Supporting Information for

Phthalate Esters in Indoor Window Films in a Northeastern Chinese Urban Center: Film Growth and Implications for Human Exposure

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S1.Supplementary Tables

Table S1. The results of QA/QC (mean ± standard deviation) in the present study.

	$DMP\text{-}D_4$	$DEP\text{-}D_4$	$DiBP\text{-}D_4$	$DBP\text{-}D_4$	$BBP\text{-}D_4$	$DEHP\text{-}D_4$
Recoveries in method blank (n = 16) [a]	70 ± 11%	70 ± 12%	71 ± 8.4%	74 ± 9.1%	84 ± 7.1%	74 ± 5.0%
Recoveries in method spiked (n = 16) [a]	71 ± 9.2%	71 ± 10%	73 ± 7.7%	74 ± 7.5%	86 ± 8.4%	77 ± 5.9%
Recoveries in film samples (n = 64) [a]	70 ± 5.9%	75 ± 5.2%	76 ± 4.3%	79 ± 5.0%	85 ± 8.5%	81 ± 8.7%
	DMP	DEP	DiBP	DBP	BBP	DEHP
Values in method blanks (n = 16) [b, c]	27 ± 6.0 ng/m^2	5.0 ± 2.2 ng/m^2	42 ± 19 ng/m^2	57 ± 11 ng/m^2	2.0 ± 2.0 ng/m^2	57 ± 12 ng/m^2
MDLs [d]	43 ng/m^2	11 ng/m^2	99 ng/m^2	90 ng/m^2	8.0 ng/m^2	93 ng/m^2
Recoveries in method spiked (n = 16) [c,e]	116 ± 11%	108 ± 13%	113 ± 10%	116 ± 7.8%	96 ± 7.5%	114 ± 11%
Values in film samples before corrected by blank (n = 64) [c]	230 ± 130 ng/m^2	29 ± 14 ng/m^2	520 ± 290 ng/m^2	1700 ± 840 ng/m^2	57 ± 67 ng/m^2	6900 ± 5900 ng/m^2
Values in film samples after corrected by blank (n = 64) [c,f]	170 ± 120 ng/m^2	19 ± 14 ng/m^2	410 ± 300 ng/m^2	1500 ± 840 ng/m^2	52 ± 66 ng/m^2	6800 ± 5900 ng/m^2

[a] : The mass of each PAE-D4 that was loaded was 100 ng.
[b] : Values in method blanks were divided by the sampling area of window for each of batch of real samples.
[c] : All results adjusted by dividing by the recoveries of deuterated spikes.
[d] : The method detection limits (MDLs) was calculated by the mean blank values plus three times the standard deviation.
[e] : The mass of each PAE that was loaded was 500 ng.
[f] : Concentrations of each PAE were subtracted from the mean blank values of each batch of two blank samples.

Table S2. The converted median concentrations of DiBP, DBP and DEHP (in ng/m^3 air) in indoor air in this study and monitoring data from various studies around the world

Country	Year	DiBP	DBP	DEHP	References
China	2014	280	660	200	This study
China	2015	350	1600	140	This study
USA	2014-2015	na [a]	na [a]	300	Bi et al., 2015[1]
China	2013	na [a]	1100	1100	Song et al., 2015[2]
China	2011-2012	na [a]	1939	2437	Pei et al., 2013[3]
Sweden	na [a]	270 [b]	850 [b]	200 [b]	Bergh et al., 2011[4]
Sweden	na [a]	190 [c]	600 [c]	240 [c]	Bergh et al., 2011[4]
Sweden	na [a]	230 [d]	550 [d]	100 [d]	Bergh et al., 2011[4]
USA	2006	130	140	68	Rudel et al., 2010[5]
Japan	2006-2007	75	200	147	Kanazawa et al., 2010 [6]
Germany	2000-2001	na [a]	1083	156	Fromme et al., 2004[7]
USA	1999-2001	61	220	77	Rudel et al., 2003[8]

na [a]: not available.
[b]: Samples collected at private homes.
[c]: Samples collected at workplaces.
[d]: Samples collected at day care centers.

