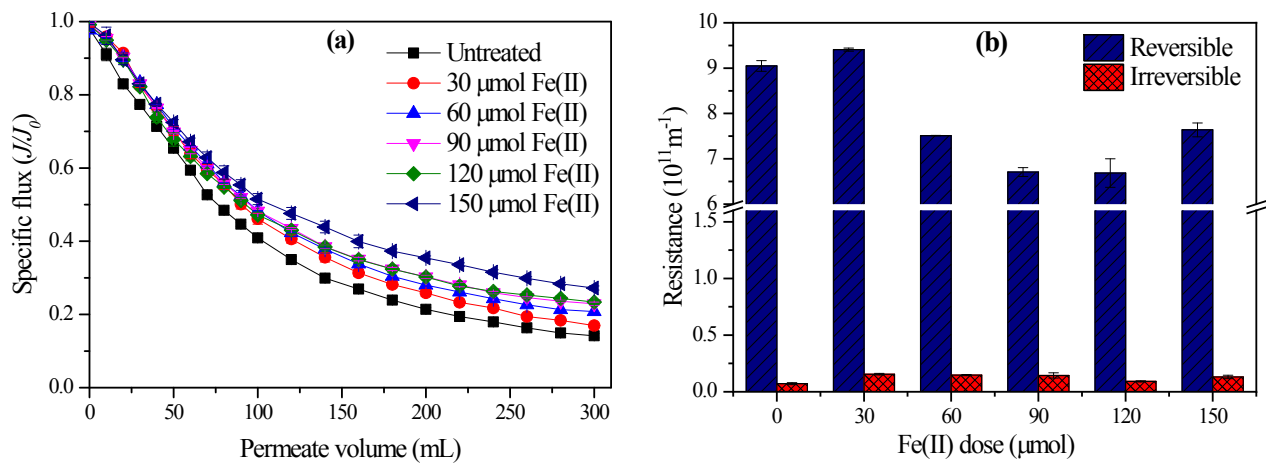


Fig. S3 Effects of Fe(II) doses on the membrane fouling during filtration of the algae-laden water: (a) Flux decline and (b) fouling resistances

