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Analysis of Heavy metals in Water, Sediments and Fish samples of Madivala Lakes of Bangalore, Karnataka.

Abida Begum[1]*, HariKrishna S[2] , Irfanulla Khan[3]

[1]Department of chemistry, P.E.S School of Engineering,Hosur Road, Near Electronic city, Bangalore-100,India.

[2]Shirdi Sai Engg. College, Anekal, Bangalore,India.

[3] Mohamed Ishaq College, Bangalore,India.

Abstract : Heavy metal (Pb, Cd, Cr, Ni) concentration in water sediments and fish was analysed from Madivala lake in the month of June 2008. There was an appreciable increase in metal concentrations in going from the water to the sediment samples.The Heavy metal concentration, in water was in the order Pb > Cr > Cd > Ni , in sediments Pb > Cr > Cd > Ni . Ten fish species[Catla,Silver carp , Common carp, Tilapia(*Oreochromis niloticus*) Mrigal Etroplus suratensis, Murrels (Channa marulius), Nandus nandus Amblypharyngodon mola Catfishes (Heteropneustes fossilis)] were collected from this lake and analyzed for Heavy metal content of muscle , liver, gills and kidney tissues. The maximum concentration of heavy metals was found in Kidney and liver, the order of heavy metal level in various argons is Muscle >Gills >liver >kidney. The Order of heavy metal concentration in Muscle Pb >Cd>Ni>Cr, in Gills Pb =Cd>Ni>Cr, in kidney Pb >>Cd>Ni>Cr and in liver Pb >Cd>Ni>Cr The presence of elevated levels of Pb and Cd in almost argons is a serious matter of concern and the potential for human exposure to heavy metals from eating fish caught in the lake.[1,2]

Keywords: Madivala Lake ; Heavy Metals Concentration; Fish diversity.

Introduction

Many of the sediments in our rivers, lakes, and oceans have been contaminated by pollutants. Some of these pollutants are directly discharged by industrial plants and municipal sewage treatment plants, others come from polluted runoff in urban and agricultural areas, and some are the result of historical contamination. Contaminated sediments can threaten creatures in the benthic environment, exposing worms, crustaceans and insects to hazardous concentrations of toxic chemicals. Some kinds of toxic sediments kill benthic organisms, reducing the food available to larger animals such as fish. Some contaminants in the sediment are taken up by benthic organisms in a process called bioaccumulation. When larger animals feed on these contaminated organisms, the toxins are taken into their bodies, moving up the food chain in increasing concentrations in a process known as biomagnification. As a result, fish and shellfish, waterfowl, and freshwater and marine mammals may accumulate hazardous concentrations of toxic chemicals. Contaminated sediments do not always remain at the bottom of a water body. Anything that stirs up the water, such as dredging, can resuspend sediments. Resuspension may mean that all of the animals in the water, and not just the bottom-dwelling organisms, will be directly exposed to toxic contaminants.

Different aquatic organisms often respond to external contamination in different ways, where the quantity and form of the element in water, sediment, or food will determine the degree of accumulation .[3,4] The region of accumulation of heavy metals within fish varies with route of uptake, heavy metals, and species of fish concerned. Their potential use as biomonitors is therefore significant in the assessment of bioaccumulation and biomagnification of contaminants within the ecosystem. Many dangerous chemical elements, if released into the environment, accumulate in the soil and sediments of water bodies The lower aquatic organisms absorb and transfer them through the food chain to higher trophic levels, including fish. Under acidic conditions, the free divalent ions of many metals may be absorbed by fish gills directly from the water. Hence, concentrations of heavy metals (HM) in the organs of fish are determined primarily by the level of pollution of the water and food Under certain conditions, chemical elements accumulated in the silt and bottom sediments of water bodies can migrate back into the water, i.e. silt can become a secondary source of heavy metal pollution

Sampling area

Bangalore lies in the southeast of the South Indian state of Karnataka. It is in the heart of the Mysore Plateau, at an average elevation of 920 m. It is positioned at 12.97° N 77.56° E and covers an area of 741 km². Bangalore receives about 900 mm of rain annually, the wettest months being August, September, October Bangalore's pollution is not only affecting our health. It could actually be draining this city of its colour. Around 30 years ago, in Bangalore, there were about 262 lakes which subsequently reduced to 81. As reported, these lakes were created for drinking, bathing, agricultural, recreational and fishing purposes as there was no river which flows throughout the year.[5]