Table S3. Parameters for the equations to calculate the daily exposure dose (DED) for DiBP, DBP and DEHP via indoor air inhalation (DED_{air}), film ingestion ($DED_{film\text{-}i}$) film dermal absorption ($DED_{film\text{-}da}$) for teenagers and adults[9]

Category	Units	Teenagers (Age: 12-19 [9, 10])	Adults (Age ≥ 20 [9, 10])
IR	m^3/day	14	13.3
BW	kg	52 [9, 10]	62.9[11]
BSA[9]	cm^2	3692	4615
FAS [9]	mg/cm/day	0.096	0.096
AF [9, 12]	-	0.03	0.03
IEF [9, 13]	-	0.875	0.875
DIR [9, 10]	(g/day)	0.05	0.05

Table S4. Summery of PAE concentrations (in μg/g film) in the glass window film samples in winter and summer.

	Winter			Summer		
	25^{th}-75^{th} percentile	Geo. Mean	Median	25^{th}-75^{th} percentile	Geo. Mean	Median
DMP	23-48	23	27	9.5-29	18	12
DEP	2.2-5.9	2.1	2.4	1.2-3.0	2.0	1.7
DiBP	60-170	110	110	23-41	32	32
DBP	220-460	320	320	120-270	170	180
BBP	6.0-18	11	12	2.6-4.7	3.2	3.6
DEHP	990-2200	1700	1500	340-630	460	440
Σ_6PAEs	1300-2800	2200	2000	510-850	700	650

Table S5. Summary of the median and 25^{th}–75^{th} percentile values for DED_{air} (in μg/kg-bw/day), DED_{film-i} (in μg/kg-bw/day), $DED_{film-da}$ (in μg/kg-bw/day), DED_t (in μg/kg-bw/day) and HQ for the summer and winter samples.

	Season	DiBP	DBP	DEHP	Total	DiBP	DBP	DEHP	Total
		Teenagers				Adults			
DED_{air}	winter	0.065 (0.031-0.11)	0.16 (0.089-0.43)	0.066 (0.058-0.11)	0.34 (0.18-0.65)	0.051 (0.024-0.089)	0.12 (0.07-0.34)	0.052 (0.045-0.086)	0.27 (0.14-0.51)
DED_{air}	summer	0.083 (0.051-0.094)	0.38 (0.27-0.67)	0.032 (0.024-0.039)	0.49 (0.35-0.79)	0.065 (0.040-0.074)	0.30 (0.22-0.53)	0.025 (0.019-0.031)	0.38 (0.28-0.62)
DED_{film-i}	winter	0.095 (0.051-0.15)	0.27 (0.18-0.38)	1.2 (0.83-1.9)	1.7 (1.0-2.4)	0.079 (0.042-0.12)	0.23 (0.15-0.32)	1.0 (0.70-1.5)	1.4 (0.87-1.9)
DED_{film-i}	summer	0.027 (0.019-0.034)	0.15 (0.10-0.22)	0.37 (0.29-0.53)	0.54 (0.41-0.69)	0.022 (0.016-0.028)	0.13 (0.085-0.19)	0.31 (0.24-0.44)	0.45 (0.34-0.57)
$DED_{film-da}$	winter	0.020 (0.011-0.031)	0.058 (0.039-0.081)	0.26 (0.18-0.39)	0.35 (0.22-0.50)	0.021 (0.011-0.032)	0.060. (0.040-0.084)	0.27 (0.18-0.41)	0.37 (0.23-0.52)
$DED_{film-da}$	summer	0.006 (0.004-0.007)	0.033 (0.022-0.048)	0.078 (0.061-0.11)	0.12 (0.087-0.15)	0.006 (0.004-0.008)	0.034 (0.023-0.049)	0.081 (0.063-0.12	0.12 (0.090-0.15)
DED_t	winter	0.19 (0.13-0.28)	0.55 (0.32- 0.87)	1.6 (1.1-2.3)	2.3 (1.7-3.3)	0.16 (0.11-0.23)	0.46 (0.27-0.72)	1.4 (0.92-2.0)	2.0 (1.5-2.8)
DED_t	summer	0.11 (0.09-0.12)	0.62 (0.43-0.96)	0.50 (0.37-0.70)	1.3 (0.91-1.56)	0.087 (0.074-0.10)	0.49 (0.35-0.77)	0.42 (0.32-0.60)	1.1 (0.76-1.3)
HQ	winter	0.019 (0.013-0.028)	0.055 (0.031-0.087)	0.031 (0.021-0.047)	0.11 (0.068-0.17)	0.016 (0.011-0.023)	0.046 (0.027-0.072)	0.027 (0.018-0.040)	0.095 (0.058-0.14)
HQ	summer	0.011 (0.009-0.012)	0.062 (0.043-0.096)	0.010 (0.008-0.014)	0.087 (0.061-0.12)	0.008 (0.007-0.010)	0.044 (0.035-0.74)	0.008 (0.006-0.012)	0.071 (0.049-0.094)

