

Supplementary materials

Occurrence, Spatial Variation, and Exposure Risk of Bisphenol Analogues in Drinking Water of Sichuan Province

Authors: Jie Chen¹, Zhiwei Gan¹, Ruonan Wang^{2*}, Zhi Li¹, Weiyi Sun^{1*}

1. College of Architecture and Environment, Sichuan University, Chengdu 610065, China

2. Sichuan Province Ecological Environment Monitoring Station, Chengdu 610074, China

*Corresponding author:

Ruonan Wang (441546756@qq.com)

Weiyi Sun

Tel: +86-28-85460916

Fax: +86-28-85460916

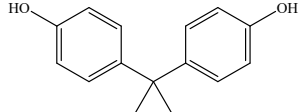
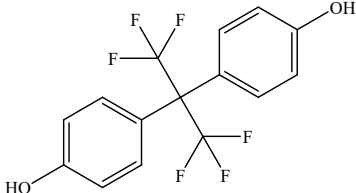
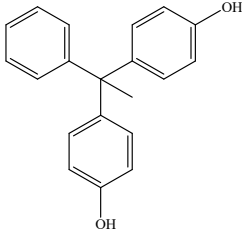
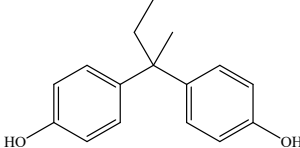
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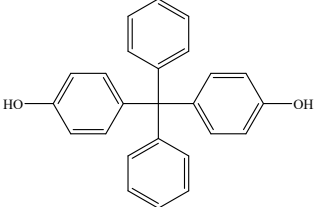
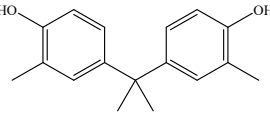
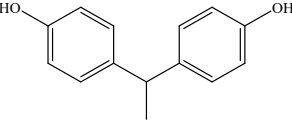
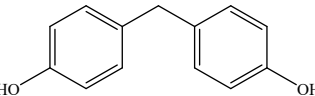
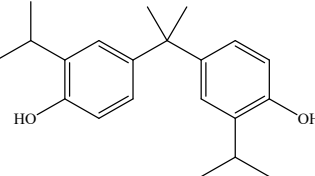
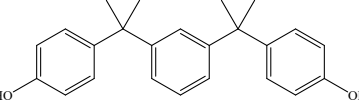
Section 1 Details on post-extraction spike method

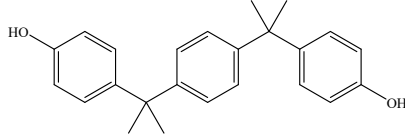
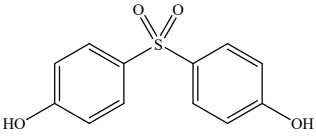
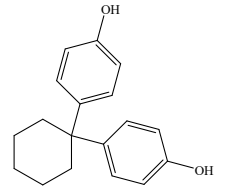
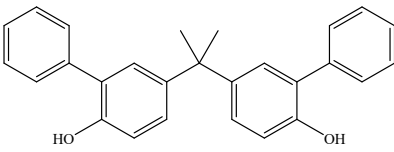
For recovery experiments, we prepared one composite sample per matrix. Specifically, for surface water, tap water, and bottled water, equal aliquots from several individual samples within each matrix were mixed to obtain a representative composite sample. The BP peak areas measured from randomly selected water samples were designated as A. The corresponding peak areas for standards spiked post-extraction were denoted as B, while those for standards spiked prior to extraction were labeled as C. The recovery (RE) and matrix effect (ME) were subsequently calculated according to the following equations, respectively:

$$RE=(C-A)/(B-A)\times 100\%$$

Table S1 The physicochemical data and structures of the BPs

Abbreviation	Structure	CAS NO.	Full name	Molecular formula	Log K_{ow}^a	Half-life in water(day)	Water Solubility ($mg L^{-1}$) ^b
BPA		80-05-7	2,2-bis(4-hydroxyphenyl)propane	$C_{15}H_{16}O_2$	3.32	37.5	300 at 25°C
BPAF		1478-61-1	4,4'-(hexafluoroisopropylidene)diphenol	$C_{15}H_{10}F_6O_2$	4.47	180	-
BPAP		1571-75-1	4,4'-(1-phenylethylidene)bisphe-nol	$C_{20}H_{18}O_2$	4.86	37.5	-
BPB		77-40-7	2,2-bis(4-hydroxyphenyl)butane	$C_{16}H_{18}O_2$	4.13	37.5	-

