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PII: S0039-9140(16)30852-9
DOI: http://dx.doi.org/10.1016/j.talanta.2016.10.108
Reference: TAL17045

To appear in: *Talanta*

Received date: 12 September 2016
Revised date: 27 October 2016
Accepted date: 28 October 2016

Cite this article as: Chang He, Xianyu Wang, Phong Thai, Jochen F. Mueller, Christie Gallen, Yan Li and Christine Baduel, Development and Validation of a Multi-residue Method for the Analysis of Brominated and Organophosphate Flame Retardants in Indoor Dust, *Talanta* http://dx.doi.org/10.1016/j.talanta.2016.10.108

Development and Validation of a Multi-residue Method for the Analysis of Brominated and Organophosphate Flame Retardants in Indoor Dust

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Abstract

Flame retardants are associated to numerous adverse health effects, can accumulate in humans and have been used intensively worldwide. Recently, dust has been identified as a major human exposure route for flame retardants. The aim of this study was to develop a multi-residue method using a two-step SPE purification. It enabled us to effectively limit co-extracted matrix/interferets and therefore a simultaneous analysis of brominated and organophosphate flame retardants for indoor dust was achieved. The optimized method was validated according to standard protocol and achieved good accuracy and reproducibility (percent error ranged from -29 % to 28 %). Standard Reference Material (SRM) for dust was also analysed, and good agreement was found with reported brominated and organophosphate flame retardants (OPFRs) concentrations. The applicability of the validated method was demonstrated by the analysis of ten indoor dust samples from ten Australian homes. Overall 89 % of the analytes were detected in these samples. The average concentrations of ∑OPFRs and ∑PBDEs in those samples were 41 and 3.6 μg/g, respectively. Tris(2-butoxyethyl) phosphate and tris(2-chloroisopropyl) phosphate were the most abundant OPFRs, accounting for 57-92 % ∑OPFRs, while decabromodiphenyl ether dominated the Polybrominated diphenyl ethers (PBDE) congeners contributing between 71-94 % to the ∑PBDEs.

Graphical abstract