## Abstract

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| Author(s) | Vijay Vilas Dhamale, Enzo Palombo, Dr David Beale, Dr Arash Zamyadi |

### Title

Metabolic profiling to identify fundamental differences in toxic and non-toxic cyanobacterial strains

### Description

Current methods for identifying and assessing pathogen viability and infectivity in water are time consuming, expensive and possibly unreliable. There is, therefore, a strong need for rapid methods that enable the sensitive assessment of pathogens in a variety of water sources, by identifying and characterising viability and toxin production. The level of cyanobacterial toxin concentration is linked to ambient environmental temperatures. Liquid Chromatography coupled with Mass Spectrometry (LC-MS)-based metabolomics is an attractive approach that can detect the small biomolecules with a M/Z ranging from 100 to 1700 g/mol, including cyanobacterial toxins (150-1000 g/mol). Such an approach not only aids in the identification of metabolites, but also assists in understanding the key metabolic pathways and helps to identify biomarkers relating to the early onset of a bloom within a water body. In the current study, toxic and non-toxic cyanobacteria, namely *Cylindrospermopsis raciborskii* and *Nodularia spumigena*, respectively, and toxic and non-toxic strains of *Microcystis aeruginosa* were investigated. The most significant metabolites detected in toxic strains were D-Sedoheptulose-7-phosphate, Adenosine, D-Glucose and Uracil, whereas the most significant metabolites detected in non-toxic strains were Mevalonic acid, Xylitol, Taurocholic acid and Vanillic acid. Metabolite separation was observed between toxic and non-toxic strains of cyanobacteria. The significant metabolites produced by these cyanobacterial strains can be used to predict if a toxigenic bloom is occurring in water bodies. In addition to predicting bloom events, these signature biomarkers can assist in identifying toxin-inducing environmental triggers and understanding the relevant metabolic pathways. Environmental metabolomic techniques enable the exploration between the link of toxicity and increased metabolic activity in cyanobacteria may lead to the development of novel and reliable methods for rapid bloom detection.