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Evalution of Heavy Metals Accumulation (Zn, Cu, Pb, Cd, Hg) In Shell of *Barbatia helblingii* From North of Qeshm Island (Persian Gulf, Iran)

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Abstract

The aim of present study was to survey Zn, Cu, Pb, Cd and Hg concentrations in shell of the bivalve, *Barbatia helblingii*, were sampled from the north of Qeshm Island (This Island located in Persian Gulf) in winter and spring season. The results show that the most concentrations were for Zn (6.1± 3.1) µg/g in winter and Pb (0.07±0.05) µg/g had the lowest concentration in spring. The pattern of metals accumulation in shell was as follow: Zn>Cu>Pb>Cd>Hg (in winter) and Zn>Cu>Pb>Cd>Hg (in spring). There is a significant negative relationship between the level of Cu and Cd metal in shell and all of the biometric parameters (P<0.05), however, no significant correlations were observed between Hg and Pb in the shell and the biometric parameters. Layer stratification of water of Persian Gulf, and its turn over, increasing phytoplankton and also the biologic factors as biometric characteristics variation were influenced the seasonal variation of metal concentrations, but portion of each factor was different.

Keywords: *Barbatia helblingii*, **Heavy metal, Qeshm Island, Seasonal variation**

INTRODUCTION

Marine organisms, especially molluscs have the ability to absorb metals from the environment where they live. Therefore, during the last decades the use of molluscs for biomonitoring of metals has been reported in several studies [5, 10, 11]. The Persian Gulf is one of the most important waterways in the world for the purpose of oil producing and transporting, and unfortunately vast amounts of oil have been spilled into the Gulf that caused considerable damage to habitats and marine resources [3, 6]. Research on metal pollution in Persian Gulf has been increased during the recent years. Most papers have dealt with metal concentration in sediments and fishes [1] and few papers concern the molluscs [4].

The northern coast of Qeshm Island is impacted principally by human activities including shipyards, factories and fish traps. Also, it must be emphasized that there is no published report on heavy metals in *B. helblingii*. Therefore, the objectives of this study were: (1) to measure the concentrations of (Zn), (Cu), (Hg), (Pb) and (Cd) in *B. helblingii*; (2) to estimate the seasonal variation of metal loading in the shell of them; and (3) to determine the correlation between biometric characteristics of *B. helblingii* and metal concentration in the shell.

MATERIALS AND METHODS

Collection of Samples

B. helblingii specimens (25 individuals in each season) were collected from the Northern coast of Qeshm Island (26˚55′36.5″N 55˚48′46.7″E) during winter and spring.

Sample preparation

Surface sediment and epibiota were removed from the shells and the clean mussels were placed on a clean tissue paper to allow draining the excess water. Then, the samples were dried for 72 h at 80 ºC in an oven to a constant weight. The shells powdered by mixer mill, to become homogeneous (Yap et al, 2004).

Sample digestion and quantification of Zn, Cu, Pb, Cd and Hg

Dried shells (1 g) was digested in 10 ml of HNO_3 (69%). Then, they were put into a hot-block digester first at low temperature (40 ºC) for 1 h and then were fully digested at high temperature (140 ºC) for at least 3 h. Similarly, the digested samples were then diluted to 25 ml volume with double distilled water (DDW). The samples were filtered through Whatman No. 1 filter paper and the filtrate was stored until metal determination [10, 11]. The prepared samples were evaluated for concentration of Cd, Cu and Zn using a flame atomic absorption spectrophotometer (67OG), while Pb and Hg concentrations were determined using a graphite furnace atomic absorption spectrophotometer (67OG) and cold vapor atomic absorption (AMA 254 LECO USA), respectively.

Statistical analysis

The differences between metal concentrations in shell, and also between two seasons were tested for significance using non-parametric tests (Mann-Whitney U). Spearman correlation test was used to verify the influences of the metal concentrations on shell, and within metal concentrations. All statistical analysis was conducted with SPSS, version 15.0 for Windows (SPSS Inc., Chicago, IL). Statistical significance was defined as p≤0.05.

