

## ACCUMULATION OF HEAVY METALS IN COLACHEL ESTUARINE SEDIMENTS, KANYAKUMARIDISTRICT, TAMIL NADU, INDIA

V. MARY KENSA

Department of Botany, S.T. Hindu College, Nagercoil, Tamil Nadu, India

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### ABSTRACT

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An investigation was carried out to assess the distribution of heavy metals in the Colachel estuary at five stations. Estuary is a transition zone between land and sea as well as fresh water and salt water. Contamination of sediments, water resources and biota by heavy metals are of major concern. These heavy metals are non-degradable and often accumulate through trophic level causing a deleterious biological effect. Heavy metal accumulation in aquatic environment is a cause for concern due to toxicity of metal and their accumulation in aquatic habitats. Among the heavy metals, zinc, copper and chromium concentration is very high. Hence periodical monitoring of the water quality is required to assess the conditions of estuarine water bodies.

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### INTRODUCTION

Heavy metals are metallic elements which have a high atomic weight and a density much greater than water. The unscientific disposal of untreated effluents has resulted in the accumulation of heavy metals in land, water bodies and plant growing in the effluents (Armienta *et al.*, 2001; Qudeh *et al.*, 2002; Singh *et al.*, 2004). Estuaries are highly productive doorways between land and sea. It serves as a good nursery and breeding ground for many of the commercially important species of finfishes and shell fishes (AchuthanKutty *et al.*, 1981). Heavy metal contamination has been recognized as a major environmental concern due to their pervasiveness and persistence. Indian environment is becoming

fragile and environmental pollution is one of the undesirable side effects of industrialization, urbanization, population growth and unconscious attitude towards the environment. The discharge of heavy metals in the environment has been several obvious impacts on aquatic ecosystems (Dixit and Tiwari, 2007). Among the various toxic pollutants, heavy metals are particularly severe in their action due to tendency of bio-magnification in the food chain (Topping, 1973) sediments is the ultimately depository of many chemical compounds including heavy metals from natural and anthropogenic sources.

Aquatic organisms living in the sediment accumulates heavy metals to a varying degree (Bryan and Thunderstone, 1977). The bio availability of heavy metals may widely depend on sediments

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\*Address for correspondence - Email : surejkensa@gmail.com

characteristics, water chemistry, hydrograph and biological factors etc. (Ahmed, 2001). Sediments act as indicators of the burden of heavy metals in coastal environments, as they are the principal reservoir for heavy metals (Fitchko and Hutchinson, 1975). Metals introduced into the marine environment by dumping, domestic wastes, industrial effluents, ship breaking activities, urban run-off, atmospheric deposition and mining activities as well as upstream run off. The heavy metals create a major ecological crisis, since they are non-degradable and often accumulate through trophic level causing deleterious biological effects (Jain, 1978). Organic carbon plays a major role in the distribution and retention of trace elements in the sediments, which transport trace metals to the estuarine systems as sediments (Kumar, 1996). The present investigation aims to study the heavy metal distribution in sediments of Colachel estuary.

#### Study Area

It is formed by the confluence of river Kothaiyar and Pampoori Vaikal at Kodimunai about 0.5 km ahead of the mouth. The length of the vaikal is 15 km and it joins the estuary at Kurumbanai. At the area and, intensive coir retting is carried out along the bank of the Vaikal.

#### MATERIALS AND METHODS

To evaluate the concentration of heavy metals, three stations were selected. Station I was fixed at Colachel near the river mouth, Station II at Kurumbanai 2 km away from station I. The estuarine environment is subjected to pollution through sewage disposal, agricultural runoff and setting activity. A total of five sediment samples were collected. The collected samples were initially air dried and finely powdered using an agate motor. All the heavy metals were estimated by Atomic Absorption spectroscopic method.

#### RESULTS AND DISCUSSION

The concentration of seven heavy metals are listed

**Table 1.** Concentration of heavy metals (in ppm) units

Samples	Cu	Zn	Ni	Pb	Co	Cr	Mn
I	2	13	16.5	6.3	7.5	17.5	4.5
II	6.5	15	4.3	10.2	9.5	19.5	8
III	7	19.5	5.5	17	14	24	16
IV	13.6	21.4	18.7	15.5	19.7	21.8	26.5
V	8	28.4	5.2	18.1	15.7	13.7	30

in Table 1.