S2.Supplementary Figures

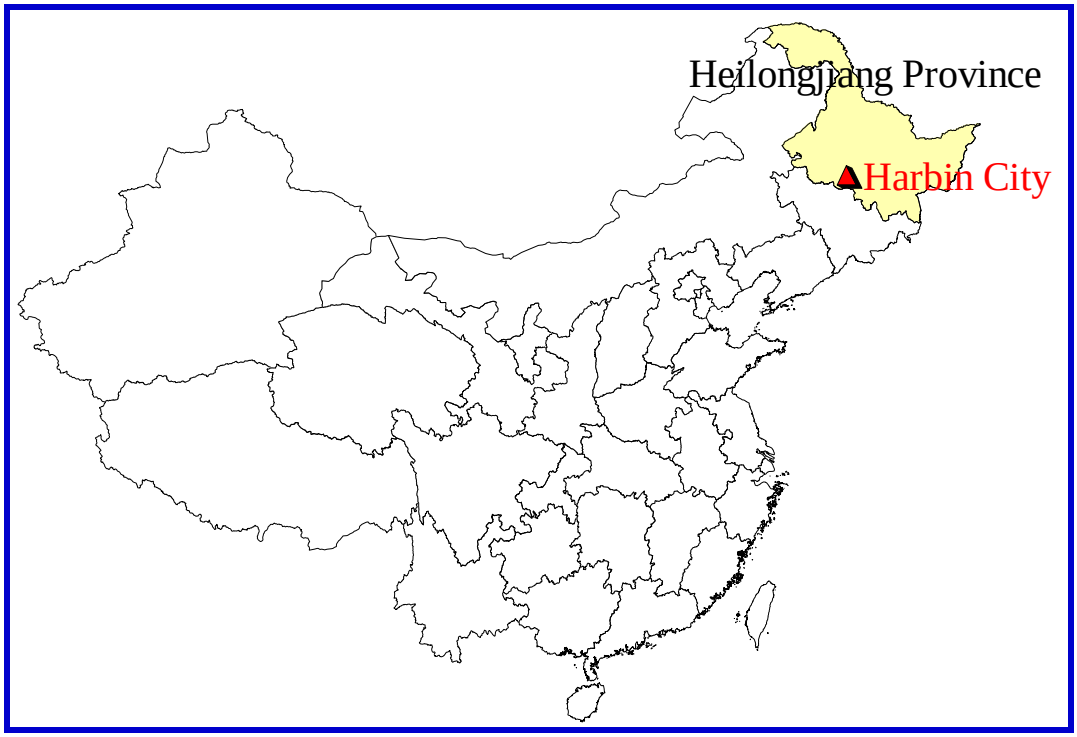


Figure S1. The location of sampling sites in Harbin City, Heilongjiang Province, China.

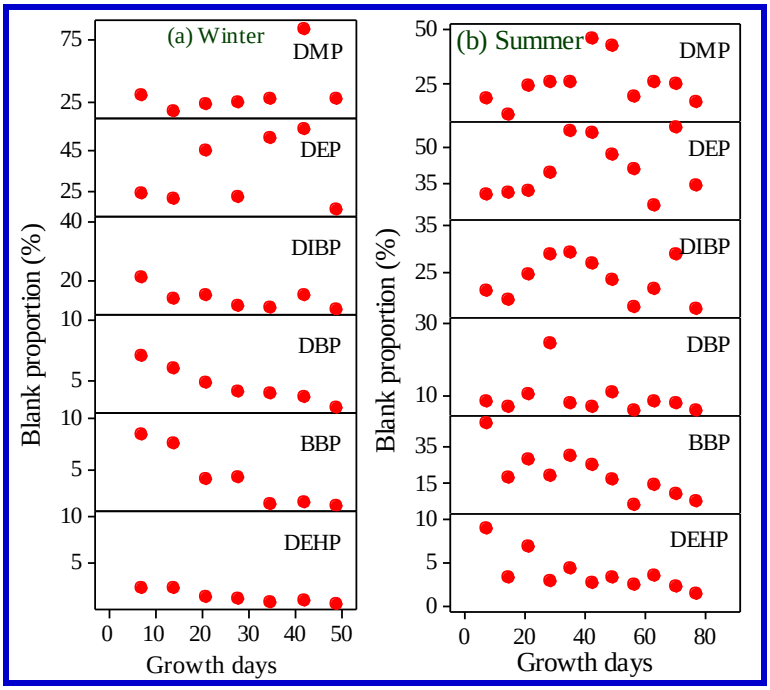


Figure S2. Blank proportion (%) over time calculated by dividing the mean blank values by the values detected in film samples collected over time.

