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Wan Y, Diamond ML, Siegel JA. 2022. Quantitative filter forensics for semi-volatile organic compounds (SVOCs) in social housing apartments *Indoor Air*, **32(2)**, e12994. DOI: 10.1111/ina.12994

Abstract

Flame retardants and phthalates are commonly used in consumer products and building materials, and as such, are prevalent in indoor air. Polycyclic aromatic hydrocarbons (PAHs) can have both indoor and outdoor sources and can also be found in indoor air. Flame retardants, phthalates and PAHs were measured in indoor air in 71 units in low-income social housing multi-unit residential buildings (MURBs) using silicone rubber (polydimethylsiloxane or PDMS) passive air samplers deployed for 1 week in Toronto, Canada, in late spring and winter of 2017. Tris(1,3-dichloro-2-propyl) phosphate (TDCiPP), diethyl phthalate (DEP) and phenanthrene were the dominate flame retardant, phthalate and PAH, with median concentrations of 1640 pg/m^3, 1840 and 79.0 ng/m^3, respectively. Flame retardant and phthalate concentrations were 2 to 18 times higher than those in predominantly detached and semi-detached houses in Toronto measured using the same passive samplers. These results indicate higher exposures among residents of low-income social housing (63% with income < $23,400) than those of higher socio-economic status single-family dwellings (67% with income > $100,000).

Main findings

- Quantitative filter forensics (QFF) was used to quantitatively estimate indoor particle-bound SVOCs
- Phthalates (e.g., $DEHP_{Median}$ = 141 ng/m^3) and PAHs (e.g., $Phenanthrene_{Median}$ = 0.84 ng/m^3) in multi-unit social housing apartments (N = 36-55) in Toronto, Canada were present at similar or higher concentrations compared with those reported in other dwellings.
- In general, phthalate and PAH composition profiles had low intra- and inter-unit variation across three sampling periods.
- In general, SVOC concentrations were lower after energy retrofits, with significance reached for some PAHs.

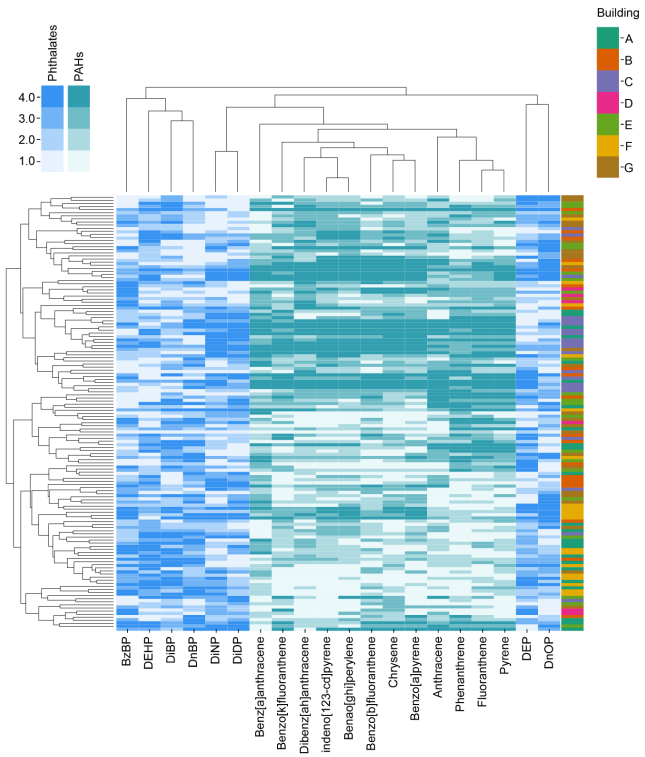

Figure 1. Hierarchical clustering analysis for phthalates (blue) and PAHs (green) in seven social housing MURBs in Toronto, Canada. All measured SVOCs are included in this analysis, with detection frequencies varying from 3% to 100%. We characterized concentrations of measured SVOCs into four quartiles and express with intensity. The building code for each apartment tested is indicated in the rightmost column. The dendrogram of the top represents the SVOC clusters, and the dendrogram on the left refers to apartment clusters. Abbreviations: DEP, Diethyl Phthalate; DiBP, Diisobutyl phthalate; DnBP, Di-n-butyl phthalate; BzBP, Benzyl butyl phthalate; DEHP, Bis(2-Ethylhexyl) phthalate; DnOP, Di-n-octyl phthalate; DiNP, Diisononyl phthalate; DiDP, Diisodecyl phthalate.

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