Miniaturised low-cost algae detection module for toxin producing algae

S. Zieger, G. Mistlberger, L. Troi, A. Lang, C. Holly and I. Klimant
Graz University of Technology, Institute of Analytical Chemistry and Food Chemistry (TU Graz, ACFC) Stremayrgasse 9, 8010 Graz, Austria
E-Mail: zieger@tugraz.at

Abstract

Harmful algae blooms – an overgrowth of algae in water systems – can produce different toxins and lead to various environmental damages and human disorders such as paralytic shellfish poisoning (PSP). Therefore an easy and low-cost detection and identification of harmful algae species at an early stage has become more important over the last few years. [1] [2]

Taking this into account, we developed a miniaturised low-cost device which is able to identify algae based on their pigmentation. Since the spectral behaviour of an algae results from its pigmentation, we are able to detect algae species by their absorbance behaviour. In contrast to existing technologies, our device is modular and can integrate up to 8 different excitation wavelength and 4 different emission channels. It is operated in a flow-through mode similar to a flow-cytometer, however, using only low-cost components like LEDs and photodiodes. Due to the miniaturised design, the sensitivity and selectivity increase, whereas background effects are reduced. First measurements were promising that we are able to detect single cell events such as a flow-cytometer since we can obtain signals down to a concentration of about 2 cells per 5 microliters illuminated volume. Using multivariate data analysis as reference, we try to develop an even simpler mathematical algorithm for classifying algae passing through the device and enable an in-situ analysis.

As the first application of the device, it is working as a fully integrated early warning system for harmful algae blooms in the submersible probe for the European FP7-ocean-2013 project 'SCHeMA' (Grant Agreement 614002).

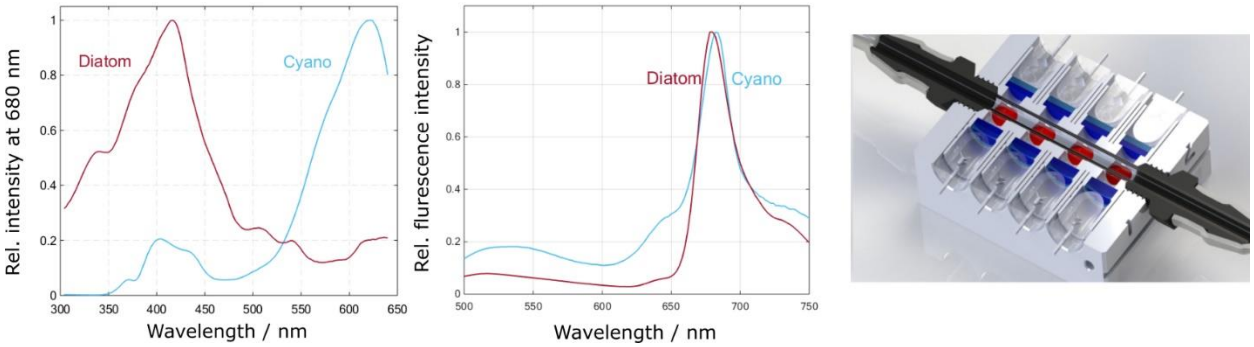

Figure 1: The left and the middle picture shows the excitation and emission spectra of different algae species. The picture on the right side illustrates the rendered picture of our low-cost prototype featuring 8 different excitation wavelength in one optic block.

1. Faber, S. Saxitoxin and the Induction of Paralytic Shellfish Poisoning. *J. Young Investig.* **23,** 7 (2012).
2. Bláha, L., Babica, P. & Maršálek, B. Toxins produced in cyanobacterial water blooms - toxicity and risks. *Interdiscip. Toxicol.* **2,** (2009).