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Heavy metal Concentrations in *Meretrix casta* (bivalve) shells of Vellar Estuary, Tamil Nadu Coast, India

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Abstract

The present study endeavors the heavy metal concentrations in Meretrix casta shells occurred in the tidal zone of Vellar estuary, Tamil Nadu coast of India. In this estuary fifteen samples were collected at 100 m interval in the entire tidal zone. Cu, Fe, Zn Cd, Pb, Hg and Mg were analysed by inductive coupled plasma – optical emission spectroscopy (ICP–OES). The results of heavy metal concentrations was Fe (1.221 mg/l), Zn (0.019 mg/l), and Mg (0.241 mg/l), the element Cu, Cd, Pb, and Hg, were below detection limit in all the fifteen locations. The ICP-OES analysis reaveled that the concentration are only in noticeable levels. The recent study indicates that the Meretrix casta shells of tidal zone of Vellar estuary is free from heavy metal pollution.

Key words: *Vellar estuary, Meretrix casta, ICP-OES, heavy metals concentrations.*

1. Introduction

Meretrix casta (Chemnitz) (Bivalvia: Family Veneridae) is an important clam occurring in estuaries and environment, remarkable in backwaters of both east and west coast of India. In the east coast, it forms a fishery in Vellar, Pulicat and Bhimunipatnam backwaters (Seshappa, 1971). Clam production in Vellar estuary is about 730 t/year (Silas et al., 1982). The mollusk shell which are important group of organisms in any environment accumulate more and amount of metals through food and their shell, during respiration. *Meretrix casta* shells were studied by several researches. The rate of filtration in bivalve mollusk is impaired by the presences of heavy metal pollutants, (Mathew, 1984). The copper content of three species of bivalves of commercial food value *Anadaragranosa*, *Meretrix casta*, *Cressostrea* in habiting Vellar estuary were determined (Kumaraguru (1979). Bivalves are widely used as indicators to assess the bioavailability of metals in coastal water in many parts of the world (Blockmore 2001; Cohen et al., 2001; Sunlu (2002). Mercury, cadmium, and lead are major toxic metals that cause environmental degradation in marine ecosystems (Matta et al., 1999). Effect of particle size on thermal decomposition of lime shell suitability control and energy storage (Kale, 2002). Jong-woo choi1 et al., 2013, Conducted a study on Pb concentrations and isotopic compositions in the soil and sediments around the abandoned mine. Heavy metal analysis *Perna viridis* and *Meretrix casta were done by* (Menon, 1983). Concentrations of heavy metals (Cd, Cu, Cr, Pb and Zn) in *Meretrix meretrix*, Roding, water and sediments from two estuaries in Sabah, North Borneo, were determined by (Mohd et al. 2007). Concentrations of trace elements in *Meretrix* spp. (Mollusca: Bivalvia) along the coasts of Vietnam, studied by (Nguyen Phuc Cam Tu et al. 2010).

2. Description of the Study area

Vellar estuary is situated in Tamil Nadu State on the east coast of India (Lat. 11° 28' N & Long. 79° 45'E). The river originates from the Servarayan hills in Salem district (Tamil Nadu, South India). After flowing a distance of 480 km, it forms an extensive estuarine system at Parangipettai. The estuary is subjected to semi diurnal tide with maximum tidal amplitude of about 0.8 m. The Estuary is demarcated and divided into four zones based on, Rochford (1951) classification of estuarine environment, viz. Marine zone, tidal zone, gradient zone and fresh water zone (Ramamoorthi 1954; Antony Fernando et al., 1983). The location map of the study area is shown in (Fig.1).

3. Material and Methods

3.1 Sample collection

Meretrix casta was collected along the tidal zone (this zone extends up to 3 km from marine zone. The shells were collected within fifteen 1×1m squares in the entire study area. Distance between sample spots was 100 m. In the demarcated area, available *Meretrix casta* shells were collected by hand digging and picking. The shells were then washed with seawater at the point of collection and placed into clean plastic bags and packed separately with sample numbers.