Madivala lake area is 114.3 hectare, shore line is 5.84 k.m., depth is 4.5m, breadth is 0.7km and length is 1.8 k.m. Karnataka State Forest Department carries out the routine maintenance of this lake. Children park and boating facility are available. Madiwala lake receives sewage and storm water from surroundings localities. Untreated sewerage flows in to the lake from Bommanahally CMC area kodichikkanahally side. the lake is dirty, and full of hyacinth weeds.Owing to hydrographic, morphometric and drainage conditions of the area, the lakes are strongly predisposed to environmental degradation. Even though there are no on-site sources of contamination, its proximity to industrial locations, the presence of waste water from domestic and Municipal sewage, pose a serious threat to the ecosystem of these lakes

Table 1. Physiochemical parameters measured in the sampling sites.

Stations	Temperature (°C)	Salinity (%)	pH	DO (mg/l)
1	30.1	16.0	5.9	6.4
2	30.1	17.5	5.6	6.9
3	29.9	18.6	6.9	6.0
4	29.9	19.2	6.9	5.9
5	27.4	17.3	7.5	5.8
6	27.0	17.8	7.3	5.4

Materials and Methods

Water samples and Sediment samples were collected in June 2008 from various stations (region of maximum/minimumwater flow, inlet and outlet areas).Sediments were collected via a polyethylene corer, preserved according to standard methods. Samples were digested in acid-cleaned Teflon microwave vessels with 5ml of ultrapure nitric acid and 2ml ultrapure hydrofluoric acid. and were digested for 30min at 200°C. After allowing at least 2h for cooling, the vessels were opened and 0.8g boric acid was added to dissolve the fluoride precipitates and were detected by Atomic Absorption Spectrometer. pH and salinity were measured with a YSI 33 model portable conductivity meter.

Fish samples[Catla,Silver carp , Common carp, Tilapia(Oreochromis niloticus), Mrigal Etroplus suratensis, Murrels (Channa marulius), Nandus nandus Amblypharyngodon mola Catfishes (Heteropneustes fossilis)]were purchased from the lakes. The size of the fish collected varied, depending on the species, between 12 cm and 54 cm, and their age was from 6 months to 1 years.Fish from each variety dissected to separate organs (flesh, gills, liver and kidney) according to FAO method. The separated organs were put in petridishes to dry at 120 ^{o}C until reaching a constant weight. The separated organs were placed into digestion flasks and ultrapure Conc. HNO_3 and H_2O_2 (1:1 v/v) was added . The digestion flasks were heated to 130 ^{o}C until dissolution , diluted with water and analysed for heavy metal concentration using atomic absorption Spectrometer.[6-8]

Results and discussion

The **pH** value of water is an important indication of its quality and it is dependent on the carbon-dioxide carbonate–bicarbonate equilibrium. Acid-base reactions are important in groundwater because of their influence on pH and the ion chemistry. The pH value in the study area varies between5.6 and 7.5. low pH of water may be attributed to discharge of acidic water by agricultural and domestic activities. A pH value of 7.5 may be due to the presence of carbonates of calcium and magnesium. The fish community in these lakes includes the native species and the introduced species for the purpose of fish production. There are more than 30 species of fishes identified from these lakes . Fishes belonging to genus Puntius, Labeo, Cirrhinus, Channa, Mystus are more common. Oreochromis mossambica (Tilapia), which has inadvertently entered and dominated these lakes are prolific breeder and are multiping faster. Other exotic fish species commonly found are Hypophthalmicthys molitrix (Silver carp), Cyprinus carpio (Common carp) and Ctenopharyngodon idella (Grass carp), which are mainly stocked for fish production.. Puntius filamentosus, Channa striatus and Labeo konitus were few endangered species. To conserve all endemic fish species and the total fish diversity, it is necessary to prevent drainage of pesticides and fertilizers from surrounding crop fields, heavy siltation during heavy rainfall, high density of fingerling stocking of selected culture fishes, fish diseases. Sustainable fish production by taking appropriate steps for sustaining fish diversity is necessary to conserve these vulnerable, but valuable resources[9-11]. The Heavy metal concentration, in water was in the order Pb > Cr > Cd > Ni , in sediments Pb > Cr > Cd > Ni . Ten fish species[Catla,Silver carp , Common carp, Tilapia(Oreochromis niloticus) Mrigal Etroplus suratensis, Murrels (Channa marulius), Nandus nandus Amblypharyngodon mola Catfishes (Heteropneustes fossilis)] were collected from this lake and analyzed for Heavy metal content of muscle , liver, gills and kidney tissues. The maximum concentration of heavy metals was found in Kidney and liver, the order of heavy metal level in various argons is Muscle >Gills >liver >kidney. The Order of heavy metal concentration in Muscle Pb >Cd>Ni>Cr, in Gills Pb =Cd>Ni>Cr, in kidney Pb >>Cd>Ni>Cr and in liver Pb >Cd>Ni>Cr The presence of elevated levels of Pb and Cd in almost argons is a serious matter of concern and the potential for human exposure to heavy metals from eating fish caught in the lakes .

