Application of passive sampling in analysis and monitoring of cyanobacterial toxins

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Toxins produced by cyanobacteria have become an important group of pollutants in the aquatic environment. The occurrence of cyanotoxins in water reservoirs may be associated with serious human health risks, therefore there is a need for suitable and efficient tools for cyanotoxin monitoring. Passive sampling, which is being increasingly applied in monitoring of various environmental pollutants, represents a method based on passive accumulation of chemicals from the environment into passive sampler's receiving phase (sorbent), which has an affinity for specific pollutant(s) of interest.
Our research is currently focusing on optimization and application of passive samplers for sequestration of major cyanobacterial toxins, microcystins (MCs) and cylindrospermopsin (CYN). We optimized, evaluated and calibrated an integrative passive sampler for monitoring of MCs. In laboratory experiments, the optimized samplers showed linear uptake of MCs over a period of at least 14 days, with minimal detectable time-weighted average (TWA) concentrations of MCs being at pg/L level. Optimized passive samplers were then employed in a field study carried out at three different drinking water reservoirs and adjacent drinking water treatment plants. Deployed passive samplers showed great ability to sequester MCs throughout the season. When compared with MC concentrations obtained from parallel grab sampling, TWA concentrations derived from passive samplers reflected very well observed seasonal dynamic and spatial variations of MC concentrations. In order to develop passive sampling device for sequestration of an emergent cyanobacterial toxin CYN, we evaluated CYN-binding ability of several commercially available sorbents. The highest recovery rate of CYN in SPE experiments was observed for activated carbon, copolymer sorbents and mixed-mode ion exchangers. These sorbents will be used as a receiving phase of experimental passive samplers for CYN and further evaluated in laboratory experiments. Our studies have demonstrated that passive sampling provides a valuable tool, which can be effectively employed also in cyanotoxin research.

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