5. EDS spectra of the membranes fouled during the algae-laden water

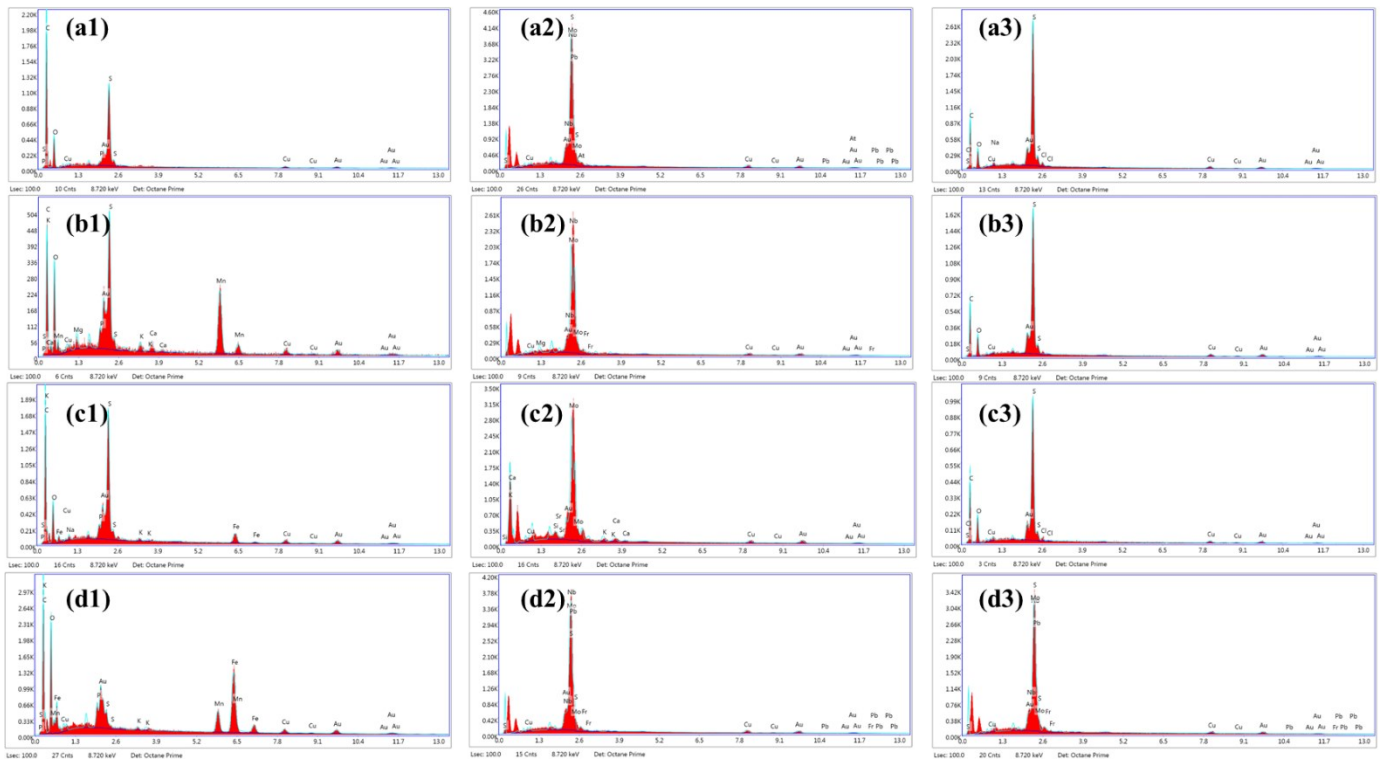


Fig. 4 EDS spectra of the membranes fouled by the algae-laden water: (a) untreated , (b) permanganate only (c) Fe(II) only and (d) Fe(II)/permanganate. 1, 2 and 3 represent the fouled membrane, the physical cleaned membrane and the chemically cleaned membrane. The doses of Mn(V) and Fe(II) were 50 μmol and 150 μmol , respectively.

6. Fluorescent EEM spectra of UF permeate at increasing doses of permanganate and Fe(II) /UF

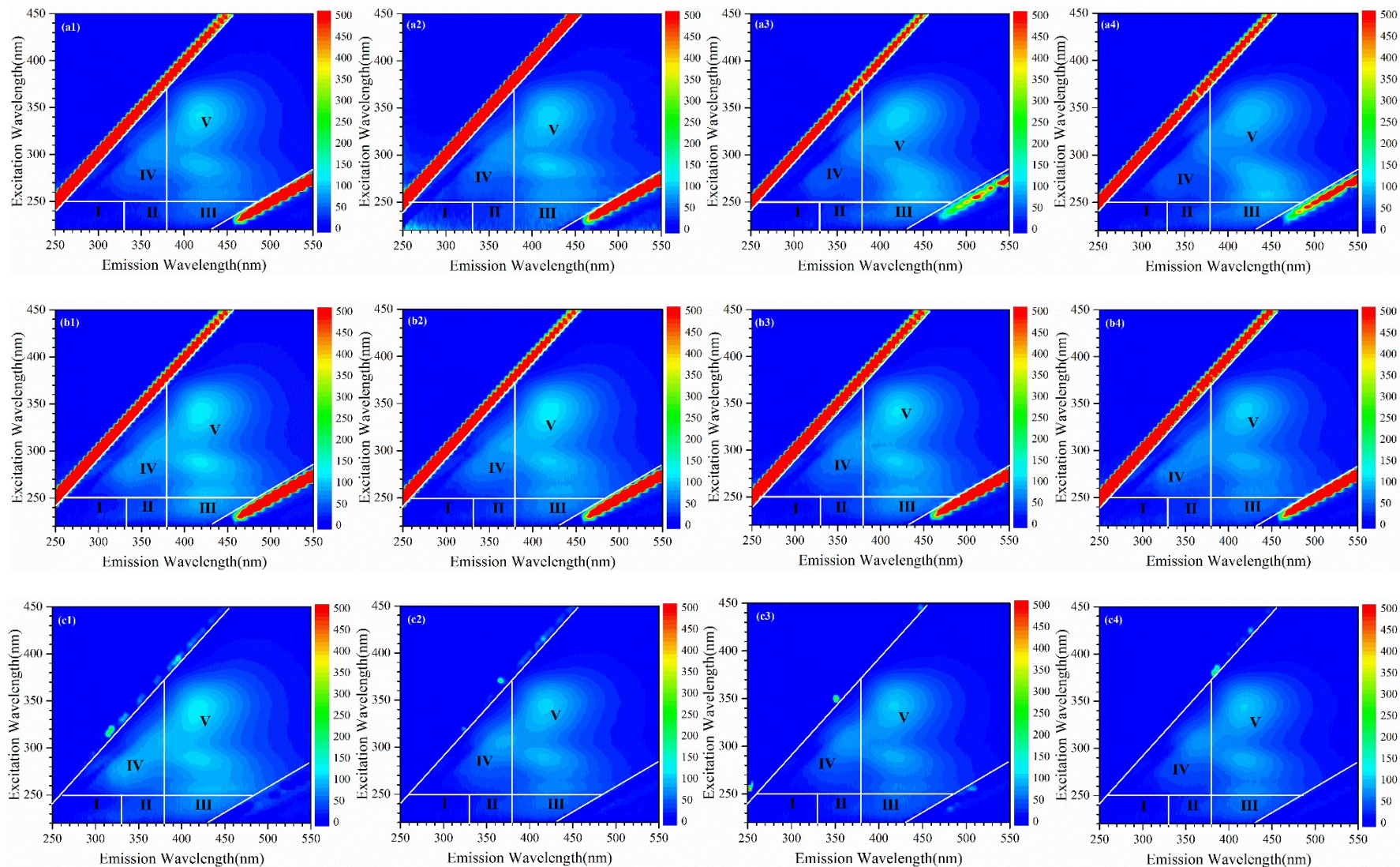


Fig.S5 Fluorescent EEM spectra of UF permeate in the treatment of algae-laden water with hybrid processes: (a) permanganate oxidation, (b) Fe(II) coagulation and (c) Fe(II)/ permanganate. For permanganate, 1, 2, 3, 4 represent 10, 20, 30 and 40 μmol , respectively. For Fe(II), 1, 2, 3, 4 represent 30, 60, 90 and 120 μmol , respectively.