Toxic Cyanobacterial Blooms in Brussels: A Case Study

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Currently, cyanobacterial blooms are regularly observed in Belgium surface waters. Yet, only specific recreational lakes and ponds are being monitored for the presence of toxic cyanobacteria. However, an international inter-institutional study from 2007-2010 (B-Blooms 2) showed a high prevalence of blooms. While the Flemish and Walloon regions took steps to monitor these blooms, the many ponds and lakes in the Brussels region, are not subjected to a structured monitoring plan. This may present an unknown risk to public health. At the end of the summer of 2018, we took samples of suspected cyanobacterial blooms from 4 different ponds in the region to obtain preliminary data concerning cyanobacteria species composition, presence of genes encoding cyanotoxins and cyanotoxins.

Material and Methods

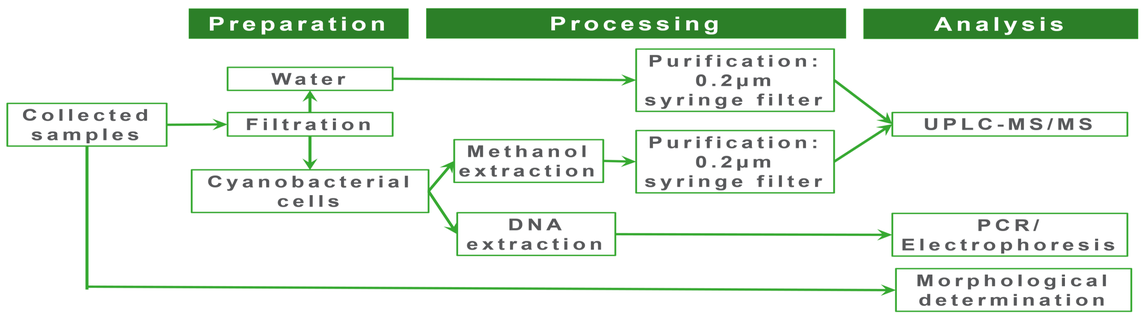


Table1: Overview of the collected samples, their location and their filtered mass to volume ratio.

Collected Samples	Location	Mass/volume of sample (g/l)
BL1	Boudewijn park fase 1	27.67
BL2	Boudewijn park fase 2	10.85
BL3	Mellaert's ponds	6.75
BL4	Ter coigne	1.22

Results

Table 2: Morphological identification of the bloom samples

Morphological identification				
Samples	BL1	BL2	BL3	BL4
species	Microcystis spp Colonies (2 morphotypes).	Older bloom of *Microcystis* spp.	Filamentous *Planktothrix* spp. and a few *Microcystis* spp.	No cyanobacteria were visible
Remarks	The extra-cellular matrix is also visible (fig.1A).	The extra-cellular matrix is absent or deteriorating (fig. 1B)	(fig. 1C-1D).	

Microscopical observations:

