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Environmental Chemistry

Supplementary Material

Plasticisers in the terrestrial environment: sources, occurrence and fate

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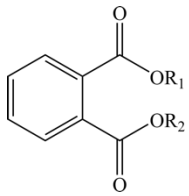
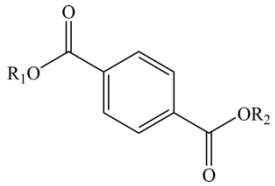
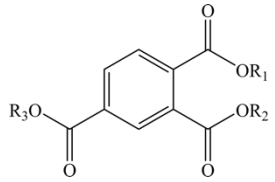
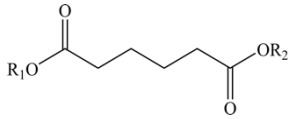
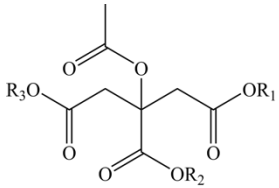
Table S1: Chemical structures of the common classes of plasticiser.

Class	Structure	Example	R_1	R_2	R_3
Phthalate		DEP	CH_2CH_3	R_1	
		BBP	$(CH_2)_3CH_3$	CH_2Ar	
		DEHP	$CH_2CH(CH_2CH_3)CH_2CH_2CH_2CH_3$	R_1	
		DnOP	$(CH_2)_7CH_3$	R_1	
Terephthalate		DEHTP	$CH_2CH(CH_2CH_3)CH_2CH_2CH_2CH_3$	R_1	
Trimellitate		TOTM	$(CH_2)_7CH_3$	R_1	R_1
Adipate		DEHA	$CH_2CH(CH_2CH_3)CH_2CH_2CH_2CH_3$	R_1	
Citrate		ATBC	$(CH_2)_3CH_3$	R_1	R_1

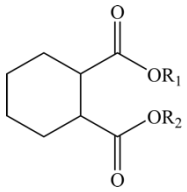
DiNCH		DiNCH	C_9H_{19} (mixture of isomers)	R_1

Table S2: Mean phthalate concentrations (mg kg^{-1}) extracted from all studies of plasticiser soil occurrence. Instances where phthalates were present below the detection limit were assigned null values. Data was calculated manually for sampling groups 35-37 and 98-101. Any non-detects were assigned concentrations of half of the detection limit during manual mean concentration calculations. Data for sampling groups 98-101 were calculated as the mean value for the year from the 3 different sampling points. For the sake of consistency, the total sum phthalate concentration for each sampling group was calculated from the individual mean concentrations reported in each study.

Study sample group	Region	Description	Land use	Target analytes	DMP	DEP	DiBP	DnBP	BBP	DEHP	DnOP	DnNP	DiNP	DiDP	DPrP	DMEP	DMPP	DEEP	DnPP	DnHxP	DnHpP	HEHP	DBEP	DCHxP	DPhP	Sum phthalates	Study
1	China	Soil from vegetable greenhouses (n=111)	Agricultu re	16	0.364	0.108	1.118	1.471	0.194	1.465	1.239	0.026				0.015	0.246	0.041	0.088	0.084			0.015	0.035	0.240	6.749	(Chai et al. 2014)
2	China	Agricultural soil from greenhouses and open fields from Shenyang (n=16)	Agricultu re	5	0.032	0.114	0.325	0.961		0.407																1.839	(Chen et al. 2017)
3	China	Agricultural soil from greenhouses and open fields from Beijing (n=12)	Agricultu re	5	0.047	0.116	0.315	0.597		0.448																1.523	
4	China	Agricultural soil from greenhouses and open fields from Xianyang (n=6)	Agricultu re	5	0.038	0.147	0.298	0.362		0.382																1.227	
5	China	Agricultural soil from greenhouses and open fields from Shouguang (n=12)	Agricultu re	5	0.046	0.149	0.341	0.659		0.491																1.686	
6	China	Agricultural soil from greenhouses and open fields from Siyang (n=11)	Agricultu re	5	0.023	0.095	0.241	0.65		0.336																1.345	
7	China	Agricultural soil from greenhouses and open	Agricultu re	5	0.026	0.09	0.243	0.55		0.344																1.253	