Proportions of PAEs in the blank samples over time suggested that, in general, the precision of DBP, DiBP, BBP and DEHP increased along with the sampling time (see Figure S2). The levels of DBP, DiBP, BBP and DEHP in blanks were generally less than 30% of the levels in film samples. The precision of DEP and DMP was not as good as the other four PAEs. The PAE concentrations in each batch of samples were firstly subtracted from the mean blank values of the corresponding batch of samples. If the subtracted concentrations were lower than three times the standard deviation of the blank values, the PAE concentrations in the films were then treated as 1/2 of MDLs. That is, the concentrations below mean blank values plus three times the standard deviation (MDLs) were treated as half the value of MDLs for statistical analysis.

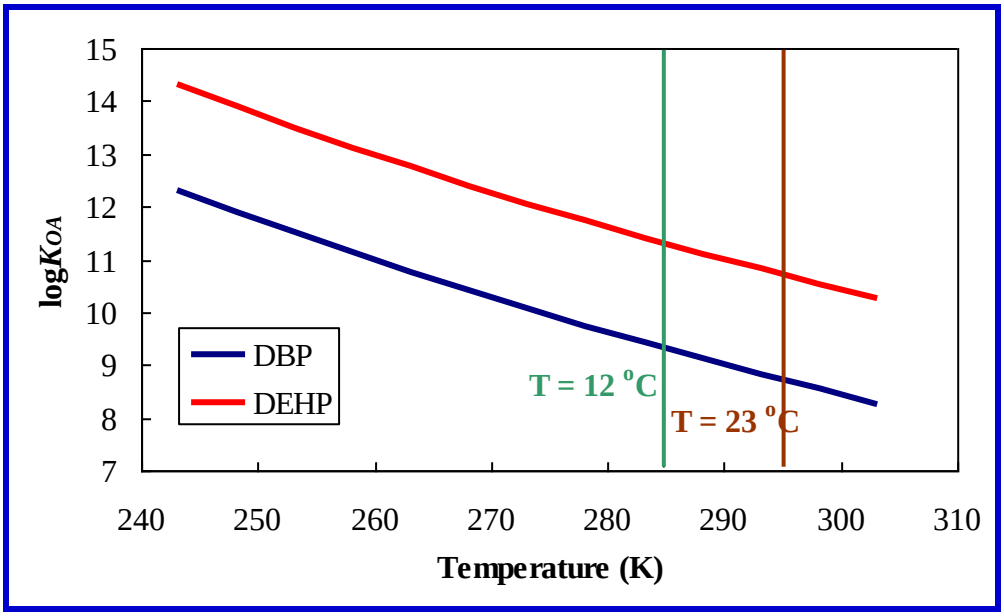
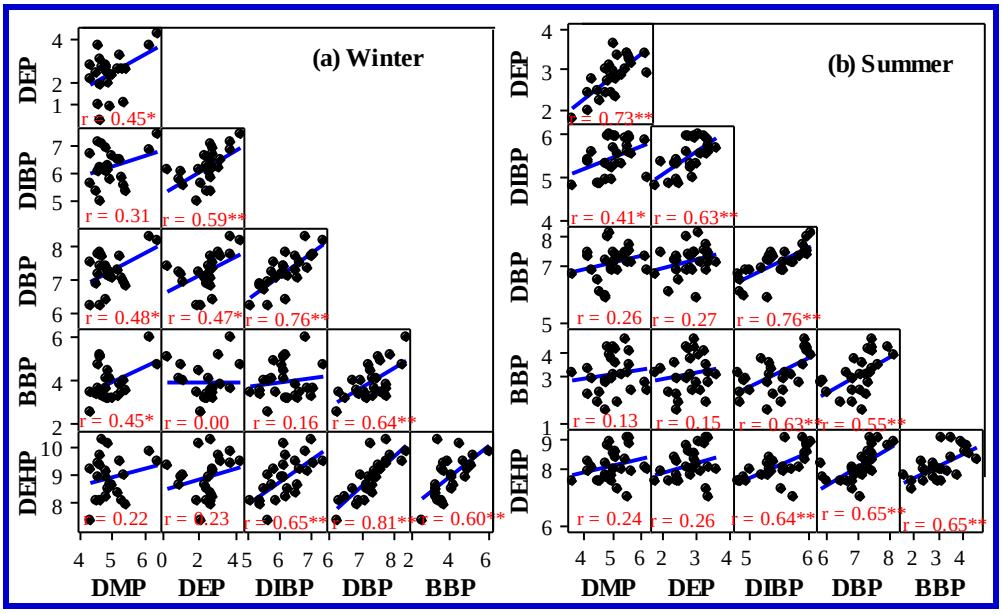


Figure S3. $LogK_{OA}$ as functions of temperature.



