

## **Supplementary Information**

### **Seasonal freezing drives spatiotemporal dynamics of dissolved organic matters (DOMs) and microbial communities in reclaimed water recharged river**

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**Table S1.** The latitude and longitude information of each sampling sites.

Sampling site	Latitude	Longitude	Distance / km*
Y3	N43°71'06.5"	E125°35'24.0"	--
Y4	N43°79'40.3"	E125°34'26.6"	9.32
Y5	N43°79'77.2"	E125°34'33.1"	0.4
Y6	N43°80'20.8"	E125°34'18.7"	0.5
Y7	N43°84'10.8"	E125°35'53.8"	4.47
Y8	N43°88'43.4"	E125°35'32.4"	4.82
Y10	N43°94'63.5"	E125°36'64.7"	7
Y11	N43°95'52.3"	E125°35'67.3"	1.27
Y12	N43°95'68.8"	E125°36'46.1"	0.65
Y13	N43°96'67.1"	E125°36'39.9"	1.1

\*The distance of adjacent sampling points.

**Table S2.** Accession Identifiers for the raw reads uploaded to the National Center for Biotechnology Information (NCBI) Sequencing Read Archive (SRA).

Sequencing Read Archive Study Accession ID	SRP296939
BioProject Accession ID	PRJNA683092
Sample Name	BioSample Accession ID
Y3	SAMN37346636
Y4	SAMN37346637
Y5	SAMN37346638
Y6	SAMN37346639
Y7	SAMN37346640
Y8	SAMN37346641
Y10	SAMN37346642
Y11	SAMN37346643
Y12	SAMN37346644
Y13	SAMN37346645
Y3F	SAMN38368947
Y5F	SAMN38368948
Y6F	SAMN38368949
Y7F	SAMN38368950
Y8F	SAMN38368951
Y11F	SAMN38368952
Y13F	SAMN38368953

F: ice-sealed period.

