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ANALYSIS OF HEAVY METALS IN MUTHUPET ESTUARY, SOUTH EAST COAST OF INDIA

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ABSTRACT

A study has been undertaken to analysis of heavy metals and trace elements in Muthupet estuary, Muthupet east coast, Thiruvarur district, Tamil Nadu India and compared with standard. In the present study we observed that most of the heavy metals and trace elements increased in Muthupet estuary as compared to standard as BIS, ICMR and WHO. The problem of pollution is more pronounced in the aquifers of Muthupet estuary region. In addition to human activities, the limited availability of potable water resources are being deteriorated by pollutants due to urbanization, increase in population and over exploitation, intense agricultural activities and industrialization. Hence, it needs for an immediate focus on the monitoring of water quality of this region.

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INTRODUCTION

The increasing population, urbanization and industrial sources are given rise to environmental stress and pollution all over the world. In fact, most of the developed countries have already realized that human existence on the earth may be endangered if suitable steps are not taken for the abatement; the pollution to the water bodies causes a serious threat to the mankind (Agarwal, 2005). Estuaries are complex and dynamic environmental components which receive large amounts of contaminants from urban and industrial sites (Leight *et al*., 2005). Industrialization and urbanization of the coastal region often lead to decrease in coastal resource and destruction of natural defense structures (Zhao *et al*., 2011). Discharge of agricultural wastes, industrial effluents and urban activities is considered to be the primary sources for increasing nutrient load in nearby aquatic water bodies (Kucuksezgin *et al*., 2006). Eutrophication is of great environmental distress, leading to complicity in the aquatic environment, causing problems such as formation of algal blooms which results reduction in oxygen levels, leads to mortality of aquatic fauna and flora

and eventually loss of biodiversity (Yadav *et al*., 2007). India is bestowed with long coastline of 8,129 km and of this 6,000 km is rich in estuaries, creeks, brackish water, lagoons and lakes. In the present study we observed that most of the heavy metals and trace elements increased in Muthupet estuary as compared to standard.

MATERIALS AND METHODS

Location of sample Collection

Muthupet is a panchayat town in Thiruvarur district in the Indian state of Tamil Nadu. The town lies adjacent to the Bay of Bengal and is in the southernmost part of the Cauvery delta. Muthupet is bounded by Korayar and Bamaniyar rivers to the east and west respectively. The rivers Koriayar and Pamaniyar join near Muthupet, and there is a lagoon, which is rich in fish. Muthupet is an ideal place for fishing, pearl hunting and bird hunting. It is well known for its fishing industries such as finfish (koduva), shrimp and crab. Muthupet estuary (Lat. 11° 42' N, long 79° 39' E) is formed by the tributaries of Cauvery river and opens into estuary on the South East coast of India. The water sample was collected from Muthupet estuary, Muthupet east coast, Muthupet district, Tamil Nadu India.

Heavy Metal analysis of water sample

The water samples were collected in Polyvinyl chloride container and preserved with 6(N) HNO_3 solution to pH < 2, (10 ml/l sample) for estimation of arsenic and others heavy metals such as iron, copper, cadmium, chromium, mercury, zinc and arsenic etc. and Sulphate anion content was determined by using UV- Vis Spectrophotometer (Specord-40, Analytik Jena). The concentrations of metals were determined by using atomic absorption spectroscopy (AAS) and the results were tabulated.

RESULTS AND DISCUSSION

Pollution of the aquatic environment and its effects on the living resources, especially the fishery resources, has assumed considerable interest as well as importance in the recent times. Most of the rivers which discharge large quantities of water into the coastal marine environment are polluted and these pollutants obviously end up in .the inshore coastal waters. The vast marine environment has long been used as a site for the disposal of wastes. In some cases the polluted material is discharged directly into the sea and in other cases the pollutant reaches the rivers and estuaries and finally ends up in the sea. Estuaries, the important contributors of fisheries in India, suffer from severe loss of fish production due to increased industrialization and urbanization along the coastal zone by continuous discharge of industrial effluents (Padmini *et al*., 2007). Under the influence of a variety of inter-related biotic and abiotic structural compounds and intensive chemical, physical and biological processes, estuaries are highly variable systems (Madhupratap, 1987). The human race is under tremendous threat due to undesired changes in the physical, chemical and biological characteristics of air, water and soil. Due to increased human population, industrialization, use of fertilizers and man- made activities, water is highly polluted with different harmful contaminants (Patil *et al*., 2012).

