Available online at http://www.journalijdr.com

IJDR

International Journal of
DEVELOPMENT RESEARCH

ISSN: 2230-9926

International Journal of Development Research
Vol. 06, Issue, 05, pp. 7719-7722, May, 2016

Full Length Research Article

A STUDY ON THE DISTRIBUTION OF COPPER AND ZINC IN AGNIAR ESTUARY, SOUTHEAST COAST OF INDIA

Kamalakannan, P., Sathick, O and *Muthukumaravel, K.

Department of Zoology, Khadir Mohideen College, Adirampattinam 614 701, Tamil Nadu, India

ARTICLE INFO

Article History:

Received 18th February, 2016
Received in revised form
22nd March, 2016
Accepted 22nd April, 2016
Published online 18th May, 2016

Key Words:

Heavy Metals,
Monthly Variation,
AGNIAR estuary.

ABSTRACT

The seasonal variations of heavy metal distribution were studied during July 2014 to June 2015 in the Agniar estuary (Lat.10° 20' N Long.79° 23'E) Adirampattinam southeast coast of India. The range of distribution of copper in the estuarine water and sediments are found to be 3.8 to11.6 µg/g and 33.3- 41.1 µg/g respectively. In both water and sediment maximum concentration of copper was observed in November 2014. The minimum concentration of copper was observed during March 2015 in water and June 2015 in sediments. The concentration of zinc was found to be more than that of copper both in the estuarine water as well as in the sediments. The concentration of zinc in water recorded from 6.5 µg/g to 20.7 µg/g and in the sediment from 36.5 µg/g to 52.8 µg/g The metal concentration was found to be maximum in June 2015 in both water and sediments

INTRODUCTION

Heavy metals such as copper, zinc, manganese, chromium and cobalt in normal concentration are recognised as effective catalyst for biological systems and are toxic when present in higher concentration (Forstner and Prosi, 1978). These metals are relatively insoluble in water. But they are sorbed to solid particles and settle down and thus they occur more in sediments. Elevated levels of these metals are attributed to large scale industrialization, urbanization and intensive agricultural practices. Review of literature showed that the study of heavy metal pollution in the estuary of different parts of the India has been carried out by several investigators .The best studied estuaries on the East coast of India were Vellar estuary (Kumaraguru, 1980; Shanthi *et al.,* 1990; Shekar Kovale , 1987; Senthilanthanm *et al.,* 1986, 1988; Lyla and Ajmalkhan,1996; Senthilnathan and Balasubramanian, 1997 and Mohan, 1997); the Zuari estuary (Chalapathi Rao and Satyanarayana Rao, 1971); the Mondovi and Zuari estuaries (Zingdae *et al.,* 1976); the estuaries between Chennai and Pondicherry (Hema Achyuthan *et al.,* 2002) and on the west on coast of India, the Cochin backwaters were studied by Rajendran and Kurian (1986).

Corresponding author: Muthukumaravel, K.
Department of Zoology, Khadir Mohideen College, Adirampattinam 614 701, Tamil Nadu, India

A good number in the differend parts of world were also studied. Some of them are the Conway estuary (Eiderfield *et al.,* 1971), the Severn estuary (Butterworth *et al*., 1972), the Tamar estuary (Bryan and Hummerstone, 1973), the Loire estuary (Frenet, 1981), the Humfer estuary (Gradiner, 1982; Jones and Jeffenier, 1983) and the Karnafully river estuary by Hossain *et al.* (1988). The present survey was undertaken to study the distribution of heavy metals such as Cu and Zn in the water and sediments of the Agniar estuary.

MATERIALS AND METHODS

A study on the concentration of heavy metals, Cu and Zn in the water and sediments was made for a period of 12 months from July 2014 to June 2015.

Measurement if metal concentration in water

Surface water samples from the Agniar estuary were collected twice a month, using clean plastic bucket and transferred into precleaned polythene bottles of three litre capacity. The bottles and plastic buckets used for collection were cleaned by 30% v/v nitric acid and then washed with distilled water. As soon as the sample was collected it was preserved by adjusting the pH 4±0.1 using 50% v/v nitric acid and brought to the laboratory. Then it was filtered immediately through 0.45 mm

Millipore HA membrane filter. Metal concentrations (Cu and Zn) in the water and sediment samples were analysed by the pre concentration procedure developed by Brooks *et al.,* (1967) using the principle of Chelation and solvent extraction technique which involves the use of Ammonium Pyrolidine Dithio Carbamate (APDC) and Methyl-Isobutyl Ketone (MIBK). Final quantification was made in Atomic Absorption Spectrophotometer. Pre concentration procedure was found to have a recovery of 95% on known standards. The levels of metals in water is expressed in $\mu g l^{-1}$.