BPBP		1844-01-5	bis(4-hydroxyphenyl)diphenylmethane	C ₂₅ H ₂₀ O ₂	6.08	37.5	-
BPC		79-97-0	2,2-bis(4-hydroxy-3-methylphenyl)propane	C ₁₇ H ₂₀ O ₂	4.74	37.5	-
BPE		2081-08-5	4,4'-ethylidenebisphenol	C ₁₄ H ₁₄ O ₂	3.19	15.0	-
BPF		620-92-8	4,4'-methylenedi-phenol	C ₁₃ H ₁₂ O ₂	3.06	15.0	-
BPG		127-54-8	2,2-bis(4-hydroxy-3-isopropylphenyl)propane	C ₂₁ H ₂₈ O ₂	6.55	37.5	-
BPM		13595-25-0	4,4'-(1,3-phenylene)diisopropylide	C ₂₄ H ₂₆ O ₂	6.25	60.0	-

BPP		2167-51-3	ne)bisphenol 4,4'-(1,4-phenylenediisopropylidene)bisphenol	$C_{24}H_{26}O_2$	6.25	60.0	-
BPS		80-09-1	4-hydroxyphenyl sulfone	$C_{12}H_{10}O_4$ S	1.65	15.0	Insoluble
BPZ		843-55-0	4,4'-cyclohexylidenebisphenol	$C_{18}H_{20}O_2$	5	37.5	-
BPPH		24038-68-4	2,2-bis(2-hydroxy-5-phenyl)propane	$C_{27}H_{24}O_2$	7.17	37.5	-

^a K_{ow} : Octanol-water partition coefficient, data collected from Chen. et al., 2025. ^b Water Solubility: data collected from pubchem.com.

Chen, D., Kannan, K., Tan, H., Zheng, Z., Feng, Y.-L., Wu, Y., & Widelka, M. (2016). Bisphenol Analogues Other Than BPA: Environmental Occurrence, Human Exposure, and Toxicity—A Review. *Environmental Science & Technology*, 50(11), 5438-5453. doi:10.1021/acs.est.5b05387

Table S2 Geographical information of the surface water sampling sites

Type	Sampling sites	Longitude(° E)	Latitude(° N)	Economic zone ^a
river	S1	104.0833	30.7	CPEZ (Chengdu city)
river	S2	103.8775	30.7497	CPEZ (Chengdu city)
river	S3	103.80917	30.94722	CPEZ (Chengdu city)
lake-reservoir	S4	104.33333	29.4667	SSEZ
lake-reservoir	S5	101.45861	26.52139	PXEZ
river	S6	105.4	28.8667	SSEZ
river	S7	105.46404	28.9135	SSEZ
river	S8	105.45694	28.89278	SSEZ
river	S9	104.19414	31.29351	CPEZ
lake-reservoir	S10	104.77889	31.5353	CPEZ
river	S11	104.71806	31.5181	CPEZ
lake-reservoir	S12	105.60761	32.51983	NESEZ
river	S13	105.8272	32.5533	NESEZ
river	S14	105.4883	30.6072	CPEZ
river	S15	105.4677	30.6349	CPEZ
lake-reservoir	S16	104.62444	29.61611	SSEZ
river	S17	105.00111	29.6425	SSEZ
river	S18	104.95638	29.7417	SSEZ
river	S19	103.63639	29.65806	CPEZ
river	S20	103.65583	29.51056	CPEZ
river	S21	106.18365	30.93972	NESEZ
river	S22	106.14133	30.8565	NESEZ
river	S23	104.52389	28.79444	SSEZ
river	S24	104.49434	28.67381	SSEZ
river	S25	106.64694	30.5117	NESEZ
river	S26	107.56272	31.3144	NESEZ
river	S27	106.74138	31.8936	NESEZ
lake-reservoir	S28	106.88	31.9	NESEZ
river	S29	102.95639	29.99028	CPEZ
lake-reservoir	S30	104.0425	30.0575	CPEZ
river	S31	103.3405	29.9184	CPEZ
lake-reservoir	S32	104.49333	30.1691	CPEZ
river	S33	102.24942	31.8876	NWSEEZ
river	S34	102.30361	32.00444	NWSEEZ

river	S35	102.27861	31.96556	NWSEEZ
river	S36	102.28139	31.96389	NWSEEZ
river	S37	102.27972	31.955	NWSEEZ
river	S38	102.26056	31.9325	NWSEEZ
river	S39	102.2502	31.9176	NWSEEZ
river	S40	101.95333	30.0275	NWSEEZ
river	S41	101.9595	29.91815	NWSEEZ
river	S42	101.96611	29.98586	NWSEEZ
river	S43	101.96735	30.04543	NWSEEZ
river	S44	102.27667	27.9375	PXEZ
lake-reservoir	S45	102.32982	27.804	PXEZ

