

A New Passive Sampler Provides Unparalleled Ability to Quantitatively Monitor Exposure to Microcystins in Water



The Problem

Microcystins are natural toxins produced by cyanobacteria blooms in surface water (Figs. 1 and 2). These toxins can cause numerous health problems including serious effects on the liver, kidney and reproductive system. The USEPA recently issued 10-day exposure health advisories for microcystins, but concentrations in water can vary several orders of magnitude over a 10-day time period due to the complexities of bloom formation and persistence, toxin production, extracellular release, transport and fate. Our ability to assess potential human health risk due to exposure to microcystins is greatly limited by our inability to accurately measure this 10-day exposure.



Fig. 1 - Cyanobacteria bloom in Dian Lake, China.

The Solution

We have developed the Composite Integrative Passive Sampler (CIPS) to quantitatively measure the 10-day time-weighted-average (TWA) concentration of microcystins in water. There is a linear accumulation of microcystins into the CIPS over the 10 days that allows us to calibrate the CIPS in the laboratory and back-calculate the TWA concentration of microcystin in water during the 10-day deployment in a surface water or drinking water plant. The details of how this works are provided in a separate publication.¹

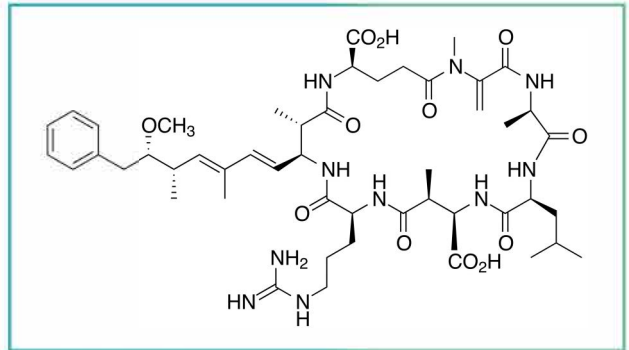


Fig. 2 - Microcystin LR (MC-LR)

The Results

We deployed CIPS in Dian Lake in Kunming, China for 10 days toward the end of a cyanobacteria bloom while taking water samples every day (Fig. 1). All sampling was performed in triplicate and samples were analyzed for the microcystin MC-LR using EPA Method 544. CIPS provided a TWA concentration equal to sequential daily grab samples (Fig. 3), with much lower variability. Grab sampling could easily result in over- or under-estimating exposure depending on when one collected the sample. You would need to collect and analyze water samples every day to obtain the same representative value that CIPS provides using only a single sample. CIPS provides unparalleled ability to quantitatively monitor exposure to microcystins in water.

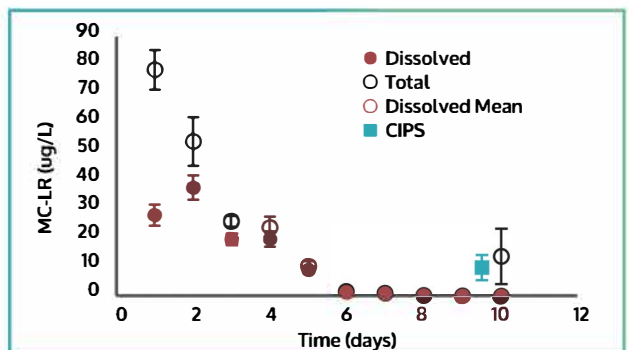


Fig. 3 - CIPS provides unparalleled ability to measure MC-LR exposure. Microcystin LR concentrations vary 1000-fold over the 10-day period the US EPA uses to assess for adverse human health effects.

¹ Laboratory calibration of the Composite Integrative Passive Sampler (CIPS) for microcystin LR [\[link to the publication\]](#)