		fields from Haimen (n=12)																									
8	China	Agricultural soil from greenhouses and open fields from Nanjing (n=13)	Agricultu re	5	0.031	0.108	0.221	0.491		0.39																1.241	
9	China	Agricultural soil from greenhouses and open fields from Changshu (n=5)	Agricultu re	5	0.022	0.108	0.223	0.157		0.365																0.875	
10	China	Agricultural soil from greenhouses and open fields from Fuzhou (n=12)	Agricultu re	5	0.04	0.128	0.363	0.463		0.446																1.440	
11	China	Agricultural soil from greenhouses and open fields from Kunming (n=12)	Agricultu re	5	0.032	0.088	0.311	0.263		0.314																1.008	
12	China	Urban surface soils (n=7)	Urban	13	0.01	0.01	0.1	0.09	0.05	0.11	0.05	0.06					0.04		0.03	0.01		0.01		0.06		0.630	(Cheng et al. 2015)
13	China	Urban deep soils (n=7)	Urban	13	0.01	0.02	0.04	0.04	0.05	0.08	0.01	0.04					0.03		0.04	0.01		0.01		0.03		0.410	
14	China	Agricultural soil (n=32)	Agricultu re	7	0.0131	0.0087 4	0.217	0.254	0.0001 3	0.118	0.00681															0.618	(He et al. 2018)
15	China	Riparian soil (n=26)	Mixed	7	0.0144	0.0113	0.194	0.225	0.0003 7	0.108	0.00667															0.560	
16	China	Urban soils of the YRD (n=17)	Urban	11	0.030	0.001	0.049	1.392	0	3.399	0.011	0			0				0	0.018						4.900	(Hongjun et al. 2013)
17	China	Suburban soils of the YRD (n=28)	Urban	11	0.027	0.251	0.104	0.657	0	2.701	0.025	0.005			0.05 3				0	0.061						3.884	
18	China	Rural soils of the YRD (n=37)	Rural	11	0.032	0	0.089	0.413	0	1.224	0.005	0			0				0	0.019						1.782	
19	China	Agricultural soil from Chongquing (n=1)	Agricultu re	8	0.0035	0.0015	0.009 4	0.0092		0.0798										0		0		0		0.103	(Hu et al. 2020)
20	China	Agricultural soil from Shanxi (n=1)	Agricultu re	8	0.0029	0.001	0.011 3	0.0095		0.0369										0		0		0		0.062	
21	China	Forest soil from Zheijang (n=1)	Rural	8	0.0037	0.0021	0.017 7	0.0161		0.0824										0		0		0		0.122	
22	China	Urban soil from Jilin (n=1)	Urban	8	0.0167	0.0072	0.123 2	0.1007		1.1422										0.001 5		0.008 7		0.006 9		1.407	
23	China	Agricultural soil from Zheijang (n=1)	Agricultu re	8	0.0047	0.002	0.028 9	0.1005		0.1462										0		0		0		0.282	
24	China	Agricultural soil (n=8)	Agricultu re	6	0.001	0		0.01	0	0.44	0.20															0.651	(Kaewlaoyo ong et al. 2018)
25	China	Garden soil (n=10)	Urban	6	0	0		0.04	0	0.16	0.003															0.203	
26	China	Roadside soils (n=6)	Urban	6	0	0		0.07	0	0.15	0.03															0.250	
27	China	Suburban agricultural and wasteland	Mixed	6	0.018	0.022		0.070	0.064	0.295	0.189															0.658	(Kong et al. 2012)

		soil - farmland, vegetable and orchard (n=85)																									
28	China	Urban soils (n=30)	Urban	7	0.010	0.016	0.311	0.790	0.029	1.875	0.031															3.062	(Li et al. 2006)
29	China	Soil from vegetable greenhouses (n=60)	Agriculture	15	0.008	0.02	0.13	0.44	0.004	0.38	0.002					0.0003	0	0.0005	0.001	0.002			0	0	0.002	0.990	(Li et al. 2016a)
30	China	Agricultural soils from 36 fields (n=108)	Agriculture	16	0.14	0.34	1.118	1.987	0.49	0.292	0.364	0				0.131	0.102	0.196	0	0.019			1.071	0.125	0	6.375	(Li et al. 2016b)
31	China	Agricultural soil from suburban greenhouses (n=32)	Agriculture	6	0	0.01775		0.09888	0.01906	0.19237	0.02368															0.352	(Li et al. 2020)
32	China	Soil in the vicinity of landfill (n=4)	Landfill	16	0.0272	0.0124	0.2327	0.0603	0.0197	0.3021	0		0.1473			0	0.0267	0.0630	0	0.0055		0.0212	0	0.0044		0.923	(Liu et al. 2010b)
33	China	Soil used to cover landfill (n=2)	Landfill	16	0.0648	0	0.2528	0.1706	0.0905	3.3102	0		0			0	0.0518	0	0	0		0.0528	0	0.2257		4.219	
34	China	Alluvial soils (n=26)	Mixed	16	0.0209	0.2045	0.1442	0.0815	0.0159	0.3292	0		0.0274			0.0173	0.0049	0.0099	0	0.0111		0.0214	0.0071	0.0315		0.927	
35	China	Agricultural soils from industrial greenhouses (n=40)	Agriculture	6	0.017925	0.020525		1.7325	0	0.843675	0.0119															2.627	(Ma et al. 2019)
36	China	Agricultural soils from industrial greenhouses (n=40)	Agriculture	6	0.0192	0.0316		0.81665	0.0005	1.187275	0.407325															2.463	(Ma et al. 2020)
37	China	Agricultural soils (n=15)	Agriculture	6	0.02831	0.044667		0.306927	0.000019	0.227027	0.00415667															0.611	(Song et al. 2021)
38	China	Agricultural soils (n=241)	Agriculture	15	0.023	0.0038	0.086	0.0949	0.001	0.546	0.0069	0.0083				0.002	0.0014	0.0033	0.0022	0.0005			0.0183	0.0353		0.833	(Sun et al. 2016)
39	China	Agricultural soils (n=89)	Agriculture	16	1.836	0.25	0.252	0.919	0.023	0.96	0.685	0.005				0.246	0.006	0.053	0.005	0.006			0.072	0.007	0	5.325	(Tao et al. 2020a)
40	China	Mixed land uses (n=1757)	Mixed	6	0.00497	0.0104		0.1718	0.008933	0.342	0.011															0.549	(Teng et al. 2015)
41	China	Agricultural soil - CK (no polytunnel or mulch film) (n=8)	Agriculture	6	0.003	0.003		0.023	0.001	0.411	0.013															0.454	(Wang et al. 2013a)
42	China	Agricultural soil - HS (n=31)	Agriculture	6	0.002	0.003		0.115	0.001	0.622	0.064															0.807	
43	China	Agricultural soil - GL (double polytunnel, single layer mulch film) (n=39)	Agriculture	6	0.008	0.006		0.262	0.006	2.445	0.458															3.185	
44	China	Agricultural soil - SS (single layer polytunnel, single layer mulch film) (n=27)	Agriculture	6	0.001	0.007		0.201	0.001	1.419	0.240															1.869	
45	China	Agricultural soil - PK (single layer polytunnels, mulch film, alternating	Agriculture	6	0.003	0.006		0.236	0.007	2.877	0.026															3.155	