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112 **Figure S4**. Correlation analysis of natural logarithm PAE concentrations (in ng/m^2) in

113 window film samples collected in winter (a) and summer (b).

114 The correlation coefficients are given in red color in the scatterplot matrices. One star

115 (*) and two stars (**) mean correlation is significant at the 0.05 and 0.01 level

116 (2-tailed), repectively.

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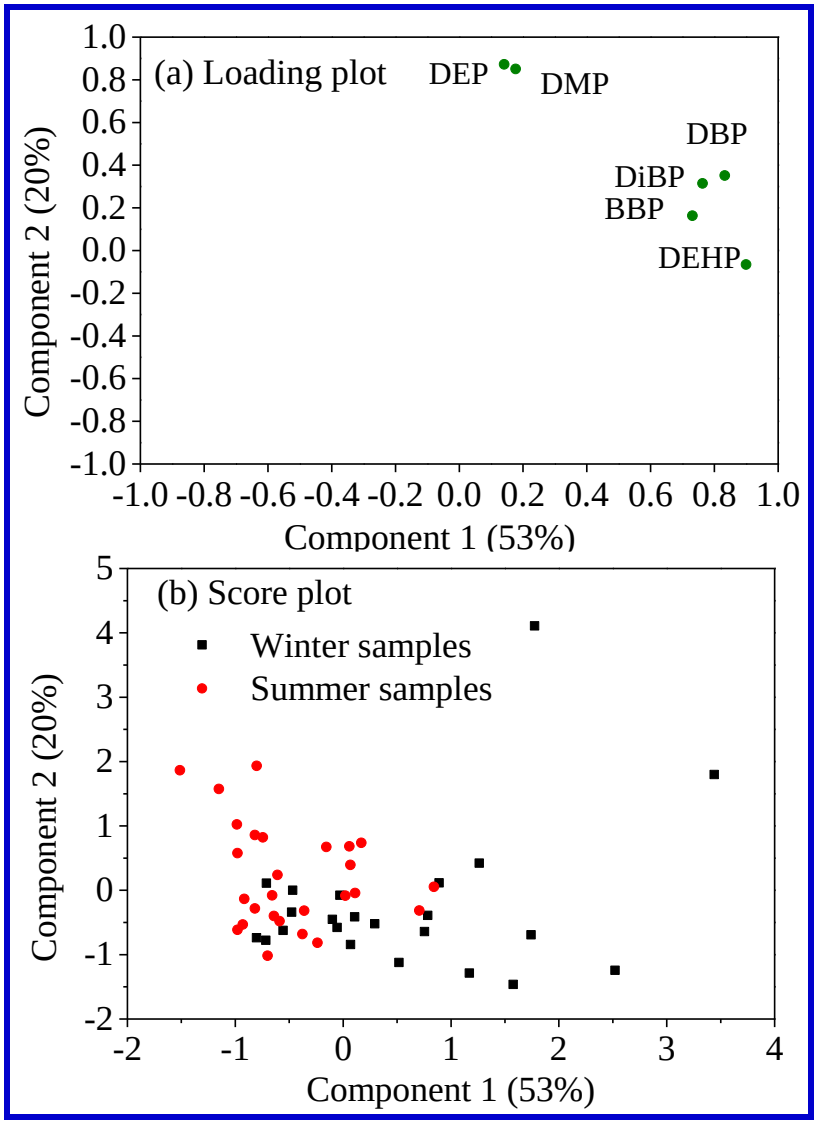

Figure S5. Loading plots (a) and score plots (b) of PCA for PAEs in the window film samples. For the abbreviation in the score plots, W means winter samples; S means summer samples.

