EXPLORING THE POTENTIAL OF PEROXYMONOSULFATE (PMS) AS A BETTER ALTERNATIVE TO HYDROGEN PEROXIDE TREATMENT FOR THE *IN-SITU* MITIGATION OF CYANOBACTERIA HARMFUL ALGAL BLOOMS (CYANO-HABS)

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ABSTRACT

Peroxymonosulfate (PMS) is a known oxidizing agent used in water treatment (especially in the pool and spa industry) as it can perform targeted oxidation for the removal of contaminants of emerging concern and has disinfection properties. Moreover, PMS has been used in bench-scale studies for the removal of cyanotoxins from drinking water [1], which are a group of naturally occurring toxins produced from the toxic strains of cyanobacteria [2]. Despite that, there is limited information in the literature regarding PMS's application in mitigating toxic cyanobacteria in surface waters. Other peroxide compounds such as H_2O_2 have been extensively used on cyanobacteria-contaminated sites with varying efficiencies [3]. Though efficient, the requirement for high H_2O_2 doses to restore contaminated sites can negatively affect non-targeted species of the aquatic ecosystem (phytoplankton and zooplankton), which impose restrictions on H_2O_2 *in-situ* application in surface waters. Thus herein, PMS was investigated as an alternative peroxide compound for its algicidal properties on two cyanobacteria species (*Microcystis sp.* and *Aphanizomenon sp.*) and its toxicity on non-targeted zooplankton species (*Echinogammarus veneris sp.*). The experiments were conducted in an actual surface water matrix (Kouris Reservoir in Cyprus), spiked with pure cultures and PMS doses of 1-5 mg/L (H_2O_2 equivalents). The loss of the photosynthetic activity of the cyanobacterial cells and mobility of the *Gammarus* species was monitored for 48 hours. Treatment experiments showed that both species required as low as 3 mg/L PMS, while toxicity studies on zooplankton showed that species are more sensitive to multiple than single PMS doses which is opposite to liquid H_2O_2. Experiments on the simultaneous degradation of cyanobacterial cells from *Microcystis sp.* and microcystin-LR confirmed that PMS could degrade both the toxins and the cells at the same time, while H_2O_2 could not. The structures of the transformation products of microcystin-LR during treatment (up to 72 hours of contact time) were determined in dedicated experiments.

KEYWORDS: cyanobacteria, cyanotoxins, peroxymonosulfate, mass spectroscopy, water quality

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