

Description of Services:

Phycological Services

Potentially Toxicogenic (PTOX) Cyanobacteria Screen:

Microscopic observation is used to determine if cyanobacteria are present. If potentially toxicogenic (PTOX) cyanobacteria are present, dominant cyanobacteria are identified and recommendations are made for toxin analysis.

Qualitative Algal Identification:

All algae, including cyanobacteria, are identified but not quantified. A species list is composed in order of relative abundance based on the empirical judgment of the phycologist.

Cyanobacteria ID & Enumeration:

Only cyanobacteria species are identified and enumerated.

Total Algal ID & Enumeration:

All algae and cyanobacteria in the sample are identified and enumerated.

Algal ID, Enumeration & Biovolume:

All algae and cyanobacteria are identified, enumerated and biovolumes are calculated.

Molecular/Genetic Analysis (rt qPCR)

16s rRNA – Total Cyanobacteria are determined to be present or absent via the *Phytoxigene Assay*

mcyE/ndfA/cyrA/sxtA – The genes responsible for the production of microcystin, nodularin, cylindrospermopsin and saxitoxin are amplified using the *Phytoxigene Assay*

anaC – The gene responsible for anatoxin-a production is screened for using rt qPCR

Toxin Analyses

Microcystins/Nodularin:

ELISA - A useful screening tool for the detection of microcystins and nodularins (Adda Kit) with a low detection limit. Confirmatory analysis (*e.g.* LC-MS/(MS)) is recommended for any positive samples.

LC-MS/MS - A powerful and highly specific technique used in confirmatory analysis to accurately identify and quantify specific variants of microcystin (MC) and nodularin (NOD). Currently, the suite includes **14** variants of MC ([DAsp³]MC-RR, MC-RR, MC-YR, MC-HtyR, MC-LR, [DAsp³]MC-LR, [Dha⁷]MC-LR, MC-WR, [Leu¹]MC-LR, MC-HilR, MC-LY, MC-LA, MC-LF, MC-LW) and NOD-R. Internal standards (*e.g.* d₇-MC-LR, d₅-MC-LF) and/or standard addition are used in calibration.

Total MCs/NODs via MMPB (2-methyl-3-methoxy-4-phenylbutyric acid) LC-MS/MS –

Through chemical oxidation, microcystins/nodularins can be detected equally, regardless of variant. The analysis of MMPB allows for the determination of **total** Adda MCs/NODs, bound and unbound, in complex matrix material or water samples.

Method 546 (ELISA) – US EPA approved method for the analysis of microcystins/nodularins in raw & finished drinking water. A freeze-thaw sample preparation is employed resulting in a longer TAT.

Anatoxin-a / Homoanatoxin-a:

LC-MS/MS – A highly specific, this technique is used to accurately identify and quantify anatoxin-a in water and other sources at trace levels. The additional analysis of homoanatoxin-a can also be conducted if requested, which is frequently found in the benthos with anatoxin-a.

Cylindrospermopsin & Epi-Cylindrospermopsin:

LC-MS/MS – A highly specific confirmatory and quantitative analysis for cylindrospermopsin and epi-cylindrospermopsin with low detection limits.

Method 545 (LC-MS/MS)- Anatoxin-a & Cylindrospermopsin

US EPA approved method for the analysis of anatoxin-a & cylindrospermopsin in **finished drinking water**.

Saxitoxins (Paralytic Shellfish Toxins):

ELISA – A sensitive screening tool for saxitoxin (STX) in water with limited cross-reactivity to many STX analogs.

LC-MS/MS – A highly specific analysis utilized to quantify a suite of PSTs, including dcSTX, STX, NEO, C1/C2, GTX (1,2,3,4,5,6), dcGTX2&3

Dermatoxins – Lyngbyatoxin-A, Debromoaplysiatoxin, Aplysiatoxin:

LC-MS/MS – Currently the only method available for the reliable detection and quantification of the dermatoxins lyngbyatoxin-a, debromoaplysiatoxin and aplysiatoxin.

Domoic Acid:

LC-MS/MS – A specific technique to accurately identify and quantify domoic acid.

BMAA (β -N-methylamino-L-alanine):

LC-MS/MS – A specific and direct analysis technique utilized to accurately identify and quantify free BMAA in all matrices. BMAA analysis also includes the isomers BAMA, DAB and AEG.

Brevetoxins (PbTX-2, PbTX-3):

ELISA – The recommend screening approach to analyze brevetoxins and associated metabolites.

GreenWater Laboratories utilizes a high level of quality assurance and control to provide reliable results to its clients. We maintain standards of all the toxins listed above, which is necessary for the accurate confirmation and quantification of toxins.

Complex matrices

GWL/CL has extensive experience with toxin extraction from complex matrices, such as tissues, blood, gastrointestinal contents, and algal supplement material. See our Biological/Complicated Matrices Page for more information:

<https://greenwaterlab.com/biological-matrices>