

Supplementary Tables

Table S1: QA/QC parameters for phthalates extraction and analysis.

S.No.	Phthalates	CAS no.	Log K _{ow}	Retention Time (RT)	Linearity (R ²)	% Recovery	LOD (mg/L)	LOQ (mg/L)
1.	Dimethyl phthalate	131-11-3	1.6634	6.2	0.9982	99.42±1.38	0.42	1.274
2.	Diethyl phthalate	84-66-2	2.6456	8.4	0.9988	100.64±0.27	0.755	2.289
3.	Diallyl phthalate	131-17-9	3.355	9.4	0.9884	98.37±0.94	0.574	1.74
4.	Diphenyl phthalate	84-62-8	4.0968	12.7	0.9994	100.92±0.66	0.583	1.766
5.	Benzyl butyl phthalate	85-68-7	4.8445	13.95	0.9945	99.51±2.62	0.635	1.925
6.	Di-n-butyl phthalate	84-74-2	4.61	14.8	0.9945	99.84±1.58	0.492	1.493
7.	Di-cyclohexyl phthalate	84-61-7	6.2026	24	0.992	100.83±2.25	0.248	0.753

Table S2: Dimethyl phthalate (DMP) content in water samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	2.87 ±0.12	3.64±0.29	2.52±0.03
2	3.02± 0.12	2.89±0.09	2.62±0.07
3	3.17±0.08	4.11±0.006	3.22±0.17
4	3.34±0.32	2.87±0.08	2.22±0.02
5	2.74±0.06	3.79±0.02	4.05±0.04
6	2.85± 0.03	3.39±0.13	2.51±0.06
7	2.48±0.02	3.37±0.04	4.34±0.16
8	2.09 ±0.007	3.64±0.09	2.45±0.06
9	2.08 ±0.001	4.09±0.16	4.49±1.29
10	2.33±0.005	3.37±0.07	3.34±0.05
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	75.43***	0.784
Site	9	14.538***	
Season × Site	18	17.547***	
Error	60		
Total	90		

Data shown are Mean ± SD, n=3. Significant at ***p≤0.001, **p≤0.01.

Table S3: Diethyl phthalate (DEP) content in water samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	1.37±0.05	1.199±0.094	1.309±0.017
2	1.22±0.035	1.236±0.01	1.796±0.209
3	1.25±0.077	2.165±0.044	1.739±0.082
4	1.09±0.014	1.108±0.05	1.432±0.389
5	1.30±0.212	1.963±0.029	5.094±1.25
6	1.29±0.007	1.611±0.021	1.420±0.389
7	1.38±0.358	1.521±0.038	5.039±0.518
8	1.612±0.047	1.457±0.009	6.857±0.883
9	1.22±0.13	1.395±0.089	6.707±1.158
10	1.42±0.279	1.117±0.031	7.156±.202
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	389.808***	1.193
Site	9	44.309***	
Season × Site	18	41.495***	
Error	60		
Total	90		

Data shown are Mean ± SD, n=3. Significant at ***p≤0.001, **p≤0.01.

Table S4: Diallyl phthalate (DAP) content in water samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	16.07±0.157	15.801±0.022	15.873±0.072
2	16.047±0.172	15.82±0.036	15.919±0.07
3	17.69±0.018	15.809±0.006	15.946±0.02
4	16.52±0.075	15.86±0.034	16.110±0.036
5	17.19±0.464	15.974±0.242	21.157±0.518
6	17.36±0.349	16.11±0.314	16.339±0.075
7	16.46±0.45	15.882±0.087	19.395±1.098
8	16.87±0.909	16.151±0.246	19.975±0.553
9	16.95±0.915	15.779±0.019	22.386±1.55
10	16.93±0.303	15.976±0.122	22.034±0.351
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	225.338***	1.459
Site	9	37.639***	
Season × Site	18	32.19***	
Error	60		
Total	90		

Data shown are Mean ± SD, n=3. Significant at ***p≤0.001, **p≤0.01.

