Sediment quality assessment framework for PFAS: results from a preparatory study and regulatory implications

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Introduction: Since 2015, a program aims to develop guidelines for the ecotoxicological quality assessment of sediments in Switzerland based on the chemical status. The program has addressed sediment sampling and sample pre-treatment recommendations mainly for shallow rivers, as well as sediment quality guidelines (SQGs) and a quality classification system. A list of 20 substances was selected for sediment monitoring, including perfluorooctanesulfonic acid (PFOS) as a candidate indicator for per- and polyfluoroalkyl substances (PFAS) contamination. We will present the outcomes of a preparatory study consisting of 18 sites, where PFAS concentrations were quantified in the <2 mm and <63 μm fractions. We also report on the possibility to derive SQGs according to the current state of knowledge about this class of chemicals, with a special focus on PFOS.

Methods: The concentrations of 12 PFAAs (PFHxA, PFHpA, PFHxS, PFOA, branched PFOS (br-PFOS), linear PFOS (n-PFOS) (sum-PFOS calculated as br-PFOS + n-PFOS), PFNA, PFDA, PFUnDA, PFDoDA, PFTrDA and PFTeDA,) and perfluorooctanesulfonamide (FOSA) were determined following Mazzoni et al. [1] by liquid chromatography tandem mass spectrometry (HPLC-MS/MS) coupled to an on-line turbulent flow chromatography (TFC) for on-line purification of the extracts in surficial sediments from 18 wadeable streams across Switzerland. The sites were chosen to represent different levels and kinds of anthropogenic pressure, including two reference sites. Method detection limits ranged from 0.001 to 0.020 ng/g d.w. depending on the compound.

Results and Discussion: The results confirmed the suitability of using perfluorooctanesulfonic acid (PFOS) as indicator of per- and polyfluoroalkyl substances (PFAS) contamination in sediments from small streams in Switzerland, being the most detected and on average the most prevalent among the analyzed PFAS (Fig 1). While the fine fraction (<63 μm) was more appropriate to screen for direct emission sources and studying the compounds profile at the study sites, the analysis of the <2 mm fraction and the normalization to a sample consisting of 100% of the <63 μm fraction was in principle feasible for PFOS. While SQGs for PFOS for protecting benthic invertebrates from general toxicity could be derived,

the available effect database is still too sparse and it is only possible to derive preliminary values. SQGs to protect wildlife and human health from secondary poisoning using the Equilibrium Partitioning approach and trophic web models were also derived that can be used to protect other receptors. Normalization to the organic carbon content in the field (0.2 to 12.9%) was determinant in the quality assessment outcome. While this is a widely accepted practice for hydrophobic organic contaminants, its endorsement for PFOS would also benefit from validation.
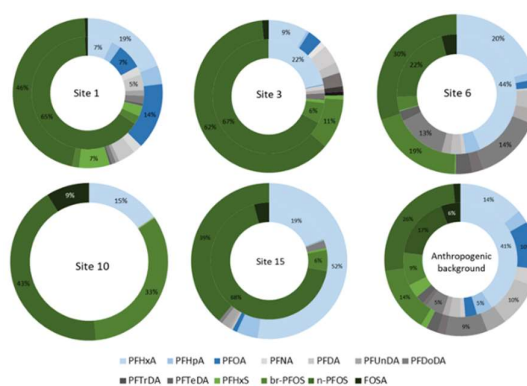
Fig. 1: PFAS in sediment <63 μm (outside donut) and <2 mm (inside donut).

References: [1] Mazzoni et al. (2016) *J Chromatogr* **1453:** 62-70.