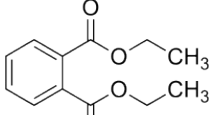
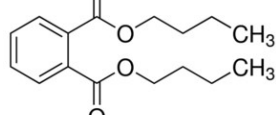
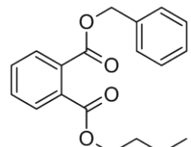
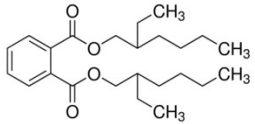


Contamination level of four priority phthalates in north Indian wastewater treatment plants and their fate in sequencing batch reactor system

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Supplementary Data

Table S1 Chemical and physical properties of phthalates analyzed in the study.

Name of Phthalate	Chemical formula*	Molecular weight (g/mol)*	CAS number*	Log K _{OW} *	Henry's constant k _H (atm m ³ /mol)	Chemical structure*
Diethyl Phthalate	C ₁₂ H ₁₄ O ₄	222.2	84-66-2	2.70	2.66 x 10 ⁻⁷	
Dibutyl Phthalate	C ₁₆ H ₂₂ O ₄	278.4	84-74-2	4.83	8.83 x 10 ⁻⁷	
Benzylbutyl Phthalate	C ₁₉ H ₂₀ O ₄	312.4	85-68-7	5.00	7.61 x 10 ⁻⁷	
Diethylhexyl Phthalate	C ₂₄ H ₃₈ O ₄	390.57	117-81-7	8.71	1.7 x 10 ⁻⁷	

*National Center for Biotechnology Information. PubChem Compound Database; <https://pubchem.ncbi.nlm.nih.gov/>

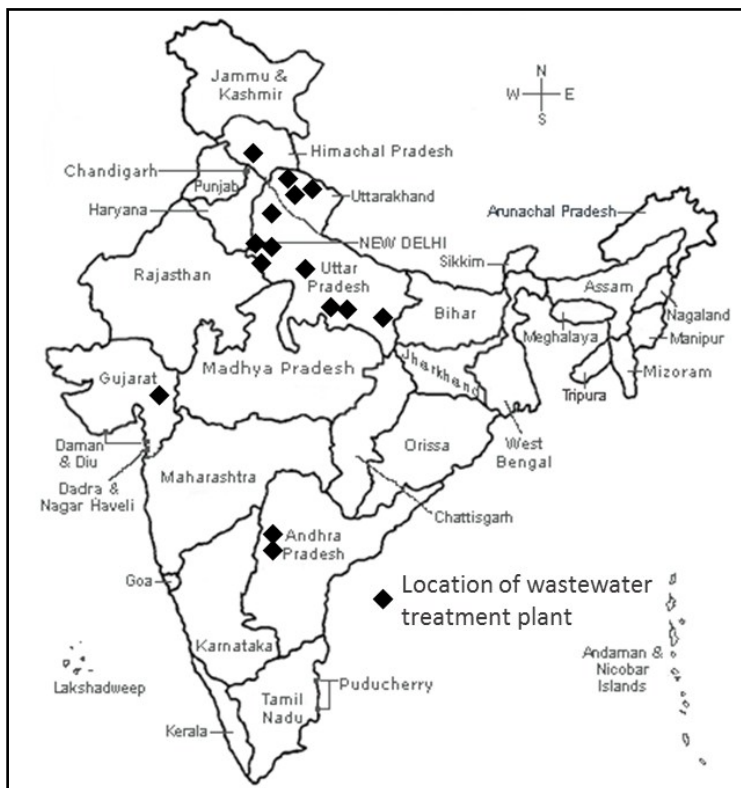


Figure S1 Map showing location of sampled fifteen wastewater treatment plants (WWTPs).