		every 2-3 years) (n=22)																									
46	China	Agricultural soils - paddy field	Agricultu re	6	0.0278	0.0603		0.1596	0.020	0.2215	0.0434															0.533	
47	China	Agricultural soils - vegetable field	Agricultu re	6	0.0252	0.0364		0.0704	0.0124	0.1365	0.0274															0.308	(Wang et al. 2017)
48	China	Agricultural soils - bean field	Agricultu re	6	0.0212	0.0361		0.0299	0.0102	0.1454	0.0255															0.268	
49	China	Suburban agricultural soil in greenhouses (n=44)	Agricultu re	6	0.004	0.005		0.17	0.006	1.84	0.2															2.225	(Wang et al. 2015a)
50	China	Urban soils (n=62)	Urban	6	0.0235	0.0234		0.5217	0.0117	0.7653	0.0235															1.346	(Wang et al. 2018)
51	China	Agricultural soils from 4 fields (n=59)	Agricultu re	6	0.0543 1	0.0194 6		0.3165 9	0.0394 8	0.16617	0.0423															0.638	(Wang et al. 2015b)
52	China	Cultivated agricultural surface soils (n=23)	Agricultu re	4	0.0266	0.0349		0.0285		0.0279																0.118	(Wang et al. 2013b)
53	China	Agricultural soils (n=228)	Agricultu re	6	0	0		0.0061 2	0.0008 61	0.183	0.00697															0.197	(Wei et al. 2020)
54	China	Residential soils from a non-industrialised area (n=44)	Urban	6	0.67	1.08		1.66	1.25	11.12	0.65															16.43 0	
55	China	Roadside soils from a non-industrialised area (n=36)	Urban	6	0.83	1.37		1.77	1.48	14.5	0.76															20.71 0	
56	China	Farmland soils from a non-industrialised area (n=32)	Agricultu re	6	1.1	1.76		2.22	1.86	16.59	0.67															24.20 0	
57	China	Non-cultivated soils from a non-industrialised area (n=33)	Rural	6	0.53	0.91		1.23	1.3	11.4	0.56															15.93 0	
58	China	Residential soils from an industrialised area (n=44)	Urban	6	1.53	3.91		5.63	1.6	26	1.16															39.83 0	(Wu et al. 2015)
59	China	Roadside soils from an industrialised area (n=36)	Urban	6	2.17	4.41		8.79	1.75	31	1.49															49.61 0	
60	China	Farmland soils from an industrialised area (n=32)	Agricultu re	6	2.1	4.01		4.88	2.36	16.61	1.49															31.45 0	
61	China	Non-cultivated soils from an industrialise	Rural	6	1.24	2.62		3.51	1.3	11.5	1.25															21.42 0	