Conclusions

The probable source of the pollutants is anthropogenic, arising from agricultural activities, Electroplating materials and lubricants used near the lake. The potential risk for human exposure to these metals emanates from the fish caught in the lakes and subsequently consumed, as there are already significant levels of these metals in the fish species analysed.

Table-2: Detection of Heavy Metals in fish species harvested from Madivala lake Bangalore

Fish Samples	**Heavy Metal Concentration µg/kg**															
	Muscle				**Gill**				**Kidney**				**Liver**			
	Cr	**Cd**	**Ni**	**Pb**	**Cr**	**Cd**	**Ni**	**Pb**	**Cr**	**Cd**	**Ni**	**Pb**	**Cr**	**Cd**	**Ni**	**Pb**
Catla	1.54	1.1	0.14	2.55	2.35	4.78	5.75	7.3	2.85	4.39	4.97	6.35	3.65	9.23	4.75	9.35
silver carp	1.12	2.05	1.24	2.98	2.79	4.80	3.75	4.5	2.77	4.35	1.92	7.89	3.14	8.45	3.65	9.45
common carp	1.02	1.98	1.19	2.45	4.56	6.45	4.40	4.30	2.56	4.30	1.85	6.35	2.45	6.25	3.54	9.05
Tilapia	1.32	1.76	0.80	2.67	5.67	7.23	3.65	5.56	2.43	4.29	1.80	6.34	2.65	6.00	5.55	7.37
Mrigal	1.44	1.45	0.78	2.15	4.35	6.52	6.42	4.66	2.42	4.25	1.89	6.30	2.60	6.94	3.70	7.35
Etroplus suratensis	1.26	2.43	0.54	2.23	3.42	4.88	5.43	3.42	2.37	4.21	4.56	6.22	2.54	6.82	3.49	7.30
Murrels (Channa marulius)	1.50	2.08	0.72	2.45	5.63	4.82	4.55	3.20	2.34	4.19	2.46	8.97	2.36	6.53	3.46	7.29
Nandus nandus	1.35	1.98	0.54	2.65	6.91	4.85	5.25	2.98	2.30	4.17	2.98	7.56	2.77	6.59	3.14	7.25
Amblypharyngodon mola	1.65	1.65	0.56	2.74	2.64	4.80	3.75	2.67	2.24	4.12	4.56	7.34	2.40	6.23	3.05	7.16
Catfishes (Heteropneustes) fossilis)	1.54	1.1	0.14	2.05	2.25	4.8	3.75	7.3	2.77	4.3	1.87	6.3	2.6	6.23	3.75	7.3

