# THE TOXISENSE DETECTION SYSTEM: A NOVEL CENTRIFUGAL-BASED MICROFLUIDIC (LAB-ON-A-DISC) SYSTEM FOR DETECTING CYANOBACTERIAL TOXIN MICROCYSTIN-LR

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- Cyanobacterial toxins of the microcystin family are notoriously ubiquitous, and are typically bloom in fresh or brackish water sources [1]. Microcystin-LR, which is the most frequently occurring strain of the microcystin family presents a major threat to marine resources.
- Consequently, integrated monitoring solutions for causative algal species with a sensitivity target of 1 µg/L of Microcystin-LR in drinking water are critically needed [2].
- Here we present a low-cost fully integrated and portable *ToxiSense* microcystin detection system. The system uses LED-photodiode detection technique to detect microcystin in fresh water samples.
- We developed a competitive assay using recombinant antibodies for the detection of free microcystin toxin, and integrated on 7-layered centrifugal microfluidic cartridge for sample incubation, flow control and detection.

Figure 1. The *ToxiSense* Centrifugal Microfluidic Disc

Figure 2. The *ToxiSense* Microfluidic disc holder

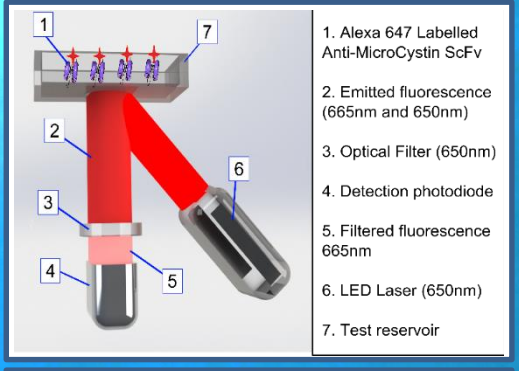



Figure 3. The Fluorescent detection configuration for reservoir detection

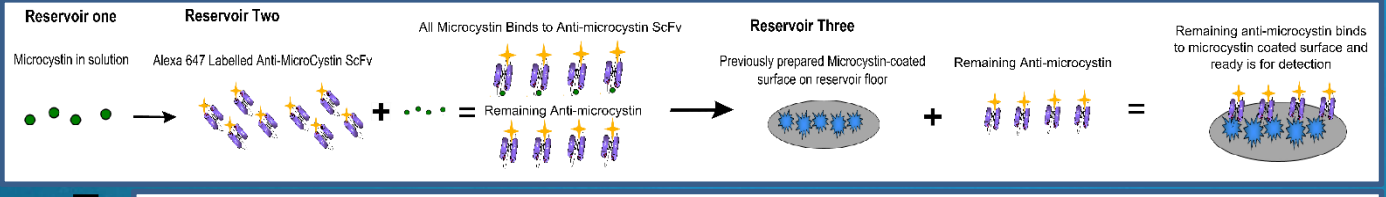
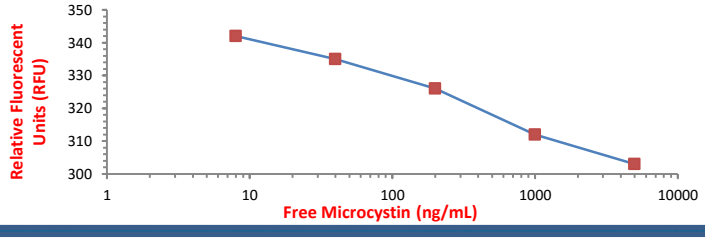



Figure 4. The competitive inverse assay process. Each of the five radially aligned reservoirs are a functional assay step (shown above), with reservoirs four and five representing a *Control* and *Waste* reservoir.

From the resultant system above, microcystin concentration can be determined. From competitive inverse assay process (figure 4), we can see that as microcystin concentration present in sample increases, there will be a corresponding reduction in the recorded fluorescent signal. This provides the basis of detection.




**Conclusion:** Here, we have presented a novel, portable toxin-detection system which has been adapted to detect low concentration levels of microcystin (ng/ml) in samples of water. This cost-effective system can be further modified to allow for autonomous, in-situ detection and real-time monitoring of fresh or brackish water sources.

**References:**

[1] C. MacKintosh, K. a. Beattie, S. Klumpp, P. Cohen, and G. a. Codd, "Cyanobacterial microcystin-LR is a potent and specific inhibitor of protein phosphatases 1 and 2A from both mammals and higher plants," FEBS Lett., vol. 264, no. 2, pp. 187–192, 1990.
[2] World Health Organization, Toxic Cyanobacteria in Water: A guide to their public health consequences, monitoring and management. 1999.