biology and life sciences forum

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Abstract

Green Nanotechnology for the Remediation of Cyanotoxins from Contaminated Waters †

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† Presented at the 7th Iberian Congress on Cyanotoxins/3rd Iberoamerican Congress on Cyanotoxins, Ponta Delgada, Portugal, 18–20 July 2022.
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Abstract: The presence of contaminants in water may involve a risk to human and animal health. Conventional water treatment methods such as coagulation, flocculation, and sedimentation are ineffective for cyanotoxin removal. In addition, high amounts of cyanotoxins can be released during those processes if cells lyse. Thus, new mitigation strategies must be developed to ameliorate the consequences of harmful algal blooms. In this sense, nanotechnology has become a promising tool for the treatment of contaminated water. Several nanomaterials with specific chemical affinities can be combined into hybrid structures, leading to nanostructured agents with a large surface area and with the ability to absorb different contaminants. In addition, these structures can include magnetite, which enables separation from the detoxified substance by magnetic extraction, which is considered a green technique. This approach has been successfully applied to the removal of dyes, endocrine disruptors, and heavy metal ions. Recently, we have described the use of carbon nanoparticles to remove around 60% of microcystins from contaminated solutions, but with a low efficiency in the adsorption of anatoxin-a and cylindrospermopsin. In this work, a new set of biocompatible magnetic nanocomposites were tested using artificially contaminated water. The toxin content in solutions was determined before and after treatment by ultra-performance liquid chromatography–tandem mass spectrometry (UHPLC-MS/MS). With these new nanocomposites, cyanotoxin elimination was highly improved, reaching toxin removal rates of up 80%. Therefore, the implementation of the nanotechnology in water treatment could be a promising approach to reduce the presence of natural toxins in the water.

Keywords: cyanotoxins; nanotechnology; UHPLC-MS/MS; nanoparticles; Microcystis

Citation: González-Jartín, J.M.; Alfonso, A.; Alvariño, R.; Rodríguez-Cañás, I.; Vieytes, M.R.; Piñeiro, Y.; de Castro, L.; González, M.; Rivas, J.; Botana, L.M. Green Nanotechnology for the Remediation of Cyanotoxins from Contaminated Waters. *Biol. Life Sci. Forum* **2022**, *14*, 12. https://doi.org/10.3390/blsf2022014012

Academic Editor: Vitor Gonçalves

Published: 19 July 2022

Author Contributions: Conceptualization, L.M.B. and J.R.; methodology, A.A. and Y.P.; investigation, J.M.G.-J., R.A., I.R.-C., M.R.V., L.d.C. and M.G.; writing—original draft preparation, J.M.G.-J.; funding acquisition, L.M.B. and J.R. All authors have read and agreed to the published version of the manuscript.

Funding: The research leading to these results has received funding from the following FEDER cofunded-grants from the Conselleria de Cultura, Educacion e Ordenación Universitaria, Xunta de Galicia, GRC (ED431C 2021/01), from the Ministerio de Ciencia e Innovación IISCIII/PI19/001248,

PID 2020-11262RB-C21, from the European Union Interreg Agritox EAPA-998-2018, and H2020 778069-EMERTOX.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Datasets used in this study are available from the corresponding author on reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.