The distribution of metals within the aquatic environment is governed by complex processes of material exchange affected by various natural and anthropogenic activities (Ip *et al*., 2007). Although metals are natural constituents of the earth's crust and are present in all ecosystems, their concentrations have been dramatically increased by human activities (Guerzoni *et al*., 1984). Since heavy metals are toxic, persistent and non-degradable in the environment, the contamination of sediments by these elements represent the greatest ecological risk to coastal marine ecosystem (Garcia *et al*., 2008). Such pollution has several distinct biological effects, including diseases in plant and animal species (Lamb *et al*., 1991), local or complete extinction of some species (Vermeij, 1993) and loss or modification of habitat (Nee and May, 1992).

Heavy metals are persistent pollutants in aquatic ecosystems. The trace metal occurs in all compartments of the marine environment and has a tendency to accumulate in organisms from different tropic levels of marine food webs. The accumulation of trace metals in aquatic organisms can pose a long-term burden on biogeochemical cycling in the ecosphere. Bioaccumulation becomes an environmental problem when chemicals accumulated are toxic. Toxicity may occur along the food chain when the contaminated species or a substance is consumed (Heng *et al*., 2004). Once trace metals enter the food chain, they may accumulate to dangerous levels and be harmful to human health (Manahan, 2000). Marine fishu have been widely employed as biomonitors for heavy metals pollution due to their ability to accumulate metals without harming themselves. The reliable use of marine molluscs as indicator organisms for metal contamination requires an understanding of how environmental parameters effect metal accumulation. Particularly bivalve molluscs have been considered as a potential biomonitor for metallic contamination in marine ecosystems (Jung and Zauke, 2008).The problem of pollution is more

pronounced in the aquifers of Muthupet estuary region. In addition to human activities, the limited availability of potable water resources are being deteriorated by pollutants due to urbanization, increase in population and over exploitation, intense agricultural activities and industrialization. Hence, it needs for an immediate focus on the monitoring of water quality of this region. Table 1 represent the analysis of metals in Muthupet estuary, Muthupet east coast, Thiruvarur district, Tamil Nadu India and compared with standard (BIS, 1998; ICMR, 1994; WHO, 1998). In the present study we observed that most of the heavy metals and trace elements increased in Muthupet estuary as compared to standard as BIS, ICMR and WHO (Table 2).

Table 1 shows the analysis of metals in Muthupet estuary, Muthupet east coast, Thiruvarur district, Tamil Nadu India

S.No	Parameters	Results
1.	Chloride (mg/l)	883
2.	Sulphate (mg/l)	341
3.	Phosphate (mg/l)	0.26
4.	Nitrate (mg/l)	64
5.	Nitrite (mg/l)	26
6.	Calcium (mg/l)	373
7.	Magnesium (mg/l)	196
8.	Sodium (mg/l)	471
9.	Potassium (mg/l)	1.42
10.	Zinc (mg/l)	18
11.	Copper (mg/l)	3.09
12.	Iron (mg/l)	1.07
13.	Manganese (mg/l)	47
14.	Cadmium (mg/l)	1.90
15.	Selenium (mg/l)	0.011
16.	Arsenic (mg/l)	0.14
17.	Mercury (mg/l)	0.020
18.	Boron (mg/l)	0.13

Table 2 Water quality standards (BIS, ICMR and WHO)

.No.	Parameters	BIS (1998)		ICMR (1994)		WHO (1998)	
		P	E	P	E	P	E
1.	Calcium	75	200	75	200	75	200
2.	Magnesium	30	100	50	150	50	150
3.	Sodium	-	-	-	-	200	-
4.	Potassium	-	-	-	-	-	-
5.	Chloride	250	1000	250	1000	200	600
6.	Sulphate	200	400	200	400	200	400
7.	Nitrate	40	40	20	50	-	50-100
8.	Phosphate	-	-	-	-	-	0.001
9.	Manganese	20	80	30	100	20	100
10.	Cadmium	0.01	0.01	-	0.05	-	0.05
11.	Selenium	--	-	-	--	-	-
12.	Arsenic	0.05	-	-	0.2	-	0.2
13.	Mercury	0.001	0.001	-	-	-	-
14.	Zinc	5	15	-	-	-	-
15.	Copper	0.05	1.5	1.0	3.0	1.0	1.5
16.	Iron	0.3	10.3	1	0.3	1	0.3

Note: P = Permissible limit; E = Excessive limit All parameters are expressed in mg/L except pH, Turbidity (NTU),

CONCLUSION

It is observed from this study, that the maximum concentrations of all the metals especially copper and cadmium in the water are observed in samples collected from Muthupet estuary. It may be due to the river Paminiyar, Koraiyar, Kandaparichanar, Kilaithangiyar and Marakkakoraiyar discharge their water into the wetlands and form a large lagoon before reaching the sea. As far as the importance of fish in the human diet is concerned, it is necessary that the biological monitoring of water and fish should be done periodically to ensure the safety of seafood consumption. The safe disposal of industrial effluents and domestic sewage should be practiced to avoid such contamination. Also, the laws enacted to protect the environment should be enforced effectively.

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