

## The Level of Cd, Hg, Mn and Pb in Sediment and Invertebrate from North of the Persian Gulf

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**Abstract:** During present study the concentration of Cd, Hg, Mn and Pb in sediment and Invertebrate of Musa estuary, Hendijan and Bushehr coasts was determined using atomic absorption spectrometer. The results showed that the highest level of Cd, Hg and Mn was observed in Musa estuary sediment and organisms. The maximum concentration of Pb was recorded in Bushehr coast. Musa estuary receives heavy metals from petrochemical units that are established a decade ago in the area, while Bushehr coast is suffering from huge amounts of tankers traffic and oil transportation in its bank. The correlation between metals level in sediment and Invertebrate showed that there are significant correlation between Hg concentration in sediment and *Thalamitaprymna*.

**Key words:** Heavy metal • Sediment • Crustacean • Persian Gulf

### INTRODUCTION

Heavy metals are divided into two main groups including essential and non-essential metals. The essential ones are vital for enzymes activities, whilst nonessential metals are potentially harmful for biological activities of organisms [1,2]. They could be circulated by blood in the body and accumulate in the target organs, interfere with organ function [3] and subsequently appear in toxic forms both for the organisms [4] and humans who consume seafood [5]. Petrochemical wastewater, agricultural runoff, urban effluent and tankers traffic are known as the main sources of heavy metals [6].

Musa estuary, Hendijan and Bushehr coast are located in the northwest Persian Gulf. Each one of these stations is subjected to different anthropogenic activities, for example, petrochemical activities, oil-related activities and urban effluent are responsible for contamination in Musa estuary, Hendijan and Bushehr coast respectively. Therefore the main aim of current study is concentrated on the levels of Cd, Hg, Mn and Pb in the sediment and

invertebrate of the north Persian Gulf in order to estimate metals contamination in the area. In addition, the other aim of this study is to determine the correlation between the concentration of each metal in sediment and that concentration in the benthic organism.

### MATERIALS AND METHODS

The samples of sediments and Invertebrate were collected from three different stations along the northwest Persian Gulf during August 2011. The sampling stations were chosen in Musa estuary, Hendijan and Bushehr coast (Fig. 1). Sediment, crab (*Thalamitaprymna*) and shrimp (*Metapenaeus affinis*) samples were collected from each station, transferred to the laboratory using icebox and kept frozen at -20°C prior to analysis.

Samples thawed in room temperature before analysis and oven dried at 105°C for 24 hour. One gram of the samples digested in concentrated nitric acid. The remaining digested solution was made up to certain volume with double distilled water.

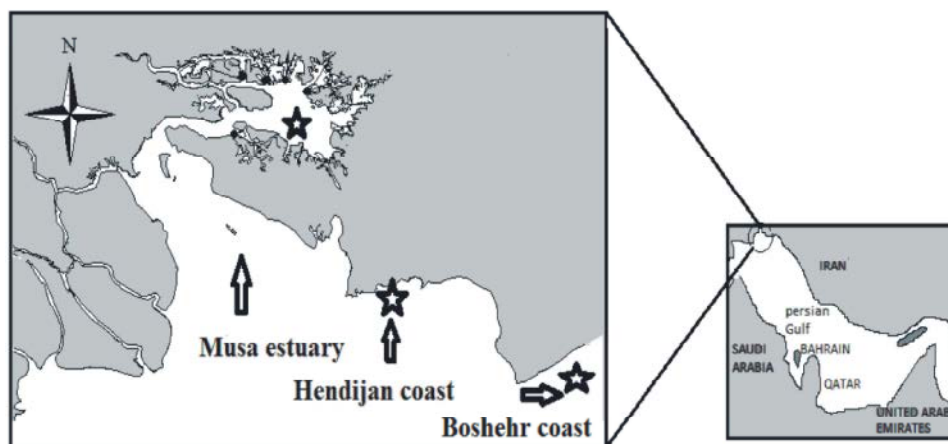


Fig. 1: The location of Musa estuary, Hendijan and Bushehr coast

To determine the metals in the samples, a GBC (Savant AA Sigma) flame atomic absorption spectrometer (AAS) was used. All chemical reagents were analytical reagent grade (Merck). The glassware and plastic containers were acid washed with nitric acid 10% and rinsed with double distilled water before use. To avoid samples contamination and check the accuracy of the method, blank samples and CRM (Dorm-2, muscle of Dogfish, National Research Council of Canada) were analyzed.