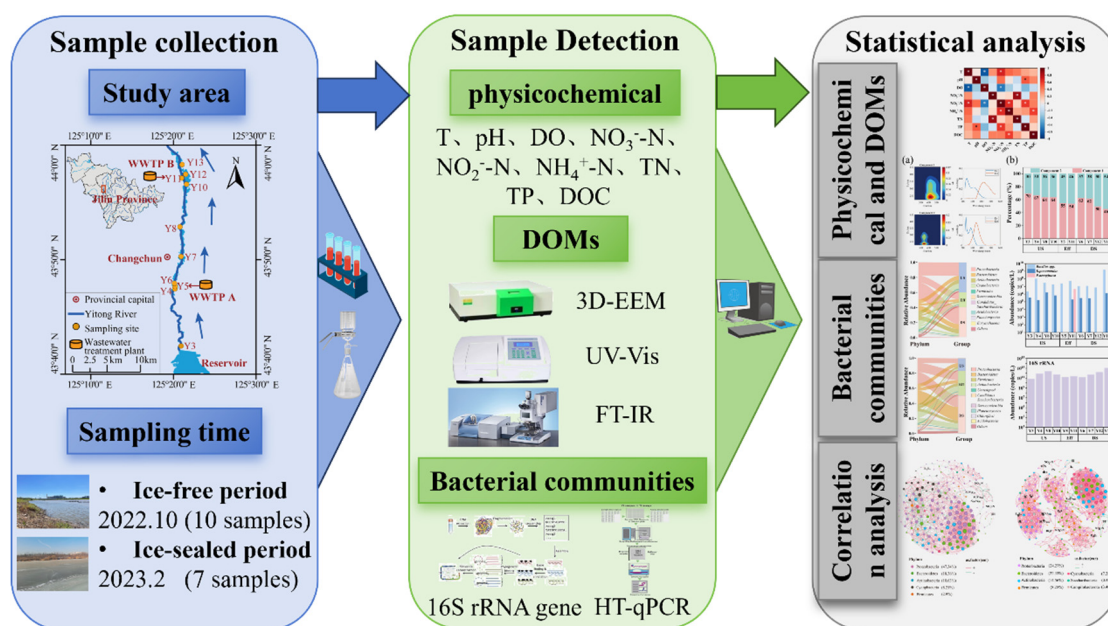


Figure S1. Flowchart of experimental content

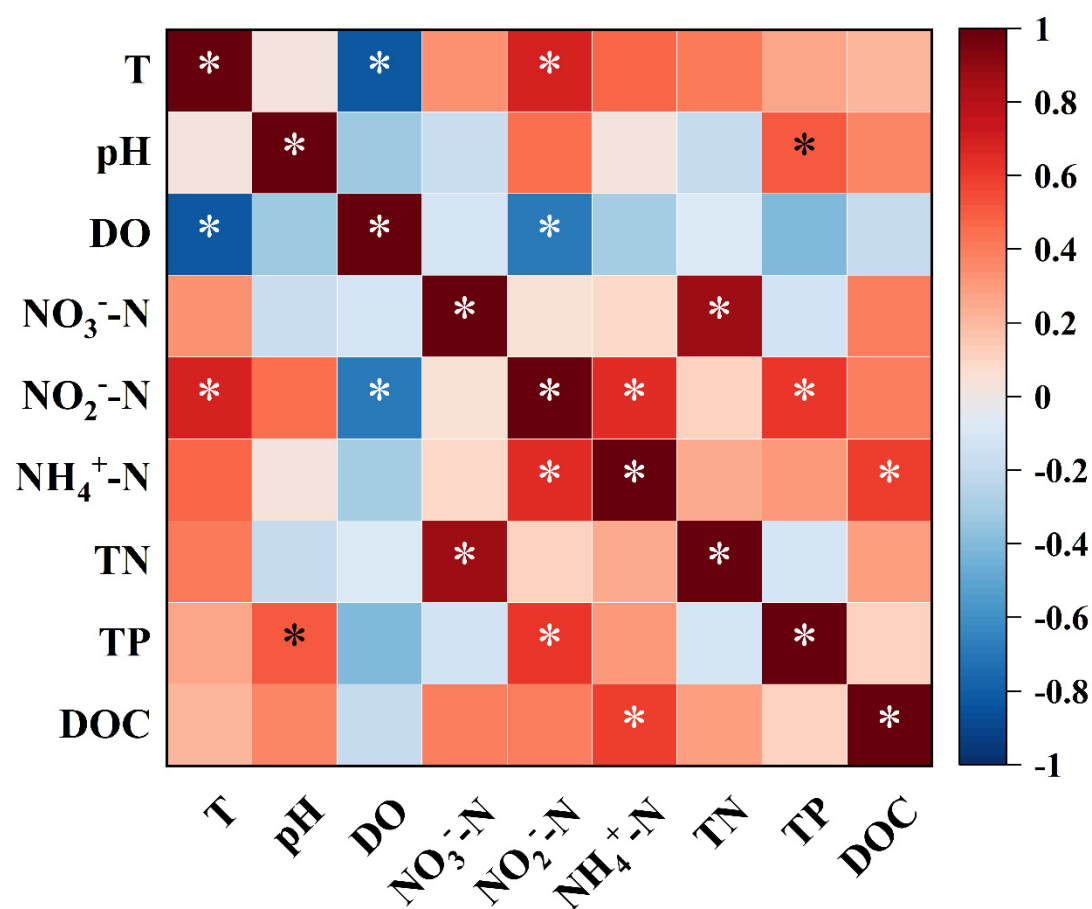
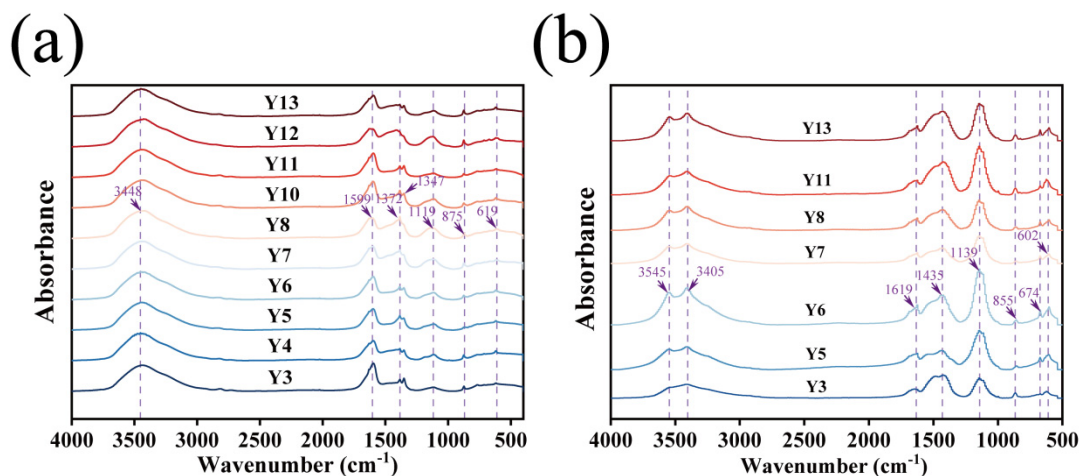