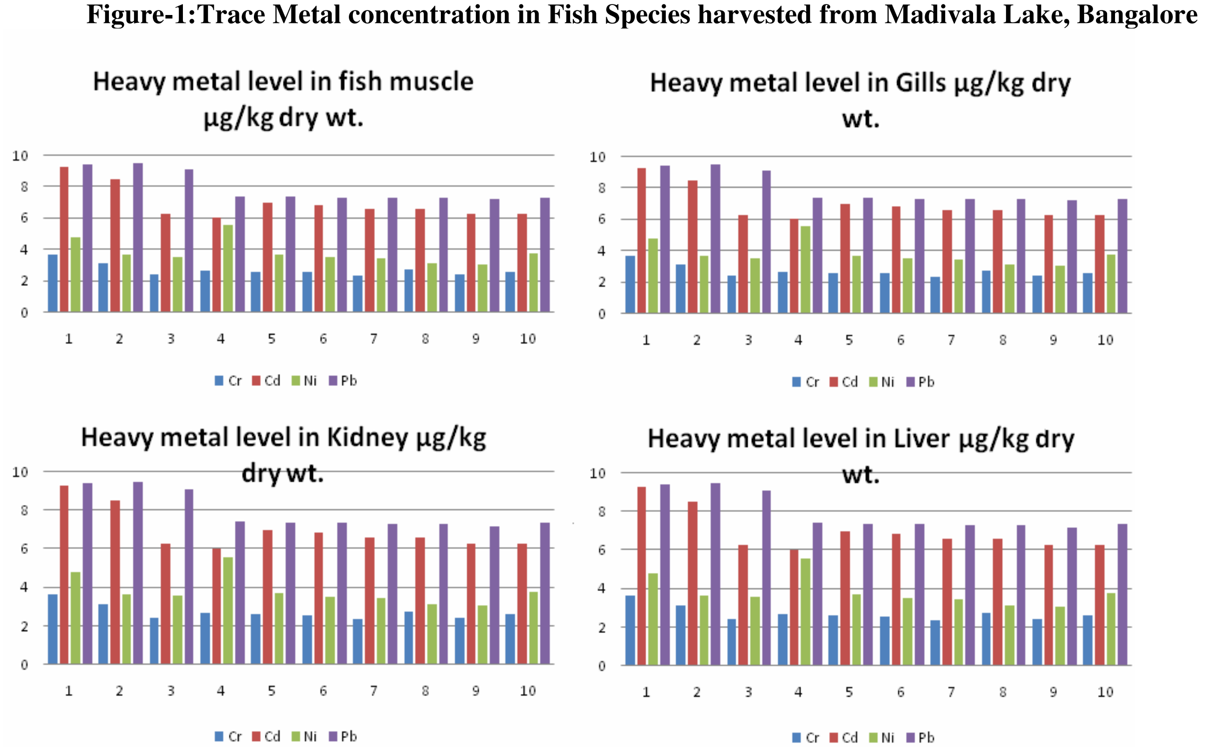
Table-3 Heavy Metal Concentrations in water (µg/L) in various Sampling Stations

Heavy metal Load in water (µgL^{-1})	Stations					
	1	**2**	**3**	**4**	**5**	**6**
Cr	2.5	2.1	1.05	1.17	0.22	0.25
Ni	5.6	6.4	1.20	1.35	1.26	1.00
Cd	4.9	3.2	1.09	1.02	1.02	1.02
Pb	7.2	5.2	2.3	1.08	0.98	0.66

Table-4 Heavy Metal Concentrations in Sediments (µg/kg) in various Sampling Stations

Heavy metal Load in sediments (µgkg^{-1})	Stations					
	1	**2**	**3**	**4**	**5**	**6**
Cr	2.455	2.25	1.95	1.65	0.75	0.55
Ni	6.6	6.45	1.74	1.73	1.69	1.57
Cd	5.42	3.98	1.53	1.52	1.57	1.85
Pb	7.9	5.64	2.85	1.53	1.10	1.25

Figure-1:Trace Metal concentration in Fish Species harvested from Madivala Lake, Bangalore



1.Catla,2.Silver carp ,3. Common carp, 4.Tilapia(Oreochromis niloticus) 5.Mrigal 6.Etroplus suratensis, 7.Murrels (Channa marulius), 8.Nandus nandus 9. Amblypharyngodon mola and 10. Catfishes (Heteropneustes fossilis)

