SUPPORTING INFORMATION FOR ABDALLAH ET AL, 2013

ORGANOPHOSPHATE FLAME RETARDANTS IN INDOOR DUST FROM EGYPT; IMPLICATIONS FOR HUMAN EXPOSURE

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8 pages, 4 tables.

Table SI-1: Characteristics of the sampled microenvironments.

House no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ventilation	AC	N	AC	N	N	AC	AC	AC	N	AC	N	N	N	AC	AC	N	AC	N	N	AC
No. of electronics	5	3	4	2	3	4	6	4	4	5	3	3	5	7	5	4	5	5	4	6
No. of Foam furniture	7	14	10	12	8	10	15	11	8	10	7	12	14	9	10	8	12	10	9	11
Carpeted	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of Construction	1987	1992	1983	1986	2002	2004	1985	1982	1994	1997	1985	1985	1985	2001	1997	1986	1983	1994	1986	2001
Office no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ventilation	AC	AC	AC	N	AC	AC	N	N	AC	AC	AC	AC	N	AC	N	AC	AC	N	AC	AC
No. of electronics	7	5	5	8	6	5	3	5	9	7	11	6	5	7	4	14	8	6	9	8
No. of Foam furniture	14	11	6	8	8	12	9	11	6	15	10	11	8	6	9	11	4	8	7	10
Carpeted	Yes	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	No
Year of Construction	1991	1995	1991	1987	1982	1984	1986	1984	1991	1993	1986	1988	1993	1991	1988	1992	1991	1986	1984	1992

Car no.	1	2	3	4	5	6	7	8	9	10
Manufacturer	Toyota	Hyundai	Hyundai	Mitsubishi	KIA	Hyundai	Renault	Mitsubishi	Nisan	FIAT
Year	2006	2008	2009	2005	2008	2010	2012	2005	2009	1988
Ventilation	AC	AC	AC	AC	AC	AC	AC	AC	AC	N
Seat cover	Fabric	Fabric	Leather	Fabric	Fabric	Fabric	Fabric	Leather	Fabric	Fabric
Car no.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Manufacturer	OPEL	FIAT	FIAT	KIA	Hyundai	OPEL	Renault	Mitsubishi	Lada	Chevrolet
Year	1998	1986	2009	2010	1999	2006	2011	2008	1998	2006
Ventilation	AC	N	AC	AC	N	AC	AC	AC	N	AC
Seat cover	Leather	Fabric	Fabric	Fabric	Fabric	Fabric	Fabric	Leather	Fabric	Fabric

Table SI-1 (continued): Characteristics of the sampled microenvironments.

PMEs	Coffee Shop1	Coffee Shop2	Coffee Shop3	Coffee Shop4	Rest-aurant1	Rest-aurant2	Rest-aurant3	Res-taurant4	Super-market1	Super-market2	Super-market3
Ventilation	AC	N	N	N	AC	AC	AC	N	AC	N	AC
No. of electronics	9	14	19	12	12	9	9	6	18	16	14
No. of Foam furniture	24	6	18	16	22	32	26	4	4	1	2
Carpeted	Yes	No	No	Yes	No	No	No	No	No	No	No
Year of Construction	2008	2012	2006	2010	2004	2000	2002	2011	2006	2000	1996

Sample Extraction:

The method is largely based on the recent method described by Van den Eede et al[1]. In detail, a sample aliquot (~50 mg) was accurately weighed and spiked with 50 ng IS (TCEP-d_{12}, TBOEP-d_6, TDCPP-d_{15}, TPHP-d_{15} and TAP). Samples were extracted using 2 mL Hex-Ac (3:1 v/v) by a combination of vortexing and ultrasonic extraction (2 × 1 min vortex and 5 min ultrasonic extraction) which was repeated three times. After each extraction cycle, dust extracts were centrifuged at 3500 rpm for 2 min and supernatants were collected and transferred into clean glass tubes. The pooled supernatants were evaporated until dryness under a gentle nitrogen flow and redissolved in 1 mL Hex.

Prior to fractionation, Florisil® cartridges were conditioned with 6 mL of Hex. The extracts were quantitatively transferred and fractionation was achieved by eluting with 8 mL of Hex (F1) followed by 10 mL of EA (F2). The EA eluate (F2) was evaporated until dryness and resolubilized in 80 µl of isooctane containing 200 pg µl-1 of BDE-77 used as a recovery determination standard (RDS).

Instrumental Analysis:

GC-EI/MS analysis of PFRs in F2 was performed using a FOCUS GC coupled to a DSQII mass spectrometer (Thermo Fisher Scientific, Austin, TX, USA) operated in electron ionization (EI) mode according to the method previously described[1]. Separation of target analytes was performed on Agilent DB-5 capillary column (30m x 0.25mm; 0.25µm) using helium as the carrier gas. One µL of purified extract was injected using cold splitless injection. The injection temperature was set at 90 °C, hold 0.03 min, ramp 700 °C/min to 290 °C. Injection was performed using a pressure of1 bar until 1.25 min and purge flow to split vent of 50 mL/min after 1.25 min. The GC temperature program was 90 °C, hold 1.25 min, ramp 10 °C/min to 240 °C, ramp 20 °C/min to 310 °C, hold 16 min. Helium was used as a carrier gas with a flow rate of 1.0 mL/min. The mass spectrometer was run in selected ion monitoring (SIM) mode. Dwell times ranged between 20 and 30 ms in different acquisition windows. The ion source, quadrupole and interface temperatures were set at 230, 150 and 300 °C, respectively, and the electron multiplier voltage was at 2200 V.