RESULTS AND DISCUSSION

Patterns and differences of metal accumulation in winter and spring

The levels of Zn, Pb and Hg were decreased significantly in spring (P<0.01) (Table 1). However, mean concentrations of Cu were increased in shell (P<0.01) from winter to spring (Table 1). Also, mean Cd concentrations were increased in shell (P<0.01) (Table 1). Yap et al. suggested that the variations of metal concentrations in mollusc's shells could be a permanent record of its environmental changes. On the other hand, decreasing of Zn concentration is probably

due to the increasing of water temperature and salinity, and stratification of the water column in Persian Gulf in spring that cause to decrease the availability of metal ions.

Table 1. Mean± S.D. concentrations of Cu, Cd, Pb, Zn (µg/g d.w) and Hg (µg/kg d.w) in total shell of *B. helblingii*.

	Shell		
Metal	Winter	Spring	t-Test
Cu	4.54	5.6	$P<0.01$
Cd	0.02	0.18	$P<0.01$
Pb	0.35	0.07	$P<0.01$
Zn	6.1	4.14	$P<0.01$
Hg	2.03	1.62	$P<0.05$

In general metal concentration pattern for shell was different from that of the shell (Table 2). Also the pattern of metal concentration in the shell in spring was different compare to the winter. In the shell, Zn concentration in winter showed higher levels followed by Cu, and Pb followed by Cd, but this pattern was reversed in spring (Table 2).

Table 2. Patterns of metal occurrences in shells of *B. helblingii*.

	Winter	Spring
Shell	Zn>Cu>Pb>Cd>Hg	Cu>Zn>Cd>Pb>Hg

Factors correlate with metals concentration

According to table 3, there is no significant correlation between Hg concentration in the shell and biometric parameters. Also Zn level in the shell displayed a positive relationship with biometric parameters, but that was statistically significant only for length and height ($P<0.05$) (Table 3). But results revealed that there are significant correlations between Cu and Cd level in the shell and biometric parameters (Table 3).

Table 3. The relationship of the metal concentrations of total shell of *B. helblingii* and biometric parameters.

parameter	Cu	Cd	Pb	Zn	Hg
Dry Weight (g)	-0.32*	-0.35*	0.06	0.27	0.19
Length (cm)	-0.38**	-0.37**	0.04	0.32*	0.03
Height (cm)	-0.28*	-0.33*	0.09	0.30*	0.21
Width (cm)	-0.32*	-0.27	-0.04	0.09	0.12

Values given are the correlation coefficients (r) and their levels of significance (*$p<0.05$,**$p<0.01$)

Also, separate investigation of shell revealed that Cd level in the shell had a significant negative relationship with all the biometric parameters ($P<0.05$), except for shell width which was not statistically significant ($P>0.05$) (Table 3). Also, Cu level in the shell was showed a significant negative relationship with biometric parameters (Table 3). Generally in tropical zone, growth rate of the organisms is high, particularly at early life stages and tissues growth is more quickly than metal absorption rate, and this leads to a reduction in metal concentration, but increasing of body size and age will increase the concentration of metal in tissues. The results are in agreement with the results of some species like *Acanthopleura haddoni*, *Ostrea cucullata* and *Pitar* sp. in Aden Gulf [9], and also *Laternula elliptica* in King Gourge Island. Sokolowski et al, reported that the seasonal variations of Cu metal in bivalves are attributed to physiological conditions, and environmental variations such as salinity [7]. According to the significant negative relationship which is seen between Cu concentration in shell and biometric parameters (Table 3), its increasing in shell is probably due to the decreasing of biometric parameters in spring. Significant negative correlation ($P<0.05$) between the concentration of this metal in shell and biometric parameters may be due to the exposure of *B. helblingii* to various Cu concentration in the environment at various life stages.

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