

Novel method for the detection of cyanobacterial toxin microcystin-LR using a centrifugal microfluidic (Lab-On-A-Disc) sensing system

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Globally, the most prevalent cyanobacterial toxins, in blooms from fresh and brackish waters, are the cyclic peptide toxins of the microcystin family. The need for on-site algal-toxin monitoring has become increasingly urgent due to the amplified demand for fresh-water and for safe, 'toxin-free' shellfish and fish stocks. Along with routine testing of shellfish stocks for biotoxins including microcystin, the EU also require routine monitoring for the presence of the causative algal species. Herein, we describe a novel, Lab-On-A-Disc (LOAD) platform which has been developed to assess microcystin toxin levels in-situ. Using recombinant antibody technology, the LOAD platform combines immunofluorescence with centrifugally driven microfluidic liquid handling to achieve a next-generation disposable device for high throughput sampling. A low-complexity, 'LED-Photodiode' based optical sensing system was tailor-made for the system, which allows the fluorescence signal of the microcystin-specific reaction to be quantified. This system can rapidly and accurately detect the presence of microcystin in less than 10 minutes with minimum user interaction and maximum reproducibility. This method provides a low cost diagnostic alternative to the current laborious and costly methods used for toxin monitoring.

Keywords: Microcystin, toxin detection, Microfluidics, Lab-On-A-Disc, LOAD, recombinant antibody technology, immunofluorescence detection, low cost diagnostic device