Supplementary materials

Text S1. Sample preparation by SEM

1) Sampling: bacteria, algae or cell samples should be centrifuged (rotational speed 1000–3000 r/min), the thickness after centrifugation is about 2 mm, remove the supernatant, add appropriate pH (7.2–7.4) 0.1 m PBS to wash twice, 10 min each time; the samples should be fixed immediately after cleaning, 2.5% glutaraldehyde fixed for 4 h, washed twice with 0.1 m PBS, each time 10 min.

2) Gradient dehydration: dehydration of the sample with aqueous solution of ethanol at a concentration gradient of 30%, 50%, 70% (can be overnight), 80%, 90%, 10 min per step, followed by dehydration in 100% ethanol for 10 min×2 times.

3) Dry: after adding 100% ethanol for the second time, do not remove the supernatant and dry the critical point directly. It takes 1 day to dry, so prepare the drying sample the day before it is observed by scanning electron microscope. Freeze drying or vacuum drying can also be used. Note: the whole process should be continuous, 4℃, do not kill the sample.

Table S1 Routine indexes of EOM isolated from bacteria.

EOM	TOC	TN	DON	NO_3-N	NO_2-N	NH_3-N
Control	2.870	0.809	0.690	0.059	0.000	0.059
O_3	3.356	1.044	0.873	0.000	0.031	0.140
UV	2.966	1.044	0.863	0.000	0.040	0.140
Cl_2	5.730	1.584	1.020	0.323	0.074	0.167
O_3 + Cl_2	3.636	0.926	0.542	0.208	0.035	0.140
Cl_2/ UV	2.439	0.638	0.216	0.060	0.362	0.000
O_3 + Cl_2/ UV	2.905	1.151	0.864	0.157	0.016	0.113

Table S2 Routine indexes of IOM isolated from bacteria.

IOM	TOC	TN	DON	NO_3-N	NO_2-N	NH_3-N
Control	3.815	1.596	1.323	0.079	0.000	0.194
O_3	6.726	1.852	1.550	0.000	0.000	0.302
UV	4.444	1.703	1.428	0.000	0.000	0.275
Cl_2	12.279	5.143	4.987	0.062	0.035	0.059
O_3 + Cl_2	9.326	3.049	1.674	0.966	0.026	0.383
Cl_2/ UV	12.460	4.032	3.551	0.041	0.381	0.059
O_3 + Cl_2/ UV	9.093	2.579	0.026	1.010	0.000	1.542

Table S3 Regional division of EEM spectrum.

Region	Organic matter type	Emission wavelength(EM, nm)	Excitation wavelength(EX, nm)
I	Tyrosine protein substance	280–330	220–250
II	Tryptophan protein substance	330–380	220–250
III	Fulvic acid substance	380–500	220–250
IV	Soluble microbial metabolites	280–380	250–280
V	Humic acid substances	380–500	250–400

Table S4 Comparative CHO cell cytotoxicity of DBPs.

Class	DBP	LC_{50} (mol/L)
THMs	TCM	9.17×10^{-3}
	BDCM	1.15×10^{-2}
	DBCM	5.36×10^{-3}
	TBM	3.96×10^{-3}
HAAs	MCAA	8.48×10^{-4}
	DCAA	7.30×10^{-3}
	TCAA	2.40×10^{-3}
	MBAA	9.60×10^{-6}
	DBAA	5.21×10^{-4}
HANs	DCAN	5.73×10^{-5}
	BCAN	8.46×10^{-6}
	DBAN	2.85×10^{-6}
	TCAN	1.60×10^{-4}
HNMs	TCNM	5.36×10^{-4}
NAs	NDMA	4.04×10^{-6}
	NDEA	1.96×10^{-6}

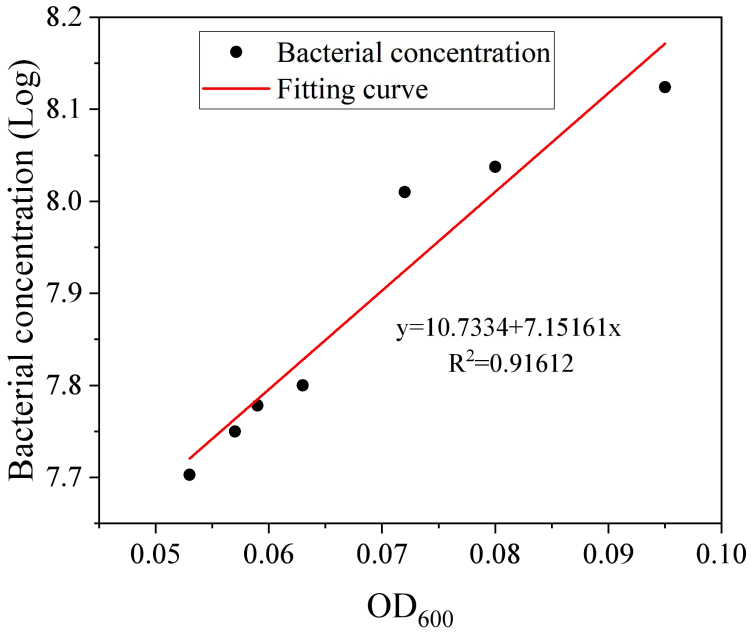

Fig. S1 OD_{600} density curve of bacterial suspension.