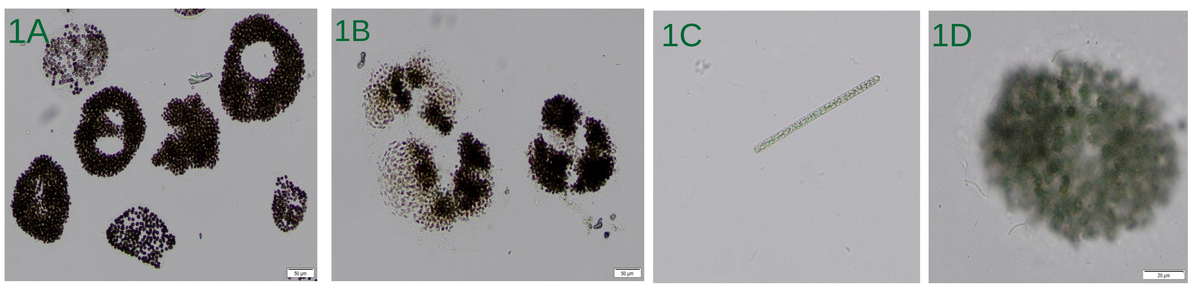


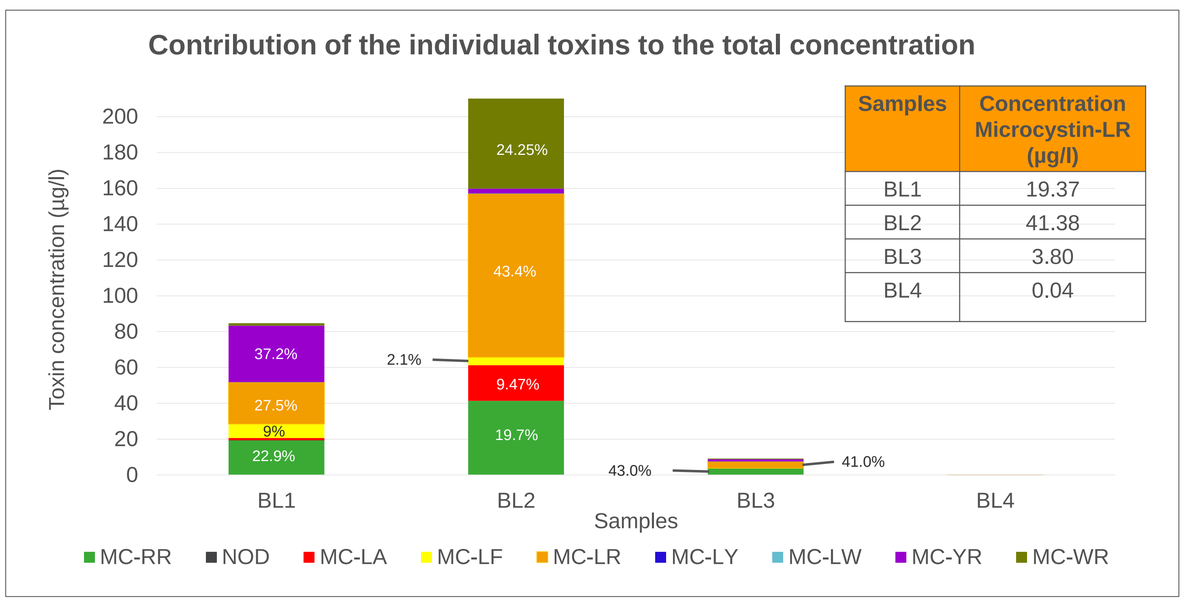
Figure 1: A. Microscopic image of sample BL1, showing *Microcystis* colonies. B. Microscopic image of sample BL2, showing *Microcystis* colonies. C. Microscopic image of sample BL3, showing a *Planktothrix* filament.
D. Microscopic image of sample BL3, showing a *Microcystis* colony.

Molecular confirmation of *mcy* genes:

We were able to detect *mcyA, mcyB and mcyE* in BL1, 2 and 3 using PCR. In BL4, no genes responsible for toxin synthesis were observed.

Quantification of cyanotoxins:

Figure 2 shows the total concentration of Microcystin congeners and Nodularin, as well as the concentration of MC-LR in the different samples in the accompanying table.
Both samples BL1 and BL2 contain high total concentrations of toxins. In BL3, the concentration is below the guidelines for recreational lakes suggested by the WHO (20 µg/l). In BL4, the total concentration of toxin is very low.
Additionally, figure 2 presents the contributions of the different Microcystin congeners. The differences in congener contributions are striking when samples BL1 and BL2 are compared. MC-LR and MC-RR are the dominant congeners but with different values, and they are associated with different congeners (MC-YR and MC-LA, respectively) though the samples were collected in ponds which are located very close to each other.



Samples	Concentration Microcystin-LR (µg/l)
BL1	19.37
BL2	41.38
BL3	3.80
BL4	0.04

Figure 2: Illustration of the independent contributions of the Microcystin congeners to the total concentration of the toxins.

Two toxic blooms in Two ponds

In this preliminary study, we found ample indications that there are toxic blooms present in the Brussels region. Moreover, the two blooms samples collected in neighboring ponds in the Boudewijn park, close to the royal palace, both exhibited high levels of Microcystins, but with a different composition of MC congeners. The concentration of MC-LR that indicates a moderate probability for adverse health effects in recreational waters, proposed by the WHO (20 µg/l), is nearly exceeded in BL1 and definitly exceeded in BL2. We were also able to confirm that the most probable producer of the toxins is member of the *Microcystis* genus. We also determined the presence of the *mcyE* gene in both samples. These results indicate that there should be a further investigation in the risks posed by these kinds of blooms in the Brussels region.

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