HILL PUBLISHING

The Journal of the Science of Food and Agriculture, 2018, 2(3), 65-70
http://www.hillpublisher.com/journals/jsfa

Study on the Indicators of Heavy Metals Content in Hard Clam (Bivalvia) Common in Myeik Estuarine Areas

U Aung Aung Aye, Nang Mya Han
Department of Marine Science Myeik University

How to cite this paper: Aye, U. A. A. & Han, N. M. (2018) Study on the Indicators of Heavy Metals Content in Hard Clam (Bivalvia) Common in Myeik Estuarine Areas. *The Journal of the Science of Food and Agriculture, 2(3)*, 65-70.
http://dx.doi.org/10.26855/jsfa.2018.03.003

Corresponding author: U Aung Aung Aye, Department of Marine Science Myeik University
Email: aungaungaye2009@gmail.com

Abstract

Hard clam (Bivalvia) is commonly available, popular and most consumed seafood in Myeik region. It is available throughout the year and consumes by making various preparations. It can also be used as a biomonitor to indicate pollution caused by heavy metals. During 2015 January to December observation Myeik coastal areas (latitude 12˚ 44′ N and longitude 098˚ 52′ E), based on Atomic Absorption Spectroscopic spectral results (AAS), the concentrations of some elements like cadmium (Cd) composition, January (0.113 ppm), February (0.113 ppm), March (0.108 ppm), April (0.110 ppm), May (0.108 ppm), June (0.118 ppm), July (0.108 ppm), August (0.114 ppm), September (0.116 ppm), October (0.123 ppm), November (0.110 ppm), and December (0.121 ppm) and zinc (Zn) composition, January (0.738 ppm), February (0.594 ppm), March (0.561 ppm), April (0.619 ppm), May (0.538 ppm), June (0.497 ppm), July (0.495 ppm), August (0.515 ppm), September (0.509 ppm), October (0.455 ppm), November (0.373 ppm), and December (0.453 ppm) were determined in hard clam. Lead (Pb) composition in hard clam was not detected in the present study. The amount of cadmium (Cd) content in this area is occurred under the level of dangerous, the flesh of hard clam is safety to consume as a good food.

Keywords

AAS, hard clam, heavy metals

1. Introduction

Hard clam (Bivalvia) is an economically important of marine bivalve in the Myeik estuarine area, which is belonging to the family Veneridae. Hard clam plays as a food for human consumption in various ways (fresh soup, dried stick and smoked). Among the exploited molluscan resources, bivalves, especially clams contribute greater part of the catch, occurring abundantly along the coast of Tanintharyi Region. Among the clams, *M. meretrix* is as developing resources for profitable exploitation. Moreover, hard clams are the best for assessments of levels of environmental pollution in coastal and estuarine areas because they are ubiquitous, sedentary, and filter feeders.

Majority of the molluscs are known by their shell, but in some forms the shell is absent. Molluscs have been classified based on their morphological, anatomical and biological features and they are second only to Arthropod in numerical abundance. The number of species identified under phylum molluscs varied from 80,000 to 1, 00, 000. [1]

They are more abundant in the littoral zones of tropical seas. Though seven classes of molluscs are available, gastropods and bivalves constitute 98% of the total population of molluscs and they inhabit land, freshwater and marine environments. The other classes of molluscs are exclusively marines. [2]

The bivalves comprise about 10,000 living species. They have two valves made of calcium carbonate in a hard called “aragonite” connected by a flexible pigment and an „adductor muscles” for closing the valves tightly; the mantle cavity is enlarged enclosing the visceral mass and other internal organs. [3]
The continuous development and expansion of industry, coupled with increasing human activity, has caused marine environments to deteriorate rapidly. [4] *M. meretrix* is ideal for identifying the toxicological effects of biologically available marine pollutants. *M. meretrix* larvae were highly sensitive to heavy metal contamination and Cd exposure induced antioxidant enzymatic activities at the early development stage. [5]
Human exploitation of world mineral resources and modernized industrialization has resulted in high levels of heavy metals in the surroundings areas. The marine creatures near the industrial and urban area are more disposed to the accumulation of such metals. The occurrence of heavy metals causes harmful on the fauna and flora of the environment. There are number of toxic heavy metals such as cadmium (Cd), mercury (Hg), lead (Pb) and Zinc (Zn), whose increasing levels in the environment are alarm today. They are released in large concentration through effluent discharges from industries such as tin-tungsten and wolfram production. Hence, the toxic heavy metals are related to their solubility in water and once drifted to the environment, these elements effect to the environmental food chain. The concentrations of toxic metals are more in the bottom dwellers of marine life especially in molluscs. Not only hard clam but also all of the marine organisms of coastal areas are always facing by stressful condition of environmental impact.
The objective of the research is to detect some heavy metal concentrations of hard clam in Myeik coastal areas. Moreover, present investigations were done for the period of one year from 2015 January to December.