Table S5: Diphenyl phthalate (DPP) content in water samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	1.44±0.017	2.704±0.055	ND
2	3.26±1.260	0.984±0.022	1.297±0.339
3	6.20±0.042	2.140±0.028	0.773±0.0003
4	3.29±0.208	2.203±0.147	0.8245±0.011

5	4.39±0.255	1.612±0.009	3.478±1.628
6	3.73±0.062	2.683±0.356	0.808±0.008
7	2.37±0.575	2.696±0.110	1.736±0.082
8	2.01±0.178	2.294±0.099	2.890±1.27
9	2.19±0.111	1.797±0.153	9.763±1.059
10	0.947±0.197	0.835±0.0059	2.880±0.825
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	26.126***	1.615
Site	9	27.697***	
Season × Site	18	42.849***	
Error	60		
Total	90		

Data shown are Mean ± SD, n=3. Significant at ***p≤0.001, **p≤0.01.

Table S6: Benzyl butyl phthalate (BBP) content in water samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	6.975±0.060	ND	8.334±0.0009
2	9.701±0.220	ND	10.931±0.095
3	ND	2.576±0.042	10.022±0.255
4	ND	ND	10.360±1.119
5	2.37±0.05	2.323±0.012	15.26±0.396
6	ND	ND	11.804±0.154
7	ND	ND	15.955±0.166
8	11.57±0.53	ND	18.033±0.544
9	6.976±0.013	ND	19.950±0.906
10	3.926±0.025	ND	26.758±0.955
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	12610***	1.092
Site	9	430.144***	
Season × Site	18	390.610***	
Error	60		
Total	90		

Data shown are Mean ± SD, n=3. Significant at ***p≤0.001, **p≤0.01.

Table S7: Dibutyl phthalate (DBP) content in water samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	9.49±0.014	11.114±2.317	8.193±0.001
2	9.91±0.069	10.653±1.632	8.667±0.154
3	18.219±0.134	17.156±0.003	8.798±0.364
4	13.802±1.975	11.726±0.001	8.694±0.208
5	19.766±0.107	12.388±2.986	8.484±0.046
6	15.913±0.033	10.641±1.777	8.721±0.361
7	13.827±2.808	13.399±0.239	8.266±0.001
8	9.868±0.264	8.401±0.009	8.393±0.051
9	10.816±0.018	13.432±3.05	9.332±0.533
10	8.515±0.048	11.077±2.77	9.793±0.009
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD

Season	2	90.516 ***	3.9
Site	9	18.496***	
Season × Site	18	9.919***	
Error	60		
Total	90		

Data shown are Mean ± SD, n=3. Significant at ***p≤0.001, **p≤0.01.

Table S8: Dicyclohexyl phthalate (DcHP) content in water samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	ND	ND	ND
2	ND	ND	ND
3	12.15±0.057	ND	ND
4	ND	ND	ND
5	12.156±0.090	ND	ND
6	12.306±0.024	ND	ND
7	ND	ND	ND
8	12.41±0.075	ND	15.424±0.670
9	ND	12.215±0.082	22.593±6.25
10	ND	ND	23.973±1.236
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	145.759 ***	3.550
Site	9	120.593***	
Season × Site	18	113.811***	
Error	60		
Total	90		

Data shown are Mean ± SD, n=3. Significant at ***p≤0.001, **p≤0.01.

Table S9: Dimethyl phthalate (DMP) content in sediment samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	6.6926±.03895	15.4494 ±.07435	6.3337±.06169
2	8.7068±0.06169	8.3790 ±0.02175	6.6420 ±.10381
3	ND	9.3681±1.21406	ND
4	ND	9.7983±0.6098	ND
5	ND	12.1483±0.59695	ND
6	7.0942±0.04508	17.2962 ±0.24519	7.0137±0.00218
7	8.2202±1.79361	8.5435±0.86289	ND
8	6.5415 ±0.00573	13.1554±0.07751	ND
9	17.2177±0.09946	7.3939±0.02056	ND
10	8.1081±0.50896	7.0194±0.14434	6.6934±0.029
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	2314***	1.351
Site	9	269.368***	
Season × Site	18	224.097***	
Error	60		
Total	90		

Data shown are Mean \pm SD, n=3. Significant at ***p \leq 0.001, **p \leq 0.01.