Figure S2. Spearman correlation analysis of water quality indicators, \*  $p < 0.05$ .

**Table S3.** Meaning of the characteristic parameters of the UV spectra

UV spectral characterization parameters	Calculation methodology	References
$A_{253}/A_{203}$	The absorbance ratio of organic matter at 253 nm and 203 nm	[1]
$E_2/E_3$	The absorbance ratio of organic matter at wavelengths of 250 nm and 365 nm	[2]
$E_2/E_4$	The absorbance ratio of organic matter at wavelengths of 254 nm and 436 nm	[3]
$S_R$	The ratio of spectral slopes in the 275 nm to 295 nm wavelength range to those in the 350 nm to 400 nm wavelength range	[4]



**Figure S3.** Region between 4000 and 400  $\text{cm}^{-1}$  of typical FT-IR absorbance: (a) ice-free period; (b) ice-sealed period.

**Table S4.** Alpha diversity indexes of the river

	Shannon	Simpson	Chao1	Ace
Y3O	5.41	0.99	1381.66	1326.83
Y4O	5.67	0.98	1588.86	1553.79
Y5O	5.88	0.98	1275.27	1270.99
Y6O	5.34	0.99	1702.35	1693.49
Y7O	5.21	0.98	1687.13	1661.36
Y8O	5.38	0.99	1668.31	1668.00
Y10O	5.34	0.98	1446.46	1437.37
Y11O	6.07	0.99	1623.30	1616.50
Y12O	4.86	0.98	1136.28	1113.39
Y13O	3.51	0.85	795.19	799.23
Y3F	4.11	0.02	81.00	81.00
Y5F	6.23	0.99	2854.38	2834.33
Y6F	5.94	0.99	2871.71	2846.88
Y7F	5.96	0.99	2794.27	2781.84
Y8F	5.48	0.98	2579.48	2562.19
Y11F	5.98	0.98	2572.29	2518.00
Y13F	4.63	0.94	2762.80	2820.69

## References

1. Peuravuori J, Pihlaja K. Molecular size distribution and spectroscopic properties of aquatic humic substances. *Anal. Chim. Acta.* **1997.** 337, 133-49.
2. Niu C, Zhang Y, Zhu G, Wang M, Zhou Y, Liu X. Comparison of optical properties of DOM and CDOM in lake Tianmuhu catchment. *Res. Environ. Sci.* **2014.** 27, 998-1007.
3. Helms JR, Stubbins A, Ritchie JD, Minor EC, Kieber DJ, Mopper K. Absorption spectral slopes and slope ratios as indicators of molecular weight, source, and photobleaching of chromophoric dissolved organic matter. *Limnol. Oceanogr.* **2008.** 53, 955-69.
4. Praise S, Ito H, An Y, Watanabe K, Watanabe T. Dissolved organic matter characteristics along sabo dammed streams based on ultraviolet visible and fluorescence spectral properties. *Environ. Monit. Assess.* **2018.** 90, 146.