2. Materials and methods

The hard clam were collected in live forms from field by hand picking method from the Myeik estuarine area (Latitude 12˚ 26.57' N and Longitude 098˚ 37.37' E) during the study period (from 2015 January to December) and then washed thoroughly by using seawater to remove sand, mud and debris and then transported to laboratory of Myeik University for the observation. And then, the sample was subsequently cleaned with tap water in the laboratory. After that, half shell of hard clam or stainless steel knife was used to take the flesh meat from shell. The prepared fresh sample was cut into small pieces for heating. And the entire sample (5g) was dried to get ashes at 550 ℃ for 2hr by hotplate. Powdered samples of hard clam were stored in air-tight container. Then, each dried sample was digested by 5ml of dilute 10% Hydrochloric acid and heated at 200 ℃ when until boiling and cooling. After that, same process doing continuously another two times. The wet ash acid residue remaining after this reaction retained all metallic constituents as soluble. After finished the digestion with hydrochloric acid, the ash solution filtrated by filter paper. Each sample was then made to a constant volume of 50 ml by added with 35ml of distilled water. Finally, heavy metals concentrations of hard clam were ready to determine. The concentrations of Cd, Zn, and Pb in the sample will be quantitatively detected by AAS (Atomic Absorption Spectroscopic) method. All morphological identification and photographs were recorded from the live specimens, and the classifications were described down to Order and follow by the identification methods of FAO species identification guide for fishery purposes, the living marine resources of the Western Central Pacific Volume I.

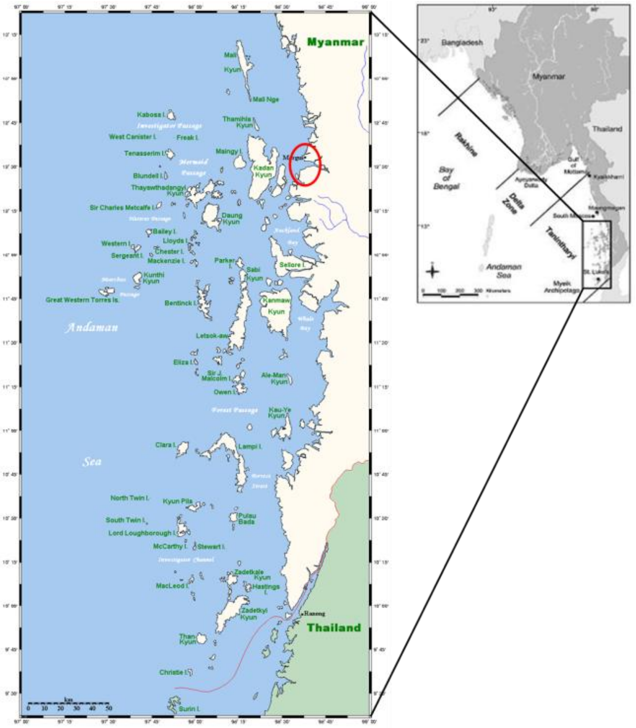

Figure 1. Map showing the location of study areas

3. Results and discussion

Classification system of *Meretrix meretrix* (Hard Clam)

Kingdom: Animalia
Phylum: Mollusca
Class: Bivalvia (= Pelecypoda)
Sub-class: Lamllibranchia
Superorder: Veneroida
Order: Veneroida
Sub order: Veneracea
Super Family: Veneracea
Family: Veneridae
Genus: Meretrix
Species: *M. meretrix* (Linnaeus, 1758)

FAO Name: Asiatic hard clam
Common Name: Hard clam
Local Name: Shut-Kha-Yu, Shut
Habitat: Hard clam are commonly found in sand and muddy-sand bottoms of the intertidal and sublittoral waters to a depth of about 10 m in Myeik estuarine areas.

Figure 2. Dominance of *M. meretrix* in the catch

Figure 3. Color Variation between *M. meretrix*

Figure 4. Anatomical features of *M. meretrix*

Quantitative Determination of Some Heavy Metals Present in Hard Clam by AAS Method

The concentrations of some elements in selected animal were quantitatively determined by using AAS method at URC (Universities' Research Centre), Yangon. The results were shown in Table 1.

From the Table and Figure, it was investigated that Cd composition, January (0.113 ppm), February (0.113 ppm), March (0.108 ppm), April (0.110 ppm), May (0.108 ppm), June (0.118 ppm), July (0.108 ppm), August (0.114 ppm), September (0.116 ppm), October (0.123 ppm), November (0.110 ppm), and December (0.121 ppm) in hard clam were found to compose.

