ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2015; 1(13): 254-257
www.allresearchjournal.com
Received: 21-10-2015
Accepted: 25-11-2015

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Heavy metals position of Bagad River (A tributary of Ganga) at Budaun region

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Abstract
It is a micro level study of Bagad River at Budaun district of U.P. which will be useful in studying and understanding impact of water pollution on human, residing in any region of the country in terms of health status. Heavy metals are sometimes called “trace elements”. They are the metallic elements of the periodic table. Heavy metals have become of particular interest in recent decades within the framework of environmental investigation. This has without doubt been due to the fact that highly sensitive analytical procedures are available for determining and detecting metal content with high precision. Medical geology is a subfield of geology that studies the effects of chemical in the environment, especially trace elements, on the health of humans and animals. The chemistry of drinking water commonly has been cited as an important factor in many diseases. These diseases are apparently related to contaminant drinking water with heavy metals such as Zn, Hg, Cd, Cu, Ni, and Cr. Renal failure is related to contamination drinking water with lead and cadmium, liver cirrhosis to copper and molybdenum, hair loss to nickel and chromium, and chronic anemia to copper and cadmium.

Keywords: Bagad River, Heavy Metals, Geology, Drinking Water, Liver Cirrhosis.

1. Introduction

The environment is under more sustained threat from human activity in the 21st century than at any other time in the history with extensive potential social and health consequences. Human health broadly defined, encompassing physical, mental and spiritual dimensions, is highly dependent on the context in which we live. Any threat to our environmental certainties, therefore, has a significant impact on human well-being. Natural water contains different concentrations of metals. Some of the different states are soluble in water while other exists in the solid phase. The total concentration of metals in any natural water is the summation of soluble metals and insoluble metals or metals bound to colloids (Drever, 1997) [1]. Generally, trace amount of metals are always present in freshwaters from the weathering of minerals and soils. In addition, particularly in developed countries, industrial wastewater discharges are the major source of metals pollution in fresh water. The metals accumulation in an environment has direct impact to human and to the ecosystem. Significant amount of metals are also to enter surface water from sewage and atmospheric deposition. Some metals, including cobalt, copper, zinc, iron, manganese, molybdenum and vanadium present in trace concentrations are important for the physiological functions of living tissue. However, any excessive levels of essential metals can be detrimental to the living organism. The heavy metals, of particular concern to surface water systems are non-essential elements like cadmium, mercury, lead, arsenic and antimony (Kennish, 1992) [2]. The accumulation of metals due to long term exposure may progressively lead to more severe disruption in the normal functioning of the organic system. Contamination of heavy metals in the environment is of high concern because of their toxicity and threat to human life and environment (Purves, 1985 and Ma and Rao, 1997) [3, 4]. The extent to which a non-biodegradable metal becomes toxic depends upon the amount and the form in which they occur and undergo a global biogeochemical cycle in which natural waters are the main pathways (Nurnberg, 1984) [5]. Cook *et al.,* (1990) [6] and Deniseger *et al.,* (1990) [7] have reported the heavy metal residues in contaminated habitats may accumulate in micro-organisms, aquatic flora and fauna, which, in turn may enter in to the human food chain and result in health problems.

2. Material & Methods

The study was conducted from January 2010 to December 2011 in Budaun district of the northern state of India, Uttar Pradesh. Gajraula industrial area are situated near the bank of Bagad river have large number of industries like chemical units, pulp and paper, single super phosphate plant, pharmaceuticals, dairy product processing and others.The waste effluents of all industries release in to stream of river. The river Bagad covers an area of 200 km transversing through Amroha and Budaun. It is Perennial River, originate from the *Bairage* of district Bijnor and has been connected from drainage purpose with of river Ganga. A total two sampling stations Shaswan and Hussainpur Kham were selected from various locations adjoining the Gajraula region covering 200 Km stretched of the Bagad River. Among the water samples were collected from various location of Bagad River as well as the downstream, whereas the Bagad River finally mixed in to the Ganga River. In the field, Global Positioning System (GPS) was used to locate accurately the sampling sites. Each location was given a unique ID. The field area comprised of water collection of the river was done from the bank of river Bagad. Bagad River severely contains treated or untreated effluents in composite from of all the industries of Gajraula industrial area. The samples were collected from the Bagad River to assess the heavy metals. Water samples were collected from Shaswan and Hussainpur Kham. Water samples were collected in the months of February (winter), May (Pre-monsoon), August (monsoon) and October (post-monsoon) during January 2010 to December 2011. All the samples were taken in new white 125 ml high-density polypropylene (HDP) pre-cleaned bottles. Before sampling, sample bottles were cleaned by soaking with 10% nitric acid for 24 hours and then thoroughly washed with double distilled water and followed by mil-Q water. Subsequently, all the bottles were dried in oven at 50^0C for 6 hours. Water samples were collected from 5-10 cm below the river surface water. Concentrations of the trace elements (Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd and Pb) were measured by using Atomic Absorption Spectrophotometer. First the instrument was calibrated by using known concentration of metal sample and a standard curve was drawn. Total mercury concentration in unfiltered water sample (100 ml) was determined by cold vapor technique according to the standard method (APHA and AWWA, 1998).