Figure-2 Heavy metals Level in Water of Madivala Lake , Bangalore

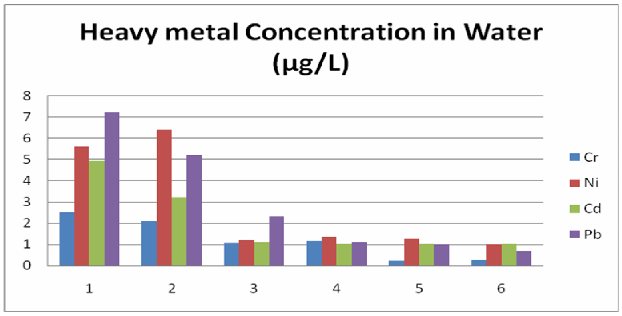
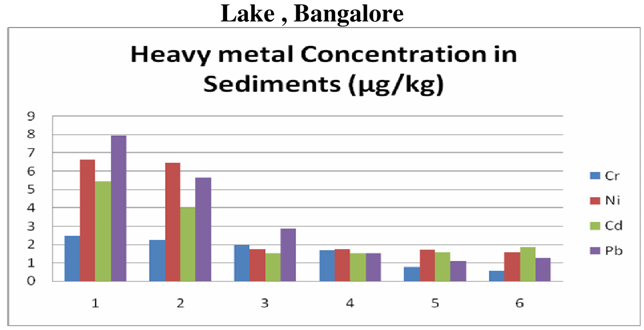


Figure-3 Heavy metals Level in Sedimets of Madivala Lake , Bangalore



References

1. Abida Begum, Ramaiah.M , Harikrishna,Irfanulla Khan and VeenaK "Heavy Metal Pollution and Chemical Profile of Cauvery River water" E-Journal of Chemistry 2009,6(1) 47-52 .
2. Abida Begum, Ramaiah.M , Harikrishna,Irfanulla Khan and VeenaK ''Analysis of Heavy metals concentration in Soil and Litchens from Various localities of Hosur Road", E-Journal of Chemistry 2009,6(1) 13-22 .
3. Abida Begum, S. HariKrishna , Irfanulla Khan, Chemical Composition of Rrainwater in South Bangalore, Karnataka, Rasayan J. Chem. Vol.1, No.4 ,2008,774-781
4. Abida Begum, Harikrishna S and Irfanulla Khan, Ramaiah.M , VeenaK and vinutha.K , Analysis of Flouride level in water and fish species of Sankey, Bellandur and Madivala Lakes of Bangalore. *Rasayan Journal of Chemistry* ,Vol 1,No.3, 2008 596-601.
5. Abida Begum, Harikrishna S and Irfanulla Khan, Ramaiah.M , VeenaK and vinutha.K " Nutrients and Heavy metal profile of Madivala Lake Bangalore South." in *Rasayan Journal of Chemistry* ,Vol 1,No.3, 2008, 572-580.
6. Abida Begum, Harikrishna S and Irfanulla Khan "A study of Fertilizer application and irrigation effects on paddy crop fields near Cauvery River Basin." *Nature Environment and pollution technology journal* to be published in March 2009.
7. Abida Begum, Harikrishna S, Irfanulla Khan and Veena K ,Flouride removal studies using natural materials, *Environmental pollution control Journal* April 2008, Vol 11 No.3 , p 64-67, 972-1541.
8. Clesceri, L. S, Standard methods for the examination of water and waste water. In *Collection and Preservation of Samples and Metals* (eds Arnold, E., Greenbergy and Eaton, A. D.), APHA, AWWA, WEF, Washington, DC, 1998.
9. Facetti J, Dekov V. M. & Grieken R. V. Heavy metals in sediments of Paraguay river. A preliminary study, *Sci Total Environ* 1998, **209**, 79–86.
10. Karnataka State Pollution Control Board, Water quality monitoring of rivers, 2002, **2**, 11–18.
11. Lokhande, R. S. and Kelkar, N., Studies on heavy metals in water of Vasai Creek, Maharashtra. *Indian J. Environ. Protect*., 1999, **19**, 664–668.
12. *www.http://parisara.kar.nic.in/lda.htm* as accessed on 13 September 2005, **35,** 3-21.
13. Lark B. S, Mahajan R K and Walia T. P. S, Determination of metals of toxicological significance in sewage irrigated vegetables by using atomic absorption spectrometry and anodic stripping voltammetry. *Indian J. Environ. Health*, 2002, **44**, 164–167.
14. Vaithiyanathan P, Ramanathan AL, Subramanian V, Transport and Distribution of Heavy Metals in Cauvery River, *Water, Air, and Soil Pollution*, 1993,**71**,13-28.

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