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RESEARCH ARTICLE

Status of heavy metal pollutants around the south eastcoast of India

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Abstract

Distributions of Al, Cd, Cr, Cu , Hg, Ni, Pb, and Zn metals concentrations in the sediment and water samples were analyzed from 11 sampling stations around the southeast, coast of India. The highest Al, Cd, Cr, Cu , Hg, Ni, Pb, were recorded at Chennai and Tuticorin cities. Which are mainly due to industrial effluents and untreated sewage outfalls. Zinc concentrations around the coast is highly influenced by river runoff.

INTRODUCTION

Sediments are important carriers of trace metals in the environment and reflect the current quality of the system. Build up heavy metals in the coastal environment is mainly due to the increase in pace of industrialization and urbanization (Christopher and Betty 1999, Md, shhidul lslam and Masaru Tannaka 2004). Knowledge on the heavy metal contamination levels in the coastal environment is essential, since man uses as fish and shellfish inhabiting this region. Very limited information is available on the heavy metal pollutants in the southeast coast of India (Tamil Nadu State). Hence the present investigations is aimed to understanding the heavy metal contamination levels of Al, Cd. Cr, Cu , Hg, Ni, Pb and Zn in the southeast coast of India.

Geographical location of the sampling stations:

The coastline of southeast coast of India (Tamil Nadu State) has length of about 1076 km constitutes about 15% of the total coastal length of India and stretches along the Bay of Bengal, Indian ocean and Arabian sea. There are 11 sampling sites are selected for this study based on the pollution input into the coastal Environment through urbanization, industrial and harbor activities and river runoff. The geographical location of sampling stations are as follows: chennai (13° 04' N and 80° 17' E). Pondicherry (11° 56' N and 79 ° , Cuddullore (11° 43' N and 79 °$_{49}$, E), Porto novo (11° 3' N and 79 ° 48' E) Nagapatanam (10° 46' 0 N and 79° 49' 60 E) Mandapam (9° 17' N and 79° 22' E), Tuticorin harbour (8° 48' and 78° 11' E), Cape Comarin (8° 04' N and 77° 36' E).

Methodology:

Sediments were collected at 1 meter depth near shore by using Peterson grab and surface water from 11 stations during the month of July year 2008 from the south east coastal cities and towns of India. Sediments were removed by plastic spoons from the Centre portion of the sediment inside the grab to avoid any metal contamination during collection. In every sampling site 8 water and sediment samples were collected for analysis. One gram of dried and powdered sediment samples was used for metal Analysis by the hot acid digestion method (Bruland et

al.,1974). A separate digestion procedure was adopted for sediment mercury analysis (Windom and cutshall, 1976).

Metal concentration in the water samples were estimated by chelex -100 resin extraction procedure (Kingstom et al.,1978) and analyzed by using a flame atomic absorption spectrophotometer (Perkin -Elmer 380). Mercury concentrations in the water samples was analyzed by cold vapor atomic absorption technique, after a pre concentration step (Garderner and Riely, 1974) . The precision and detection limit of the instrument is ± 0.01 ug. The mean values of water and sediment metal concentration were calculated from 8 samples for each samping site and given in table 1 and 2.

Results and Discussion:

Distribution of metal concentration in the sediment and concentrations were recorded at Chennai north (station 1) followed by Chennai harbor (station 2) ,Chennai south (station 3) , Tuticorin (station 9 and 10) and Pondicherry (station 4) . The heavy metal concentration in the Chennai coastal area is slightly higher in comparison to our previous study Off Madras (pragateeswaran et al., 1986). This high level of metal concentration was attributed mainly to industries, chemical factories, harbor activities and domestic effluents. Chennai city (station 1,2 and 3) and Tuticorin town (station 9 and 10) had witnessed a boom in industrial and chemical estates in comparision to other sampling stations. Roberto Zonta et al., (2007) are also observed increased levels of metal concentration from Porto Marghera, Venice Lagoon Italy. Similarity Peerzada and Rohoza r (1989) and Mathew Leon and Jan wamken (2008) were also recorded the increased levels of metal concentration in the harbor of Darwin and Queens land. Australian are mainly due to domestic sewage out fall and industrial outfall respectively. In the present study, distribution of Al, Cd. Cr, Cu , Hg, Ni, Pb and Zn concentrations was uniform in the coastal towns of Cuddulore Porto Novo, Nagapattanam, Mandapam and Cape Comarin (station 5,6,7,8 and 11) where industrial and harbor activities are very low when compared to Chennai (station 1,2 and 3) and Tuticorin (station 9 and 10).