		d area (n=33)																									
62	China	Urban soils (n=127)	Urban	5	0.006184	0.001274		0.99003		0.1397	0.002374															1.140	(Xia et al. 2011)
63	China	Rural soils (n=40)	Rural	2				0.3551		0.02214																0.377	
64	China	Agricultural soils	Agriculture	2				14.06		4.858																18.918	(Xu et al. 2008)
65	China	Agricultural soils	Agriculture	2				7.60		2.35																9.950	
66	China	Agricultural soils, Panyu district (n=10)	Agriculture	16	0.005	0.008	0.056	0.095	0	0.729	0	0.001				0.001	0.015	0.001	0.005	0.003		0.002	0	0.007		0.928	(Zeng et al. 2008)
67	China	Agricultural soils, Haizhou district (n=4)	Agriculture	16	0.026	0.052	0.585	1.08	0.454	2.75	0	0				0	0.077	0.024	0.052	0.008		0.016	0.008	0.044		5.176	
68	China	Agricultural soils, Tianhe district (n=12)	Agriculture	16	0.006	0.006	0.071	0.121	0.004	0.597	0.007	0.001				0.001	0.035	0.003	0.015	0		0	0.003	0.007		0.877	
69	China	Agricultural soils, Liwan district (n=8)	Agriculture	16	0.025	0.039	0.273	0.323	0.035	4.09	0.009	0				0.009	0.034	0.004	0.007	0.002		0.010	0.015	0.014		4.889	
70	China	Agricultural soils, Baiyun district (n=6)	Agriculture	16	0.009	0.012	0.068	0.089	0.025	0.610	0	0				0.006	0.025	0.005	0.037	0.092		0	0.001	0.027		1.006	
71	China	Roadside soils (n=17)	Urban	16	0.152	0.092	7.15	8.13	0.402	63.2	0.561	0.001				0.003	0.093	0.038	0.064	0.002		0.073	0.026	0.036		80.053	(Zeng et al. 2009)
72	China	Soil from residental areas (n=13)	Urban	16	0.074	0.034	1.59	2.06	0.032	16.1	0.017	0.007				0.025	0.118	0.043	0.004	0.026		0.033	0.008	0.025		20.196	
73	China	Parkland soils (n=7)	Urban	16	0.067	0.036	1.69	2.01	0.047	29.4	0.004	0.008				0.025	0.062	0.018	0.007	0.003		0.009	0	0.014		33.400	
74	China	Agricultural soils from both open and greenhoused -fields (n=78)	Agriculture	16	0.019	0.039	0.637	0.249	0.016	0.669	0.004	0.004				0.028	0.009	0.013	0.097	0.007			0	0.046	0.016	1.853	(Zeng et al. 2020)
75	China	Residential soil (n=11)	Urban	16	0.11759	0.01946	0.94001	2.13107	0.07116	2.95386	0.30139	0.95283	0.03331				3.71906	0	0	0.01395			12.54289	3.9576	0.03093	27.785	(Zhang et al. 2019)
76	China	Residential soil (n=7)	Urban	16	0.13671	0.01083	0.55048	1.66546	0.03208	0.70835	0.02596	0.50638	0.04541				2.72003	0	0	0.0049			2.20679	1.84014	0.00391	10.457	
77	China	Agricultural soil (n=28)	Agriculture	16	0.0964	0.01332	0.44304	1.90148	0.03483	0.3838	0.06273	0.14471	0.01917				2.58417	0	0	0.00689			1.89301	0.70356	0.00673	8.294	
78	China	Agricultural soils (n=13)	Agriculture	6	0.024	0.026		0.045	0.022	0.143	0.036															0.296	(Zhang et al. 2015a)
79	China	Soils from agricultural greenhouse facilities sampled in Spring (n=9)	Agriculture	15	0.219	0.248	0.071	0.462	0.053	0.898	0.05		0.05			0.049	0.042	0.058			0.048		0.096	0.043	0.054	2.441	(Zhang et al. 2015b)
80	China	Soils from agricultural greenhouse facilities sampled in Summer (n=9)	Agriculture	15	0.156	0.556	0.076	0.655	0.059	1.471	0.047		0.05			0.072	0.060	0.038			0.053		0.067	0.090	0.049	3.499	
81	China	Soils from agricultural greenhouse facilities sampled in Autumn (n=9)	Agriculture	15	0.013	0.286	0.046	0.263	0.033	0.995	0.064		0.059			0.056	0.037	0.028			0.048		0.077	0.048	0.093	2.146	
82	China	Soil (n=93) from 'plastic-	Agriculture	16	0.0352	0.0187	0.197	0.144	0.0697	0.181	0.091	0				0	0.0303	0.0669	0	0.0608			0.143	0	0	1.038	(Zhou et al. 2020)

		sheds' (n=31) used to grow vegetables																									
83	Europe	Agricultural soils collected from across the Czech Republic (n=40), collected in 2011, 2013 and 2017. I have noted her the 2011 concentrations.	Agriculture	2				0.47		0.48																0.950	
84	Europe	Agricultural soils collected from across the Czech Republic (n=40), collected in 2011, 2013 and 2017. I have noted her the 2013 concentrations.	Agriculture	2				0.47		0.27																0.740	(Langová et al. 2020)
85	Europe	Agricultural soils collected from across the Czech Republic (n=40), collected in 2011, 2013 and 2017.. I have noted her the 2017 concentrations.	Agriculture	2				0.39		0.38																0.770	
86	Europe	Soils of various vegetations and soil types collected from all over Scotland over three years - Arable (n=17)	Agriculture	1						0.153																0.153	
87	Europe	Soils of various vegetations and soil types collected from all over Scotland over three years - Dry and moist heath (n=38).	Rural	1						0.234																0.234	(Rhind et al. 2013)
88	Europe	Soils of various vegetations and soil types collected from all	Rural	1						0.0949																0.095	

		over Scotland over three years - Improved grassland (n=28)																									
89	Europe	Soils of various vegetations and soil types collected from all over Scotland over three years - Mire and wet heath (n=59).	Rural	1						0.302																0.302	
90	Europe	Soils of various vegetations and soil types collected from all over Scotland over three years - Non-native conifer (n=21).	Rural	1						0.210																0.210	
91	Europe	Soils of various vegetations and soil types collected from all over Scotland over three years - Unimproved grassland (n=20).	Rural	1						0.167																0.167	
92	Europe	Urban soils (n=30)	Urban	6	0.014	0.007		0.072	0.003	0.729	0.005															0.830	(Škrbić et al. 2016)
93	Europe	Forest soil (n=1)	Rural	9	0.00002	0.00144	0.0173	0.0052	0	0.0274	0		0.0082	0												0.060	(Tran et al. 2015)
94	Europe	Rural soil (n=1)	Rural	9	0.001	0.0047	0.0026	0.004	0.00039	0.121	0.0035		0.0033	0.0135												0.154	
95	Europe	Agricultural soil (n=1)	Agriculture	9	0	0.0075	0.0389	0.0096	0.0013	0.242	0		0.0674	0.0402												0.407	
96	Europe	Urban soil (n=2)	Urban	9	0.00125	0.093	0.0215	0.0925	0.0026	0.31	0.0034		0.5	0.065												1.089	
97	Europe	Soil samples from 4 different locations used to grow crops, sampled at three times throughout the year.	Agriculture	2				0.4		0.185																0.585	(Zorníková et al. 2011)
98	Europe	Soil samples from 4 different locations used to grow crops, sampled at three times	Agriculture	2				0.61		0.06833333																0.678	

