Characterization of Flame Retardants in Baby Products and the Evaluation of Dermal Loading and Hand-To-Mouth Transfer Efficiency

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Abstract:
Under the revised California Technical Bulletin (TB117-2013), some infant products containing polyurethane foam (PUF) were exempt from flammability testing compliance; however, it is unknown how the revision affected flame retardant (FR) usage in such products. There are currently no published data that characterize hand-to-mouth transfer efficiency of FRs from baby products. The purpose of this study was 1) to understand the current use of FRs in baby products purchased after the revised standard, and 2) to quantify dermal loading and hand-to-mouth transfer efficiency of selected FRs from these products. Five manufacturers of baby products containing PUF, one bath product, three changing pads, and one sleep positioner, were purchased in 2015 in both California and Colorado (n=10) and analyzed for the presence of FRs. Tris (1-chloro-2-propyl) phosphate (TCPP) was found in all ten products tested (203 to 43,000 µg/g). Tris (1,3-dichloro-2-propyl) phosphate (TDCPP) was found in only a single product (63 µg/g). Two products that contained the highest levels of TCPP, the bath product and one of the changing pads, were each handled by three participants for 15 s, and a wipe sample of one hand was collected to determine dermal transfer. After accounting for the average of TCPP found in the lab blank and other lab materials (range <0.010 µg (LOD) – 0.237 µg), the amount of TCPP loaded onto the hands of the participants was below detection. Additionally, we evaluated hand-to-mouth transfer from the three participants handling the bath product; after handling, the participants pressed three fingers from their second hand into their saliva. We concluded that the transfer of TCPP from hands to saliva was below detectable levels. It is hypothesized that the covering over the foam components reduced transfer to hands. These data show that FRs continue to be added to baby products; however, the transfer of FRs onto hands and into saliva as a result of hand-to-mouth behaviors through product coverings is expected to be negligible for TCPP. Further research is needed to estimate the role of other routes of exposure, such as inhalation and dermal absorption.