Cyanotoxins in Sri Lankan waterbodies: A case study in Chandrika *wewa* in the Walawa river basin

M.H.M.A.S.V. Gunawardane[1], W.G.S.M. Kumari[1*], M.M. Wijesooriya[1], G.W.A.P. Randima[1], K. Masakorala[1], K.S.S. Atapattu[2] and K. Sanjaya[2]

[1]Department of Botany, Faculty of Science, University of Ruhuna, Matara, Sri Lanka
[2]Department of Limnology and Water Technology, Faculty of Marine Sciences and Technology, University of Ruhuna, Matara, Sri Lanka

Abstract

Cyanobacteria are a highly diverse group of prokaryotes and some of them release toxins (cyanotoxins) into their aquatic habitats. Due to high toxicity, tendency to bioaccumulate and biomagnify, cyanotoxins may risk human and animal health. Chandrika wewa (448 ha) supplies drinking water for more than 5000 families in the Walawa river basin. However, a systematic study has not been conducted to detect cyanotoxin contamination in the reservoir. Therefore, the objectives of the present study were (a) to confirm the presence or absence of cyanotoxins and (b) to identify the impacts of physicochemical parameters of water on spatial distribution of cyanotoxins. Sub-surface water samples were collected from 33 sites representing the entire reservoir and subsequently NO_3^--N, PO_4^{3-}-P, cyanotoxins, chlorophyll-*a* and phytoplankton composition were measured. The concentrations of two cyanotoxins, microcystin (MC) and nodularin (NOD) were determined by using enzyme-linked immunosorbent assay (ELISA). *In-situ* physiochemical properties were measured using a multi-parameter water quality meter. Results showed the presence of phytoplankton in the genera of *Tribonema*, *Microspora*, *Pediastrum* and *Microcystis*. *Microcystis* was dominant in all sampling sites with the density of 200-790 cells/mL. The MC and NOD concentrations were between 0.77-1.19 µg/L and 0.69-1.27 µg/L, respectively. Further, absence of filamentous cyanobacteria that is resembles to the morphology of the members in the genera of *Nodularin* was confirmed. However, there were significant positive correlations between MC (r^2 = 0.992, $p<0.05$) and NOD (r^2 =0.883, $p<0.05$) concentrations with *Microcystis* density. Therefore, it can be assumed that NOD is unlikely to be present in this reservoir and the detected NOD is due to the cross reaction of NOD antibodies with MC in water samples. Further, filamentous cyanobacteria that are known to produce MC was not found. Hence, *Microcystis* is likely to be responsible for the detected MC toxin. There was no correlation between any of the physicochemical parameters with the spatial distribution of MC toxin. The concentration of MC in this reservoir was slightly above the World Health Organization (WHO) guidelines for drinking water (1 µg/L). Therefore, continuous monitoring of toxins and physicochemical parameters of the reservoir is recommended to minimize cyanotoxin associated health hazards that could happen in the future.

Keywords: Cyanobacteria, ELISA, Microcystin, Nodularin

[*]***Corresponding Author***: shirani@bot.ruh.ac.lk

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