JWARP> Vol.3 No.6, June 2011

OPEN ACCESS

Cylindrospermopsin in Water Supply Reservoirs in Brazil Determined by Immunochemical and Molecular Methods

PDF (Size:1867KB) PP. 349-355 DOI: 10.4236/jwarp.2011.36044

Author(s)

Maria do Carmo Bittencourt-Oliveira, Viviane Piccin-Santos, Paula Kujbida, Ariadne do Nascimento Moura

ABSTRACT

It is reported for the first time in Brazil and South America the presence of cylindrospermopsin (CYN) in water supply reservoirs. CYN is a powerful hepatotoxic alkaloid implicated in outbreaks of human sicknesses. We detected CYN in different sources of water in Northeastern Brazil using molecular and immunological techniques. The highest concentrations of toxin occurred in the Jucazinho reservoir with the phytoplankton containing the potentially CYN-producing C. raciborskii and Sphaerospermopsis aphanizomenoides (previously known as Aphanizomenon aphanizomenoides). The polyketide synthase (PKS) and peptide synthetase (PS), which are directly related to the ability to produce CYN, were found in all the analyzed samples. The result of the present study emphasizes the need to improve monitoring of CYN in water bodies used for drinking and recreation, in order to avoid exposure of human populations to this toxin.

KEYWORDS

Aphanizomenon, Cyanobacteria, Cylindrospermopsis Raciborskii, CYN, Sphaerospermopsis Aphanizomenoides, Toxin

Cite this paper

M. Bittencourt-Oliveira, V. Piccin-Santos, P. Kujbida and A. Moura, "Cylindrospermopsin in Water Supply Reservoirs in Brazil Determined by Immunochemical and Molecular Methods," *Journal of Water Resource and Protection*, Vol. 3 No. 6, 2011, pp. 349-355. doi: 10.4236/jwarp.2011.36044.

References

[1] M. Neff, "Ecotoxicology of Arsenic in Marine Environment," Environmental Toxicology and Chemistry, Vol. 16, 1997, pp. 917-927.

[2] "Arsenic in Drinking Water," National Research Council, National Academies Press, Washington. DC., 1999.

[3] R. A. Armstrong, "Nutrient uptake as a Function of Cell Size and Surface Transfer Density: A Michaelis like Approximation to the Model of Pasciak and Gavis," Deep- Sea Research, Part I, Vol. 55, No. 10, 2008, pp. 1311- 1317.doi:10.1016/j.dsr.2008.05.004

[4] D. L. Aksnes and J. K. Egge, "A Theoretical Model for Nutrient Uptake in Phytoplankton," Marine Ecological Progress Series, Vol. 70, 1991, pp. 65-72. doi:10.3354/meps070065

[5] A. J. Miao, W. X. Wang and P. Juneau, "Comparison of Cd, Cu, and Zn Toxic Effects on Four Marine Phytoplankton by Pulse-Amplitude-Modulated Fluorometry," Environmental Toxicology and Chemistry, Vol. 24, No. 10, 2005, pp. 2603-2611. doi:10.1897/05-009R.1

[6] G. F. Riedel and J. G Sanders, "The Interrelationships among Trace Elements Cycling, Nutrient Loading, and System Complexity in Estuaries: A Mesocosm Study," Estuaries, Vol. 26, No. 2A, 2003, pp.339-351. doi:10.1007/BF02695972

[7] J.G. Sanders and G. F. Riedel, "Trace Element Transformation during the Development of an Estuarine Algal Bloom," Estuaries, Vol. 16, No. 3A, 1993, pp. 521-532. doi:10.2307/1352599

• Open Special Issues
• Published Special Issues
• Special Issues Guideline

JWARP Subscription

Most popular papers in JWARP

About JWARP News

Frequently Asked Questions

Recommend to Peers

Recommend to Library

Contact Us

[8] P. Michel, B. Boutier, H. Herbland, B. Averty, L. F. Artigas, D. Anger and E. Charttier, "Behavior of Arsenic on the Continental Shelf of the Gironde Estuary: Role of Phytoplankton in Vertical Fluxes during Spring Bloom Condition," Oceanologica Acta, Vol. 21, No. 2, 1997, pp. 325-333. doi:10.1016/S0399-1784(98)80019-4

[9] S. K. Mandal, M. Dey, D. Ganguly, S. Sen and T. K. Jana, "Biogeochemical Controls of Arsenic Occurrence and Motility in the Indian Sundarban Mangrove Ecosystem," Marine pollution Bulletin, Vol. 58, No. 5, 2009, pp. 652-657. doi:10.1016/j.marpolbul.2009.01.010