Measurement of metal concentration in sediments

Monthly sediment samples were collected using Van Veen Grab and the samples were stored in frozen condition in deep freezer (-20^0C) for further analysis. The preserved sediment samples were dried at 110^oC for Cu and Zn (EPA, 1979) to constant weight for the estimation of then trace metals. The sediment samples were ground using an Agate mortar and pestle and sieved for further estimation. After drying, the sediment was gently heated and digested with hydrofluoric acid in a Teflon beaker (100ml) to dryness, whereby silica volatilizes as silicon tetrafluoride. This was then followed by treatment with the nitric acid, perchloric acid serially and digested to dryness again to destroy the organic matter spectrophotometer and finally the metal concentrations in the sediment samples are expressed in µg/g dry weight.

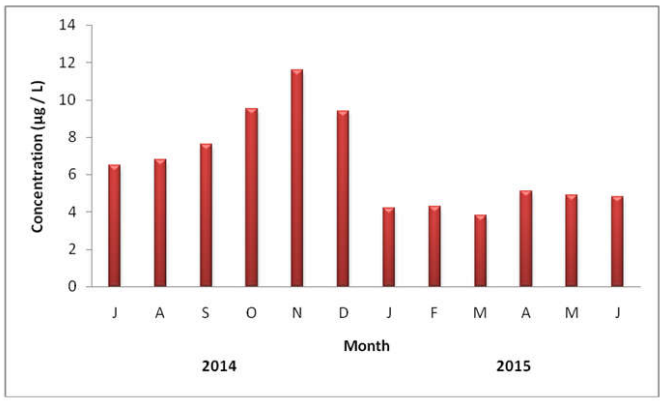

Fig. 2. Monthly changes in concentration of copper in water during 2014 to 2015 in Agniar estuary

The concentration of zinc was found to be more than that of copper both in the estuarine water as well as in the sediments. The concentration of zinc in water recorded from 6.5 µg/g to 20.7 µg/g and in the sediment from 36.5 µg/g to 52.8 µg/g The metal concentration was found to be maximum in June 2015 in both water and sediments (Fig.3&4). The result of the present investigations provide a base line data on the levels of heavy metals (Cu and Zn) in the Agniar estuary. The concentration of zinc was found to be greater than copper in the estuary.

