J. Env. Bio-Sci., Vol. 24 (2): 195-198, 2010 ISSN 0973-6913 (Print), ISSN 0976-3384 (On Line)

ESTIMATION OF HEAVY METALS AND METALOIDS FROM WASTE WATER OF BINDAL RIVER DEHRADUN

Ashok K.[1], B.S. Bisht[2], V.D. Joshi[3] and B. Indu[4]

[1.] Dept. of Biotechnology, HNBGU (A Central University) Srinagar Garhwal-246174, India
[2.] Dept. of Zoology / Entomology, HNBGU (A Central University) SRT Campus, Badshahithaul Tehri-249199 (Uttarakhand) India
[3.] Dept. of Zoology, Govt. PG College Kotdwara Garhwal (Uttarakhand), India
[4.] Dept. of Biotechnology, Himachal Institute of Life Sciences, Paonta Sahib, Distt- Sirmour-173025, India
asokumr@gmail.com

The pollution of the environment with toxic heavy metals is spreading throughout the world along with industrial progress. Cadmium, chromium, cobalt, copper, manganese, mercury, molybdenum, nickel and zinc are known to be the most commonly heavy metals used and the more widespread contaminants of the environment. Traces of these heavy metals are necessary as Co-factors of enzymatic reactions, but high levels of them may cause extreme toxicity to living organisms due to inhibition of metabolic reactions. In the present investigation, the sewage water collected from Bindal River Dehradun from different sites was investigated for heavy metal contamination.

Some heavy metals have bio importance as trace elements but, the biotoxic effects of many of them in human biochemistry are of great concern. The term heavy metal refers to any metallic element that has a relatively high density and is toxic or poisonous even at low concentration[1].Heavy metals are the metals that have atomic density greater than 4g/cm^3, or 5 times or more, greater than water. However, being a heavy metal has little to do with density but concerns chemical properties. Heavy metals include Lead (Pb), Cadmium (Cd), Zinc (Zn), Arsenic (As), Chromium (Cr), Copper (Co) etc. Toxic heavy metals in air, soil, and water are global problems that are a growing threat to the environment. Eventually there are so many sources of heavy metal pollution but few have the coal, natural gas, paper and alkali industries. These heavy metals are found in air, soil and water which are global problems and a growing threat to humanity. They leach into underground waters, moving along water pathways and eventually depositing in the aquifer, or are or are washed away by run off into surface water, thereby resulting in water and co-ordination mechanism when ingested, they combine with the bodies bio-molecules, like proteins and enzymes to form stable bio-toxic compound, thereby mutilating their structures and hindering them from the bio-reaction of their functions. A pollutant is any substance in the environment, reducing the quality of life and many eventually cause death. Flame Atomic Absorption Spectrometry (FAAS), Electrothermal Atomic Absorption Spectrometry (ETAAS), Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Inductively Coupled Plasma Mass Spectrometry (ICP-MS), Instrumental Neutron Activation Analysis (INAAS), Cold Vapor Atomic Absorption Spectrometry (CVAAS), Less common techniques such as Glow Discharge and Laser- Induced Break Down Spectrometry have been used in the analysis of gaseous constituents [2-7].

Therefore, researcher develops a feasible method to accelerate the process of decay and removal by encouraging the microbial and associated biota (flora and fauna), within the ecosystem to degrade, accumulate and remove the pollutants from the identified sites. This process is known as bioremediation[8]. Researchers are currently investigating ways to augment contaminated sites with non-narrative microbes including genetically engineered microorganisms specially suited to degrade the contaminants of concern particular sites. It is possible

that this process known as bioaugmentation could expand the range of possibilities for future bioremediation system. Release of heavy metal without proper treatment poses a significant threat to public health because of its persistence, biomagnifications and accumulation in food chain[9].

MATERIALS AND METHODS

1. Selection of Sample

The waste water of Bindal River, Chakarata Road Dehradun was selected for the study of heavy metal. The Bindal River flow in the heart of the city Dheradun and have many pollutants in the water of it. The water of Bindal River is much polluted and almost the waste material of near about region of Bindal River is disposed off in the selected river i.e Bindal.

2. Sample collection

Six samples were collected from Bindal River, Dehradun (Uttarakhand) from different sites. Then the samples enriched for further analysis for 24 hrs at 37^0C.

3. Filtration of sample

The sewage and sludge of Bindal River filtered with What Man No. 10 filters. The residue discarded and the supernatant used for heavy metal detection by ICP-MS.

4. Analytical Analysis heavy metal by ICP-MS:

ICP-MS (Inductive Coupled Plasma- Mass Spectroscopy) was used for the analysis of trace elements in the waste samples. For total concentration, 100 ml filtrate obtained by filtration method [2]. The concentration of Zn, Ca, Mg, Cu, Cd, Co, Cr, As, Ni, Pb and Mn in each of the sample were determined. Blank values were negligible for all elements under consideration, which indicated the rather high purity of the reagents used.

RESULTS AND DISCUSSION

Water sample and sludge analyzed by ICP-MS and compared with the other data. The concentration of Heavy metal ions (Zn, Cu, Cr, As Pb) and trace elements (Ni, Pb, Mn, Mg) were high in analyzed samples where as Cd is not detected in the analyzed samples (Table-1). The sample collected from Khurbura Dehradun (BR6) had maximum metal concentration and all metals were present except Cadmium, which was not detected in all analyzed samples (Fig. 1). Co was found in minimum (8.7 ppb) extent whereas Mn (200 ppb) was found in maximum extent in analyzed samples. The Ca and Mg (66 mg/l or ppm and 27mg/l or ppm) were maximum concentration. They are indicator of hardness of water.

