Research Article

Heavy metals in water, sediment, and edible macroalgae (*Nostochopsis* spp.)

Wilailak Suanmali[1*], Siripen Trichaiyaporon[1], Richard L. Deming[2]

[1] Faculty of Science, Chiangmai University, Chiangmai Province 50200

[2] Department of Chemistry and Biochemistry, Faculty of Science, California State University, Fullerton, California 92834, USA

* Corresponding author, E-mail: aewilailak_s@hotmail.com

Naresuan Phayao J. 2015;8(3):147-149.

Abstract

The concentrations of the heavy metals: cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn) were examined among different sources of couple areas of Nan province, Thailand. The heavy metal concentrations were very low in water, and low and fluctuated concentration with Zn of 884.67 to 3,786 mg/kg in sediment. Whereas, in blue green algae (*Nostochopsis* spp.) Zn concentration was 884.67 to 1,634 mg/kg, but the others were not detectable.

Keywords: Edible macroalgae, *Nostochopsis* spp., heavy metals accumulation, water quality

Introduction

Numerous of chemical contaminants were released into the aquatic environment and bioaccumulation in the food chain, including numerous aliphatic and aromatic compounds, heavy metals, and phthalate esters, [1-2] as well as toxic effect points often far away from the source of pollution [3]. The species of green algae and other biota [4,5] could be regard as an indicator species for heavy metal, as well as sediment and water. [6] Even a number of blue-green algae species release toxins that can cause death. In the Nan River of northern Thailand, one of edible algae named Nostochopsis is a branching, filamentous blue green alga found in freshwater lotic ecosystems and in many different habitats. [7] The aim of the study was to distribution of heavy metals of water, sediment and edible algae.

Material and Method

The surface water in clean acid washed bottle and preserved by nitric acid, 10-centrimeter in depth of sediment, and the washed algae with kept in icebox, were collected from Pua and Wangpha district.

The water samples of 5 different sites (8, 2, and 5 sampling in 2009, 2010, and 2011, respectively) were filtrated, analyzed, and measured within 24 h including biochemical oxygen demand (BOD) by azide modification method, orthophosphate phosphorus by ascorbic acid, ammonia-nitrogen by nesslerization method, nitrate-nitrogen by cadmium reduction). [8] Heavy metals cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn) were analyzed by In house method TE-CH-260 based on AOAC (2005) Ch.9, 999.10 by inductively coupled plasma mass spectrometry (ICP-MS) technique.

Received: 11 July 2015; Accepted: 15 December 2015

The sediment samples were air dried, ground, sieved with 200-mesh sieve, and stored in plastic containers digestion by concentrated nitric and perchloric acid, and used for the heavy metal analysis by ICP-MS technique.

The algae samples were transferred into an evaporating basin, dried, and digested in concentrated nitric and perchloric acids to dissolve heavy metals and major component. The heavy metals were measured by ICP-MS technique, Perkin Elmer ELAN, model 9000.

Data were presented as proportion, and the range.

Results

The BOD, phosphate, ammonia nitrogen, nitrate nitrogen, were varied from 0 to 6.45, 0.2 to 1.35, 0 to 0.4, and 0.2 to 30 mg/L respectively.

The metal concentrations in water were low. The metal concentrations in sediment of five sites were low and fluctuated concentration with the maximum level of Zn 884.67 to 3,786 mg/kg.

In algae, the Cd, Cr, Cu, Hg, Ni and Pb were not detectable (ND), while only Zn concentration were 884.67 to 1,634 mg/kg (dry weight).

Discussion

Among 9 crops, the field pumpkin and red beet were characterized by the highest zinc accumulation, especially in the leaves of 119.14, and 64.97 mg/kg, respectively. [9] The study showed that the Zn concentration in edible algae contained the highest concentration, up to 1,634 mg/kg, extremely high. The source of contamination usually came from industry waste, metal plating and plumbing. The edible plants especially growing far from chemicals and hazardous heavy metals could be though to be less exposed to pollution, as well as the growing environment. Thus the pollutant levels among the water reservoirs did not identify the cause of impairment. To investigate the relation between the site of measurement and sources of contamination is quite important for surveillance and monitoring. The surveillance should be determined in all seasonings.

In conclusion, the consuming the metal contaminated dietary intake is a concern.

Acknowledgement

The research was financial supported by Environmental Science Program, the Graduate School Chiangmai University, Kamphaengphet Rajabhat University, and Office of the Higher Education Commission.

References

1. Valls M, de Lorenzo V. Exploiting the genetic and biochemical capacities of bacteria for the remediation of heavy metal pollution. FEMS Microbiol Rev. 2002:26(4),327–38.
2. Gochfeld M. Cases of mercury exposure, bioavailability, and adsorption. Ecotoxicol Environ Saf. 2003;56(1):174–9.
3. Fernandez M, Cuesta S, Jimenez O, Garcia MA, Hernandez LM, Marina ML, et al. Organochlorine and heavy metal residues in the water/sediment system of the southeast regional park in Madrid, Spain. Chemosphere. 2000;41(6):801-12.
4. Haritonidis S, Malea P. Bioaccumulation of metals by the green algae Ulva rigida from Thermaikos Gulf, Greece. Environ Pollut. 1999:104;365–72.
5. Deniseger J, Erickson J, Austin A, Roch M, Clark MJR. The effects of decreasing heavy metal concentrations on the biota of Buttle Lake. Water Res. 1990;24:403–16.

6. Varol M, Sen B. Assessment of nutrient and heavy metal contamination in surface water and sediments of the upper Tigris River, Turkey. Catena. 2012;92:1-10.
7. Peerapornpisal, Y. *Diversity, phylogenic criteria and cyanotoxins of toxic blue-green algae in Thailand*. Proceeding of the 10th Technical Conference of BRT; 2006 Oct 8-11; Marinetime Park and Spa Resort, Krabi Province.
8. American Public Health Association, American Water Works Association, Water Environment Federation. Standard Methods for the Examination of Water and Wastewater, 20th edition. Baltimore: United Book Press; 1998.
9. Sekara A, Poniedzialek M, Ciura E, Jedrszczyk E. Zinc and copper accumulation and distribution in the tissues of nine crops: Implications for phytoremediation. Polish J Environ Stud. 2005;14(6):829-35.