DWQI
Cyanotoxin Practical Quantitation Level (PQL)

Testing Subcommittee Update

02/22/2023

Background

- The overgrowth of photosynthetic microorganisms is known as a harmful algal bloom (HAB)
  - There are recreational and drinking water risks associated with HABs, particularly when HABs dominated by cyanobacteria species
  - Cyanobacteria can sometimes produce toxins during bloom events
  - These toxins include microcystin; which has in excess of 200 congener
  - Detection of microcystin is usually performed using one of two methods:
    - EPA 546 – Enzyme Linked Immunosorbent Assay (ELISA)
    - EPA 544 – LC-MS/MS

Round Robin Project Development

- Division of Water Supply&Geoscience (DWSG) requested NJDEP Division of Science&Research (DSR) to evaluate and draft drinking water values for commonly detected cyanotoxins following UCMR-4
  - Toxicologists within NJDEP DSR developed a draft drinking water value for microcystin of 0.07 µg/L
    - Testing Limitations for commonly used quantification/detection of microcystin
      - EPA 546 MRL – 0.3 µg/L
      - ADDA-OH Kit Detection Limit – 0.1 µg/L
  - Discussions with utilities of the draft number lead to the proposed use of an enhanced sensitivity kit, which was not an approved modification of EPA 546
    - EPA has since allowed this kit as an approved substitution/modification to 546
    - SAES test kit uses different detection chemistry to have a lower detection limit; 0.016 µg/L
- Discussions with DWSG, DSR, and OQA lead to a formal request to DSR for a proposed project to look at the validation of the SAES kit, the lower-level detection limit of microcystin in finished drinking water, and to look at ways to increase testing capacity for either 546 and/or 544

Previously Reported – Round Robin

- **Objective 1**
  - Compare the performance of the SAES kit to ADDA-OH at low levels to measure reliability for precision and accuracy.
    - NJDEP lab was in process of obtaining OQA certification for 546 at the time and has since completed certification.
- **Objective 2**
  - Send out spiked samples with known concentrations to utilities routinely performing microcystin analysis to see real world recovery and data at low levels
    - A concept like how Abraxis (ELISA kit vendor) performs proficiency testing with known concentrations
- **Objective 3**
  - Compare the SAES kit at low levels to EPA 544 with spiked finished drinking water to measure sample recovery

Updated Report – Round Robin

Laboratory	Kit	Expected	Actual	% Difference
NJDEP BFBM/DSR	ADDA	0.07	0.068	97.14%
NJDEP BFBM/DSR	SAES	0.07	0.088	125.71%
1	ADDA	0.07	0.101	144.29%
2	SAES	0.07	0.065	92.86%
3A	ADDA	0.07	<DL	
3B	SAES	0.07	0.049	70.00%

Laboratory	Kit	Expected	Actual	% Difference
NJDEP BFBM/DSR	ADDA	0.1	0.082	82.00%
NJDEP BFBM/DSR	SAES	0.1	0.104	104.00%
1	ADDA	0.1	0.134	134.00%
2	SAES	0.1	0.108	108.00%
3A	ADDA	0.1	<DL	
3B	SAES	0.1	0.053	53.00%

Laboratory	Kit	Expected	Actual	% Differences
NJDEP BFBM/DSR	ADDA	0.3	0.328	109.33%
NJDEP BFBM/DSR	SAES	0.3	0.304	101.33%
1	ADDA	0.3	0.339	113.00%
2	SAES	0.3	0.262	87.33%
3A	ADDA	0.3	<DL	
3B	SAES	0.3	0.215	71.67%

Updated Report – Round Robin

	Expected	Reported	Recovered
Sample 1-0.07	0.07 µg/L	0.09 µg/L	128.57%
Sample 2-0.1	0.1 µg/L	0.134 µg/L	134.00%
Sample 3-0.3	0.3 µg/L	0.389 µg/L	129.67%
Sample 1a-Spike	0.07 µg/L	0.079 µg/L	112.86%
Sample 2a-Spike	0.1 µg/L	0.137 µg/L	137.00%
Sample 3a-Spike	0.3 µg/L	0.363 µg/L	121.00%
Sample 0	0	0	N/A

Samples spiked before extraction

Samples spiked after extraction

micrograms/L	EPA 546	EPA 544	Expected	Difference EPA 546/544	Difference EPA 546/Expected	Difference EPA 544/Expected
0.07	0.09	0.083	0.07	108.43%	128.57%	118.57%
0.1	0.124	0.13	0.1	95.38%	124.00%	130.00%
0.3	0.389	0.39	0.3	99.74%	129.67%	130.00%
0	0	0	0	N/A	N/A	N/A

Summary of Findings

- Based on data generated from the study, no value below 0.1 µg/L for total microcystin is recommended for finished drinking water due to numerous factors associated with testing for microcystin when using a biological based kit
  - This is true regardless of kit chemistry used (either ADDA-OH or SAES)
- The value of 0.1 µg/L is at the detection limit of the ADDA-OH kit and based on the round robin study, under ideal conditions, can be detected and accurately reported using either kit chemistry.
  - However, this value is at the very low detection limit for the ADDA-OH kit
  - Laboratories validating at a 0.1 µg/L value would have to validate using the SAES kit
- A PQL of 0.3 µg/L, the MRL established during UCMR4 for the ADDA detection chemistry and is achievable using both detection chemistries, would allow laboratories to utilize either kit (ADDA or SAES)
  - This value helps eliminate the possibility of false negative results at or near the detection limit of the curve