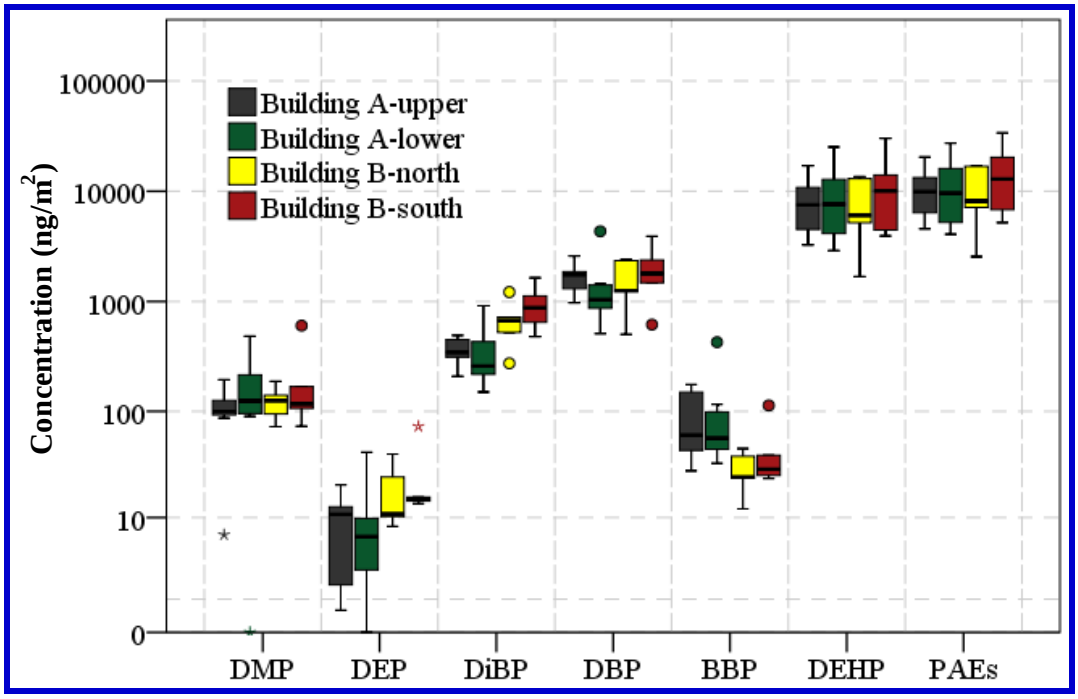

Figure S6. Comparison of PAE concentrations (ng/m^2) in the building A and B with different sampling methods.

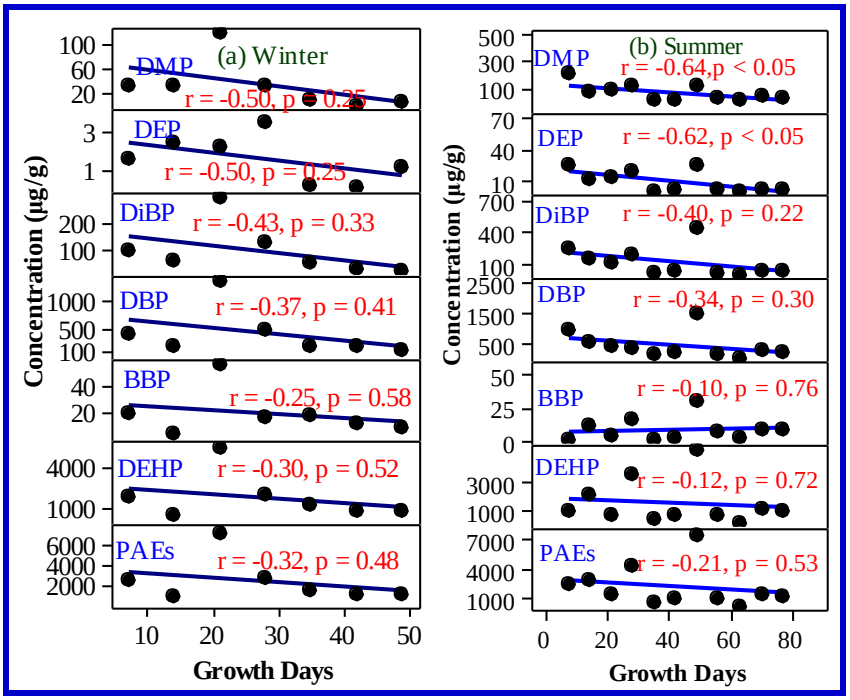

Figure S7. The PAE concentrations (in µg/g) in the glass window films as a function of growth days in winter (a) and summer (b).

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