Table S10: Diethyl phthalate (DEP) content in sediment samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	ND	3.8548 \pm .02722	3.7802 \pm 0.55423
2	4.2764 \pm 0.66619	3.1010 \pm .01074	3.1031 \pm 0.01783
3	ND	3.1738 \pm .02722	4.3247 \pm 0.02281
4	ND	3.2168 \pm 0.02262	3.2592 \pm 0.08378
5	ND	4.4669 \pm 0.72715	4.3845 \pm 0.5642
6	ND	14.6796\pm1.79803	5.5688\pm1.45449
7	9.7155\pm1.59329	4.0971 \pm 0.30788	3.1522 \pm 0.06154
8	3.2705 \pm 0.12538	13.3284 \pm 0.20839	3.407 \pm 0.08857
9	7.2555 \pm 0.0462	7.6362 \pm 0.2475	3.2626 \pm 0.05387
10	3.4407 \pm 0.03566	3.1951 \pm 0.0324	3.5078 \pm 0.05329
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	262.042***	1.646
Site	9	94.528***	
Season \times Site	18	101.417***	
Error	60		
Total	90		

Data shown are Mean \pm SD, n=3. Significant at ***p \leq 0.001, **p \leq 0.01.

Table S11: Diallyl phthalate (DAP) content in sediment samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	ND	77.0881 \pm 0.01797	49.7222 \pm 2.35627
2	47.7786 \pm 0.17625	82.8745\pm0.2145	48.6002 \pm 1.31488
3	47.5867 \pm 0.17971	69.6976 \pm 0.41034	47.4157 \pm 0.17095
4	ND	67.9446 \pm 0.13133	49.4377 \pm 2.21596
5	ND	48.4843 \pm 1.20221	58.9257\pm7.9152
6	ND	57.7331 \pm 1.2711	48.1233 \pm 0.35504
7	57.8988\pm0.84279	50.4666 \pm 0.87367	ND
8	48.279 \pm 0.11082	56.8159 \pm 0.80455	47.342 \pm 0.06175
9	48.9393 \pm 1.18678	55.1409 \pm 0.53775	47.9988 \pm 0.0615
10	47.3977 \pm 0.11428	48.0145 \pm 0.79510	47.5669 \pm 0.29353
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	2720***	4.809
Site	9	248.9***	
Season \times Site	18	458.31***	
Error	60		
Total	90		

Data shown are Mean \pm SD, n=3. Significant at ***p \leq 0.001, **p \leq 0.01.

Table S12: Diphenyl phthalate (DPP) content in sediment samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	ND	3.0553±0.05321	91.1823±6.3245
2	7.2114±1.64613	5.3445±0.88634	3.0453±0.1331
3	ND	10.7057±2.7117	13.838±11.5605
4	ND	ND	73.5299±1.9646
5	ND	14.3233±0.85987	41.6235±10.769
6	ND	16.2011±0.5599	8.8075±0.9014
7	117.71±11.09698	9.9991±0.7603	ND
8	4.194±0.51518	23.2789±15.15	ND
9	ND	6.4193±0.2499	5.8782±0.0953
10	ND	8.8025±2.147	ND
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	72.988***	13.613
Site	9	72.966***	
Season × Site	18	134.948***	
Error	60		
Total	90		

Data shown are Mean ± SD, n=3. Significant at ***p≤0.001, **p≤0.01.

Table S13: Benzyl butyl phthalate (BBP) content in sediment samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	7.2411±0.03522	8.3326±0.04899	13.2037±0.24058
2	27.3986±1.524	9.1893±0.05910	7.3898±0.148
3	8.5176±0.0857	8.584±0.16544	7.8841±0.0303
4	9.5319±0.0136	8.7622±0.03086	18.6403±0.316
5	16.857±0.059	24.5197±0.09379	8.2934±0.0223
6	7.3419±0.0205	41.4616±0.23064	71.2323±0.27893
7	83.089±0.9562	19.6437±0.1086	36.4153±0.199
8	8.2026±0.9429	25.6506±0.61697	52.617±0.0927
9	10.1406±2.9138	28.0511±0.19682	32.22±0.207
10	7.1785±0.0779	7.2272±0.02301	65.654±0.0829
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	3758***	1.943
Site	9	3335***	
Season × Site	18	2621***	
Error	60		
Total	90		

Data shown are Mean ± SD, n=3. Significant at ***p≤0.001, **p≤0.01.

