Bi-ennial Global Interlaboratory Assessment on POPs – Fourth Round 2018/2019, Dioxin-like POPs and Perfluoro Alkyl Substances

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Introduction

The fourth round of the 'Bi-ennial Global Interlaboratory Assessment on Persistent Organic Pollutants (POPs)' as part of the UN Environment's support to the implementation of the Global Monitoring Plan (GMP) under the Stockholm Convention was implemented jointly by Örebro University and de Vrije Universiteit, Amsterdam. The 4th Round in 2018/2019 basically followed the same approach as was used in the three previous assessments (in 2010/2011, 2012/2013, 2016/2017) [1]-[3]. The aim of these proficiency tests is to test the performance of POPs laboratories worldwide on a comparative basis Here, we report the performance of the laboratories that submitted results for dioxin-like POPs (dl-POPs) and perfluoroalkyl substances (PFAS).

Materials and Methods

- Test solutions of analytical standards containing 17 PCDD/PCDF, 12 dl-PCB, and 22 PFAS;
- Test samples for the analysis of dl-POPs and PFAS: Sediment, air extract (in toluene for dl-POPs; in methanol for PFAS), fish and human milk
- Test samples for PFAS only: Human plasma and water;
- Performance was assessed according to the QUASIMEME proficiency testing organization (www.quasimeme.org);
- z-score interpretation with 1 z = 12.5% coefficient of variation (CV) as follows:
  |z| < 2 = Satisfactory performance (S),
  2 < |z| < 3 = Questionable performance (Q),
  |z| > 3 = Unsatisfactory performance (U).

