**Quantification of 16 urinary biomarkers of exposure to flame retardants, plasticizers, and organophosphate insecticides for biomonitoring studies**

Nayana K. Jayatilakaa

Paula Restrepoa

Zachary Davisa

Meghan Vidala

Antonia M. Calafata

Maria Ospinaa

a Division of Laboratory Sciences, National Center for Environmental Health, Centers for Disease Control and Prevention, 4770 Buford Hwy, MS 103-2, Atlanta, Georgia 30341, USA

[goh3@cdc.gov](mailto:goh3@cdc.gov)

[pkr1@cdc.gov](mailto:pkr1@cdc.gov)

[yip3@cdc.gov](mailto:yip3@cdc.gov)

[vtp3@cdc.gov](mailto:vtp3@cdc.gov)

[aic7@cdc.gov](mailto:aic7@cdc.gov)

[meo3@cdc.gov](mailto:meo3@cdc.gov)

Corresponding author

Nayana K. Jayatilaka

Division of Laboratory Sciences, National Center for Environmental Health, Centers for Disease Control and Prevention, 4770 Buford Hwy, MS 103-2, Atlanta, Georgia 30341, USA

E-mail: [goh3@cdc.gov](mailto:goh3@cdc.gov) Phone: +1 770 488 7382

**Table S1:** EPA registered OP pesticides and their potential DAP metabolites

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Dimethyl-phosphate (DMP) | Dimethylthio-phosphate (DMTP) | Dimethyldithio-phosphate (DMDTP) | Diethyl-phosphate (DEP) | Diethylthio-phosphate (DETP) | Diethyldithio-phosphate (DEDTP) |
| Azinphos methyl | x | x | x | - | - | - |
| Chlorethoxyphos | - | - | - | x | x | - |
| Chlorpyrifos | - | - | - | x | x | - |
| Chlorpyrifos methyl | x | x | - | - | - | - |
| Coumaphos | - | - | - | x | x | - |
| Dichlorvos (DDVP) | x | - | - | - | - | - |
| Diazinon |  | - | - | x | x | - |
| Dicrotophos | x | - | - | - | - | - |
| Dimethoate | x | x | x | - | - | - |
| Disulfoton | - | - | - | x | x | x |
| Ethion | - | - | - | x | x | x |
| Fenitrothion | x | x | - | - | - | - |
| Fenthion | x | x | - | - | - | - |
| Isazaphos-methyl | x | x | - | - | - | - |
| Malathion | x | x | x | - | - | - |
| Methidathion | x | x | x | - | - | - |
| Methyl parathion | x | x | - | - | - | - |
| Naled | x | - | - | - | - | - |
| Oxydemeton-methyl | x | x | - | - | - | - |
| Parathion | - | - | - | x | x | - |
| Phorate | - | - | - | x | x | x |
| Phosmet | x | x | x | - | - | - |
| Pirimiphos-methyl | x | x | - | - | - | - |
| Sulfotepp | - | - | - | x | x | - |
| Temephos | x | x | - | - | - | - |
| Terbufos | - | - | - | x | x | x |
| Tetrachlorvinphos | x | - | - | - | - | - |
| Trichlofon | x | - | - | - | - | - |
| x: potential metabolite to the listed pesticide  - : not applicable | | | | | | |

**Stability**

Once the samples are received, they are stored at -70℃ until analysis. The samples then are thawed to room temperature before the analysis, and sometimes undergo a few freeze-thaw cycles when reanalysis is necessary. Therefore, the stability of the target analytes was evaluated for freeze-thaw stability and bench-top stability. Freeze and thaw stability of the analytes was determined by analyzing two quality control materials after three freeze-thaw cycles, and comparing the values with the initial measurements. Bench-top stability was assessed by analyzing two quality control materials left at room temperature for one day, and comparing the values with the initial measurements. Post-preparative stability of the extracted samples was also examined by analyzing processed samples from two quality control materials after storing them at room temperature for one day, and comparing the values with initial measurements. All analysis were performed in triplicates. The conditions explained above evaluate the short-term stability of the target analytes and the results are shown in Table S2. These results suggest that the all target analytes are stable for the short-term conditions considered above. Long-term stability of the target analytes will be assessed by analyzing two quality control samples in triplicates after storing at or below -70℃ for a year and two years.

**Table S2:** Short-term stabilities of the target analytes

|  |  |  |  |
| --- | --- | --- | --- |
| Analyte | Stability Tests (% absolute difference from initial measurement)d | | |
| Freeze-thaw Stability (3 cycles)a | Bench-top Stabilityb | Processed Sample Stabilityc |
| BCEtP | 1.6 | 0.3 | 0.4 |
| BCPP | 1.4 | 2.1 | 3.1 |
| BDCPP | 2.4 | 4.5 | 0.9 |
| DBuP | 3.4 | 1.8 | 2.1 |
| DBzP | 0.4 | 0.6 | 2.3 |
| DPhP | 1.1 | 3.2 | 3.5 |
| DCP | 0.4 | 0.0 | 1.6 |
| TBBA | 0.9 | 0.7 | 0.1 |
| iPPPP | 0.9 | 1.2 | 3.4 |
| tBPPP | 0.5 | 2.5 | 1.1 |
| DMP | 0.7 | 4.1 | 2.9 |
| DMTP | 0.5 | 4.5 | 0.6 |
| DMDTP | 0.4 | 0.1 | 0.6 |
| DEP | 1.6 | 0.6 | 0.9 |
| DETP | 1.0 | 0.2 | 1.8 |
| DEDTP | 0.9 | 1.8 | 0.1 |
| a Freeze-thaw stability - assessed by analyzing samples after three freeze-thaw cycles, and comparing the values with the initial measurements  b Bench-top stability - assessed by analyzing samples after storing at room temperature for one day, and comparing the values with the initial measurements  c Processed sample stability - assessed by analyzing processed samples after storing them at room temperature for one day, and comparing the values with initial measurements  d Two different urine specimens, spiked at two levels, and prepared in triplicates | | | |