Identification of fluorophores released by cyanobacterial species using fluorescence spectroscopy and PARAFAC analysis

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Abstract:

Commercially available fluorescence probes are used for on-line monitoring of cyanobacterial blooms. Their mode of operation is via the analysis of fluorescent cell pigments, i.e. chlorophyll-a and phycocyanin. However, while this provides information on cell biomass there are limitations such as identification of specific species, stage of the bloom, organic matter released and toxin/taste and odour production. New developments in fluorescence have demonstrated that it is possible to monitor the fluorescence of algal organic matter (AOM) which could give further real time information on bloom conditions. Hence, the aim of this research was to investigate fluorescence excitation-emission matrix (EEM) spectra of the AOM produced by six cyanobacterial species throughout the growth phase, to investigate whether species specific fluorescence signatures existed. A six component (C1-C6) PARAFAC model was developed for the dataset. Varying patterns of peak signals originating from the AOM indicated that potential markers could be ascertained. For example, while Tryptophan-like fluorescence was present in all EEMs; it was dominant only in *C. vulgaris* AOM. Additionally the fluorophore pattern for *M. aeruginosa* was dominated by 'Peak A' indicating its specific signature to differentiate among the species. Due to recent developments in in-situ fluorescence these key peaks could be monitored simultaneously with pigment fluorescence to give information on the species and phase of growth. This would assist plant operators better manage the bloom that they are trying to treat. Overall, outcome of this study implies development of an online protocol which could lead to the creation of 'next generation fluorescence probes'.