The Influences of Household Behavior, Environmental, and Demographic Factors on Indoor and Outdoor Air Quality

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Tuesday, March 21, 2023
10:45 AM – 12:30 PM
3811/P300
Exposure Assessment/Biomonitoring
Music City Center
Hall C

Abstract:

Americans spend approximately 90% of their time indoors, with more than 66% of that time spent in residential buildings. On average indoor air pollutants can be anywhere from two to five times higher than outdoors. Shifts in building construction, composition of building materials, and increases in use of consumer products indoors has resulted in increased exposure to semi-volatile organic compounds (SVOCs). There are a number of factors pertaining to household behavior and environmental and demographic factors that may influence concentrations or types of SVOCs found indoors. In this study, paired indoor and outdoor sampling for twenty-four locations across the United States took place using a community engaged approach. Samples were analyzed for over 1500 SVOCs to identify common patterns in exposure profiles representative of indoor and outdoor air quality. Of the 1500 SVOCs analyzed a total of 81 were detected in at least one sample (indoor or outdoor). This list was filtered to conduct paired comparisons between number of detects resulting in a total of 51 chemicals. Further filtering for paired comparisons of concentration of chemicals resulted a total of 22 SVOCs. Unique differences between indoor and outdoor profiles were identified, with indoor having 28 compounds with significantly higher detections and 10 with significantly higher concentrations than outdoor ($p < 0.05$). Influences of household behavior and environmental and demographic factors on these compounds were then investigated. A significant relationship between household use of air fresheners or candles/incense and specific fragrance chemicals (amyl cinnamal, eugenol, benzyl benzoate, galaxolide, lilal, and b-citronellol) was discovered. Additionally, associations between carpet use and detection frequency or concentrations of fragrance chemicals, flame retardants, or building material-related chemicals was also found. These associations were chemical dependent with some showing a positive association and others having a negative association with carpet use. Environmental and demographic factors also had an influence on indoor and outdoor profiles with the majority of chemicals identified being associated with emission from combustions sources (i.e. polycyclic aromatic hydrocarbons, furans). Results from this study provide valuable information regarding indoor and outdoor chemical profiles and factors that impact the composition and concentrations of these chemicals. These findings may also help inform ways to reduce chemical exposure, by identifying certain consumer behaviors that may affect exposure profiles.