^aEconomic zone: Chengdu Plain Economic Zone (CPEZ), South Sichuan Economic Zone (SSEZ), Northeast Sichuan Economic Zone (NESEZ), Panxi Economic Zone (PXEZ), and Northwest Sichuan Ecological Economic Zone (NWSEEZ).

Table S3 information for bottled water samples

Samples	Water type	Procedure origin	Package material
B1	Natural mineral water	national	Polyethylene terephthalate
B2	Packaged drinking water	local	Polyethylene terephthalate
B3	Purified drinking water	local	Polyethylene terephthalate
B4	Natural mineral water	local	Polyethylene terephthalate
B5	Purified drinking water	local	Polyethylene terephthalate
B6	Natural drinking water	local	Polyethylene terephthalate
B7	Natural mineral water	national	Polyethylene terephthalate
B8	Natural mineral water	local	Polyethylene terephthalate

Table S4 Mass spectrometer parameters for the determination of the target compounds

Name	Retention time (min)	Precursor ion (m/z) ^a	Daughter ions	DP ^b (volts)	EP ^c (volts)	CE ^d (volts)	CXP ^e (volts)	Corresponding internal standard
BPA	4.57	227.1	133.1	-85	-10	-35	-9	BPA-d16
			212	-85	-10	-25	-9	
BPA-d16	4.53	338.9	268.7	-100	-9	-31	-14	
BPAF	5.98	335	265	-97	-9	-31	-14	BPAF-d4
			314.8	-97	-9	-25	-16	

BPAF-d4	5.97	338.9	268.7	-100	-9	-31	-14	
BPAP	5.42	289	274.1	-130	-10	-28	-8	BPA-d16
			211.1	-132	-10	-34	-8	
BPB	5.02	240.9	211.2	-85	-9	-37	-9	BPA-d16
			225.9	-85	-9	-25	-10	
BPBP	5.95	351.1	273.2	-97	-10	-35	-13	BPAF-d4
			258.1	-97	-10	-33	-13	
BPC	5.47	255.3	146.8	-100	-9	-34	-5	BPA-d16
			240	-100	-9	-27	-11	
BPE	4.14	213.1	118.9	-82	-10	-33	-8	BPA-d16
			197.2	-82	-10	-36	-8	
BPF	3.73	199.2	104.8	-88	-9	-28	-5	BPF-d10
			93	-88	-9	-30	-5	
BPF-d10	3.66	209.3	110.2	-90	-9	-30	-5	
BPG	6.61	311.2	296.1	-115	-9	-31	-14	BPAF-d4
			175	-115	-9	-42	-7	
BPM	6.71	345.2	251.2	-120	-9	-41	-11	BPAF-d4
			133.1	-120	-9	-54	-8	
BPP	6.71	345.2	330	-130	-9	-35	-12	BPAF-d4
			315.1	-130	-9	-48	-15	
BPPH	6.98	379.1	209	-133	-9	-47	-10	BPAF-d4
			363.2	-124	-9	-50	-8	
BPS	2.5	249	108	-90	-9	-36	-6	BPS- ¹³ C ₁₂
			92	-90	-10	-48	-6	
BPS- 13C12	2.5	261	97.8	-90	-10	-48	-6	
BPZ	5.53	267.2	173	-102	-8	-35	-12	BPA-d16
			145.1	-102	-8	-49	-9	

a: In sequence, they are quantitative ions and qualitative ions. DP^b: Declustering Potential; EP^c: Entrance Potential; CE^d: Collision Energy; CXP^e: Collision Cell Exit Potential.