Table S2 Indexing and operational conditions of the fifteen WWTPs from where phthalate contamination in untreated and treated wastewater was evaluated

WWTP index	City	WWTP configuration	Flow rate (m ³ /d)	MLSS ^a (mg/L)	COD (mg/L)	BOD (mg/L)	TSS (mg/L)	TKN (mgN/L)	PO ₄ -P (mg P/L)
H	Shimla	ASP ¹ + Coagulation	4440	3200±354	659±149	335±129	373±83	69.0±16.5	4.8±1.5
UP4	Kanpur	Conventional ASP ²	130000	3696±340	754±281	268±24	655±166	42.3±18.2	3.3±1.2
U2	Haridwar	Conventional ASP	17000	3228±276	287±70	164±30	208±42	34.5±3.4	3.1±0.4
D4	Delhi	ASP + Biofor	181600	1495±221	612±92	241±38	222±40	61.0±7.1	11.3±1.3
U3	Haridwar	PST ³ +SBR ⁴	27000	7156±546	368±39	180±9	222±27	27.7±1.5	2.5±0.6
D1	Delhi	A-O ⁵ + Membrane Bio Reactor	4540	14050±342	947±144	356±110	242±23	48.9±25.6	13.6±4.9
D3	Delhi	PST + A-O + Cl ⁶	136400	3198±320	429±98	242±51	210±18	52.7±11.5	4.6±0.6
AP1	Hyderabad	A2O ¹⁰ + coagulation + UF + Cl	20000	N.A.	628±201	242±88	407±102	39.0±5.7	2.6±0.4
AP2	Hyderabad	A2O + coagulation+ SF ¹¹ + Cl	30000	N.A.	598±167	237±57	372±134	48.0±9.4	3.4±1.2
UP1	Allahabad	MBBR ⁷ + Cl	29000	-	432±13	229±26	246±9	31.5±0.7	4.4±0.2
UP3	Allahabad	Bio tower + ASP + Cl	50000	1997±119	630±162	325±171	469±174	42.0±2.6	2.6±0.5
UP2	Saharanpur	UASB ⁸ + Oxidation Pond	38000	108000±5321	389±69	197±22	264±89	44.5±0.7	7.0±2.5
S	Surat	UASB + EA + UF ⁹ + RO ¹²	100000	N.A.	438±116	232±63	229±53	37.0±11.4	6.4±0.7
U1	Rishikesh	Oxidation pond	6000	-	434±53	210±3	288±35	21.1±5.6	3.4±0.4
D2	Delhi	Densadeg + Biofor	10000	-	405±34	170±16	236±11	33.5±0.7	3.3±0.1

1= Activated sludge process (extended aeration); 2= Activated sludge process; 3= Primary Settling tank; 4= Sequential Batch reactor; 5= Anoxic - Oxic; 6= Chlorination; 7= Moving bed biofilm reactor; 8= Up flow anaerobic sludge blanket; 9= Ultrafiltration; 10= Anaerobic-anoxic-oxic; 11= Sand Filters; 12= Reverse osmosis

a= MLSS of the aeration tank.

N.A. = Not Available (Data not provided).

Table S3 GC MS retention times, quantifying ions and quality assurance of analysis method.

Phthalate ester	Retention time (min)	Quantifying ions	r ²	LOD (µg/L)	LOQ (µg/L)	% Recovery* (n=6)
DEP	24.45	149, 177, 150	0.97	0.071	0.210	84
DBP	30.00	149, 150, 104	0.99	0.130	0.182	95
BBP	35.75	149, 206, 123	0.93	0.216	0.342	83
DEHP	40.10	149, 167, 150	0.96	0.084	0.241	80

*Spiked concentration in wastewater sample = 25 µg/L

Table S4 Quality control (QC) check of the analysis method in blanks according to method 606, USEPA

Parameter	Test Conc. (µg/L)	Average recovery (X)	Std. Dev. (S)	USEPA QC acceptance criteria		Recovery* (%)	Blank conc. (n=3)
				S limit	Range of X		
DEP	25	22.73	3.77	9	1.9-33.4	91	nd
DBP	25	25.42	3.07	8.9	10.3-29.5	102	nd - 0.312
BBP	10	8.995	3.75	4.2	5.7-11	90	nd
DEHP	50	42	3.7	38.4	1.2-55.9	84	nd

