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Calibration of organic-diffusive gradients in thin films (o-DGT) passive samplers for perfluorinated alkyl acids in water

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ABSTRACT

The application of the organic-diffusive gradients in thin films (o-DGT) passive sampling technique for the monitoring of per- and polyfluoroalkyl substances (PFAS) in the environment is still limited. Six common PFAS with different chain lengths were evaluated in water by o-DGT. Measured diffusion co-efficients (D) in agarose and polyacrylamide diffusive gels ranged from 4.55-8.63 * 10^6 cm^2s^{-1} and 3.85-7.00 * 10^6 cm^2s^{-1} at 23C, respectively. Experimental sampling rates (Rs) for both agarose- and polyacrylamide-WAX sampler configurations were within 22% relative error of D-based Rs for four of the PFAS. Larger differences for perfluorobutanesulfonic acid (PFBS) and perfluoroundecanoic acid (PFUnDA) ranged from 36% to 56%. In general, in-situ Rs can be predicted using measured D-values for per-fluorinated alkyl acids. The mass accumulation of six PFAS in two o-DGT configurations was linear over 21 days (R2 0.97). Diffusion and uptake of o-DGT depended on the gel type and specific PFAS. Field demonstrations of o-DGT with WAX and HLB binding gels and polyacrylamide diffusive gels (not prone to biodegradation) found 0.3-19.5 ngL^{-1} of PFAS in rivers near industrial areas around Guangzhou and Foshan, China, with no apparent differences between the two co-deployed samplers. This study demonstrates that the configurations of o-DGT tested provide a cost-effective monitoring tool for measuring perfluorinated alkyl acids in aquatic systems, in particular the four PFAS for which reasonable correla-tions were observed.