Table 1. The concentrations of heavy metals in hard clam

Months	Elements Concentrations (ppm)		
	Cd	Zn	Pb
January	0.113	0.738	ND
February	0.113	0.594	ND
March	0.108	0.561	ND
April	0.110	0.619	ND
May	0.108	0.538	ND
June	0.118	0.497	ND
July	0.108	0.495	ND
August	0.114	0.515	ND

September	0.116	0.509	ND
October	0.123	0.455	ND
November	0.110	0.373	ND
December	0.121	0.453	ND

ND = not detected

Similarly, Zn composition, January (0.738 ppm), February (0.594 ppm), March (0.561 ppm), April (0.619 ppm), May (0.538 ppm), June (0.497 ppm), July (0.495 ppm), August (0.515 ppm), September (0.509 ppm), October (0.455 ppm), November (0.373 ppm), and December (0.453 ppm) in hard clam were also determined.
In addition, Pb composition in hard clam was not detected to be present during the studied period.
Cadmium is widely distributed in earth's crust and it is principally used as the stabilizers and pigments in plastics and in electroplating. Molluscs accumulate large concentration of cadmium ranging from 1900-2000 ppm dry weight.[6] Highest concentration in cadmium causes several health problems in human. Cadmium and its compounds along with mercury and some other dangerous metals are, however, included in the blacklist. It is being used routinely in different industrial processes and its potential hazard to life form is predominant. Eating food or drinking water with very high cadmium levels severely irritates the stomach, leading to vomiting and diarrhea, and sometimes death. Eating lower levels of cadmium over a long period of time can lead to a build-up of cadmium in the kidneys. If the levels reach a high enough level, the cadmium in the kidney will cause kidney damage, and also causes bones to become fragile and break easily. As a conservative approach, and based on the limited human data and the studies in rats, the United States Department of Health and Human Services has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogens.
Zinc is an essential element to human being. Zinc is widely seen in nature. Zn levels remained steady during the experiment. According to WHO, the dietary requirement of zinc is up to 22mg/day which is equivalent to 0.3mg/kg bw/day. Gastrointestinal absorption of zinc varied substantially from 8-80%. The absorption decreases after ingestion with calcium and phosphorus. This is due to the precipitation of zinc in the intestine. Dermal absorption of zinc also noticed. There is little information about the toxicity of zinc exposure. Chronic exposure of zinc leads to anemia. The natural concentration of zinc in soil estimated to be 10-30 mg/kg. Zinc is used in coating of other metals, in alloys and many common goods. Besides this zinc is used for wood preservation, catalyst, ceramic, fertilizers, batteries, paints, explosives household and medical appliances.[7]
Lead is naturally occurring metal but its natural status doesn't mean it's healthy. In fact, lead is extremely toxic to humans and affects the liver, kidneys, reproductive system, and nervous system.[8] Lead is harmful to nearly all systems of the body. Lead is one of many toxic metals that cause damage by inducing oxidative stress. Because lead accumulates in the body, it can simply sit there and be a constant source of harmful effects of lead exposure are often irreversible. Lead exposure is perhaps best associated with its negative impact on intelligence.[9]
Lead has long been known to be harmful to health of human. Fortunately, at the present study, Pb composition in hard clam was not detected. The flesh of hard clam is safety to consume as a good food.

Acknowledgments

The authors are grateful to Bjorn Burchard, Managing Director of the Moby Dick Tour Co., Ltd. for the financial assistance for the project. We are thankful to all the staff of the Department of Marine Science of our Myeik University for their support.

Reference

[1] Shanmugam, A., and S. Vairamani. Coastal Biodiversity in Mangrove Ecosystem. UNU-INWEH-UNESCO. International Training Course. 2009, 658pp.
[2] Srinivasan. Studies on the Molluscan Diversity Southeast Coast India. Ph. D. Thesis, Annamalai University, India. 1999, 150 pp.
[3] Jaramillo, E., Contreras, H. and Duarte, C. Community structure of macroinfauna inhabiting tidal flats characterized by the presence of different species of burrowing bivalves in Southern Chile. Hydrobiol, 2007, 580: 85-96 pp.

[4] Rainbow, P. S. Biomonitoring of heavy metal availability in the marine environment. Mar Pollut Bull 31: 1995, 183−192.
[5] Wang Q, Liu BZ, Yang HS, Wang XY, Lin ZH () Toxicity of lead, cadmium and mercury on embryogenesis, survival, growth and metamorphosis of Meretrix meretrix larvae. Ecotoxicology 18: 2009, 829−837.
[6] Clark, R.B.. Marine Pollution. III Ed. 1992 pp 66-69. Clarendon Press, Oxford, U.S.A.
[7] Food and Agriculture Organization/ World Health Organization. Food Additives Series No. 63/ FAO JECFA Monographs 8, 1996, Available at: (http:// www. who.int/ foodsafety/ chem/ summary 72. rev. pdf).
[8] Flora. G., Gupta. D., & Tiwari. A. Toxicity of lead: A review with recent updates. Interdiscip Toxicol. 2012 Jun; 5(2):47-58. doi: 10.2478/v10102-012-0009-2.
[9] Iglesias. V., Steenland. K., Maisonet, M., & Pino, P. Exposure to lead from a storage site associated with intellectual impairment in Chilean children living nearby. Int. J. Occup Environ Health. 2011, 17 (4), 314-321.
[10] Carpenter, K. E. and Volker, H. N. The living marine resources of the Western Central Pacific Volume (1) Seaweeds, Corals, Bivalves and Gastropods. FAO Species Identification Guide for Fishery Purpose. 1998. Food and Agriculture Organization of the United Nation, Rome, 686 pp.