		throughout the year																									
99	Europe	Soil samples from 4 different locations used to grow crops, sampled at three times throughout the year	Agriculture	2				1.13		0.62																1.750	
100	Europe	Soil samples from 4 different locations used to grow crops, sampled at three times throughout the year	Agriculture	2				0.54		0.075																0.615	
101	India	Soil in vicnity of E-waste dismantling sites (n=5)	Urban	6	0.023	0.028		0.039	0.140	0.614	0.034															0.878	(Chakraborty et al. 2019)
102	India	Soil in vicinity of E-waste shredding sites (n=4)	Urban	6	0.007	0.013		0.029	0.029	0.029	0.011															0.118	
103	India	Soil in vicinity of E-waste precious metal recovery sites (n=5)	Urban	6	0.006	0.010		0.021	0.054	0.044	0.004															0.139	
104	India	Soil near open municial landfill sites (n=11)	Landfill	6	0.005	0.010		0.021	0.023	0.021	0.013															0.093	

Table S3: Limits of detection (LODs) for phthalates from all studies (n=43) of soil occurrence. If method LODs were not available, instrumental LODs were noted instead, if possible to do so. Values are in mg L^{-1} or mg kg^{-1}. nr = not reported, M = method, I = instrumental

Study	LOD Range	Unit	Type	DMP	DEP	DiBP	DnBP	BBP	DEHP	DnOP	DnNP	DiNP	DiDP	DPrP	DMEP	DMPP	DEEP	DnPP	DnHxP	DnHpP	HEHP	DBEP	DCHxP	DPhP
(Chai et al. 2014)	0.002-0.024	mg kg^{-1}	M	nr	0.002	nr	nr	nr	0.024	nr	nr				nr	nr	nr	nr	nr			nr	nr	nr
(Chakraborty et al. 2019)	0.00009-0.00024	mg kg^{-1}	M	0.00016	0.00009		0.00015	0.00024	0.00018	0.00015														
(Chen et al. 2017)	<0.00212	mg kg^{-1}	M	nr	nr	nr	nr		nr															
(Cheng et al. 2015)	0.002-0.022	mg kg^{-1}	nr	0.002	nr	nr	nr	nr	0.022	nr	nr					nr		nr	nr		nr		nr	
(He et al. 2018)	0.00003-0.00014	mg kg^{-1}	nr	nr	nr	nr	nr	nr	nr	nr														
(Hongjun et al. 2013)	0.0002-0.0025	mg kg^{-1}	I	nr	nr	nr	nr	nr	nr	nr	nr			nr				nr	nr					
(Hu et al. 2020)	0.00059-0.0108	mg kg^{-1}	M	0.00141	0.0025	0.00311	0.0047	0.0011	0.0108	0.00074					0.00059	0.00144	0.00119		0.00108		0.00102	0.00084	0.00096	
(Kaewlaoyoong et al. 2018)	0.11-0.13	mg kg^{-1}	M	nr	0.11		nr	nr	0.13	nr														
(Kong et al. 2012)	nr																							
(Langová et al. 2020)	0.00005-0.00011	mg L^{-1}	nr				0.00011		0.00005															
(Li et al. 2006)	0.002-0.0197	mg kg^{-1}	nr	nr	0.002	nr	nr	nr	0.0197	nr														
(Li et al. 2016a)	0.00023–0.0008	mg L^{-1}	I	nr	nr	nr	nr	nr	nr	nr					nr	nr	nr	nr	nr			nr	nr	nr
(Li et al. 2016b)	0.002-0.024	mg kg^{-1}	M	nr	0.002	nr	nr	nr	0.024	nr	nr				nr	nr	nr	nr	nr			nr	nr	nr
(Li et al. 2020)	0.0001-0.0001	mg kg^{-1}	M	0.0001	0.0001		0.0001	0.0001	0.0001	0.0001														
(Liu et al. 2010b)	0.000022-0.000341	mg L^{-1}	nr	nr	nr	nr	nr	nr	nr	nr		nr			nr	nr	nr	nr	nr		nr	nr	nr	
(Liu et al. 2010a)	0.000022-0.000341	mg L^{-1}	nr	nr	nr	nr	nr	nr	nr	nr		nr			nr	nr	nr	nr	nr		nr	nr	nr	
(Ma et al. 2019)	0.00010-0.00035	mg L^{-1}	nr	nr	nr		nr	nr	nr	nr														
(Ma et al. 2020)	0.00010-0.00035	mg L^{-1}	nr	nr	nr		nr	nr	nr	nr														
(Rhind et al. 2013)	0.05	mg kg^{-1}	nr						0.05															
(Škrbić et al. 2016)	nr																							
(Song et al. 2021)	0.0001-0.0006	mg kg^{-1}	I	nr	nr		nr	nr	nr	nr														
(Sun et al. 2016)	0.00005–0.00028	mg kg^{-1}	nr	nr	nr	nr	nr	nr	nr	nr	nr				nr	nr	nr	nr	nr			nr	nr	
(Tao et al. 2020a)	nr																							
(Teng et al. 2015)	0.00001-0.000025	mg kg^{-1}	nr	nr	nr		nr	nr	nr	nr														
(Tran et al. 2015)	0.0000012-0.0000071	mg kg^{-1}	nr	0.0000022	0.0000012	0.0000015	0.0000013	0.0000035	0.0000015	0.0000018		0.0000071	0.0000031											
(Wang et al. 2013a)	0.00010-0.00031	mg L^{-1}	I	nr	nr		nr	nr	nr	nr														
(Wang et al. 2017)	0.00276-0.00684	mg kg^{-1}	M	0.00375	0.00421		0.00276	0.00353	0.00684	0.00411														
(Wang et al. 2015a)	0.02-0.11	mg kg^{-1}	M	0.03	0.04		0.05	0.02	0.08	0.11														
(Wang et al. 2018)	0.0008-0.0089	mg kg^{-1}	M	0.0016	0.0035		0.0008	0.0089	0.0019	0.0014														
(Wang et al. 2015b)	0.006-0.071	mg L^{-1}	I	0.013	0.028		0.071	0.006	0.015	0.011														