[10] Y. Gao and A. Mucci, "Individual and Competitive Adsorption of Phosphate and Arsenate of Goethite in Artificial Sea Water," Chemical geology, Vol. 199, No. 1-2, 2003, pp. 91-109. doi:10.1016/S0009-2541(03)00119-0

[11] K. Knauer and H. Hemond, "Accumulation and Reduction of Arsenate by the Fresh Water Green Alga Chlorella sp. (Chlorophyta)," Journal of Phycology, Vol. 36, No. 3, 2000, pp. 506-509. doi:10.1046/j.1529-8817.2000.99056.x

[12] H. Biswas, M. Dey, D. Ganguly, T. K. De, S. Ghosh, and T. K. Jana, "Comparative Analysis of Phytoplankton Composition and Abundance over a Two-decade Period at the Land-ocean Boundary of a Tropical Mangrove Ecosystem," Estuaries and Coasts, Vol. 33, No. 2, 2010, pp. 384-394. doi:10.1007/s12237-009-9193-5. doi:10.1007/s12237-009-9193-5

[13] S. K Acharya, S. Lahiri, B. C. Kaymahashay, and A. Bhowmik, "Arsenic Toxicity in Ground Water in Parts of Bengal Basin in India and Bangladesh: Role of Quarternary Stratigraphy and Holocene Sea Level Fluctuation," Environmental Geology, Vol. 39, No. 10, 2000, pp. 1127-1137.doi:10.1007/s002540000107

[14] D. Das, G. Samnta, B. K. Mondal, R. T. Chowdhury, C. R. Chanda, P. P. Chowdhury, G. K. Basu and D. Chakraborti, "Arsenic in Ground Water in Six Districts of West Bengal, India," Environmental Geochemistry and Health, Vol. 18, No. 1, 1996, pp. 5-15. doi:10.1007/BF01757214

[15] R. Nickson, J. McArthur, N. Burgess, K. M. Ahmed, A. P. Ravenscroff, and M. Rahaman, "Arsenic Poisoning of Bangladesh Ground Water," Nature, Vol. 395, 1998, p. 338. doi:10.1038/26387

[16] J. Metral, L. Charlet, S. Burean, S. Basu Mullik, S. Chakraborty, K. M. Ahmed, M. W. Rahman, Z. Cheng and A. Vangeen, "Comparison of Dissolved and Particulate Arsenic Distribution in Shallow Aquifers of Chakdaha, India and Araihazar, Bangladesh," Geochemical transactions, Vol. 9, 2008, p. 1. doi:10.1186, 1467-4866-9-1.

[17] T. Kiorboe "Turbulance, Phytoplankton Cell Size and Structure of Pelagic Food Webs," Advances in Marine Biology, Vol. 29, 1993, pp. 1-72. doi:10.1016/S0065-2881(08)60129-7

[18] J. S. Edmonds, Y. Shibata, K. A. Francesconi, R. J. Rip pington, M. Morita, "Arsenic Transformations in Short Marine Food Chain Studied by HPLC-ICP/MS," Applied Organometalic Chemistry, Vol. 11, No. 4, 1997, pp. 281- 287. doi:10.1002/(SICI)1099-0739(199704)11:4<281::AID-AOC581>3.0.CO;2-S

[19] A. Skovgaard and S. M Deuer, "Long-Term Exposure of Dinoflagellates to 14carbon Effects on Growth Rate and Measurements of Carbon Content," Journal of plankton research, Vol. 25, No. 8, 2003, pp. 100-1009. doi:10.1093/plankt/25.8.1005

[20] A. Al-Tisan, Ibrahim and C. P. Joseph, "Distribution of Heavy Metals in Plankton Collected during the Umikata Maru Cruise (II) in the Ropme Sea Area," In: Proceeding of The Umitaka Maru symposium, Tokyo, Japan, 1995.

[21] A. Aminot and R. Keroue, "An automated Photo-Oxidation Method for the Determination of Dissolved Organic Phosphorus in Marine and Fresh Water," Marine Chemistry, Vol. 76, No. 1-2, 2001, pp. 113-126. doi:10.1016/S0304-4203(01)00052-4

[22] D. E. Cummings, F. Caccavo. Jr, S. Fendorf and R. F. Rosenzweig, "Arsenic Mobilization by the Dissimilarity Fe (III) Reducing Bacterium Shewanella alga Bry," Environmental Science and Technology, Vol. 33, 1999, pp. 723-729. doi:10.1021/es980541c

J. H. Han and J. D. Floros, Modeling the Growth Inhibition Kinetics of Baker s Yeast by Potassium