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# The Levels of Essential (Cu) and Nonessential (Cd) Heavy Metals in *Crassostrea gigas*, Sediment and Water

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**Abstract:** Heavy metals concentration in the muscle of *Crassostrea gigas,* sediment and water from six stations in Musa estuary were determined using a flame atomic absorption spectrometer (AAS). This species was selected in order to determine its ability to be as a bioindicator for the Cd as a toxic element and Cu as essential element. The concentrations of Cd and Cu in the sediment and water were apparently different among stations, while there was no significant difference for muscle metals level among the stations. Liner regression analyze showed that there were no significant correlations ($p$<0.05) between Cu and Cd concentration in the muscle and sediment and water.

**Key words:** *Crassostrea gigas* · Musa estuary · Heavy metals · Sediment · Water

## INTRODUCTION

According to previous studies, heavy metal is introduced to marine environment through both natural and anthropological activities [1-4]. This element may sink toward the bottom sediment or accumulate directly in marine organisms [2]. The accumulation process is affected by different environmental and biological factors such as salinity, temperature, season, size, sex and species [5, 6]. Heavy metals enter aquatic organisms through skin, gills and food [3, 6]. The up taken metals are distributed in the organism's body via blood and subsequently are accumulated in their tissues.

The importance of heavy metals bioaccumulation in aquatic organisms is mainly with respect to possible direct effects on aquatic organism and indirectly through the consumption of contaminated seafood [7, 8]. Some heavy metals such as mercury, lead and cadmium are known as toxic elements and some others metals such as copper and iron are regarded as essential elements [1]. Much of the potential risk of heavy metals accumulation in fish lies in their potential to boiconcentrate. In the case of safety, heavy metal concentrations in the edible part of marine organisms such as fish, shrimp and bivalve have been studied widely [2, 9-11]. The main purpose of the present study was to determine the concentration of toxic metal (Cd) and essential metal (Cu) in the edible part of *Crassostrea gigas*. The second purpose of this study was to indicate the relationships between Cd and Cu levels in sediment and the muscles and between those concentrations in water and the muscle tissue.

## MATERIALS AND METHODS

In this study, six sampling sites including Petrochemical quay (S1), Dock SorSoreh (S2), Khor-Zangi (S3), Quay 18 (S4), Quay 33 (S5) and Khor-Jafari (S6) were chosen (Fig. 1). Ten samples of *C. gigas* and fifteen sediment and water samples were collected from each station in the summer of 2011. The surface sediments samples were collected using stainless steel Van Veen Grab. Surface water samples were collected in polyethylene bottles (washed with nitric acid then deionized water), then were acidified with 10% $HNO_3$ and filtered through a 0.45 µm membrane filter. The samples were placed in an ice bath and brought to the laboratory then frozen at -20°C until analysis.

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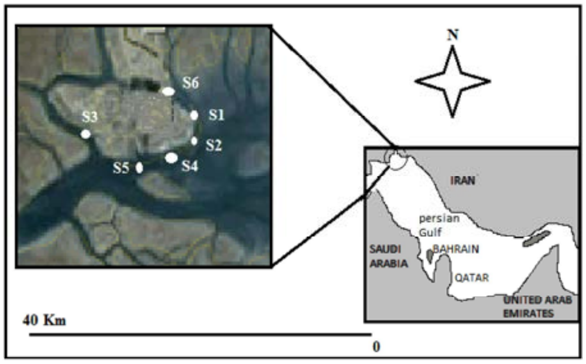


Fig. 1: Mao of Musa estuary and the stations

Each *C. gigas* sample was dissected for its muscle using stainless steel scalpels. The tissues were oven-dried at 80°C until they reached a constant weight. About 1g of the muscle was digested individually with concentrated nitric acid until it was completely dissolved. Sediment samples were oven-dried for 24 hours at 105°C, powdered in an agate mortar and then sieved through a 63-µm mesh [2]. Approximately 1g of the sediment samples from each station was digested with 2 ml of $HNO_3$ and 6 ml of HCl (Merck, Darmstadt, Germany).

All reagents used were of analytical reagent grade (Merck, Germany). The glassware were soaked in nitric acid solution (10%) for 24 hours and washed with double distilled water before use. The concentration of the metals was determined with an atomic absorption spectrometer (SavantAA Sigma). Blank samples were also processed to avoid possible contamination during sample analysis. Standard reference material DORM 2 (National Research Council of Canada: dogfish muscle) was used to check the accuracy of analytical procedures. Percent recovery means for DORM 2 were Cd: 95.6% and Cu: 97.2.

One-way ANOVA and Duncan multiple comparison test were applied in order to determine the difference between stations. The linear regression analyses were used to indicate relationship between sediment, water and muscle. The significance level was set at $\alpha = 0.05$.

## RESULTS AND DISCUSSION

The heavy metals level (µg/g d.w.) in the muscle, surface sediment and (µg/l) water was shown in Figure 2. There were no significant differences among the concentrations of Cd and Cu in the muscle of *C. gigas* from different stations. In the case of sediment, the concentration of Cd in the sediment of S1 (0.85 µg/g) and S6 (0.67 µg/g) were significantly higher than that in the other stations, while the concentration of this metal in the

