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Development and field evaluation of the organic-diffusive gradients in thin-films (o-DGT) passive water sampler for microcystins

Po Wang[1], Bowen Du[2], Jayme Smith[2], Wenjian Lao[2], Charles S. Wong[1,2], Eddy Y. Zeng[1]

[1]Guangdong Key Laboratory of Environmental Pollution and Health, Center for Environmental Microplastics Studies, School of Environment, Jinan University, Guangzhou, China
[2]Southern California Coastal Water Research Project Authority, Costa Mesa, CA

Abstract
The presence of microcystins (MCs) in waterbodies requires a simple and reliable monitoring technique to characterize better their spatiotemporal distribution and ecological risks. An organic-diffusive gradients in thin films (o-DGT) passive sampler based on polyacrylamide diffusive gel and hydrophilic-lipophilic balance (HLB) binding gel was developed for MCs in water. The mass accumulation of three MCs (MC-LR, –RR, and -YR) was linear over 10 days (R2 ≥ 0.98). Sampling rates (2.68–3.22 mL d^-1) and diffusion coefficients (0.90–1.08 × 10^6 cm^2 s^-1) of three MCs were obtained at 20C. Two different passive samplers, o-DGT and the Solid Phase Adsorption Toxin Tracking device (SPATT), were co-deployed to estimate MC levels at three lakes in California, USA. Measured total MC concentrations were up to 10.9 μg L^-1, with MC-LR the primary variant at a measured maximum concentration of 2.74 μg L^-1. Time-weighted average MC concentrations by o-DGT were lower than grab water samples, probably because grab sampling measures both dissolved and particulate phases (i.e., MCs in cyanobacteria). Passive water samplers by design can only measure dissolved-phase MCs, which are considerably less during the cyanobacteria-laden periods observed. Both o-DGT and grab samples gave comparable results for three MC variants at low levels of MCs, e.g., <0.1 μg L^-1. o-DGT showed a higher correlation with grab sampling than SPATT did. This study demonstrates that o-DGT can be effectively used for monitoring and evaluation of dissolved MCs in waters.