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Accumulation of Heavy Metal from Sea Water and Sediment on Ghed Area,Gujarat

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Accumulation of Heavy Metal from Sea Water and Sediment at Ghed Area,Gujarat

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I. Introduction

Heavy metal contamination of the coastal environment continues to attract the attention of environmental researchers due to its increasing input to the coastal waters, especially in the developing countries. Anything that stirs up the water, such as dredging, can resuspend sediments (Abida Begum, Hari Krishna S, Irfanulla Khan, 2009). Ecotoxicologists and environmental scientists use the term "heavy metals" to refer to metals that have caused environmental problems. The metals which have been studied extensively the last decades are: Cd, Hg, Zn, Cu, Ni, Cr, Pb, Co, V, Ti, Fe, Mn, Ag and Sn (Tin). Atmospheric and river inputs, dredging spoil, direct discharges, industrial dumping and sewage sludge are some of the important contributors to metal pollution, which lead to the release of metals to the marine environment(A. Valavanidis & Dr. Thomie Vlachogianni, 2010). As the mangrove forest sediments have a high potential for storing heavy metals from the water in tropical and subtropical regions (Kamaruzzaman et al., 2008; Tam and Wong, 1996; Clark et al., 1998). The high capability of mangrove to absorb and store heavy metals in its sediments is because of the physicochemical properties of these sediments (Qiu et al., 2011; Harbison, 1986).

a) Sea water

Cadmium, copper, lead and zinc salts are usually found in agricultural and industrial liquid waste which discharged into water resources. (McCrea and Fischer 1986 and Qiao-qiao et al 2007).A direct relationship between heavy metal concentrations in seawater and limpet soft tissues was found in the Vigo estuary area, the levels of Cd and Zn being the ones that showed the greater spatial differences. (M. Perez-Lopez, 2003). The current literature includes some investigation on concentration of heavy metals in sea water in several different coastal areas of the world. One of them was studied in Indonesian. His observation on heavy metals (Hg, Pb, Cd, Cu, Zn and Ni) content in sea water in beaches, were carried out in Jakarta Bay water (Lestari, 2004).Water pollution of heavy metals has become a question of considerable public and scientific concern in the light of the evidence of their toxicity to human health and biological systems (Yayıntas et al. 2007a, b; Anazawa et al. 2004; Özmen et al. 2004; Alonsa et al. 2004).The high heavy metal concentration indicated that seawater near the Kepez harbor was so polluted that all living organism may be adversely affected by this pollution. One of the sources of this pollution may be Danube River discharges annually of about 280 tons of cadmium and 4,500 tons of lead, which reach to the seawater of the Dardanells (Süren et al. 2007; Balcı and Türkoğlu 1993; Turko˘glu et al. 1992; Mee 1992).

b) Sediment

Heavy metal concentrations in surface sediments can provide historical information on heavy metal inputs at that location. Such surface sediment samples are also used as environmental indicators to reflect the current quality of marine systems for many pollutants (Förstner, 1980). Human activity may increase concentration of heavy metals in coastal sediments and at the same time areas of high rural and industrial activity will lead to increase of such sediments in such areas creating high concentrations of pollutants (Luoma,1983), (Savvdeset,et.at,1995).There is a theory that finer sediments contain more heavy metals than coarser ones. The main reason is that smaller grainsize particles have a larger surface-to-volume ratio (Salomons, 1984; Martincic, 1990).Zinc, like nickel and copper, shows partial detrital binding. It is impossible to infer bond types for lead and cadmium from the analyses in this study; however, because of the correlation between these two metals, it is assumed that they undergo proportionately similar binding forms. (Perttilä and Brügman, 1991).Distributions of arsenic (As) and metals in sediments can provide evidence of human activities and their effects on ecosystems and

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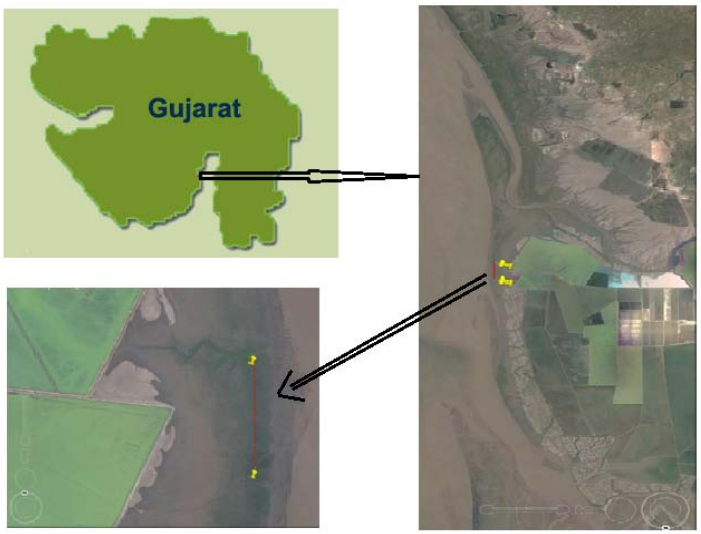
aid in assessing the risks associated with discharged human waste. Accumulation of arsenic and metals in sediments has implications for local communities, as well as for qualities of river waters (Demirak et al. 2006; Zheng et al. 2008). Accumulation of trace metals occur in upper sediment in aquatic environment by biological and geochemical mechanisms and become toxic to sediment-dwelling organisms and fish, resulting in death, reduced growth, or in impaired reproduction and lower species diversity (Praveena et al., 2007).Pollution will occur from different sources in many ways either from natural or human made. When the pollution was caused by the nature, the effect of pollution is very low and pollution does not persist for a longer duration. (Fractionation of Heavy Metals in Soil of Industrial Area of Mysore City, India, D. Shiva kumar S. Srikantaswamy, 2014).