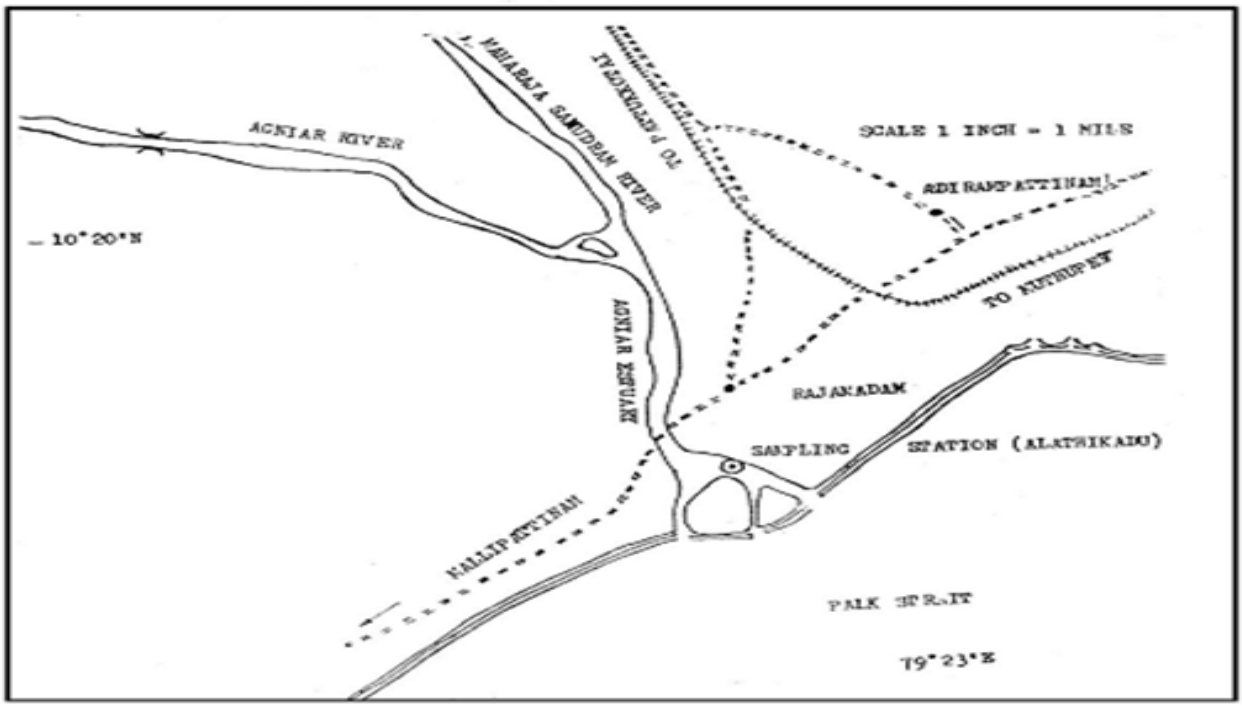

Fig. 1.

RESULTS AND DISCUSSION

The range of distribution of copper in the estuarine water and sediments are found to be 3.8 to11.6 µg/g and 33.3- 41.1 µg/g respectively. In both water and sediment maximum concentration of copper was observed in November 2014. The minimum concentration of copper was observed during March 2015 in water and June 2015 in sediments (Fig.1&2).

It is well below the tolerance limit (Copper =3 $mg l^{-1}$ and zinc =5 $mg l^{-1}$) for industrial effluents prescribed by the Indian Standard Institution (ISI, 1974). It also indicated that the study area are not highly contaminated but at same time there is the possibility for gradual accumulation of heavy metals (Cu and Zn). Levels of dissolved Cu and Zn in the present investigation showed a higher concentration during monsoon and lower concentrations in summer period. The higher concentrations

of metals observed during the monsoon could be attributed to the heavy rainfall and subsequent river run off bringing much land derived materials along with domestic, municipal, agricultural wastes which were rich sources of heavy metals.

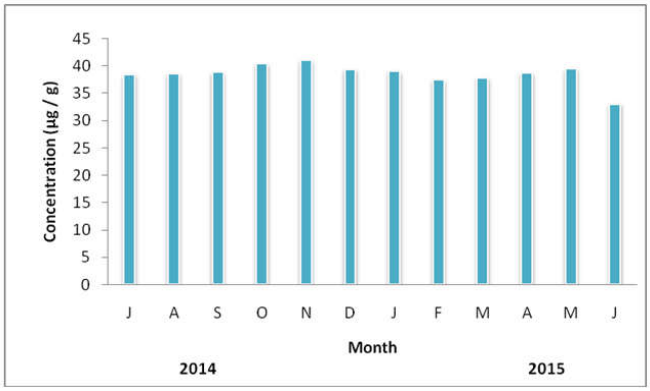

Fig. 3. Monthly changes in concentration of copper in sediment during 2014 to 2015 in Agniar estuary

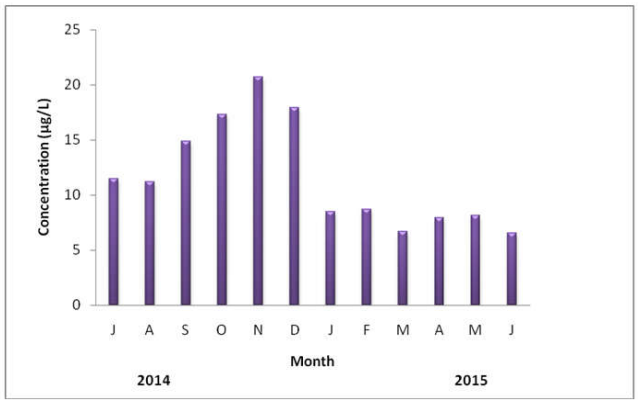

Fig. 4. Monthly changes in concentration of zinc in water during 2014 to 2015 in Agniar estuary

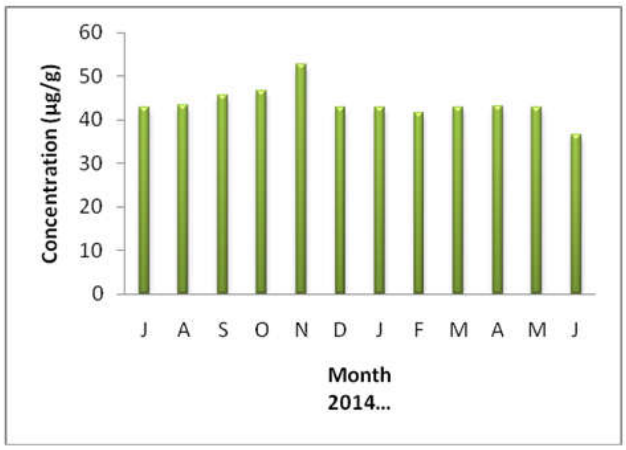

Fig. 5. Monthly changes in concentration of zinc in sediment during 2014 to 2015 in Agniar estuary