Table S5 Gradient programs for the analysis of the BPs

Time (min)	Flow rate ($\mu\text{L}/\text{min}$)	Mobile phase A ^a	Mobile phase B ^b
		(%)	(%)
0	400	60	40
1	400	60	40
6	400	20	80
6.1	400	0	100
8.5	400	0	100
8.6	400	60	40
11	400	40	40

a: Milli-Q water ; b: Methanol

Table S6 The method validation of the target compounds

Analyte	External calibration R^2	MDLs ^a (ng L^{-1})	MQLs ^b (ng L^{-1})	Recovery (RSD) (%) n=3
BPA	0.999	0.043	0.144	87.3(23.6)
BPAF	0.995	0.003	0.009	87.6(10.0)
BPAP	0.999	0.007	0.024	94.1(17.2)
BPB	0.999	0.022	0.072	110(7.57)
BPBP	0.998	0.009	0.029	63.3(38.1)
BPC	0.999	0.206	0.688	97.3(50.2)
BPE	0.999	0.019	0.064	96.3(14.3)
BPF	0.999	0.06	0.2	95.5(3.54)
BPG	0.997	0.146	0.488	50.0(68.4)
BPM	0.992	0.008	0.025	66.9(44.6)
BPP	0.993	0.004	0.014	67.0(44.3)
BPPH	0.999	0.098	0.328	39.5(79.3)
BPS	0.999	0.002	0.08	147(46.8)
BPZ	0.999	0.038	0.128	100(18.7)

a: method detection limits, b: method quantitation limits.

Table S7 The concentration of the target compounds in water samples in Sichuan, China. Values are in ng L⁻¹.

name	BPA	BPAF	BPAP	BPB	BPBP	BPC	BPE	BPF	BPG	BPM	BPP	BPPH	BPS	BPZ	ΣBP
S1	5.34	0.133	0.12	ND	0.166	ND	0.106	0.12	0.53	0.027	0.0299	0.197	0.79	0.0992	7.66
S2	3.76	0.127	0.092	ND	0.15	ND	ND	0.345	ND	0.016	0.0388	0.33	4.87	0.114	9.84
S3	1.91	0.0514	0.0571	ND	0.0786	0.413	ND	0.12	ND	0.016	0.008	ND	17.2	0.084	19.9
S4	2.95	0.128	0.146	0.044	0.23	0.659	1.02	0.12	1.27	0.279	0.365	1.19	1.19	0.138	9.73
S5	5.12	0.0822	0.133	ND	0.324	ND	0.0758	0.37	0.293	0.016	0.0194	ND	1.02	0.0629	7.52
S6	16.2	0.231	0.0725	ND	0.0456	0.413	13.3	0.318	0.293	0.016	0.0162	0.197	1.86	0.0646	33
S7	25.3	0.188	0.0833	ND	0.0773	ND	0.0687	1.7	0.293	0.026	0.0471	0.603	2.12	0.0655	30.5
S8	11.4	0.29	0.0807	0.044	0.0993	0.413	0.0384	0.374	0.293	0.0479	0.0682	0.197	1.47	0.0819	14.9
S9	3.9	0.176	0.1	ND	0.119	ND	0.0912	0.333	0.293	0.016	0.102	0.479	1.42	0.132	7.16
S10	5.58	0.071	0.109	ND	0.113	ND	0.0384	0.214	0.293	0.016	0.0208	ND	9.2	0.0896	15.7
S11	22	0.0791	0.096	ND	0.276	ND	0.0384	0.386	0.293	0.0976	0.131	0.727	4.8	0.135	29.1
S12	3.96	0.0872	0.0726	0.0864	0.08	ND	0.0733	0.12	0.293	0.0299	0.0274	ND	1.3	0.128	6.25
S13	7.4	0.0453	0.159	ND	0.164	ND	0.0659	0.12	0.293	0.016	0.0274	0.197	1.65	0.0732	10.2
S14	3.44	0.977	0.0952	ND	0.0824	ND	0.213	0.246	0.293	0.016	0.008	ND	1.8	0.161	7.33
S15	3.22	1.18	0.0626	ND	0.118	ND	0.199	0.394	0.293	0.0265	0.0323	0.197	38.9	0.129	44.7
S16	1.37	0.0705	0.145	ND	0.0641	0.413	0.0384	0.12	0.293	0.016	0.0562	0.197	0.465	0.0438	3.29
S17	3.05	0.268	0.096	ND	0.152	ND	0.0384	0.12	0.293	0.0408	0.078	0.414	2.14	0.137	6.82
S18	2.38	0.0946	0.088	0.044	0.244	0.413	2	0.12	0.968	0.0531	0.054	0.88	2.12	0.0896	9.54
S19	35.3	0.415	0.0458	ND	0.179	ND	ND	1.92	0.293	0.027	0.008	0.197	2.32	0.0816	40.8
S20	3.38	0.0897	0.113	ND	0.397	0.413	0.0384	0.245	0.293	0.058	0.109	0.197	2.54	0.0808	7.96
S21	6.14	0.0767	0.231	ND	0.0472	ND	0.106	0.12	ND	0.0253	0.0274	0.197	0.654	0.0896	7.72
S22	13.6	0.0646	0.0293	0.044	0.0574	0.413	0.0976	0.621	0.293	0.027	0.029	ND	0.297	0.0808	15.7
S23	39.1	1.5	0.246	0.044	0.698	0.413	0.278	1.3	0.293	0.0755	0.137	0.559	13.3	0.0872	58
S24	1.38	0.0759	0.084	ND	0.134	0.413	0.0384	0.12	0.293	0.0576	0.0682	0.197	0.576	0.102	3.53