Table SI-2: Selected analytical characteristics of the applied method.

PFR	Chemical name	Identification/ Quantification Ions	Internal Standard	Blank levels (ng)		LOQ (ng)
				Median	Range	
TPHP	Triphenyl phosphate	325/ 326	TPHP-d_{15}	1	0 - 4	9
EHDPP	2-Ethyl hexyl diphenyl phosphate	250/ 251	TPHP-d_{15}	0	0	2
TCEP	Tris-(2-chloroethyl)-phosphate	251/249	TCEP-d_{12}	3	0 - 6	8
TCIPP	Tris-(2-chloroisopropyl) phosphate	279/277	TCEP-d_{12}	5	3 - 8	15
TDCPP	Tris-(2,3-dichloropropyl)-phosphate	379/381	TDCPP-d_{15}	3	0 - 6	9
TBOEP	Tri-(2-butoxyethyl)-phosphate	199/299	TBOEP-d_6	0	0 - 1	3
TnBP	Tri-n-butyl-phosphate	155/211	TAP	4	3 - 7	10
TiBP	Tri-iso-butyl-phosphate	155/211	TAP	7	5 - 11	17

Table SI-3: Concentration (ng/g) of target PFRs in NIST SRM 2585 from this and other studies.

	This study (n=5)	Bergh et al[2] (n=5)	Van den Eede et al[3] (n=11)	Brandsma et al[4] (interlab study)
TPHP	970 ± 50	1100 ± 100	990 ± 70	1104
EHDPP	880 ± 20	1000 ± 120	nm ± nm	963
TCEP	720 ± 50	730 ± 60	700 ± 170	792
TCIPP	750 ± 120	880 ± 140	820 ± 100	844
TDCPP	1900 ± 110	2300 ± 280	2020 ± 260	1556
TBOEP	75000 ± 4200	73000 ± 6500	79000 ± 9600	73464
TnBP	170 ± 20	190 ± 20	180 ± 20	269
TiBP	<LOQ	<LOQ	<LOQ	<LOQ

Table SI-4: International comparison of concentrations (µg g^{-1}) of target PFRs in indoor dust from different types of microenvironments.

Microenvironment	Country	TPHP	EHDPP	TCEP	TCIPP	TDCPP	TBOEP	TnBP	TiBP
Houses	**Egypt (n=20)**	**0.10**	**0.05**	**0.05**	**0.05**	**0.15**	**0.09**	**0.02**	**0.03**
	Belgium (n=33)[3]	2.02	nm*	0.49	4.82	0.57	6.58	0.25	4.2
	Spain (n=8)[5]	2.6	nm	1.7	3.9	0.35	9.9	0.25	0.21
	Boston, USA (n=50)[6]	7.36	nm	nm	0.57	1.89	nm	nm	nm
	California, USA (n=16)[7]	2.8	0.56	2.7	2.2	2.1	11	<0.08	<0.08
	Germany (n=6)[8]	0.38	nm	0.2	0.74	<0.08	0.73	0.13	nm
	Sweden (n=10)[9]	1.6	0.6	7.6	3.1	12	8.5	0.6	1.4
	Japan (n=41)[10]	5.4	nm	7.5	18.7	4	1570	1.4	nm
	NewZealand (n=34)[11]	0.6	nm	0.11	0.35	0.23	4.02	0.08	nm
	Kuwait (n=15)[12]	1.1	0.93	0.76	1.9	0.53	10.7	0.01	0.11
	Pakistan (n=15)[12]	0.15	0.09	0.04	0.02	0.033	0.028	0.01	0.02
	Phillipines (n=34)[13]	0.08	0.07	0.02	nm	nm	nm	0.02	nm
Offices	**Egypt (n=20)**	**0.09**	**0.04**	**0.05**	**0.12**	**0.10**	**0.49**	**0.03**	**0.03**
	Belgium (n=15)[3]	4.7	nm	1.17	5.16	4.61	11.8	0.63	1.45
	Germany (n=10)[8]	2.5	nm	0.12	3	0.15	7	0.22	nm
	Sweden (n=10)[9]	8.8	15	36	32	30	250	0.7	2.4
Cars	**Egypt (n=20)**	**0.39**	**0.07**	**0.20**	**0.51**	**0.09**	**0.28**	**0.07**	**0.05**
	Spain (n=2)[14]	1.3	nm	20.1	9.3	10	25.8	0.07	0.36
	Germany (n=12)[8]	3	nm	0.95	3.1	130	21	0.11	nm
	Kuwait (n=15)[12]	2.2	0.87	3.5	35.9	35.8	5.3	0.08	0.79
	Pakistan (n=15)[12]	0.67	0.07	0.26	0.59	0.13	0.13	<0.08	0.04
PMEs	**Egypt (n=11)**	**0.96**	**0.05**	**0.28**	**0.23**	**0.60**	**0.31**	**0.11**	**0.14**

*** not measured.**

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