

Interactions of the cyanobacteria toxin microcystin-LR with iron (oxy)hydroxides.

ANNALEISE R KLEIN^{1*}, DARREN S BALDWIN²
AND EWEN SILVESTER¹

¹Department of Environmental Management and Ecology (DEME), La Trobe University, Albury-Wodonga Campus, Victoria, Australia, 3690
(correspondence: a.klein@latrobe.edu.au)

²The Murray Darling Freshwater Research Centre (MDFRC), CSIRO Land and Water, La Trobe University, Albury-Wodonga Campus, Victoria, Australia, 3690

Microcystins are a group of hepatotoxins produced by cyanobacteria that have not had their functional roles, or the environmental factors that trigger production, clearly determined. While a more global role for microcystin is commonly suggested [1], the speculation that microcystin acts as an intracellular siderophore remains plausible [2].

Cyclic voltammetry (using a boron-doped diamond electrode) was used to determine the iron binding properties of microcystin-LR. The results showed that microcystin-LR forms at least two complexes with Fe^{III}, interpreted as an initial rapidly formed complex, followed by a more stable and slower forming complex. This is consistent with a previously identified configurational rearrangements of complexed cations from outside to inside the ring structure of microcystin-LR [3]. The stability constant for the more stable Fe^{III}-microcystin-LR complex was calculated to be approximately 10¹³ in 60% v/v MeOH/water at 0.1 M ionic strength, using acid dissociation constants for the two carboxylic groups of microcystin-LR determined by HPLC and UV-Visible spectroscopy methods (pK_{a1}=2.17 and pK_{a2}=3.96) [4]. There was no evidence for the formation of a complex between microcystin-LR and Fe^{II}.

Further experiments conducted at the Australian Synchrotron using the infrared beamline have examined the cellular response of a microcystin producing and non-producing strain of *Microcystis aeruginosa* in the presence of hydrous ferric oxide in order to determine whether the presence of an iron source can stimulate microcystin-LR production.

[1] Fujii *et al* (2011) *Appl. Environ. Microbiol.* **77**, 7068-71 [2] Utkilen & Gjolme (1995) *Appl. Environ. Microbiol.* **61**, 797-800 [3] Humble *et al* (1997) *Water Res.* **31**, 1679-86 [4] Klein *et al.* (2013) *Environ. Sci. Technol.* **47**, 5178-84