(Wang et al. 2013b)	0.0001-0.001	mg kg^{-1}	nr	nr	nr		nr		nr															
(Wei et al. 2020)	0.0001-0.0005	mg kg^{-1}	nr	nr	nr		nr	nr	nr	nr														
(Wu et al. 2015)	0.02-0.04	mg kg^{-1}	nr	0.02	0.03		0.03	0.02	0.04	0.04														
(Xia et al. 2011)	0.000143-0.002857	mg kg^{-1}	M	0.000143	0.000143		0.000286		0.000286	0.002857														
(Xu et al. 2008)	0.01-0.01	mg kg^{-1}	nr				0.01		0.01															
(Zeng et al. 2008)	nr																							
(Zeng et al. 2009)	nr																							
(Zeng et al. 2020)	0.000459-0.00305	mg kg^{-1}	nr	0.000695	0.000499	0.000505	0.000948	0.000736	0.00127	0.00255	0.00305				0.000635	0.000826	0.000668	0.000459	0.00059			0.000832	0.000885	0.00125
(Zhang et al. 2019)	0.00016-0.00165	mg L^{-1}	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr				nr	nr	nr	nr			nr	nr	nr
(Zhang et al. 2015a)	0.00013–0.0021	mg kg^{-1}	M	nr	nr		nr	nr	nr	nr														
(Zhang et al. 2015b)	0.0005-0.00779	mg kg^{-1}	M	0.00251	0.0038	0.00469	0.00187	0.00313	0.00079	0.00137		0.0005			0.00331	0.00434	0.00113			0.00779		0.0022	0.0019	0.00143
(Zhou et al. 2020)	0.0018-0.0078	mg kg^{-1}	nr	0.0045	0.0035	0.002	0.0018	0.0025	0.0078	0.0068	0.0066				0.0022	0.002	0.0038	0.0027	0.0023			0.0032	0.0058	0.0052
(Zorníková et al. 2011)	0.03-0.03	mg kg^{-1}	nr				0.03		0.03															

Table S4: Half-lives of phthalates in soils and amended soils.

Phthalate	Half-life (days)	Media	Initial concentration (mg kg^{-1})	Temperature (ºC)	Soil pH	Study
DEP	0.75	Soil	0.1	20	6.25	(Cartwright et al. 2000)
DEHP	14	Soil	50	30	4	(Chang et al. 2009)
DEHP	6.3	Soil	50	30	7	
DEHP	8.7	Soil	50	30	9	
DnBP	2.8	Amended soil	50	30	7	
DnBP	1.7	Amended soil	50	30	7	
DnBP	2.2	Amended soil	50	30	7	
DnBP	1.9	Amended soil	50	30	7	
DnBP	1.5	Amended soil	50	30	7	
DnBP	2.6	Amended soil	50	30	7	
DnBP	2.8	Amended soil	50	30	7	
DnBP	2.4	Amended soil	50	30	7	
DnBP	3.2	Amended soil	50	30	7	
DnBP	2.8	Amended soil	50	30	7	
DnBP	2.2	Amended soil	50	30	7	
DnBP	3	Amended soil	50	30	7	
DnBP	35	Soil	50	5	7	
DnBP	6.9	Soil	50	15	7	
DnBP	2.8	Soil	50	30	7	
DnBP	5	Soil	50	40	7	
DnBP	5.8	Soil	50	30	4	
DnBP	2.8	Soil	50	30	7	
DnBP	4.6	Soil	50	30	9	
DEHP	6.3	Amended soil	50	30	7	
DEHP	5.3	Amended soil	50	30	7	
DEHP	5.8	Amended soil	50	30	7	
DEHP	5	Amended soil	50	30	7	
DEHP	4.6	Amended soil	50	30	7	
DEHP	6.3	Amended soil	50	30	7	
DEHP	6.3	Amended soil	50	30	7	
DEHP	5.8	Amended soil	50	30	7	
DEHP	6.9	Amended soil	50	30	7	
DEHP	5.8	Amended soil	50	30	7	
DEHP	5	Amended soil	50	30	7	
DEHP	6.3	Amended soil	50	30	7	
DEHP	69	Soil	50	5	7	
DEHP	23	Soil	50	15	7	
DEHP	6.3	Soil	50	30	7	
DEHP	8.7	Soil	50	40	7	
DnBP	0.653	Soil	20	25	8.33	(Cheng et al. 2018)
DnBP	0.338	Soil	20	25	8.33	
DnBP	0.315	Soil	20	25	8.33	
DnBP	0.872	Soil	2	25	8.33	
DnBP	0.459	Soil	10	25	8.33	
DnBP	0.338	Soil	20	25	8.33	
DnBP	0.946	Soil	2	25	5.15	
DnBP	0.983	Soil	10	25	5.15	
DnBP	1.2	Soil	20	25	5.15	
DnBP	1.41	Soil	20	5	8.33	
DnBP	0.754	Soil	20	15	8.33	
DnBP	0.338	Soil	20	25	8.33	
DnBP	0.286	Soil	20	35	8.33	
DnBP	20.4	Soil	20	25	5.15	
DnBP	1.2	Soil	20	25	5.15	
DnBP	0.918	Soil	20	25	5.15	
DnBP	4.6	Soil	20	5	5.15	
DnBP	2.79	Soil	20	15	5.15	
DnBP	1.2	Soil	20	25	5.15	