3. Results and Discussion

The data are listed in Tables 1& 2 that contain concentration of heavy metals in MgL^{-1}, sample locations. In fresh water, Ni concentration ranges from 0.001 to 0.003 mg/l (Scoulolous and Hatzianestis, 1989) [8] and also increases where Ni-containing ores reach surface water. Nickel is one of the most mobile heavy metal in the aquatic environment. The mobility of Nickel in the aquatic environment is controlled largely by the capability of various sorbets to scavenge it from the aquatic solution. In the present study Nickel values ranged between 1.00 mg/l to 2.26 mg/l.The maximum concentration of Ni 2.26 mg/l was recorded in February 2010 at Shaswan. The minimum concentration 1.00 mg/l observed in the month of February 2011 at Hussainpur Kham.

Copper is an essential micro-nutrient in many enzymatic reactions in mammals. In fresh water, most inorganic Cu in solution is present as complexes with carbonate, nitrate, sulphate and chloride, rather than hydrated divalent cupric ion. In fresh water, more than 90% of total Cu may be bound to humid substances. The mobility and bioavailability of metal species in aquatic systems very depending on their physico-chemical forms, especially their reactivity. The copper valued varied from 1.52 mg/l to 2.57 mg/l. The maximum value of 2.57 mg/l was recorded at Shaswan in the month of February 2011. The minimum value of 1.52 mg/l was observed at Hussainpur Kham in the month of October 2011.

Zinc is an essential element, necessary for sustaining all life and shows toxic effects only at very high concentration. Deficiency of zinc leads to retardation of growth, dehydration, electrolyte imbalance, abdominal pain and dizziness (Jain *et al.*, 2004) [9]. Industries and agriculture are the major contributors for increase in the concentration of zinc in river water. It produces an undesirable taste to the drinking water. The concentration of Zn in river water varies with flow as well as in the sediment accumulation. Zinc concentration varied from 1.12 mg/l to 2.53 mg/l in this present study. The maximum concentration of zinc 2.53 mg/l was recorded in October 2011 at Shaswan. The minimum concentration of zinc 1.12 mg/l was recorded in May (Pre-monsoon) and August (Monsoon) 2010 at Shaswan.

Table 1: Heavy Metals of River Bagad at Sampling Station Shaswan (Year 2010).

Sampling Station		Season	Heavy Metals					
			Nickel (Ni)	**Copper (Cu)**	**Zink (Zn)**	**Chromium(Cr)**	**Cadmium(Cd)**	**Mercury(Hg)**
		Unit	**MgL^{-1}**	**MgL^{-1}**	**MgL^{-1}**	**MgL^{-1}**	**MgL^{-1}**	**MgL^{-1}**
1.	Shaswan	February(*Winter*)	2.26	2.56	1.32	2.12	2.10	1.43
		May(*Pre-Monsoon*)	2.21	2.42	1.12	1.98	1.62	1.39
		August(*Monsoon*)	2.21	2.43	1.12	1.78	1.48	1.38
		October(*Post-Monsoon*)	2.18	2.32	1.28	1.61	1.32	1.34
2.	Hussainpur Kham	February(*Winter*)	1.13	1.75	1.65	1.13	1.02	1.10
		May(*Pre-Monsoon*)	1.12	1.74	1.64	1.12	1.06	1.05
		August(*Monsoon*)	1.11	1.86	1.63	1.08	1.68	1.08
		October(*Post-Monsoon*)	1.13	1.81	1.54	1.06	1.32	1.12

Source: Calculation is based on sample survey.

Table 2: Heavy Metals of River Bagad at Selected Sampling Stations in Year 2011.

Sampling Station		Season	Heavy Metals					
			Nickel (Ni)	Copper (Cu)	Zink (Zn)	Chromium (Cr)	Cadmium (Cd)	Mercury (Hg)
		Unit	MgL^{-1}	MgL^{-1}	MgL^{-1}	MgL^{-1}	MgL^{-1}	MgL^{-1}
1.	Shaswan	February(*Winter*)	1.29	2.57	2.00	1.50	1.42	1.42
		May(*Pre-Monsoon*)	1.27	2.42	2.50	1.98	1.52	1.21
		August(*Monsoon*)	2.21	2.40	2.52	1.92	1.02	1.24
		October(*Post-Monsoon*)	2.25	2.42	2.53	1.32	1.02	1.10
2.	Hussainpur Kham	February(*Winter*)	1.00	1.76	1.62	1.01	1.02	1.11
		May(*Pre-Monsoon*)	1.01	1.65	1.32	1.00	1.01	1.02
		August(*Monsoon*)	1.02	1.56	1.42	1.02	1.00	1.21
		October(*Post-Monsoon*)	1.14	1.52	1.52	1.03	1.03	1.31

Source: Calculation is based on sample survey.