c) Study Area

Gujarat state is located in the Western part of India. The Gulf of Khambhat, (3,120sq.km) is aligned in a north-south orientation. The Gulf has a distinctive characteristic of having world's highest tidal amplitude of concerning 11m that has potential of production of power and other danger as well. The average precipitation varies from 600mm on the western side to 800mm on the eastern side. However, about 9000km^2 around the Gulf shows a high concentration of inherent salts in the sediments and ground water has higher salinity reaching 2000ppm and above . Bhavnagar district is in Saurashtra region also known as Kathiawad, a part of Gujarat. Geographically the study area lies within the boundaries of latitudes 21̊ 49' 17.83" to 21° 49' 46.92" N and longitudes 72° 15' 21.03" to 72° 15' 22.20" E (0.9 km.).



Figure

II. Material and Method

a) Determination of metals in the sea water samples

Analysis of trace metals in sea water was done by APDC-MIBK extraction procedure. the sea water sample were filtered using 0.45 μm millipore filter paper and stored in pre-cleaned, acid washed polyethylene bottle. Samples were acidified with Supra-pure nitric acid or hydrochloric acid to a pH between 2-3. Samples were stored preferably at low temperature to avoid evaporation. Take out 400ml of seawater sample, adjust the pH to 4.0.Add 10ml of 2%APDC solution and shake well for 5min. After 30 sec, add 15 ml of MIBK solvent and shake well for again 20 min. Allow the solution to stand for 15 min for separation. After separation transfer the aqueous layer into a pre-cleaned separating funnel and the MIBK extract into a pre-cleaned 100ml capacity separating funnel. The collected aqueous solution is again extracted by adding 5ml of 2% APDC solution and 10ml MIBK solvent. After separation discard the aqueous layer and collect the MIBK extract into the separating funnel containing the first (MIBK) extract. Extract the metal now by adding 0.1 ml of concentrated nitric acid into the combined MIBK extract, shake well and allow 10min to separate the layers. Add 9.9 ml of milli-Q water shake vigorously for 5 min and allow the phases to separate. Collect the metal containing acid layer (lower layer) into a 25ml volumetric flask. Repeat the same procedure again and make up to the mark with Milli-Q water. Immediately store in a pre-cleaned plastic bottle and quantify in AAS. For every sample extraction, extract one blank and one standard taking same volume.

Calculation:- Metal concentration (ppm) = AAS reading (ppm) / 16

b) Determination of metals in the marine sediment samples (total decomposition procedure)

Sediment samples must be dried before the analysis since the metal concentrations are based on dry weight. The sediment samples soon after collection in the field are immediately air/sun dried and brought back to the laboratory. In the lab they are oven dried at 105°C (60°C in the case of Hg) for a period of 24 hrs and placed in a desicator until further analysis. The oven dried samples are then powdered using agate mortar to fine powder. The fine sediment powder is then passed through a 250μ mesh and the collected sediment is subjected to metal analysis by the following procedure. working standards (100 ppm) of relevant concentrations from stock solutions (1000 ppm) as given below using HNO_3 and UPW(Sigma / E-Merck : AAS standards).Dry powdered sediment is gently heated and digested with Hydrofluoric acid whereby Silica volatizes as Silicon tetrafluoride. This is followed by treatment with Nitric acid and Perchloric acid to destroy the organic matter. The residue after evaporation of acids is dissolved in 0.1 N HCl and desired metals are determined by Atomic Absorption Spectrophotometry (AAS).

III. Result and Discussion

The Present study was conducted to known the status of heavy metals in seawater and sediments at the coast of Ghed area near Roniyo beyt, Bhavnagar during the study period August'2014 to February'2015. Total 7 visits to the study site were made during the study period. Collection was made according to tide table. Lowest low tide and highest high tide were suitable for the collection. During study Zinc, Selenium, Lead, Manganese, and Cadmium were analyzed from seawater and sediments. here we noted that throught study .i.e., From Aug 2014 to Feb 2015 from sea water heavy meatals like Zn, Se, Pb, Cd, were 1 ppm observed While Mn values different all month, not any significantly changes occurred from sea water samples. in sediment heavy metals like Zinc, Selenium, Lead, Manganese, Cadmium have a 1 ppm there is no variation throught study.

Table No. 1: Heavy Metal Analysis from Sea water during study period (in ppm)

No	Month	Zn	Se	Pb	Mn	Cd
1	Aug'14	1	1	1	0.93	1
2	Sep'14	1	1	1	8.86	1
3	Oct'14	1	1	1	7.28	1
4	Nov'14	1	1	1	5.46	1
5	Dec'14	1	1	1	3.60	1
6	Jan'15	1	1	1	9.99	1
7	Feb'15	1	1	1	0.1	1

Table No. 2: Heavy Metal Analysis from Sediment during study period (in ppm)

No.	Month	Zn	Se	Pb	Mn	Cd
1	Aug '14	1	1	1	1	1
2	Sep'14	1	1	1	1	1
3	Oct'14	1	1	1	1	1
4	Nov'14	1	1	1	1	1
5	Dec'14	1	1	1	1	1
6	Jan'15	1	1	1	1	1
7	Feb'15	1	1	1	1	1

IV. Conclusion

The sample was collected at the coast of Ghed area near Roniyo beyt, Bhavnagar, near Nirma Industry. The variation shows that metals may present in sea water and sediment. Some metals are not detected during study period it shows that the amount of that metals are stable and it's not induced or detected.

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