Highest Zn, Al and Hg concentrations were recorded from Tuticorin (station 9 and 10) . Zn concentrations are mainly influenced by anthropogenic activities and river runoff. Christopher and Betty (1999) were noted increased levels of Cooper, Nickel and Zinc concentrations influenced by fresh water in the Thames estuary. Further Ruey- an Doong et al., (2008) have also recorded similar trend of heavy metals concentration from Gao - Ping estuary, Taiwan. Tuticorin coastal water also receives large amount of fresh water through a perennial river called Thamiraparani, which could be the main influencing factor for the highest levels of zinc recorded here.

Tuticorin thermal power station records show 1.6% of aluminum content is present in the thermal fly ash. it could be the main influencing factor for the increased level of Al in the Tuticorin coastal environment, mercury concentration in sediment and water samples was also high in the Tuticorin coast (station 9 and 10). It is mainly due to effluents from lot of ore handling in the harbor, heavy water plant and chlor alkali plant. In the Tuticorin Chlor alkali pant, mercury is being used as cathode. Similarly BaraJ et al., (1964) have also recorded the high Hg content at the Vlora stations in Vlora Bay, Albania due to the operation of the chlor-alkali plant. Further Voravit Cheevaporn and Plamsak Menasveta (2003) have also well documented Mercury pollution in the gulf of Thailand due to industrial activities and untreated sewage outfall. There was no trace of mercury in the water samples from the stations 5,6,7,8 and 11 and other metals concentrations were also low when compared to the stations 1,2,3A,9 and 10. From this study, It is quite evident that metals concentration in the sediment and water were highly influenced by industrial and domestic activity in the coastal cities effluent outfalls.

Table 1 :- Mean value of dissolved metal concentration ug/l in water samples

Station no.	station name	Al	Cd	Cu	Cr	Hg	Ni	Pb	Zn
1	Chennai north	5.3	7.6	20.2	13.8	4.6	6.8	7.2	16.1
2	Chennai harbor	5.6	7.2	22.9	15.1	4.2	6.1	6.9	14.9
3	Chennai south	4.1	6.8	16.6	10.1	3.8	5.7	5.4	11.2
4	Pondicherry	2.5	4.1	6.4	7.2	1.4	3.3	2.2	9.6
5	Cuddulore	1.9	2.3	4.6	4.7	ND	1.9	2.1	12.7
6	Porto novo	0.8	1.5	3.8	2.4	ND	2.7	1.8	10.3
7	Nagapattanam	1.2	1.9	4.3	1.8	0.2	2.6	3.1	7.1
8	Mandapam	ND	1.1	2.3	0.7	ND	0.8	1.1	4.6
9	Tuticorin harbor	7.9	5.6	14.6	12.1	5.1	5.9	6.2	20.2

10	Tuticorin south	6.6	5.3	11.4	13.1	4.9	4.7	6.1	27.1
11	Cape Comarin	1.4	2.1	2.5	3.9	ND	0.5	ND	5.6

ND = Not Detected

Table 2 :- Mean value of dissolved metal concentration ug/g in water samples

Station no.	station name	Al	Cd	Cu	Cr	Hg	Ni	Pb	Zn
1	Chennai north	16.1	18.3	43.7	27.4	11.1	22.2	13.3	127.7
2	Chennai harbor	18.4	24.9	51.3	30.7	12.9	23.4	14.7	136.3
3	Chennai south	14.3	17.7	38.2	26.3	10.5	20.9	12.1	125.4
4	Pondicherry	10.7	12.2	19.1	18.6	7.3	12.4	9.4	112.3
5	Cuddulore	9.1	11.6	18.5	15.2	2.6	11.3	8.9	146.1
6	Porto novo	11.4	11.1	14.1	13.3	2.2	10.5	9.3	147.6
7	Nagapattanam	10.2	10.4	19.6	12.5	4.4	9.1	10.5	130.2
8	Mandapam	7.4	9.1	10.7	7.1	1.2	7.7	9.6	110.5
9	Tuticorin harbor	59.7	17.9	26.6	27.5	14.7	16.8	11.2	297.7
10	Tuticorin south	51.2	14.5	23.4	25.9	13.1	12.6	10.8	326.9
11	Cape Comarin	10.6	9.4	14.8	3.9	0.9	6.3	11.1	84.2

Conclusion:

The metal concentrations in water and sediments from Chennai and Tuticorin harbors, are though low which are indicative of pollution from point sources in and around the harbor and from diffuse sources such as industrial effluents and urban runoff. However, the results also indicate that the metal concentration levels have not exceeded the maximum concentration limits (MCl). The situation calls for regular monitoring so that the safe limits are not exceeded due to increased activities at the ports and industrial developments around the southeast of India.

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