Risk Assessment Using Sediment Suspensions with Aquatic Toxicity Tests

Hülya BÖKE ÖZKOÇ, • eyma ATAY

University of Ondokuz Mayıs, Engineering Faculty, Department of Environmental Engineering, 55139, Atakum, Samsun, Turkey

hozkoc@omu.edu.tr, seymaatay@hotmail.com, Tel: +00-(90)-362-3121919

Abstract

In this study, toxicity and bioavailability of zinc to *Phaeodactylum tricornutum* were determined in sediment medium. The marine diatom *Phaeodactylum tricornutum* was exposed to different zinc concentrations (250-2000 µg L^{-1}) for 96 hours. A significant negative correlation between growth rates of *Phaeodactylum tricornutum* and zinc concentrations was observed. Exposure time and zinc concentration in medium significantly affected bioconcentration factor (BCF). Sediment microorganisms are crucial for biodegradation of matter and the cycling of nutrients while these microorganisms are susceptible to toxic pollutants. Metal bioavailability which is used of the biokinetic approach comparatively between species is often incorporated in risk assessment of metals. Bioavailability of zinc to *Phaeodactylum tricornutum* increased when the exposure time and zinc concentration increased. Abiotic factors in sediment medium, such as pH variations, light and test medium can significantly affect the tolerance of organisms. The pH variation was increased and decreased in different zinc concentrations. This variation was affected the bioavailability of zinc to *Phaeodactylum tricornutum* in the sediment medium. For the protection of the sediment ecosystem one needs information on the sensitivity of the microorganisms, plants and animals which are living in and on the surface of sediments. Thus, bioassays have been designed to determinate the effect of potentially toxic samples to biota and are necessary to establish pollution risk in sediments. Historically, sediment has provided a sink for anthropogenic contamination and consequently represent a potential ecological risk to the environment. A common adverse effect demonstrating this potential risk is sediment toxicity. This study can assist critical information for the environmental risk assessment of metals in aquatic environments.

Keywords: Sediment toxicity; *Phaeodactylum tricornutum*; Bioavailability; Zinc; Risk.

References

American Society for Testing and Materials (ASTM), 2008. Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing and for Selection of Samplers Used to Collect Benthic Invertebrates. E 1391-03, West Conshohocken, PA, United States.

Atay, •., Özkoç, H.B., 2010. Effect of Sediment on The Bioavailability and Toxicity of Copper and Zinc to A Green Alga. Fresenius Environmental Bulletin, 19 (12a), 3018-3027.

Baun, A., Justesen, K.B., Nyholm, N., 2002. Algal Tests with Soil Suspensions and Elutriates: A Comparative Evaluation for PAH-Contaminated Soils. Chemosphere, 46, 251-258.

Canadian Council of Ministers of the Environment (CCME), 1999. Protocol for The Derivation of Canadian Sediment Quality Guidelines for The Protection of Aquatic Life. CCME EPC-98E. http://www.ec.gc.ca/ceqg-rcqe/english/Ceqg/Sediment/default.cfm, (16.10.2008).

International Standards for Standardization (ISO), 2006. Water Quality – Marine Algal Growth Inhibition Test with *Skeletonema costatum* and *Phaeodactylum tricornutum*. ISO 10253.

Organisation for Economic Cooperation and Development (OECD), 2006. Sediment-Water *Lumbriculus* Toxicity Test Using Spiked Sediment. Proposal for A New Guideline for OECD Guidelines for The Testing of Chemicals, Draft Document.

Phyu, Y.L., Warne, M.St.J., Lim, R.P., 2005. Effect of River Water, Sediment and Time on The Toxicity and Bioavailability of Molinate to The Marine Bacterium *Vibrio fischeri* (Microtox). Water Research,39;12, 2738-2746.

Simpson, S.L., Batley, G.E., Chariton, A.A., Stauber, J.L., King, C.K., Chapman, J.C., Hyne, R.V., Gale, S.A., Roach, A.C., Maher, W.A., 2005. Handbook for Sediment Quality Assessment. CSIRO Energy Technology, Bangor, NSW. http://www.clw.csiro.au/cecr/, (16.10.2008).

Spacie, A., McCarty, L.S., Rand, G.M., 1995. Bioaccumulation and Bioavailability in Multiphase Systems. In: Rand, G.M. (Ed), Fundamentals of Aquatic Toxicology, Effects, Environmental Fate and Risk Assessment. 2nd ed., Boca Raton, Florida, CRC Press, 493-521.

U.S. Environmental Protection Agency (USEPA), 2002. Short-term Methods for Estimating The Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. 4th ed., EPA-821-R-02-013, Washington.