S25	62.7	0.172	0.0331	ND	0.0464	0.413	0.283	6.01	0.293	0.0261	0.0394	0.197	0.662	0.0741	71
S26	2.58	0.0859	0.168	ND	0.3	ND	0.0384	0.214	0.293	0.0289	0.067	0.197	4.14	0.0872	8.2
S27	21.8	0.0462	0.16	0.044	0.0848	ND	0.0384	1.57	0.293	0.016	0.0214	0.197	1.45	0.0797	25.8
S28	88	0.0893	0.582	0.044	0.018	0.621	1.03	2.33	0.717	0.0269	0.0382	0.493	4.19	0.0912	98.3
S29	77.7	0.0524	0.0796	ND	0.158	ND	0.122	14.6	0.293	0.016	0.0306	ND	1.05	0.0474	94.1
S30	2.68	0.122	0.158	ND	0.266	ND	0.0384	0.12	0.54	0.035	0.0607	0.197	2.95	0.0755	7.24
S31	2.57	0.061	0.0722	ND	0.06	ND	0.0384	0.205	ND	0.016	0.008	0.197	8.8	0.0628	12.1
S32	2.14	0.169	0.17	0.126	0.205	0.413	ND	0.12	1.49	0.248	0.426	1.15	0.502	0.0751	7.24
S33	1.91	0.0404	0.0318	ND	0.0369	ND	ND	ND	ND	0.016	0.008	ND	0.192	0.0572	2.29
S34	7.45	0.041	0.0697	ND	0.105	ND	0.0384	0.212	0.293	0.016	0.0201	ND	0.758	0.0936	9.09
S35	2.38	0.0401	0.026	ND	0.018	ND	ND	0.12	0.293	0.016	0.0278	0.197	0.159	0.0628	3.34
S36	1.76	0.0691	0.113	ND	0.0514	ND	0.0384	0.12	ND	0.016	0.0175	ND	1.44	0.078	3.7
S37	0.573	0.354	0.162	0.0952	0.494	0.413	ND	0.12	1.53	0.541	0.642	1.75	0.598	0.308	7.58
S38	2.79	0.0657	0.145	ND	0.233	0.413	ND	0.425	0.293	0.12	0.154	0.61	0.318	0.119	5.69
S39	1.74	0.0332	0.0518	ND	0.0794	ND	0.0384	0.12	0.293	0.016	0.0239	ND	0.207	0.066	2.67
S40	1.45	0.039	0.0379	ND	0.0706	0.413	0.0384	0.12	ND	0.016	0.008	ND	31.8	0.0641	34.1
S41	1.6	0.0519	0.039	ND	0.0546	0.413	ND	0.12	ND	0.016	0.0192	ND	1.18	0.0799	3.57
S42	1.6	0.067	0.0494	ND	0.029	ND	0.0384	0.12	0.293	0.016	0.008	ND	0.719	0.0538	2.99
S43	2.31	0.0373	0.0399	ND	0.0677	ND	ND	0.206	0.293	0.016	0.008	ND	1.52	0.0751	4.57
S44	2.42	0.052	0.075	ND	0.0888	ND	0.0384	0.23	ND	0.016	0.0168	0.197	0.449	0.1	3.69
S45	2.34	0.0771	0.146	0.044	0.116	ND	0.0774	0.271	0.293	0.0468	0.0944	0.197	0.406	0.0739	4.18
T1	41.1	79.5	1.99	1.13	5.3	5.48	2.06	2.66	88	57.5	51	20.2	1.25	1.26	358
T2	4.11	0.0606	0.333	0.101	0.175	1.29	2.52	0.12	1.22	0.016	0.008	0.197	0.209	0.0896	10.5
T3	2.51	0.381	1.04	0.0992	0.438	6.58	1.98	0.766	1.84	0.328	0.398	1.23	0.165	0.567	18.3
T4	14.5	0.493	49.7	0.423	0.603	20.6	4.02	1	1.3	0.338	0.221	1.06	1.7	4.62	101
T5	11.9	1.64	5	0.944	3.5	4.1	3.64	2.2	4.35	0.593	1.04	4.82	0.57	5.09	49.4

