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Potential toxicity of algal blooms in Wadi El-Rayian lakes, El-Fayioum (Egypt)

Thesis Submitted for Ph. D. Degree of Science in Botany (Phycology)

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Abstract

The present study mainly concerned with the Upper Lake of Wadi El-Rayian, El-Faiyom, Egypt, and the potential toxicity occurrence as a result of algal blooming phenomenon. Algal samples were collected from the Upper Lake from June 2008 to May 2009. Cyanobacterial blooms were recorded during winter from the mid of December 2008 and extended to the first week of May 2009. This study discussed deeply the limiting factors of phytoplankton blooming, either physical or chemical parameters. Also, it detected the potential toxicity of these algae and their effect on the economic fishes inhabiting the lake. Finally, it was an attempt to study the behavior of the bloom forming species namely, *Microcystis aeruginosa* and *M. flos - aquae* pure culture under lab conditions to find a solution for this problem.

Chlorophyll *a* concentrations indicated that, the lake is highly eutrophic. The higher values were recorded in winter and spring seasons. chlorophyll *a* concentrations during the blooming period, showed a gradual increase at the beginning of the bloom reaching its peak of (1822 $\mu g l^{-1}$) in February, followed by a gradual decrease till the end of the blooming period.

The hepatocyanotoxin, microcystin, was determined by mouse bioassay, brine shrimp bioassay and HPLC and its effect on Tilapia fish.
In the HPLC chromatogram of algal sample, the microcystin peak appears at the same retention time of the standard. The microcystin levels in samples were ranged from 0.11 to 6.53 $\mu g\ g^{-1}$ dry weight.
Among the environmental factors water temperature is the most important factor determining the dominance

of the bloom forming species. The appearance of *Microcystis* bloom during winter season means that the bloom prefers the low water temperature. Phosphorous is the limiting factor in blooming formation, where its level was deeply decreased in winter season ranged from 1.48 µg 1^{-1} to 3.72 µg 1^{-1}. Orthophosphate concentrations fluctuated between 0.65 µg 1^{-1} and 332.82 µg 1^{-1} during the blooming period. High nitrogen sources entering into the Lake are one of the reasons for the blooming of the microalgae.

In conclusion, the hepatocyanotoxin microcystin was detected in the mixed bloom as well as in the pure isolates of *M. aeruginosa* and *M. flos - aquae*. The toxic effect of algal bloom proved to affect on Tilapia fish at a lab scale which predict in turn to affect on the economic fishes inhabiting the lake.

This study recommended ongoing studies to understanding of microalgal toxins in a manner that will stimulate interdisciplinary research with these microorganisms. Also, address risk in the aquatic habitats when toxigenic cyanobacteria are present. And to underline the necessity of monitoring programs as well as the improvement of analytical methodologies to efficiently prevent the human health risks as a consequence of microcystins contamination.

Key words: Wadi El-Rayian, *Microcystis aeruginosa*, *M. flos - aquae* , hepatocyanotoxin, Microcystin.

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