Table S14: Dibutyl phthalate (DBP) content in sediment samples collected from different sites and seasons

Site	Winter	Summer	Monsoon
1	24.9584±0.0363	39.903±0.0231	27.0271±0.0446
2	26.5395±0.9746	45.754±0.0573	ND
3	25.707±0.0878	30.6523±6.1692	24.417±0.05098
4	25.602±0.1139	33.5489±0.106	25.4901±1.027
5	28.3903±0.3374	63.223±0.1277	24.7054±0.012
6	25.098±0.1134	32.278±0.0026	56.422±0.4415
7	30.147±0.2097	24.7735±0.1210	25.292±0.27078
8	24.356±0.0141	25.949±1.4706	27.1652±2.7028
9	26.2803±0.0568	28.299±0.2169	31.777±0.097
10	24.539±0.0067	26.8588±0.2376	25.0697±0.0929
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	451.479***	3.740
Site	9	139.531***	
Season × Site	18	222.236***	
Error	60		
Total	90		

Data shown are Mean ± SD, n=3. Significant at ***p≤0.001, **p≤0.01.

Table S15: Dicyclohexyl phthalate (DcHP) content in sediment samples collected from different sites and seasons.

Site	Winter	Summer	Monsoon
1	ND	ND	36.9267±0.0576
2	37.9648±1.5427	ND	ND
3	ND	ND	ND
4	ND	ND	37.218±0.072
5	ND	ND	36.914±0.14956
6	ND	ND	ND
7	38.3921±0.5015	37.3686±0.00102	40.2293±1.193
8	ND	ND	37.978±0.2211
9	ND	36.2185±0.047	ND
10	ND	36.926±0.0576	39.405±0.5256
ANOVA summary			
Source of variation	Degree of Freedom	F-ratio	HSD
Season	2	13020***	1.109
Site	9	3188***	
Season × Site	18	8230***	
Error	60		
Total	90		

Data shown are Mean ± SD, n=3. Significant at ***p≤0.001, **p≤0.01.

Table S16: Concentration of phthalates esters (PEs) in water samples as reported in literatures from India and other countries.

Country	Freshwater bodies	DMP	DEP	DBP	BBP	DAP	DCHP	DPP	References
Spain	Muga, Fluvia, Ter, Besos, Llobregat, Ebro	ND	50-280ng/L	NP	<LOQ–20 ng/L	NP	NP	NP	[1]
Malaysia	Selangor	2–15 ng/L	10–49 ng/L	47–213 ng/L	4–13 ng/L	NP	NP	NP	[2]
China	Lake Shichahai	0.081 µg/L	0.009 µg/L	0.066 µg/L	0.183 µg/L	0.009 µg/L	ND	NP	[3]
India	Kaveri River	ND-94 ng/L	36-520 ng/L	ND-372 ng/L	5.4-145 ng/L	NP	ND	NP	[4]
China	Chaohu Lake	0.015–3.67	0.006–0.283	0.070–17.5	NP	NP	NP	NP	[5]
China	Xi River	1.34-21.1 µg/L	0.163-2.37 µg/L	0.137- 9.96 µg/L	NP	NP	NP	NP	[6]
China	Pu River	0.296-23.0 µg/L	0.127-1.60 µg/L	0.591- 9.67 µg/L	NP	NP	NP	NP	[6]
China	Jiulong	0.034–0.15 µg/L	0.014–0.091 µg/L	0.31–0.51 µg/L	NP	NP	NP	NP	[7]
China	Huai River	<310 ng/L	25–310 ng/L	431–1299 ng/L	76–1351 ng/L	NP	NP	NP	[8]
India	Sunderban wetland	0.04–0.06 µg/L	ND–0.4 µg/L	0.32–0.88 µg/L	ND–0.1 µg/L	NP	NP	NP	[9]
India	River Ganga	0.03–0.05 µg/L	0.04–2.14 µg/L	ND–2.27 µg/L	ND–0.13 µg/L	NP	NP	NP	[9]
China	Yellow River	47.9-946.3 ng/L	78.6-679.1 ng/L	79.89-2030.1 ng/L	ND-5.9 ng/L	ND-51.9 ng/L	ND	ND	[10]
India	Vellar River	ND-0.019 µg/L	0.088–0.598 µg/L	1.055–86.03 µg/L	ND	NP	0.015–58.3 µg/L	NP	[11]

ND – not detected, NP – not performed

Table S17: Concentration of phthalate esters (PEs) in sediments samples as reported in literatures from India and other countries.