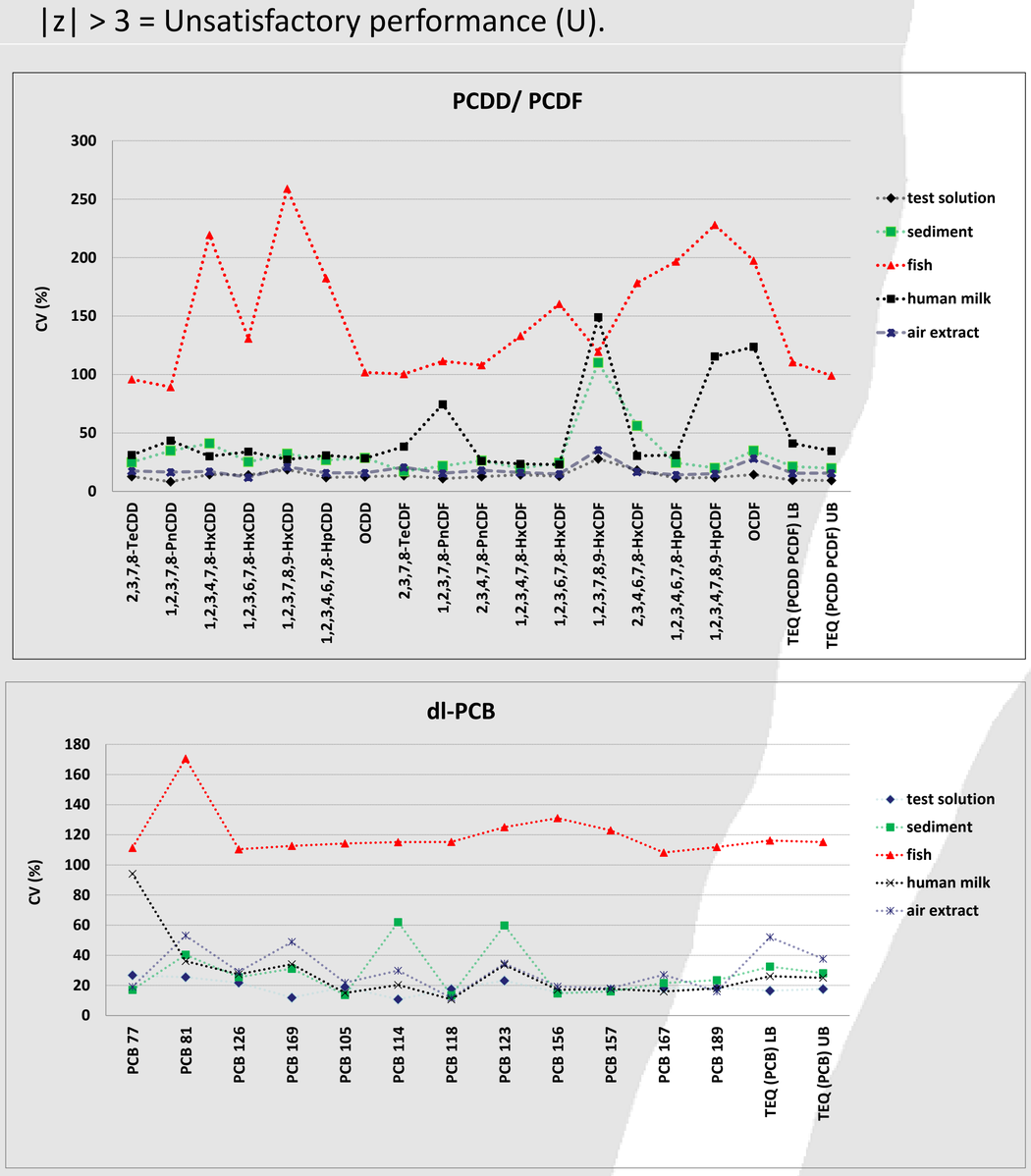

Figure 1: Performance of laboratories for analysis of PCDD/PCDF (above) and dl-PCB (below) per congener and TEQ (as %CV)

Results

A total of 148 laboratories had registered of which, 117 laboratories submitted at least one result. Of these, 64 and 39 laboratories submitted results for dl-POPs or PFAS, respectively. For each of the two groups of POPs, three laboratories did not have any satisfactory result.

For the dl-POPs, 61% of 4613 z-scores were satisfactory and 24% unsatisfactory. The vast majority uses HRGC with HRMS sector-field detection. No assigned values (AVs) could be determined for the majority of PCDD/PCDF and all dl-PCB in fish whereby almost 40 laboratories reported results but CVs varied between 89% and 259% (Figure 1).

Overall, the z-scores for PFAS were slightly better than for the dl-POPs with 66% of the 1869 z-scores being satisfactory and 18% unsatisfactory. All laboratories reported to use MS/MS detection; only two reported Orbitrap and one TOF-MS. The human milk sample posed the biggest challenge to the laboratories and AVs could be calculated only for PFOS and PFOA; for all other PFAS (including carboxylic acids, sulfonates and one telomer sulfonic acid) no AVs could be calculated. In contrast to previous assessments [4], many laboratories are now capable to determine branched PFOS besides the linear isomer (Figure 2).

