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Cyanobacteria removal by electroflotation with titanium electrodes

Tiago Burgardt[a,*], Thyara Martins Nonato[a], Fernando Hymnô de Souza[a], Benny Zuse Rousso[b,c], Maurício Luiz Sens[a]

[a]*Federal University of Santa Catarina, Postgraduate Program in Environmental Engineering, Campus Universitário UFSC/CTC Bairro Trindade – CEP 88040-900 Florianópolis – Santa Catarina/Brazil, Tel.: +55 (48) 996371771; emails: tiagoburg@me.com (T. Burgardt), thyaranonato@outlook.com (T.M. Nonato), fernando.hs@outlook.com (F.H. de Souza), mauricio.sens@ufsc.br (M.L. Sens)*
[b]*School of Engineering, Deakin University, 75 Pigdons Rd., Waurn Ponds, VIC 3216, Australia, email: benny.zuserousso@deakin.edu.au (B.Z. Rousso)*
[c]*Institute for Sustainable Futures, University of Technology Sydney, 235 Jones St., Ultimo, NSW 2007, Australia*

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ABSTRACT

Harmful cyanobacteria blooms are a major concern for water managers worldwide because they have negative environmental, social and economic impacts. This study aimed to evaluate cyanobacteria removal performance and water quality by electroflotation using titanium electrodes as a pre-treatment in water treatment plants (WTPs). Water quality, toxicity, cyanobacterial cell integrity and cyanotoxin analysis were performed. An experimental design was carried out to determine the optimum operational parameters (OOP) for cyanobacteria removal. The identified OOP were flow rate of 100.06 $m^3 \cdot m^{-2} \cdot d^{-1}$ and current density of 72.10 $A \cdot m^{-2}$, resulting in an energy consumption of 1.97 $kWh \cdot m^{-3}$. The reactor at OOP, operating for 6h, was able to remove 97% of cyanobacteria in a continuous flow reactor. Furthermore, dissolved organic carbon, turbidity, and apparent color decreased 41%, 55%, and 52%, respectively. Phytotoxicity analyses showed seed germination and radicle growth rates greater than 75% and hypocotyl growth inhibition rates from 3% to 22%. Roots showed no growth inhibition compared with the positive control. Cell permeability analysis revealed cell wall alterations in cyanobacteria after electroflotation; however, cyanotoxins were not detected in treated water. These findings indicate that electroflotation using titanium electrodes is a viable alternative as a pretreatment in WTPs.

Keywords: Electroflotation; Titanium electrodes; Water treatment; Pretreatment; Cyanobacteria; Cyanotoxins; Toxicity

* Corresponding author.