T6	92	1.25	35.3	3.43	7.19	37	4.74	20.4	4.11	0.782	1.58	5.99	0.178	8.08	222
T7	463	5.33	43.8	19.4	5.76	23.8	33.7	14.9	9.28	4.67	4.8	12.9	0.355	28.1	670
T8	51.4	1.8	18.1	2.8	2.43	206	4.02	13.4	3.69	1.82	0.896	19.8	0.34	12.2	338
T9	179	4.94	66.5	1.49	11.1	66.8	17.2	12.5	28.4	4.73	4.05	9.76	0.832	18.1	426
T10	60.5	7.21	22.9	1.67	4.59	61.7	11	88.8	15.8	4.88	2.5	14.6	0.307	5.3	302
T11	7.14	0.442	2.91	0.348	0.663	4.29	0.856	3.38	2.04	0.31	0.133	3.28	0.928	2.55	29.3
T12	9.68	0.118	1.22	0.122	0.302	4.58	0.266	1.34	0.625	0.0816	0.108	0.88	0.279	0.675	20.3
T13	626	0.15	1.07	0.114	0.618	1.93	0.198	31.4	1.04	0.262	0.313	1.26	1.01	0.864	666
T14	193	0.293	2.78	0.692	1.46	2.3	0.41	4	1.49	0.544	0.685	3.76	0.574	1.2	213
T15	46	0.184	0.63	0.044	0.246	0.413	0.0384	2.64	0.293	0.0832	0.227	ND	1.22	0.0725	52.1
B1	23.2	0.114	0.196	ND	0.312	0.758	ND	1.29	0.293	0.0848	0.0628	0.197	0.483	0.139	27.1
B2	26.7	0.0438	0.0912	ND	0.233	ND	ND	1.92	0.293	0.0608	0.0744	0.397	0.462	0.0848	30.4
B3	16.8	0.0521	0.114	ND	0.206	ND	ND	0.688	ND	0.0928	0.114	0.824	0.351	0.0912	19.3
B4	0.808	0.0414	0.0872	ND	0.282	ND	ND	0.12	0.293	0.0481	0.0692	0.357	0.54	0.0872	2.73
B5	1.3	0.0522	0.0746	0.044	0.114	ND	ND	0.236	0.293	0.0422	0.0354	ND	0.537	0.0782	2.8
B6	33.3	0.061	0.277	0.044	0.45	ND	ND	2.5	0.293	0.0276	0.025	0.197	0.936	0.075	38.2
B7	24.9	0.0365	0.106	ND	0.0912	ND	ND	1.66	0.293	0.0334	0.0186	0.197	0.33	0.053	27.7
B8	22.6	0.0438	0.11	ND	0.17	0.413	ND	1.11	ND	0.016	0.0151	ND	0.474	0.0647	25.1

Table S8 Toxicological data and predicted no-effect concentration (PNEC) values of the target BPs

Compound	PNEC(ng L ⁻¹)	Reference
BPA	647	(Wang et al., 2025)
BPAF	122	(Wang et al., 2025)
BPAP	58	(Wang et al., 2025)
BPB	275	(Wang et al., 2025)
BPBP	6	(Wang et al., 2025)
BPC	94	(Wang et al., 2025)
BPE	699	(Wang et al., 2025)
BPF	778	(Wang et al., 2025)
BPG	6	(Wang et al., 2025)
BPM	12	(Wang et al., 2025)
BPP	14	(Wang et al., 2025)
BPPH	NF ^a	
BPS	5366	(Wang et al., 2025)
BPZ	104	(Wang et al., 2025)

a: not found.