## RESULTS AND DISCUSSION

The concentration of heavy metals in sediment and the comparison between stations are shown in Table 1. The highest concentration of Cd ( $1.56 \mu\text{g/g}$ ), Hg ( $2.43 \mu\text{g/g}$ ) and Mn ( $32.87 \mu\text{g/g}$ ) was observed in Musa estuary, while the highest level of Pb ( $1.16 \mu\text{g/g}$ ) was observed in Bushehr sediment.

The concentrations of the metals in crab and shrimp are shown in Table 2. The level of Cd, Hg and Pb in Musa estuary crab and shrimp was significantly higher than that in the other stations.

Musa estuary is the nearest creek to Mahshahr city, petrochemical units and construction of PETZONE [7-9]. In addition, Imam Port that is one of the biggest ports in Iran is located in the mouth of this estuary [8]. Therefore, Musa estuary receives different types of pollution such as heavy metal from the surrounding areas. Bushehr coast was relatively rich in Pb concentration. It is likely that this high concentration of Pb was related to the oil tankers traffic in this station [10]. There is no industrial activity near Hendijan, which is a relatively remote area compared to other stations.

Pearson correlation analysis was carried out in order to determine the relationship between heavy metal concentration in sediment and the biota. There was significant correlation between the concentration of Cd in

Table 1: The concentration (Mean and standard deviation) of Cd, Mn, Hg and Pb in sediment of North Persian Gulf

Stations	Cd	Hg	Mn	Pb
Musa estuary	$1.56 \pm 0.45$	$2.43 \pm 0.66$	$32.87 \pm 12.09$	$0.76 \pm 0.13$
Hendijan coast	$0.53 \pm 0.1$	$0.13 \pm 0.04$	$30.76 \pm 9.34$	$0.32 \pm 0.1$
Bushehr coast	$0.92 \pm 0.21$	$1.05 \pm 0.48$	$34.7 \pm 8.94$	$1.16 \pm 0.33$

Table 2: The concentration (Mean and standard deviation) of Cd, Mn, Hg and Pb in crab and shrimp of North Persian Gulf

Species	Stations	Cd	Hg	Mn	Pb
<i>Thalassidroma</i>	Musa estuary	$2.56 \pm 0.76$	$2.97 \pm 0.89$	$98 \pm 21.09$	$3.27 \pm 1.55$
	Hendijan coast	$0.47 \pm 0.14$	$0.21 \pm 0.1$	$107.23 \pm 38.42$	$0.52 \pm 0.24$
	Bushehr coast	$1.6 \pm 0.83$	$0.35 \pm 0.21$	$95.31 \pm 33.02$	$2.05 \pm 1.17$
<i>Metapenaeus affinis</i>	Musa estuary	$1.04 \pm 0.33$	$0.74 \pm 0.39$	$134 \pm 54.06$	$6.81 \pm 2.04$
	Hendijan coast	$0.27 \pm 0.12$	$0.11 \pm 0.07$	$154.98 \pm 44.07$	$2.76 \pm 1$
	Bushehr coast	$0.56 \pm 0.26$	$0.16 \pm 0.06$	$151.04 \pm 53.92$	$7.23 \pm 3.62$

sediment and the concentration of that ( $r = 96$ ,  $p < 0.01$ ) in the *Thalaminaprymna*. There was also positive correlation between the concentration of Hg in sediment and that concentration in *Metapenaeus affinis* ( $r = 97$ ,  $p < 0.01$ ). Therefore, we can argue that, in spite of being benthic species, *Thalaminaprymna* and *Metapenaeus affinis* could not be considered as suitable biomonitor agents for heavy metal contamination in the study area, except for few cases.

To evaluate the contamination in the north Persian Gulf sediments, the finding of present study was compared with other areas in the Persian Gulf. The concentration of Pb and Hg obtained in this study are generally higher than those reported in Jebel Ali (UAE), RasLaffan (Qatar) and Askar (Bahrain) along the south Persian Gulf [11]. The concentration of Cd and Pb in the northern part of the Persian Gulf [12] was considerably greater than those observed in current study. Generally, the concentrations of Cd and Pb measured in current study do not exceed the guidelines that established by Canadian SQG and NOAA. Apart from these, fortunately in case of Cd and Pb, our findings are approximately within the range of those in the guideline that was established by RSA (ROPME Sea Area) [13] for the Persian Gulf.

## CONCLUSION

This study showed that the concentration of the heavy metals varied among stations. Musa estuary has the highest concentration of Cd, Hg and Pb because it receives petrochemical wastewater, while Hendijan coast is less contaminated among the other stations. Enrichment of Pb metal in Bushehr coast may be related to oil-related activities in the area. The results of Pearson correlation analysis showed that the concentrations of the metals in sediment and biota are not related.

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