The load of heavy metals was found to be minimum during summer months due to meager fresh water influx. Similar observations were made in most of the estuaries on the East coast of India such as Vellar estuary (Kumaraguru, 1980; Magandran *et al.,* 1989; scathe *et al.,* 1990 and Senthilnathan and Balasubramanian, 1997), Parangipettai coastal waters (Rajan, 1987) Uppanar, Kaduviaru and Porto Novo (senthilnathan, 1990), Pitchavaram mangroves (Subrmanian, 1981) and in the Kodaikkarai area (Pragatheeswaran *et al.* 1988). A considerable works have also been reported from the estuaries situated on the West coast of India by Chalapathy Rao and Sathyanarayana Rao (1971) in Zuari; Zingdae *et al.* (1976) in Mondovi and Zuari estuaries; Murthy *et al.* (1980,1985) in the Arabian sea; Rajendran and Kurian (1986), Govindasamy *et al.* (1998) in the Pondicherry coastal area and Govindasamy and Azariah (1999) in the Coromandel coast.

REFERENCES

Ajamal, M. and Razi-ud- din, 1988. Studies on the pollution of Hindon river and Kali Nadi (India). In:Trivedy, R. K. (Ed.) Ecological and pollution of Indian river. *Asish publishing House, New Delhi*.87-112.

Bryan, G.W.1976. Heavy metal concentration in the sea. In; Johnston, R(Ed) *Marine pollution*. Academic Press, London.

Bryan, G.W. and Hummerstone, L.G 1973. Brown seaweed as an indicator Heavy metals in the estuaries of South West England. *J Mar. Biol.Ass. (U.K)* 53: 705-720.

Butterworth, J., Lester, P.and Nickless, G.1972. Distribution of heavy metal in the Severn estuary. *Mar.pollut.Bull*.3(5):72-74.

Chalapathi Rao, V. and Sathyanarayana Rao, T.S.1971. Distribution of trace elements (Fe, Cu, Mn & Co) in the Bay Bengal. *Symp. Ind Ocean and Adjacent seas Jan* 12-18,1971, Abst.p.56.

Chalapathi, Rao, V. and Sathyanarayana Rao, T. 1971. Distribution of trace elements (Fe,Cu,Mn,&Co) in the Bay of Bengal. Symp. Ind ocean and Adjacent seas. Jan. 12.18 1971. Abst. p.56

Frenet, 1981.The distribution of mercury, cadmium and lead between water and suspended matter in the Loire estuary as a function of the hydrological regime. *Water Res*. 15(12): 1343-1350.,

Gardiner, J. 1982. Nurientents and persistent contaminants. In: A. L. H.Gameson (Ed).*The quality of the water in the Estuary. Yorkshire water Authority* U.K.

Govindan, V.S. and Devika, R .1991. Studies on the heavy metal profiles of Adyar river and waste stabilization ponds. *J. Ecological. Environ. Monit*. 1(1): 54-58.

Govinthasamy, C. and Azariah, J. 1999. Seasonal variation of heavy metals in Costal water of the Coromandal coast, Bay of Bengal, India. *Ind. J. Mar. Sci.* 28 :249-256.

Hema Achyuthan, Richard Mohan, D., Srinivasalu, S. and Selvaraj, K. 2002. Trace metals concentration in the sediment cores of estuary and tidal zones between Chennai and Pondicherry along the east coast of India. *Ind. J. Mar. Sci.* 31(2):141-149.

Hossain, M. M., Mohamed, M and Bhounjain, A.M. 1988. Some Water quality Characteristics of the Karnafully river estuary. *Mahasagar*. 21 (3): 183 -188.

Israili, A.W. 1992 . Occurrence of heavy metal in Ganga river water and Sediments. *Ind. J. Environ. Health,* 34 (1): 64-66.

Israili, A. W. and Kurshid, S. 1991. Distribution of heavy metal in Yamuna river water and sediments from Delhi to Allahabad. Poll. Res. 10 (4):215-222.

Israili, A .W.and Kurshid, S. 1993. Heavy metal load in water and sediments of river Ganga near main sewer, Varanasi-A Preliminary study. *Bull. Ind Geol Ass*. 26(1) :45-51.

Jones, P.G.W. and Feffenier, D.F. 1983. The distribution of selected trace metals In United shelf waters and the North Atlantic Can *J. Fish. Aquat. Sci*.40 (Suppl.2) :111-123.