DnBP	0.87	Soil	20	35	5.15	
DnBP	1.37	Soil	20	25	5.22	(Cheng et al. 2019)
DnBP	1.23	Soil	20	25	5.15	
DnBP	4.99	Soil	20	25	4.38	
DnBP	0.82	Soil	20	25	7.24	
DnBP	0.721	Soil	20	25	8.44	
DnBP	0.768	Soil	20	25	8.48	
DnBP	0.513	Soil	20	25	8.33	
DnBP	0.594	Soil	20	25	8.58	
DnBP	0.503	Soil	20	25	8.33	
DnBP	2.2	Soil	20	25	5.5	
DnBP	1.67	Soil	20	25	5.29	
DnBP	1.04	Soil	20	25	5.23	
DnBP	0.43	Soil	20	25	7.6	
DnBP	0.725	Soil	20	25	7.06	
DnBP	1.3	Soil	20	25	4.68	
DnBP	0.941	Soil	20	25	6.33	
DnBP	0.985	Soil	20	25	8.35	
DnBP	0.739	Soil	20	25	6.98	
DnBP	2.2	Soil	20	25	5.5	
DnBP	0.514	Soil	20	25	7.9	
DEP	3.3	Soil	0.5	23	8.1	(Hurtado et al. 2017)
DEP	9.7	Sterile soil	0.5	23	8.1	
DMP	2.29	Amended soil	100	25	7.2	(Jianlong et al. 2004)
DEP	3.7	Amended soil	100	25	7.2	
DnBP	8.53	Amended soil	100	25	7.2	
DEHP	28.4	Amended soil	100	25	7.2	
DnBP	8.5	Soil	5	30	6.5	(Liao 2010)
DnBP	7.87	Soil	5	30	7	
DnBP	8.31	Soil	5	30	7.5	
DnBP	8.74	Soil	5	30	8	
DnBP	8.82	Soil	5	25	6.8	
DnBP	7.87	Soil	5	30	6.8	
DnBP	11.01	Soil	5	35	6.8	
DnBP	7.95	Soil	5	40	6.8	
DEHP	158	Soil	1.6	5	5.9	(Madsen et al. 1999)
DEHP	86	Soil	1.6	10	5.9	
DEHP	52	Soil	1.6	20	5.9	
DEHP	301	Amended soil	1.6	5	5.9	
DEHP	125	Amended soil	1.6	10	5.9	
DEHP	55	Amended soil	1.6	20	5.9	
DEHP	79	Amended soil	1.6	20	5.9	
DEHP	86	Amended soil	3.2	20	5.9	
DEHP	89	Amended soil	9.9	20	5.9	
DEHP	77	Amended soil	35.1	20	5.9	
DEHP	20	Soil	1	13.3	7.6	(Rüdel et al. 1993)
DEHP	31	Soil	1	14.1	7.6	
DEHP	68	Soil	1	13.3	6.9	
DEHP	170	Soil	1	12.8	6.9	
DnBP	3.36	Amended soil	20	nr	7.785	(Tao et al. 2020b)
DnBP	11.65	Soil	20	nr	7.785	
DEHP	64	Soil	nr	nr	nr	(Tran et al. 2015)
DnBP	14.68	Soil	0	28	8	(Xie et al. 2010)
DnBP	30.88	Soil	1	28	8	
DnBP	19.58	Soil	10	28	8	
DnBP	31.31	Soil	30	28	8	
DEP	3.47	Soil	0	28	8	
DEP	10.19	Soil	1	28	8	
DEP	9.39	Soil	10	28	8	
DEP	19.33	Soil	30	28	8	
DMP	3.79	Soil	0	28	8	
DMP	7.02	Soil	1	28	8	