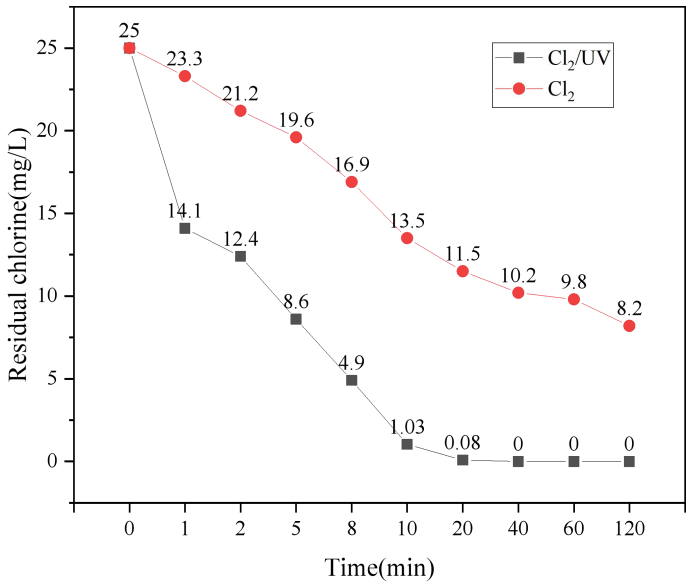

Fig. S2 Free chlorine decay with reaction time.