Country	Sediments	DMP	DEP	DBP	BBP	DAP	DCHP	DPP	References
India	Gomti	BDL– 490 ng/L	BDL– 350 ng/L	BDL- 340 ng/L	ND	NP	NP	NP	[12]
India	Kaveri	ND- 3.71 ng/L	ND- 185.2 ng/L	ND-664 ng/L	ND-7.8 ng/L	NP	NP	NP	[4]
China	Jiulong	ND- 5.1 µg/kg	ND-3.5 µg/kg	6.1–19.3 µg/kg	NP	NP	NP	NP	[13]
Malaysia	Sembrong River	0.01 - 0.04 mg/kg	0.24 - 1.29 mg/kg	0.21 - 15.63 mg/kg	0.04 - 1.00 mg/kg	NP	NP	NP	[14]
China	Yellow river delta	0.002– 0.060 mg/g	ND– 0.004 mg/g	0.245– 2.058 mg/g	ND	ND	NP	NP	[15]
China	Qiantang River sediments	0.053 µg/g dw	0.018 µg/g dw	0.170 µg/g dw	0.0018 µg/g dw	0.0006 µg/g dw	0.0014 µg/g dw	NP	[16]
China	Yellow River	49.0- 216.5 ng/g	15.8- 752.9 ng/g	63.4- 1386.7 ng/g	0.6-37.9 ng/g	23.7- 473.9 ng/g	n.d.~113 .6 ng/g	n.d.~4.3 ng/g	[17]
China	Songhua River	0.003 ug/gd w	0.017 ug/gdw	0.852 ug/gdw	0.005 ug/gdw	NP	NP	NP	[18]
China	Taihu Lake	3.500 ug/gd w	2.290 ug/gdw	1.750 ug/gdw	1.300 ug/gdw	NP	NP	NP	[19]
India	Vellar River	ND	ND- 0.018 µg/kg dry wt.	0.002– 0.35 µg/kg dry wt.	ND- 0.004 µg/kg dry wt.	NP	0.007– 0.542 µg/kg dry wt.	NP	[11]

India	Thamirapara River	ND	ND- 0.019 µg/kg dry wt.	ND- 0.514 µg/kg dry wt.	ND	ND	0.001– 2.635 µg/kg dry wt.	ND	[11]
China	Qixinghe wetland	ND 36.04 µg/kg	ND 60.13 µg/kg	8.15 48.78 µg/kg	ND 28.4 µg/kg	ND	ND	ND	[20]

ND – not detected, NP – not performed.