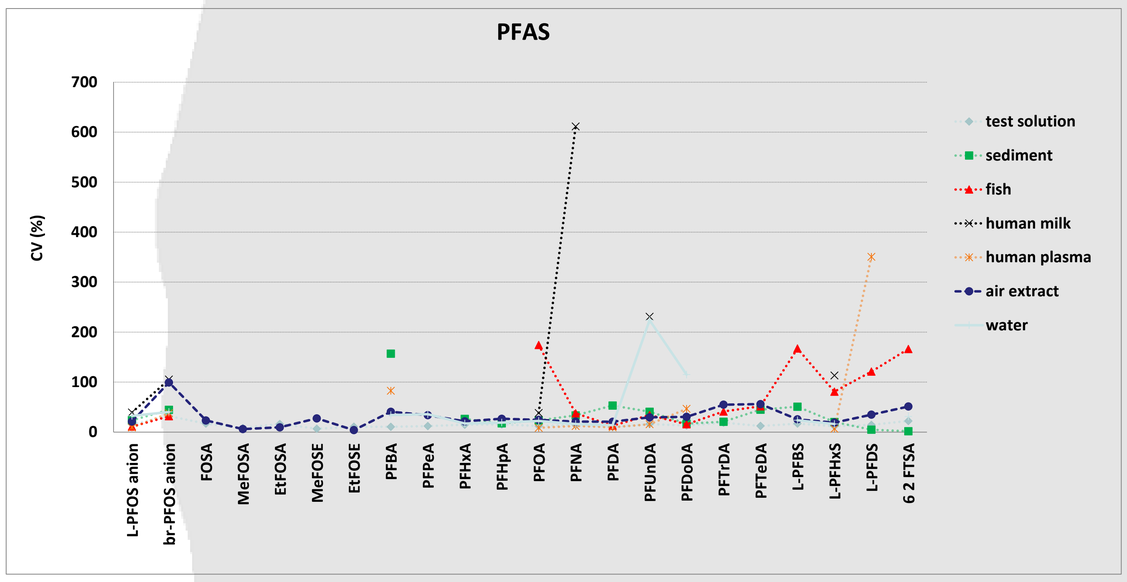

Figure 2: Performance of laboratories for analysis of PFAS (as %CV)

Discussion

Experiences from past interlaboratory assessments found that the dioxin and the PFAS laboratories are more advanced than the "usual pesticides" laboratories due to more sophisticated equipment and methods and typically with more experiences [1]-[4]. 26 of the laboratories submitted results for dl-POPs and for PFAS; interestingly, only four laboratories were very successful (>80% of the results were satisfactory) for both classes of chemicals. Six laboratories performed poorly for both (<50% satisfactory results); three laboratories were very good for PFAS but poor on dl-POPs whereas only one laboratory was very good on dl-POPs and poor on PFAS (Figure 3).

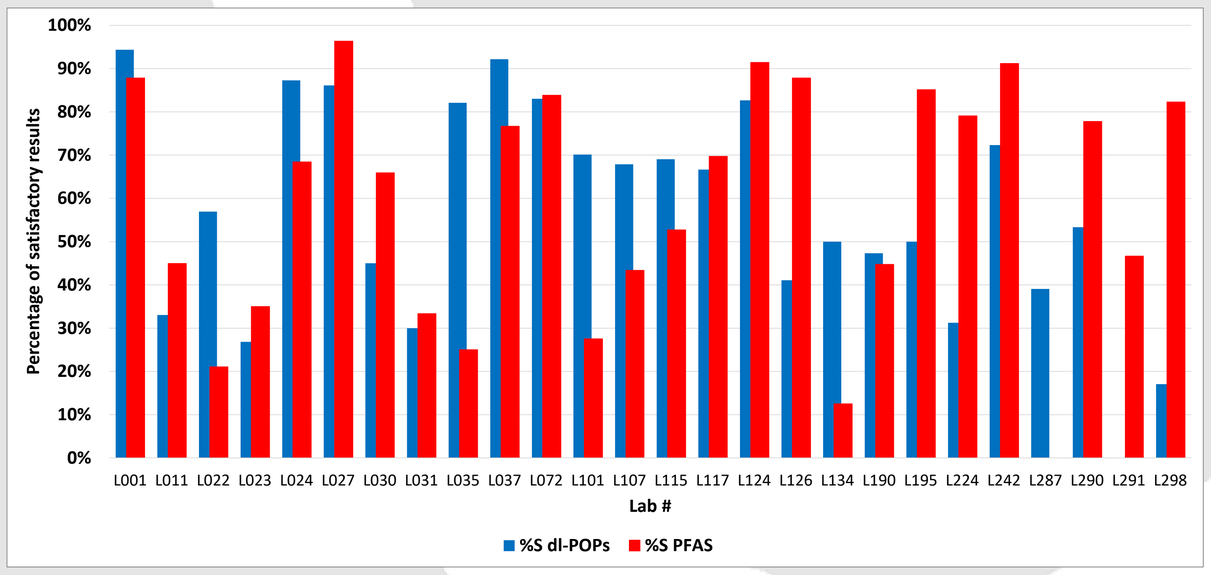

Figure 3: Comparison of performance between dioxin (blue) and PFAS (red) laboratories (% satisfactory results of total number of results submitted per POP and laboratory)

References

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4. H. Fiedler, I. van der Veen, J. de Boer (2019). Global Interlaboratory Assessments of Perfluoroalkyl Substances under the Stockholm Convention on Persistent Organic Pollutants, TrAC Trends in Analutical Chemistry (in press). https://doi.org/10.1016/j.trac.2019.03.023

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