Layla S Al-Omran, J Bioremediat Biodegrad 2018, Volume 9
DOI: 10.4172/2155-6199-C1-014

The most important factors influencing human exposure assessments of brominated flame retardants (BFRs) via indoor dust ingestion

Layla S Al-Omran
University of Basrah, Iraq

Brominated flame retardants (BFRs) are industrial chemicals widely used in consumer products to enhance their ignition resistance. Since in most applications these chemicals are used additively, they can transfer from such products into the environment. The toxicity of some BFRs has led to concern about human exposure. Ingestion of indoor settled dust appears to represent a major pathway of exposure to BFRs. However, assessment of human exposure is rendered uncertain because of a lack of knowledge about spatial and temporal variation, dust particle size and sampling collection method. Thus, the study aims to investigate the most important factors influencing human exposure assessments of BFRs via indoor dust ingestion. Concentrations of polybrominated diphenyl ethers (PBDEs) and selected novel brominated flame retardants (NBFRs) were measured in 305 indoor dust samples from different homes in Birmingham, UK. Our results revealed that substantial within-room and within-home spatial variability in BFR concentrations was apparent between two floor areas and between elevated surface and floor dust, due to the varying distances of sampled surfaces from potential BFR sources. BFR concentrations in elevated surface dust exceeded significantly those in floor dust from the same rooms. Considerable within-room and within-home temporal variability in BFR concentrations was apparent over a nine month sampling period, that is likely attributable to changes in room contents. Exposure estimates based on analysis of a dust sample taken from one specific floor area at one specific point in time may not be entirely representative of human exposure in that room. While concentrations of higher brominated compounds did not differ significantly between different dust particle size fractions, those of lower brominated compounds were significantly higher in the finest particle size, underlining the importance of selecting the most appropriate dust particle size for the purpose of exposure assessment. BFR concentrations in researcher-collected dust were higher than those in household vacuum dust.

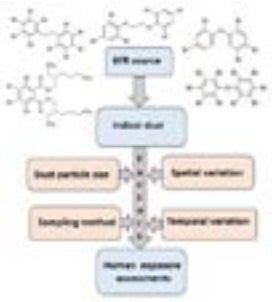

Figure1: Factors influencing human exposure assessments of BFRs via indoor dust ingestion

Recent Publications

1. Björklund, J A, U Sellstrom, C A de Wit, M Aune, S Lignell and P O Darnerud (2012) Comparisons of polybrominated diphenyl ether and hexabromocyclododecane concentrations in dust collected with two sampling methods and matched breast milk samples. Indoor Air 22(4):279-288.
2. Cao Z G, G Yu, Y S Chen, Q M Cao, H Fiedler, S B Deng, J Huang and B Wang (2012) Particle size: a missing factor in risk assessment of human exposure to toxic chemicals in settled indoor dust. Environment International 49:24-30.
3. Fang M and H M Stapleton (2014) Evaluating the bioaccessibility of flame retardants in house dust using an in vitro tenax bead-assisted sorptive physiologically based method. Environmental Science & Technology 48(22):13323-13330.

4. Mercier F, P Glorennec, O Thomas and B Le Bot (2011) Organic contamination of settled house dust, a review for exposure assessment purposes. Environmental Science & Technology 45(16):6716-6727.
5. Muenhor D and S Harrad (2012) Within-room and within-building temporal and spatial variations in concentrations of polybrominated diphenyl ethers (PBDEs) in indoor dust. Environment International 47:23-27.

Biography

Layla Salih Al-Omran is interested in analysis of organic and inorganic pollutants in both biotic and abiotic samples. She has an extensive experience in human exposure assessments of persistent organic pollutants (POPs) in indoor dust. She has built this experience during her PhD study at University of Birmingham, UK. The study involves investigating of the most important factors that affects human exposure assessments of legacy and novel brominated flame retardants via indoor dust ingestion, such as spatial and temporal variations, dust particle size, sampling methods, dust loading and organic carbon content. It has been suggested that without taking into account all of these factors, the exposure assessment will not be an entirely representative metric of exposure. This work is a part of her PhD thesis at University of Birmingham UK during 2012-2016. She has published four research papers regarding to these factors.

laylaalomran@yahoo.com

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