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Supplementary Figures

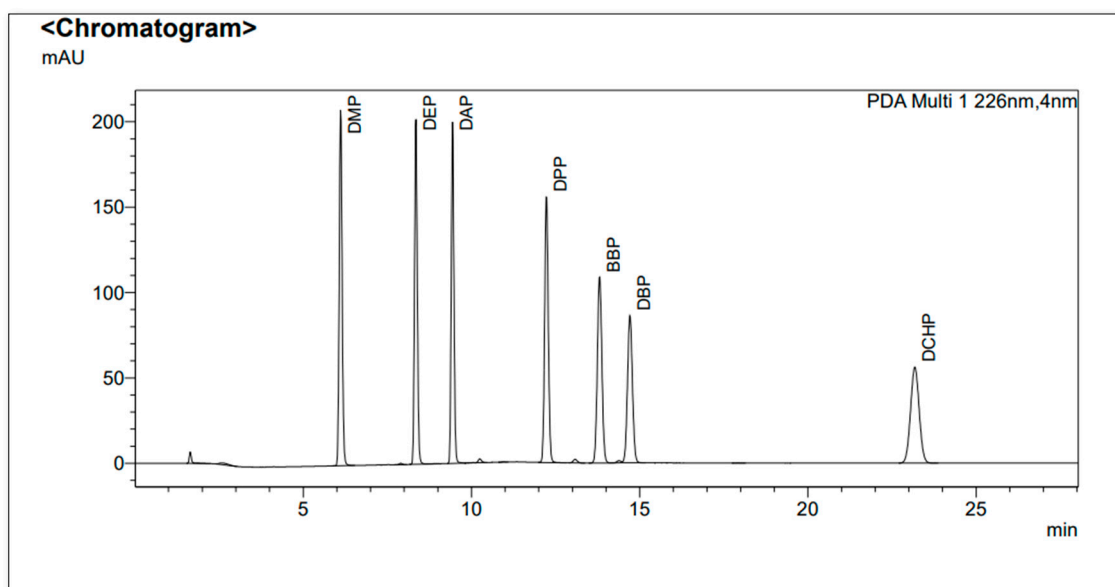


Fig. S1: UHPLC chromatogram of phthalates standard showing DMP, DEP, DAP, DPP, BBP, DBP and DcHP

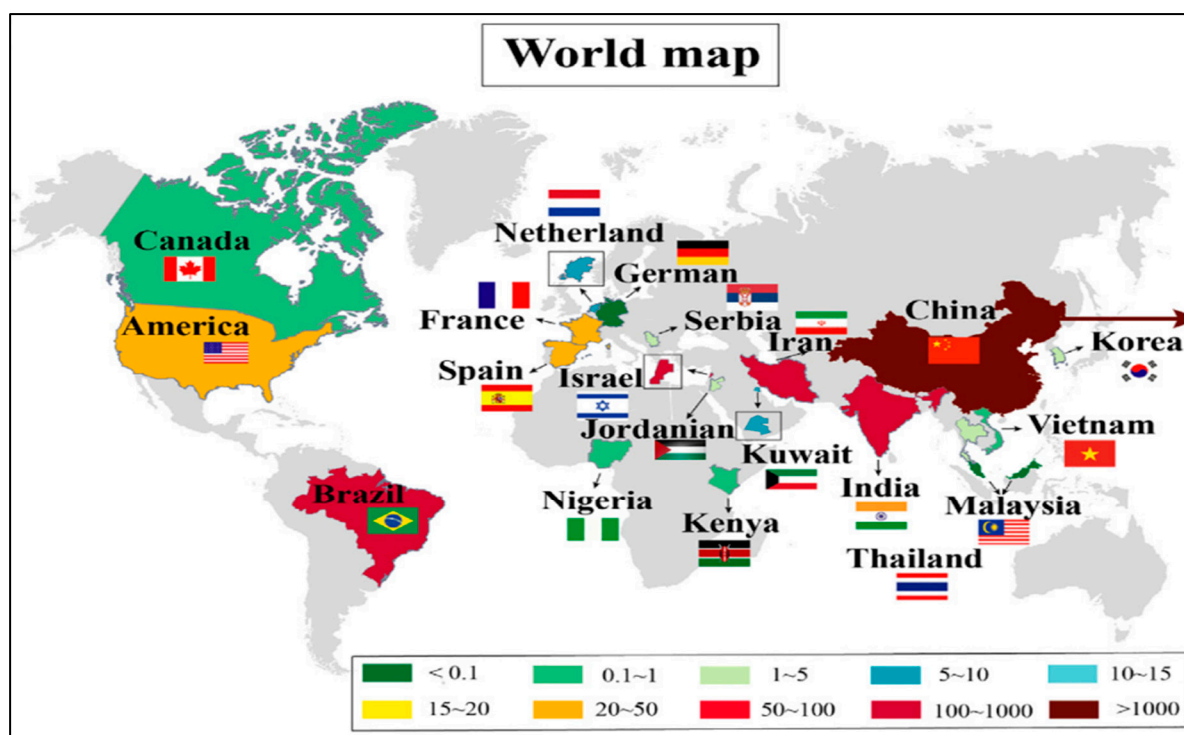


Fig S2: World map showing maximum exposure concentration of PEs in rivers, lakes and seas in some countries ($\mu\text{g/L}$) (Zhang et al., 2019).