Distribution of heavy metals in water, sediments, plants, and fish play a key role in detecting sources of heavy metal pollution in aquatic ecosystem. Most heavy metals are added during industrial activities, such as mining, steel processing, pharmaceutical manufacturing etc. The heavy metal contaminated water is very harmful for the irrigation and other purposes. The heavy metals with enrichment level exceeding the normally expected distribution in soil give rise to concern over the suitability of the water. Heavy metal contamination can be a

consequence of industrial activities that eliminate residues in the river water that in long terms, promote their accumulation. Among the metals found more frequently there are cadmium, lead, cobalt, copper, nickel and zinc. For cadmium, lead, copper and zinc, their toxicity increases as follows: lead < zinc < copper < cadmium, depending on countless abiotic and biotic factors. There are a lot of approaches available, however for the best choice, it is essential, first, to do a further analysis of the conditions of the sludge and waste water of the river.

Table 1. Total metal Analysis (Ca and Mg are in ppm , rest all the element are in ppb).

Sample No./Element	BR1	BR2	BR3	BR4	BR5	BR6
Zn	22	18	69	15	16	42
Ca	64.6	66	40.6	40	59	57.9
Mg	23.8	27	10.7	19.6	15	19.7
Cu	10	12	19	12	25	10
Cd	0	0	0	0	0	0
Co	1	5	2	8.7	4	6
Cr	25	8	10	52	11	10
As	3.5	8.5	4.6	1.4	9.8	<1
Ni	5	5	4.4	5	10.9	17.6
Pb	3	0.6	3.9	<1	<1	<1
Mn	84	16	195	14	10	200

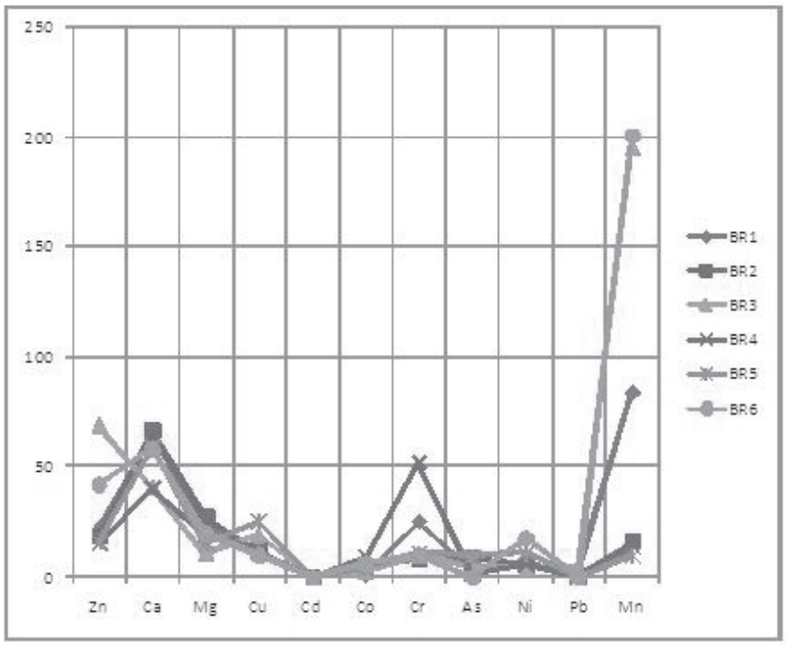

Fig. 1. Heavy metal ions distribution in waste water samples from Bindal River Dehradun.

Heavy metal toxicity is the result of complex interaction of major toxic ions with other essential or non essential ions. Generally, the growers are unaware of ion toxicity, which could be induced into the food chain by vegetables and crops irrigated with effluents. These toxic ions may retain in soil or leach out through the soil and may contaminate ground water along with the river water itself and finally enter into the food chain and cause health hazard in animals and plants. Human exposure to these metals through ingestion of contaminated food or uptake of drinking water can lead to their accumulation in human, animals and plants. Hence the treatment is necessary step before disposing off the waste in the rivers and before using the river water for irrigation or other purposes.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. P.P. Khanna, (Scientist F, Wadia Institute of Himalayan Geology) for providing the facility to estimate the total heavy metals and Mrs. K.P. Rathoure for her valuable comments and technical support.

REFERENCES

1. Declan, P Naughton and Andrea Petroczi (2008). Chemistry Central Journal, 2:22
2. Boevski, I.V. and Daskalova N., (2007). A Method for Determination of Toxic and Heavy Metals in Suspended Matter from Natural Waters by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES). Part I. Determination of Toxic and Heavy Metals in Surface River Water Samples, J. Univ. Chem. Tech. Metal., 42 (4): 419.
3. Steve, J. Hill, Toyin A. Arowolo, Owen T. Butler, Jennifer M. Cook, Malcolm S. Cresser, Chris Harington and Douglas L. Miles (2003). J. Anal. At. Spectrom, 11: 170.
4. Owen, T Butler, Jennifer M. Cook, Chris F. Harington, Steve J. Hill, John Rieuwerts and Douglas L. Miles (2005). J. Anal. At. Spectrom., 20: 130.
5. E. Hywel Evans, Jason A. Day, Christofer Palmer. W John Price, Clare M. M. Smith and Julian F. Tyson, (2006). J. Anal. At. Spectrom., 21: 592.
6. J.W. McLaren (1987) Applications, environmental, in: P.W.J.M. Boumans (Ed) ICP-MS, Part-2 Applications and fundamentals Ch.3 Wiley NewYork pp 48
7. G.Al-Enezi, M.F. Hamoda, N.Fawzi, (2005). J. Env. Sci. H. A 39(2): 455.
8. Shazia Iram, Iftikhar Ahmad and Doris Stubin, (2009). J. Bot., 41(2): 885.
9. Comis, D. (1996). J. Soil. Water Conserv., 51: 184.