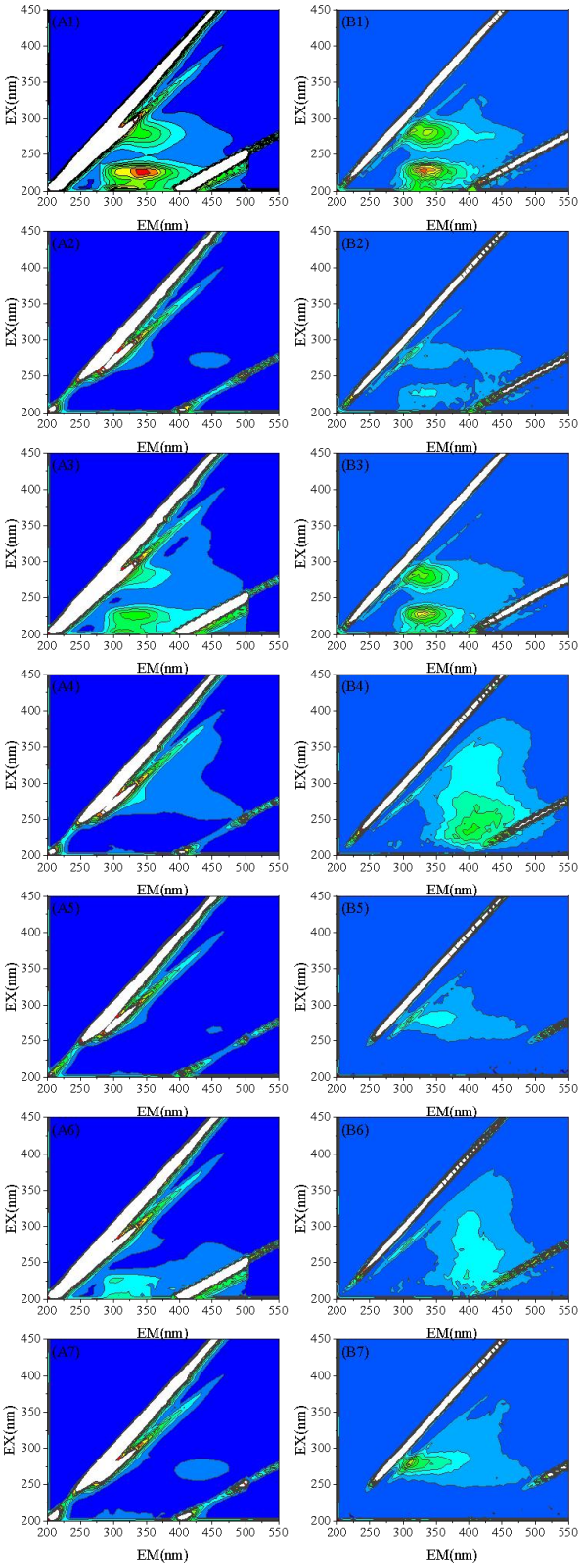

Fig. S3 Changes of EEM after different oxidation treatments. (A1) EOM-before oxidation; (A2) EOM-O_3; (A3) EOM-UV; (A4) EOM-Cl_2; (A5) EOM- O_3/Cl_2; (A6) UV/Cl_2; (A7) O_3/UV/Cl_2; (B1) IOM- before oxidation; (B2) EOM-O_3; (B3) IOM-UV; (B4) IOM-Cl_2; (B5) IOM- O_3/Cl_2; (B6) IOM-UV/Cl_2; (B7) IOM-O_3/UV/Cl_2. O_3 = 8 mg/L, UV = 48 mJ/cm^2, Cl_2 = 25 mg/L, pH = 7.2.

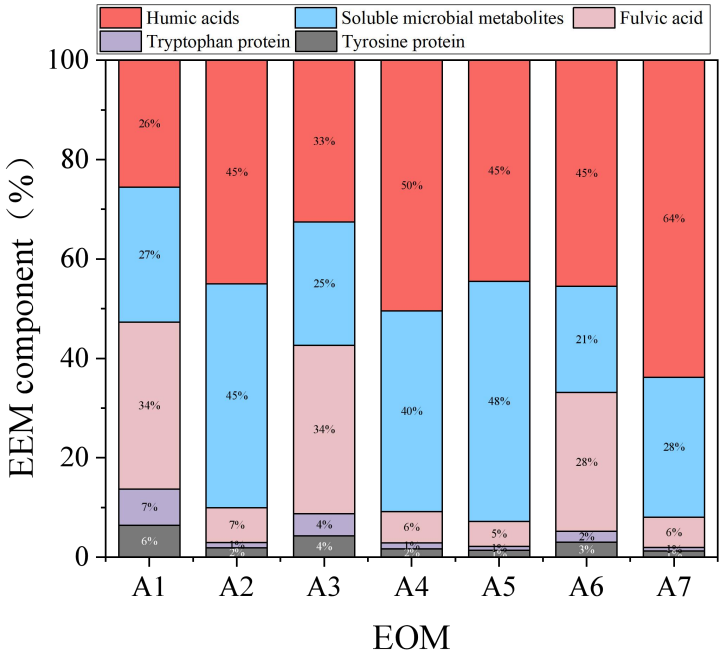

Fig. S4 Fluorescence zoning components of EOM treated by different oxidation methods. A1-before oxidation, A2-O_3, A3-UV, A4-Cl_2, A5-O_3/Cl_2, A6-UV/Cl_2, A7-O_3/UV/Cl_2; O_3 = 8 mg/L, UV = 48 mJ/cm^2, Cl_2 = 25 mg/L, pH = 7.2.

.

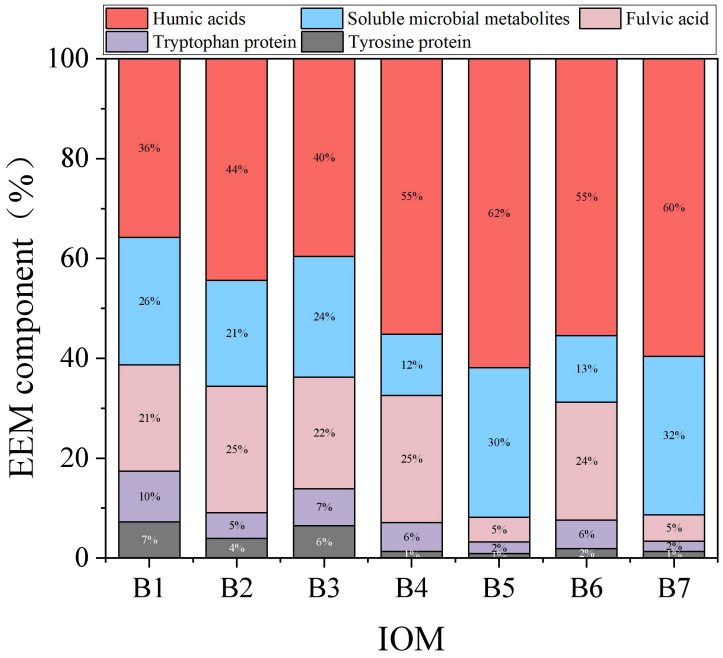

Fig. S5 Fluorescence zoning components of IOM treated by different oxidation methods. B1-before oxidation, B2-O_3, B3-UV, B4-Cl_2, B5-O_3/Cl_2, B6-UV/Cl_2, B7-O_3/UV/Cl_2; pH = 7.2, O_3 = 8 mg/L, UV = 48 mJ/cm^2, Cl_2 = 25 mg/L, pH = 7.2.