Kremling, K. 1985. The distribution of cadmium, copper, nickel and aluminum In surface waters of the open Atlantic and European shelf area. Deep Sea Res.32 (5) :513-555.

Kumaraguru, A.K., 1980 studies on the chemical and biological transport of Heavy metal pollutants copper, zinc and mercury in vellar estuary and the toxicity of three pollutants to some estuarine fish and shell fish. Ph.D. Thesis Annamalai University.

Lakshmanan, P.T. and Nambisan, P.N.K. 1983. Sesanoal variation in trace Metal content in bivalve mollusks, *Villorta cyprinoides, Metrix casta* (Chemnitz)and *perna uiridis* (Linnaeus). *Ind. J. Mar. Sci.*12 :100-103.

Langston, W. J. 1986. Metals in sediment and benthic organisms in the Mersey *Estuary.* Estuar. Coast.Shelf Sci. 23: 239-261. Magendran, A., Senthilnathan, S., Balasubramaniyan, T. and Venugopalan, V.K. 1989. distribution of copper zinc, iron and manganese in the Prawn, *Penaeus indicus in* Vellar estuary ,South East Coast India. *Proc. Nat. Symp. Nat. Res. Conser.* Feb. 1989.

Matkar, V. M., Ganapathy, S., and Pillai K. G. 1981. Distribution of zinc, copper, manganese and iron in Bombay harbor Bay. *Ind.J.Mar.Sci.* 10: 35-40.

Metzner, A.V. 1977. "Rermoving soluble metals from waste water". Wat. Sewege Works. 124: 98-101.

Mohan, P.M. 1997. Trace elements geochemistry of modern sediments of the Vellar river and its surrounding environments. *Ind. Mar. Sci.* 26(6):150 -157.

Mohandhas, R. 1988. Biology, reproduction and larval development of the pistol Shrimp *Alpheus malabaricus* (Fabricus) (Crustacea: Decapoda: Alphedae). Ph.D. Thesis, Annamalai university.

Morris, A.W.1974.Seasonal variations of dissolved metals in inshore Water of the Menai straits. *Mar.Poll. Bull.(*4) : 54-59.

Murthy, P.S.N., Rao, C.H.M.Paropkari, A.L. and Topgi, R.S. 1980. Distribution Of Al, Mn, Ni, Co and Cu in the non – lithogenic fraction of sediments of the Northen Half of the Western continental shelf of India. *Ind. J. Mar. Sci*. 9:56-61.

Pragatheeswaran, V. P., Anbazhagan, R. Natarajan and Balasubramaian, T. 1988. Distribution of copper and zinc in Kodikkarai costal environment.Mahasagar-Bull. Nath. Inst. Oceanogr. 21(3) :179-182.

Rajan, A. 1987. Studies on *Donax cuneatus* (L) (Mollusca: Bivalvia: Donacidae) From porto Nova waters. Ph.D. Thesis, Annamalai University.

Rajendren, N. and Kurian, N.1986. *Crassostrea madrasensis* (Preton) indicator of metal pollution in Cochin backwaters. Proc. Nat. Sem. Mussel Watch. 1:120-127.

Senthilnathan, S. and Balasubramanian, T. 1997. Distribution of heavy metals In estuaries of South East Coast of India. *Ind.J.Mar.Sci.* 26 ;95-97.

Senthilnathan, S. 1990. Investigations on heavy metal pollution (copper, zinc, cadmium and lead)in the estuaries of South East coast of India. Ph.D., Thesis, Annamalai University.

Shanthi, B. Rajan, A. and Kaylyani, M .1990. Seasonal variation of Fe, Zn, Mn and Cu In vellar estuary. *Env. Ecol.* 8(2): 515-522.

Shekhar Kovale, R 1987. Hydrobiological studies with special reference to distribution and accumulation of copper, zinc, manganese and iron in biota, sediment and inshore waters of Porto Novo. Ph.D. Thesis, Annamalai University.

Stoffers, P., Glasby, G.P., Pliiger, W.L. and Walter, P.1983. Reconnaissance survey of the mineralogy and geochemistry of some Newzealand lake and near shore sediments. New Zealand. *J. Mar. Fresh W. Res*. 17:461-480.

Subramaniyan, A. N.1981.Some aspects of iron, manganese, copper, zinc and phosphorus in Pichavaram. Ph.D. *Thesis, Annamalai University*.

Zingdae, M.D., Singbal, S.Y.S., Moraes, C.F. and Reddy, C.V.G.1976. Arsenic, Copper, zinc and manganese in the moraine flora and fauna of costal And estuarine water around Goa. *Ind. J. Mar. Sci.* 5: 212-217.

****