Wang, S., Peng, C., Sheng, N., Lian, L., Dai, J., & Guan, X. (2025). Occurrence, ecological risk and estrogenic effect of 19 bisphenol analogues in the surface water used for drinking water in Shanghai, China. *Water Res.*, 279, 123408. doi:10.1016/j.watres.2025.123408

Table S9 The estradiol equivalency factor (EEF₁) values of the target BPs

Compound	Value	Reference
BPA	1.93E ⁻⁰³	(Nishihara et al., 2000)
BPAF	7.74E ⁻⁰³	(Nishihara et al., 2000)
BPAP	8.03E ⁻⁰⁴	(Nishihara et al., 2000)
BPB	5.93E ⁻⁰³	(Nishihara et al., 2000)
BPC	1.29E ⁻⁰³	(Nishihara et al., 2000)
BPE	7.15E ⁻⁰⁴	(Nishihara et al., 2000)
BPF	7.19E ⁻⁰⁴	(Nishihara et al., 2000)
BPP	1.18E ⁻³	(Nishihara et al., 2000)
BPPH	NF ^a	
BPS	5.50E ⁻⁰⁵	(Nishihara et al., 2000)
BPZ	2.12E ⁻⁰³	(Nishihara et al., 2000)
BPBP	NF ^a	
BPG	NF ^a	
BPM	NF ^a	

a: not found.

Nishihara, T., Nishikawa, J.-i., Kanayama, T., Dakeyama, F., Saito, K., Imagawa, M., . . . Utsumi, H. (2000). Estrogenic Activities of 517 Chemicals by Yeast Two-Hybrid Assay. *JOURNAL OF HEALTH SCIENCE*, 46(4), 282-298. doi:10.1248/jhs.46.282

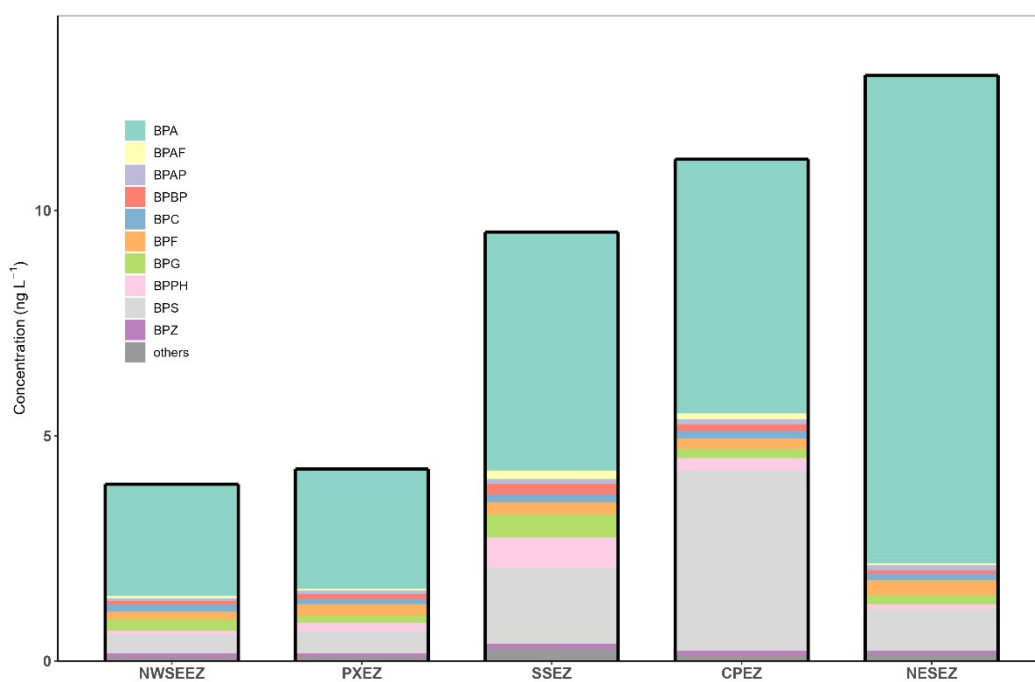


Fig. S1 Distribution patterns of the BPs in five economic zones(BPs with contributions below 1% were combined into others). The aggregated BP concentration for each economic zone is the median of total BPs (sum of all analogues) across samples in that zone. The stacked bars represent the median percentage contributions of individual analogues after normalization.