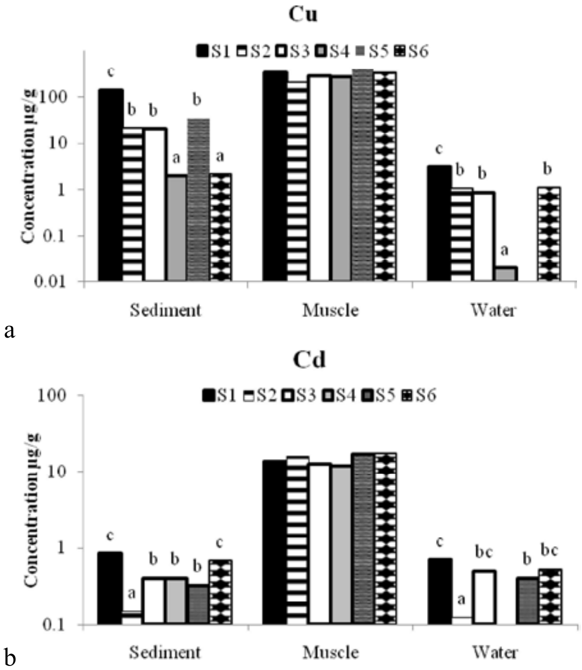


Fig. 2: Comparison between the concentrations of Cu (a) and Cd (b) in muscle, sediment and water among different stations

water samples of S1 (0.7 µg/l) was higher than that in the other stations. Regarding copper metal, sediment (141.42 µg/g) and water (3.1 µg/g) samples of S1 had the highest concentration of this metal in comparison to the other stations.

The result of liner regression analyses (Fig. 3) showed that there were no significant relationship between the concentration of Cd and Cu in the muscle of *C. gigas* and those concentrations in sediment and water.

The comparison between the sampling stations showed that the level of heavy metals varied among station and that could be related to variability in the sources of Cd and Cu input [2, 4, 6]. S1 is close to petrochemical units and receives huge amount of heavy metal from this anthropological activity. Khor-Jafari is also the nearest creek to petrochemical units and receives petrochemical-related heavy metals [2]. In addition, Khor-Jafari originates from Musa estuary and is stretched along PETZONE (Petrochemical Special Economic Zone) up to Mashahr and Sarbandar cities. This creek is used as municipal wastes receptors. Furthermore, it receives huge quantity of petrochemical wastewater along its courses. Thus, the high levels of Cd and Cu in bivalve from Khor-Jafari could be related to anthropogenic activities and effluent discharges into the creek.

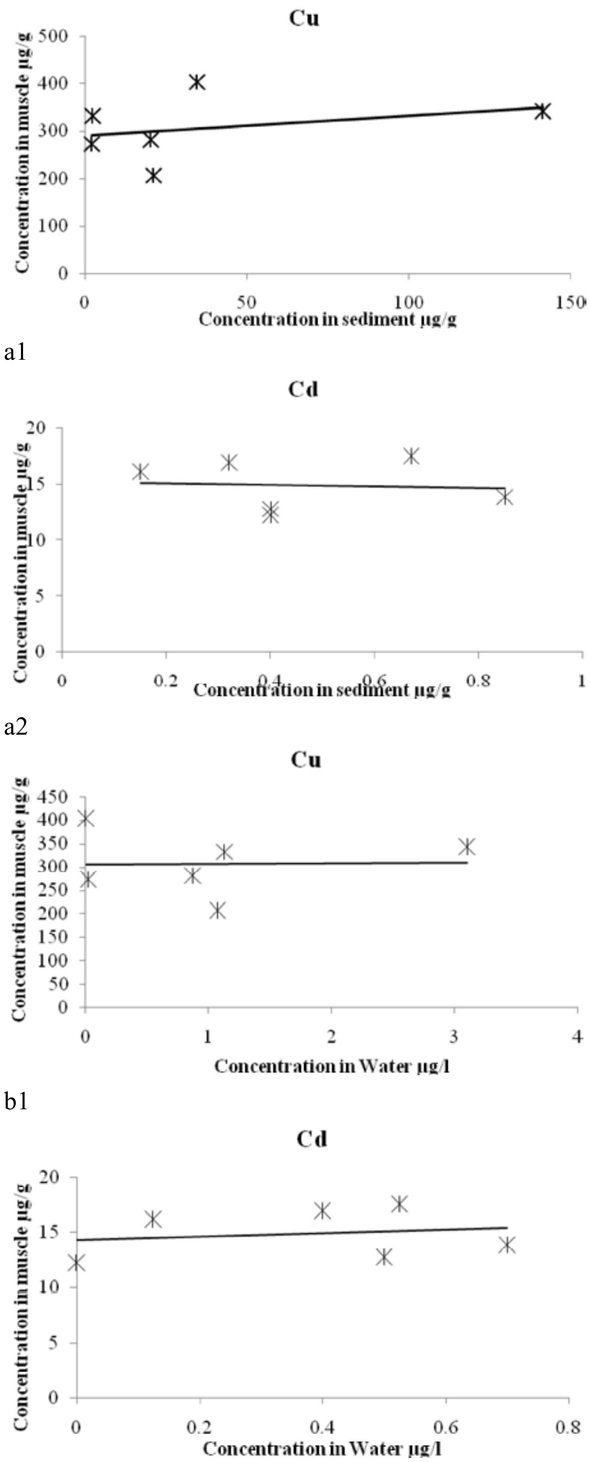


Fig. 3: Relationship between the concentration of the metals in the muscle of the *C. gigas* and those concentrations in sediment (a1 and a2) and water (b1 and b2)

There was no significant relationship between the concentration of the metals in the muscle of the *C. gigas* and its habitat. This finding could be attributed to the variation of physicochemical factors among the stations so that could control the bioavailability of the metals [2, 11].

## CONCLUSION

The results of this study showed that Petrochemical quay receives more contamination in comparison to the others stations. Therefore, *C. gigas* and other Organisms of this area are more at risk of metal contamination. The results also showed that this species wasn't able to show the concentration of Cd an Cu of its habitat.

## ACKNOWLEDGMENT

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