EXPLORING THE EFFECTS OF OZONATION ON FRESHWATER CYANOBACTERIA AND GREEN ALGAE IN SURFACE WATER

N. Tsiarta[1], E. Chatziathanasiou[1], M. G. Antoniou[1,*]

[1]Department of Chemical Engineering, Cyprus University of Technology, Limassol, Cyprus

(*maria.antoniou@cut.ac.cy)

ABSTRACT

Cyanobacteria, also known as blue-green algae, present a persistent environmental concern due to the ability of some species to produce and release toxic metabolites (also known as cyanotoxins) in surface waters [1]. Fueled by nutrient enrichment from various sources like agricultural and sewage runoffs, these blooms have become increasingly persistent and prevalent globally. The proliferation of cyanobacteria and cyanotoxins in freshwater sources have far-reaching consequences. Cyanotoxins, such as microcystins and anatoxins, which have been detected in drinking water treatment plants and networks globally, result in a range of adverse health effects, including liver cirrhosis, gastrointestinal issues, and neurological symptoms [2]. Moreover, the aesthetic effects of cyanobacterial blooming directly impact recreational activities, fisheries, and the ecological balance of aquatic ecosystems [3]. Given these challenges, effective treatment strategies are imperative to mitigate the impact of cyanobacteria in water sources. Ozonation has emerged as a promising oxidizing method for addressing cyanobacterial issues in water treatment. Specifically, ozone has the potential not only to disrupt the cellular structures of cyanobacteria but also to degrade cyanotoxins simultaneously [4]. Therefore, we investigated how different species react with ozone, determined the effective dose so that the cells are adversely damaged, and recorded the effect of the age of a bloom on ozone dosing. In this study, we tested three different cyanobacteria species, *Microcystis* spp., *Aphanizomenon* spp., and *Cylindrospermopsis* spp., as well as a green alga, *Scenedesmus obliquus*. All species were individually exposed to four ozone concentrations ranging from 0.5 – 4 mg/L at a controlled temperature (20 °C). Pure cultures were maintained in a BG-11 growth medium, and cells were inoculated in surface water collected from the Kouris reservoir in Cyprus. Results have shown that cyanobacteria are more sensitive to ozone treatment than green algae. A 4 mg/L ozone dose effectively disrupts the cyanobacterial biomass, and cells cannot recover. On the other hand, smaller doses showed a severe implication on cells' vitality for the first 2 hours. However, the cells recovered over the next three days. Interestingly, the age of the culture plays a significant factor in the response of the cells to the different doses.

KEYWORDS: freshwater cyanobacteria, ozonation, photosynthetic vitality

REFERENCES

[1] Paerl, H. W., & Huisman, J. (2008). Blooms like it hot. *Science*, 320(5872), 57–58.

[2] World Health Organization (WHO). (2018). Cyanobacterial toxins: Microcystin-LR in drinking-water.

[3] Hudnell, H. K. (2008). The state of U.S. freshwater harmful algal blooms assessments, policy and legislation. *Toxicon*, 52(2), 344–352.

[4] Zamyadi, A., MacLeod, S. L., Fan, Y., McQuaid, N., Dorner, S., & Sauvé, S. (2017). Impact of ozonation on the removal of microcystin toxins from drinking water sources. *Water Research*, 124, 477–485.