3.2 Sample preparation

The collected shells were washed thoroughly with clean water and dried. Then the shells were crushed and pulverized into powder form with the help of agate mortar and pistle. The powered samples labled separately according to the location numbers for heavy metal concentrations analysis.

3.3 Heavy metal analysis

The heavy metal concentrations were measured by inductive coupled plasma optical emission spectroscopy (ICP-OES) using a Perkin Elmer, Optima 5300; 0.5 g of shell powder was taken for analysis and one time aliquots were measured. A total of fifteen samples were digested with 5 ml of concentrated HCl: after digestion, insoluble remains were not found. After the digestion, the solution was transferred and filled into 50 ml with de ionized water, the clear solution was analyzed.

The concentrations of Cu, Fe, Zn, Cd, Hg, Pb and Mg in the shell of *Meretrix casta* were determined. To analyze heavy metal concentrations in bivalve shells was studied by several researches, (Lazareth et al., 2003: Sanal 2007; Uysal et al., 2008; Alfonso et al. 2008; Ravera et al., 2009: Schone et al., 2010; Vosloоa et al., 2012; Yesudhason et al., 2013; Kamsia budin et al., 2013 McClintock et al., 2014; Shoba et al., 2014. The samples were digested with 5 ml of HCl aquaregia in CEM microwave digester using MARSX press (self regulating microwave vessel) under the following conditions. (Table.1). Microwave parameters for *Meretrix casta* shells digestion is shown in. Table 2. Elements symbol detection wavelength (nm) by ICP-OES. The heavy metals concentration of *Meretrix casta* shells of Vellar Estuary is shown in Table 3.

4. Results and Discussion

The calculated mean concentrations of copper, iron, zinc, cadmium, mercury, magnesium and lead in *Meretrix casta* shells collected from the tidel zone of Vellar estuary, located in the Tamil Nadu coast of India is discussed below.

The shell concentrations were on average 1.22 (Fe), 0.02 (Zn) and 0.24 (Mg). The other metals Cu, Cd, Hg and Pb were below detectable limit (BDL) in all the fifteen locations. The Vellar estuary *Meretrix casta* shells of tidal zone show below the alarming level. The estuary is not having much industrial activities. Human activities are lower in this estuary compared with other estuaries; thus, metals from anthropogenic sources are in lower concentrations within the environment, and their availability for intake by *Meretrix casta* is minimal.

Among the metals present in the shells, Fe, recorded in considerable quantities than Zn and Mg. Concentrations of iron, magnesium and manganese was more in the molluscan tissue of Vellar estuary (Kesavan et al. 2010). The higher concentration of Fe in the mangrove sediments might be a result of the textured and mineralogical characteristics of the mangrove sediments (Ramanathan et al. 1999). The studied shells heavy metal concentrations are low and they are only in reporting level.

5. Conclusion

The present study revealed that the concentrations of heavy metals are low and below detectable level based on ICP-OES analysis. The concentrations of Fe, Zn and Mg were in least amount and they are only noticeable levels. The Cu, Cd, Hg and Pb were below detectable levels in all the fifteen locations. This study evidenced that *Meretrix casta* shells of tidal zone, Vellar estuary is free from heavy metal contamination at present.