Chromium is an essential element for life, and stimulates growth of terrestrial and aquatic animals. In natural surface water, chromium exists mainly as either Cr^{3+} or Cr^{6+} depending on the air availability. In aerated waters Cr will be the principle form which will get reduced to Cr^{3+} under anaerobic conditions. The amount of reduction is dependent upon the presence of the amount of organic matter. In the present study, the concentration of chromium varied between 1.00 mg/l to 2.12 mg/l. The highest concentration of chromium 2.12 mg/l was recorded at Shaswan during the month of February 2010. The minimum concentration of chromium 1.00 mg/l recorded at Hussainpur Kham during the month of May 2011.

Cadmium is bio-persistent in nature and once contaminated by organism remains for many years (Berkowitz *et al.,* 2008) [10]. Cadmium metal is used in the steel industry besides plastic, phosphate, fertilizer, cadmium batteries. Cadmium does not stay long time in natural water; either it is precipitated as carbonate or it is adsorbed on to particulate matter and incorporated in to the bottom sediment. In the present study cadmium values varied between 1.00 mg/l to 2.10 mg/l. The highest value of cadmium 2.10 mg/l was recorded at Shaswan during the month of February 2010. The minimum value of cadmium 1.00 mg/l was recorded at Hussainpur Khamduring the month of August 2011.

Mercury is a metal which exists in the earth's crust. It can be released by weathering and transported by stream waters. Mercury is very toxic in nature and creates adverse impacts on human health. Birket*et al.,* (2002) [11] reported that organic matter is not a major factor that controls the mercury distribution. Benthic macro-invertebrates also play important role in the mobilization of mercury form the bottom to the superficial sediment and to the water column. Several studies have shown that mercury is less bio-available in sediment that is rich in organic matter (Luoma, 1989) [12]. The mercury values varied between 1.02 mg/l to 1.43 mg/l during the study time. The highest value of mercury 1.43 mg/l was recorded at Shaswan during the month of February (winter) 2010, while the lowest value of mercury 1.02 mg/l was recorded at Hussainpur Kham during the month of May 2011.

4. Conclusion and Suggestions

The trace elements which enter in to atmosphere as a result of burning of fuels and industrial emanation and again enter the river line through rainfall should be reduced as they lead to bio-concentration in the food chain which can eventually be deleterious to human health. Also these trace elements are highly toxic to aquatic biota. The industries are one of the main source adding pollutants to the river water. These industries are in turn affected by their own discharge when again the water is recycled. The waste water contain large amount of heavy metals like zinc, nickel, chromium, cadmium, copper, mercury etc. making the water quality unfit for aquatic biota, drinking and other purpose. Though few suggestive measures have been recommended for the improvement and proper management of Bagad River, but their practical utility need detailed cost benefit analysis by expert planners and engineers before the implementation. The action plan will require a long period but the river condition can proved up to a great satisfaction.

5. Acknowledgement

I owe my sincere gratitude and respect to my supervisor Dr. Seema Sharma, Associate Professor, Department of Zoology, Meerut College, Meerut, without whose encouragement and erudite guidance, this work would not have been completed. I am highly indebted him for providing valuable time, sustain direction during this work.

6. References

1. Drever JI. The Geochemistry of Natural waters, third ed. Prentice Hall, New Jersey, 1997.
2. Kennish MJ. Environmental threats and environmental future of estuaries. Environ. Conserv 1992; 29(1):78-107.
3. Purves D. Trace-element Contamination of the Environment. Elsevier, Amsterdam, 1985.
4. Ma LQ, Rao GN. Chemical fractionation of cadmium, copper, nickel and zinc in contaminated Soils. J Environ Qual. 1997; 26:259-264.
5. Nuruberg HW. The Volta metric approach in trace metals chemistry of natural waters and atmospheric precipitation. Anal. Chim. Acta 1984; 164:1-21.
6. Cook JA, Andrew SM, Johnson MS. Lead, zinc, cadmium and fluoride in small mammals from contaminated grass-land established on flourspur tailings. Water Air Soil Pollut. 1990; 51:43-54.
7. Deniseger J, Ericson LJ, Austin A, Rock M, Clarck MJR. The effect of decreasing heavy metal concentrations on the biota of Buttle Lake Vancouver Island, British Columbia. Water Res.1990; 24:403-416.
8. Scoullous M, Hatzianestis J. Dissolved and particulate Trace metals in a Wetland of International Importance: Lake MikriPrespa, Greece. Water Air Soil pollut.1989; 44:307-320.
9. Jain CK, Singhal DC, Sharma MK. Adsorption of zinc on bed sediment of River Hindon: adsorption models and kinetaics. JHazar. Mater. 2004; 114:231-239.

10. Berkowitz B, Dror I, Yaron B. Contaminant Geochemistry: Interaction and Transport in the Subsurface Environment. Springer, Berlin, 2008.
11. Birkett JW, Noreng JMK, Lester JN. Spatial distribution of mercury in the sediments and riparian environment of the River Yare Norfolk. U. K. Environ. Pollut.2002; 116:65-74.
12. Luoma SN. Can we determine the biological availability of sediment-bound trace elements? Hydrobiologia, 1989; 176-177:379-396.