How does the adsorption of microcystins and anatoxin-a on nanofiltration membranes depend on their co-existence and on the water background matrix

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ABSTRACT

This work intends to study the adsorption of the cyanotoxins microcystin-LR (MC-LR) and anatoxin-a (ATX-a) on a nanofiltration membrane (150 Da molar mass cut-off and an isoelectric point of 5–6 in the presence of calcium ions), in particular, to understand the toxins' adsorption behaviour with the solution chemistry, namely with the background natural organic matter (NOM), the water pH and the co-existence of MC-LR and ATX-a. The results demonstrate that MC-LR adsorption increases with the water recovery due to MC-LR feed concentration increase. MC-LR adsorption is governed by hydrophobic interactions established between the membrane and the negatively charged MC-LR molecules, and between the MC-LR molecules. The increase of hydrophilic, positively charged low molar mass NOM and of hydrophobic, negatively charged high molar mass NOM does not impact MC-LR adsorption at pH 8. ATX-a adsorption onto the membrane is governed by electrostatic attractions with the membrane and NOM molecules. Background NOM minimises the ATX-a adsorption at pH 7 and enhances it at pH 4, i.e. NOM seems to act as a carrier for ATX-a adsorption onto the membrane. When ATX-a and MC-LR co-exist, adsorption is higher for ATX-a than for MC-LR at pH 4 and 7, and is higher at pH 4 for both cyanotoxins, consistent with the NOM interference.

Key words | adsorption, anatoxin-a, microcystins, nanofiltration, NOM

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