DMP	9.13	Soil	10	28	8	
DMP	15.68	Soil	30	28	8	
DnOP	78.84	Soil	0	28	8	
DnOP	61.14	Soil	1	28	8	
DnOP	51.65	Soil	10	28	8	
DnOP	115.22	Soil	30	28	8	
DnBP	7.8	Soil	20	25	7.12	(Xu et al. 2008)
DnBP	8.3	Soil	20	25	7.3	
DEHP	26.3	Soil	20	25	7.12	
DEHP	30.8	Soil	20	25	7.3	
DnBP	1.6	Amended soil	100	30	7	(Yuan et al. 2011)
DnBP	1.2	Amended soil	100	30	7	
DnBP	1.4	Amended soil	100	30	7	
DnBP	1	Amended soil	100	30	7	
DnBP	1.8	Amended soil	100	30	7	
DnBP	2.6	Amended soil	100	30	7	
DEHP	8.7	Amended soil	100	30	7	
DEHP	6.3	Amended soil	100	30	7	
DEHP	6.9	Amended soil	100	30	7	
DEHP	5.8	Amended soil	100	30	7	
DEHP	6.9	Amended soil	100	30	7	
DEHP	9.9	Amended soil	100	30	7	
DnBP	1.4	Soil	nr	nr	nr	(Zhou et al. 2005)
DnBP	4	Soil	nr	nr	nr	

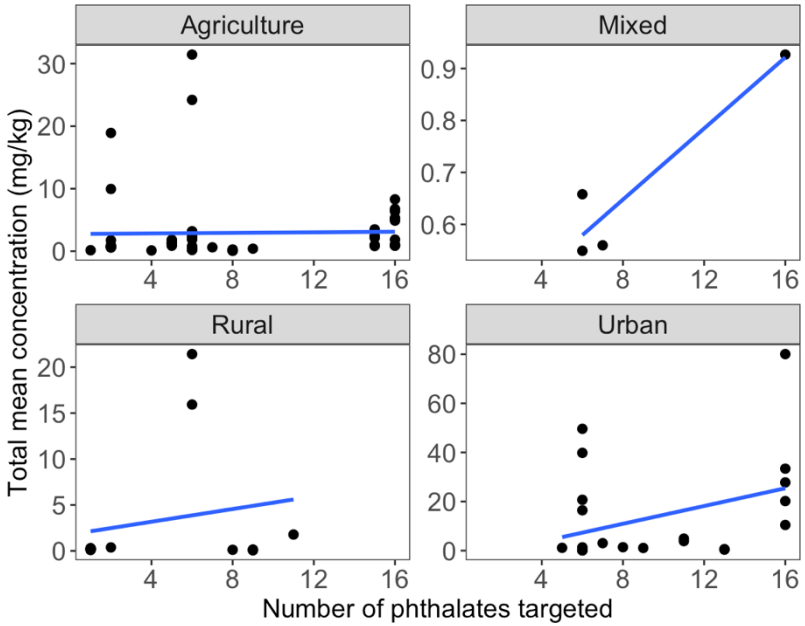


Figure S1: Relationship between analytical breadth (number of phthalates target) and total measured phthalate concentration (data for landfill studies not shown due to insufficient data points). Each data point represents the total mean phthalate concentration reported for a distinct sampling group within a study.

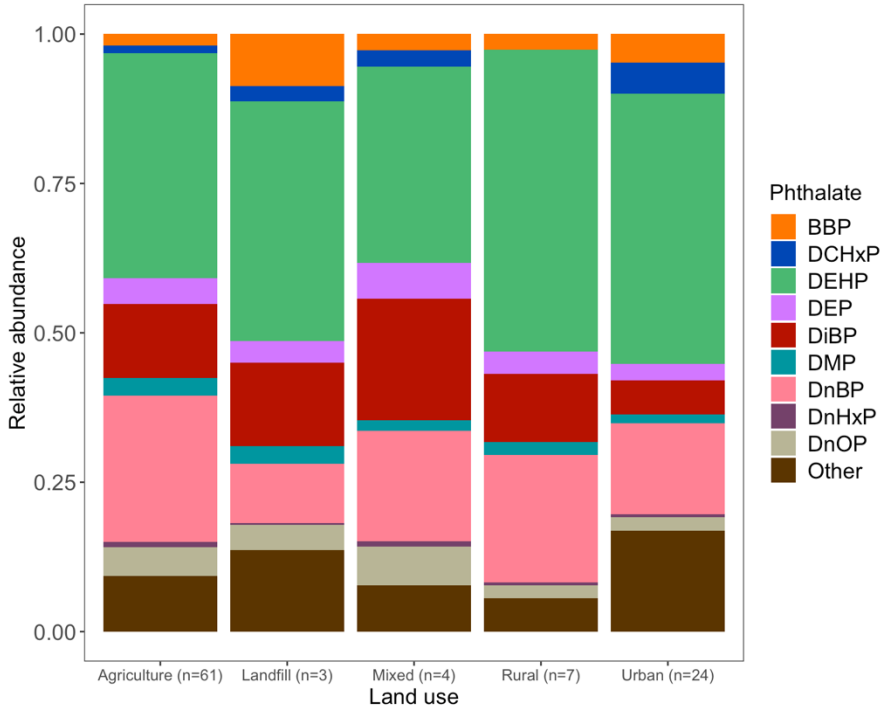


Figure S2: Average phthalate profiles in soils of different land uses. n refers to number of sampling groups of that land use. The 6 sampling groups extracted for one study (Rhind et al. 2013) only targeted 1 phthalate so could not provide any relative abundance information, so were removed from the dataset before calculation All other sampling groups targeted at least 2 phthalates. The data was produced by calculating the relative abundance value for each phthalate targeted within a sampling group (nd=0). These were then used to calculate the mean relative abundance for each phthalate for each land use, which were used give a mean relative abundance profile for each land use.

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