Optimisation and calibration of a novel passive sampler based on diffusion gradient in thin films for polar organic compounds (o-DGT)

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Passive samplers are useful tools for sampling of trace pollutants in the environment. However, concentrations of polar organic compounds in waters acquired by currently mostly used passive samplers such as POCIS are semiquantitative, due to a strong dependence of uptake rates on the variable hydrodynamic conditions and/or sorption of analytes to the membrane material separating the sorbent from the aqueous phase. Sampling rates acquired by laboratory calibrations may therefore differ from the actual sampling rates in the field. Application of a thin diffusion layer of hydrogel, which behaves as an immobilized water layer on top of the sampling surface, may help to control the analyte uptake rate, eliminating the effect of hydronamic conditons. Recently, a promising sampler design has been proposed (CHEN ET AL. 2012), which is based on DGT sampler commonly used for sampling of metals in waters. The sampler consists of agarose hydrogel layer with dispersed sorbent and a diffusion layer of pure agarose hydrogel. For accurate calibration, diffusion coefficients of the compounds in hydrogel are required. These were obtained by measuring the migration of the compounds in a stack of several hydrogel layers (RUSINA ET AL. 2010). Then, laboratory calibration experiments were conducted in an artificial flow-through system with two different water flow rates and different hydrogel thicknesses for several groups of emerging pollutants, including perfluorinated compounds and pharmaceuticals. As expected, using a diffusive layer greatly reduced sampling rates for most of the compounds. However, increasing flow velocity still resulted in increased sampling rates. These results show that further research is needed in order to evaluate the effect of hydrodynamic conditions. Due to low sampling rates, it is recommended to use a sampler design with larger sampling area for future experiments.

References

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