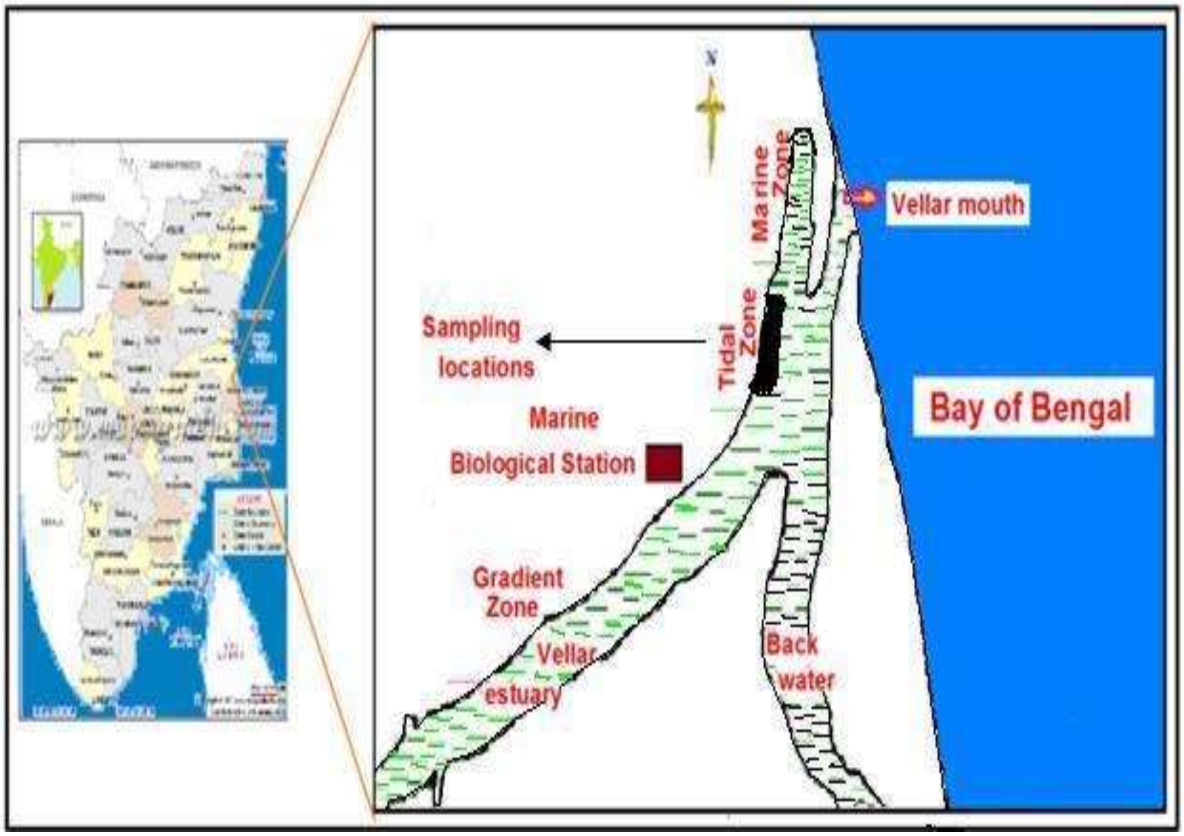

Figure 1. Location map of the study area.

Table1. Microwave parameters for *Meretrix casta* shells digestion.

Maximum	Power used	Ramp time	Temperature	Holding time
800w	75%	05:00 min	200C	05:00min

Table 2. Elements symbol detection wavelength (nm) by ICP-OES.

Cu	Fe	Zn	Cd	Hg	Mg	Pb
327.393	238.204	206.200	228.802	253.652	285.213	220.353

Table 3. Heavy metal concentration of *Meretrix casta* shells of Vellar estuary (concentrations in mg/l)

Location Number	Cu	Fe	Zn	Cd	Hg	Mg	Pb
1	BDL	1.344	0.057	BDL	BDL	0.269	BDL
2	BDL	1.490	BDL	BDL	BDL	0.246	BDL
3	BDL	1.051	0.006	BDL	BDL	0.225	BDL
4	BDL	0.959	0.005	BDL	BDL	0.278	BDL
5	BDL	1.597	0.024	BDL	BDL	0.254	BDL
6	BDL	1.714	0.022	BDL	BDL	0.231	BDL
7	BDL	0.898	0.021	BDL	BDL	0.268	BDL
8	BDL	1.130	0.024	BDL	BDL	0.242	BDL
9	BDL	1.328	BDL	BDL	BDL	0.205	BDL
10	BDL	1.023	0.021	BDL	BDL	0.213	BDL
11	BDL	0.983	0.008	BDL	BDL	0.263	BDL
12	BDL	1.483	0.008	BDL	BDL	0.258	BDL
13	BDL	1.088	0.014	BDL	BDL	0.259	BDL
14	BDL	1.174	BDL	BDL	BDL	0.224	BDL
15	BDL	1.062	BDL	BDL	BDL	0.197	BDL
Total		18.324	0.210			3.632	
Mean		1.221	0.019			0.241	

BDL, Below detectable limit.

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