#### Copper (Cu)

In the present study, the copper concentration varied from 2 -13.6 ppm with the mean value of 7.42 ppm. The lowest value was noted in station I and highest value in Station IV. The copper concentration is due to the low content of fine particles and the high degree of adsorption of the metal under saline conditions.

#### Zinc (Zn)

Zinc is one of the commonest elements in the earth crusts. It has many commercial uses as coating to prevent rust. Zinc ranks fourth among metals of the world in annual consumption. Zinc concentration varies from 13 - 21.4 ppm with the mean values of 19.46 ppm. Maximum value was observed in station V and minimum in Station I.

#### Nickel

Nickel is a very abundant element. It is found in all soils and is emitted from volcanoes. It is a hard, silvery-white metal that is combined with other metals to form alloys. The Nickel concentration depends on the origin of the soil and pathogenic prefers (Adriano, 1986). Nickel co-exists with sulphide minerals and mafic silicates with generally elevated concentrations in ultramafic igneous rocks, containing more than 90% dark minerals (Riemann and de Caritas, 1998). In the present study, nickel varies between 4.3 - 18.7 ppm with mean value of 10.04 ppm. The maximum was found in station IV and the minimum in Station II.

#### Chromium (Cr)

Khan and Hossain (1996) have recorded higher concentration of chromium (0.517 mg/L) in the Kharnafully estuary. Chromium ranges between 24 to 13.7 ppm with mean value of 19.3 ppm. Maximum value was obtained at Station III due to chromium enriched metallic compounds from industrial wastes and other sources.

#### Cobalt (Co)

It occurs in many different chemical forms. It is used in industry is imported or obtained by recycling scrap metal that contains cobalt. Cobalt is one of the most widely distributed heavy metals in terrestrial and aquatic environment. In the present study, cobalt ranges between 7.5 to 19.7 ppm with mean value of 13.28 ppm. Maximum value was observed in Station IV and minimum value is Station I. The anthropogenic influence through the application of manures and fertilizers to the adjoining coconut plantations favors the accumulation of this metal in these stations.

#### Lead (Pb)

It is a naturally occurring bluish gray metal found in small amounts in the earth's crust. Most of it comes from human activities like mining, manufacturing and the burning of fossil fuels. Lead occurs geologically in association with sulphide minerals and generally in elevated concentrations in Metal argillites, granites and coals (Reimann and Carital, 1998). The behaviour of lead during weathering and sedimentation is strongly dependent on environmental conditions. In the study area, lead varies from 6.3 to 18.1 ppm with mean value of 13.42 ppm. The minimum value was found in station I and the maximum in Station V.

#### Manganese (Mn)

It is an essential element for both plant and animals. The study area showed 4.5 - 26.5 ppm manganese with mean value of 17 ppm. Station II has minimum Mn and the Station IV has maximum Mn.

Three metal concentrations vary with respect to time as well as location (Sankaranaryanan *et al.*, 1998). Jain and Sharma (2001) reported that large amount of heavy metals in associated with organic matter indicate that these constituents play a major role in transport of metal ions. There is considerable variation in the concentration of heavy metals, towards downstream, which may be due to the variation in the sub basin geology and various degrees of human impacts (Ramesh *et al.*, 1990). Concentrations of heavy metals were evaluated by Ashraf *et al.* (2008) in Vambanad, Dileep Kumar *et al.* (2007) in Mandovi and Zuari estuaries and Howari and Banat (2001) in Yarmouk River.

#### CONCLUSION

The increased heavy metals exposure constitutes a

direct risk for people with asthma metal allergies and chemical sensitivities. Infants and children are particularly vulnerable and may suffer permanent damage. High inputs of toxic trace metals to the estuarine environment have resulted in ecological changes and great financial losses, affected commercial fisheries and in some cases have been hazardous even to human health. Hence periodical monitoring of the water quality is thus required to assess the conditions of estuarine water bodies.

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