*Recovery calculated by spiking blank samples

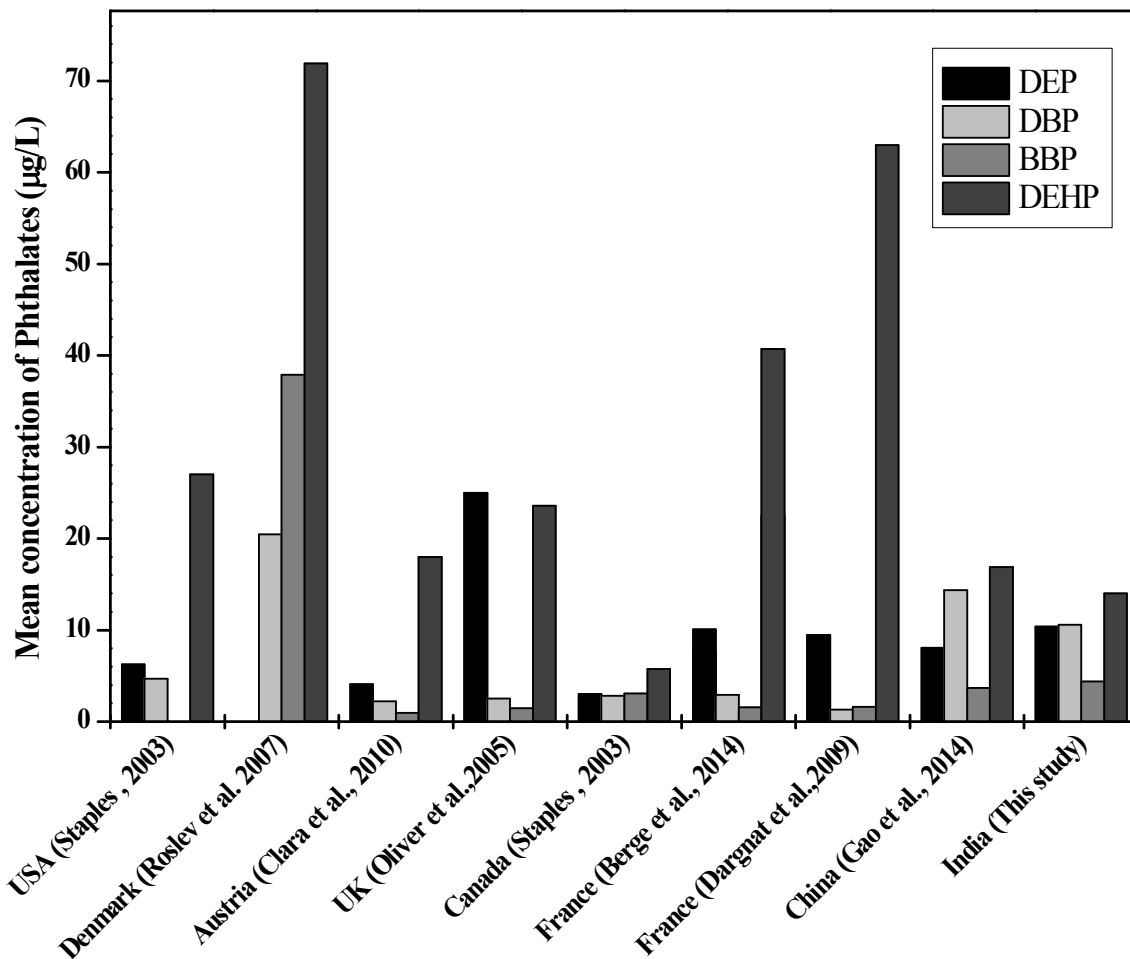


Figure S2 Mean concentration of phthalates reported in domestic wastewater in different countries.