World Applied Sciences Journal 33 (12): 1842-1845, 2015
ISSN 1818-4952

DOI: 10.5829/idosi.wasj.2015.33.12.101170

Heavy Metals Analysis of Bannu Dam's and Damai Stream During Breeding Season of Fishes

[1]Hameed Ur Rehman, [1]Muhammad Ismail, [1]Rizwan Ullah Khan, [1]Zaheer Ul Haq, [1]Farhan, [1]Muhammad Zakir, [1]Bushra Zahoor, [2]Iftikhar Ahmad and [1]Sajid Awais

[1]Department of Chemistry, Kohat University of Science and Technology-26000, KPK, Pakistan
[2]Department of Zoology, Shaheed Benazir Bhutto University Sheringal Dir upper, KPK, Pakistan

Abstract: High levels of heavy metals in dam water consider a good indicator of man-made pollution in the area. Water and soil samples were collected from four sampling sites (Barganatu dam, Baran dam, Gomal zam dam and Damai stream).These samples were preserved, dried and analyzed for heavy metals, Pb, Cr, Cd, Cu, Fe, Ni and Zn concentrations using an Atomic Absorption Spectrophotometer (AAS).The concentrations of heavy metals including, Pb, Cr, Cd, Cu, Fe, Ni and Zn were investigated in the water and soil samples. The order of heavy metals concentration in water and soil of damai stream and dam's was: Fe 53.17±0.2mg/L (Gomalzam dam soil sample) and 46.12±0.1mg/L(Gomalzam dam water sample), Pb 5.53±0.32mg/L(Gomalzam dam water sample) and 5.097±0.17mg/L(Gomalzam dam soil sample), Cu 6.05±0.11mg/L(Gomalzam dam water sample) and 3.50±0.01mg/L(Barganatu dam soil sample),Zn 3.38±0.03mg/L(Damai stream soil sample) and 2.27±0.01mg/L(Baran dam soil sample), Ni 0.77±0.01mg/L(Baran dam water sample) and 0.54±0.01mg/L(Baran dam soil sample), Cd 0.67±0.01mg/L(Damai stream soil sample) and 0.23±0.02mg/L(Damai stream water sample), Cr 0.12±0.01mg/L(Barganatu dam soil sample) and 0.08±0.03mg/L(Baran dam water sample). Except Zn and Cr, the concentration of other heavy metals in all water and soil samples of damai stream and dam's was found to be higher than the permissible level set by WHO. Based on the above fact, it is recommended that the water of this dam's is not suitable for human consumption or fish breeding.

Key words: Dam · Soil · Barghanatu · Baran · Gomal Zam and Damai Stream

INTRODUCTION

Water is essential for life and is the most important single product in human civilization. Water is an amazing substance constantly moving from sea to land and back again. It shapes the earth's surface and moderates our climate. It is the medium in which all living process occurs. Water dissolves nutrients and distributes them to cells, regulates body temperature, supports structures and removes waste products from the body [1, 2]. Rivers systems are being greatly polluted with heavy metals released from domestic wastes, industrial effluents and agricultural runoff[3]Heavy metals are environmentally everywhere, readily dissolved in, transported by water, readily taken up by aquatic organisms and are considered to be persistent component in the aquatic environment. Fishes constitute major components of most aquatic habitats and they act as bio-indicator of heavy metal levels in aquatic environment [4, 5]. The fresh water ecosystem occupies a very small area in comparison to marine ecosystem. Nowadays fresh water resources degraded at large scale, due to water pollution. The effect of heavy metal on fresh water ecosystem has become global concern. The problem of water pollution by trace metal is known to be critical all over the world and especially in a developing country, where everybody is facing the problem of water pollution due to modern industrialization and civilization [6, 7].

Heavy metals are bioaccumulated and biotransferred both by natural and anthropogenic sources. The contamination by heavy metals in water is one of the major issues to be faced throughout the world and requires attention because heavy metals above their normal ranges are extremely threatened to both plant and

Corresponding Author: Hameed Ur Rehman, Department of Chemistry, Kohat University of Science and Technology-26000, KPK, Pakistan.

animal life. All heavy metals exist in surface waters in colloidal, particulate and dissolved phases, although dissolved concentrations are generally low. The solubility of trace metals in surface waters is predominately controlled by the water pH, the type and level of ligands on which the metal could adsorb and the oxidation state of the mineral components and the redox environment of the system [8,9]. Heavy metal contamination may cause changes in the composition of the water and finally become inappropriate for human consumption [10]. The Industrial development in Pakistan from past few decades has launched many industrial zones at majorCities. These industries are producing tremendous amount of polluted products particularly heavy metals that are drained into nearby rivers and enter Continuously in to the river untreated [11,12].

MATERIALS AND METHODS

For the present investigation water and soil samples were collected during summer season from May, 2015-July, 2015. The samples of water and soil were collected in clean plastic bottles of 1 liter volume from each station at the depth of one and half feet below the surface of water from sampling station-1 (Barganatu dam) sampling station- 2 (Baran dam), sampling station-3(Gomalzam dam) and sampling station- 4 (Damaistream).Six samples were collected from each sampling site. The samples were then filtered through a membrane filter when necessary. The pH of all the water samples were noted immediately and water was acidified further. This acidified water was then brought into laboratory and stored at 4ºC until analysis. The heavy metals concentration was determined by using spectroscopic techniques.

RESULT AND DISCUSSION

Eight different water and soil samples were collected from various water bodies to analyze the heavy metals concentration. Results of metal concentrations with standard deviation of the study area were presented in the table 1.Table 1 shows the heavy metals concentration of both water and soil samples collected from four different dams and stream. In water samples, according to analysis results, the following results were obtained for the concentration ranges of the metals: Fe: 46.12±0.2 mg/L; Cu: 6.05 ± 0.1; Pb: 5.53 ± 0.32 mg/L; Zn: 1.83 ±0.03 mg/L; Ni: 0.77±0.01 mg/L; Cd: 0.23±0.002 mg/L and Cr: 0.0.08±0.003 mg/L were found. Similarly heavy metals concentrations in the soil sample were obtained in the range: Fe: 53.17 ± 0.2 mg/L; Pb: 4.84 ± 0. 52mg/L; Cu: 3.50 ± 0.01mg/L; Zn: 3.38 ± 0.03mg/L; Cd: 0.07 ± 0.01mg/L; Ni: 0.55 ± 0.08 mg/L and Cr: 0.12 ± 0.01 mg/L respectively.

Lead: Lead is a toxic metal cause's anemia, brain damage and vomiting [13]. It enters in drinking water from different industrial effluents and household sewage. The maximum permissible concentration of lead in drinking water is 0.1 ppm according to WHO [14]. The value of lead content in water and soil samples of barghanatu dam and damai stream is less than the permissible level. Lead content in all other water and soil sample was found to be higher than the maximum permissible level.

Copper: The copper levels were found in the range: 6.05 to 0.84 mg/L. The maximum permissible concentration of copper in drinking water is 2 mg/L according to WHO. The value of copper content in water sample of Gomal zam dam and soil sample of Barghanatu and Baran dam was found higher than permissible level. Other samples were found less than the permissible level. High concentration of cupper may lead to neurological complications, hypertension, liver and kidney dysfunctions [15].

Iron: Iron is a fundamental element of blood and responsible for imparting red color to blood. High concentration of Iron causes bad taste, discoloration, staining, turbidity, esthetic and operational problems in

Table 1: Heavy Metals Analysis of Bannu dams during breeding season of fishes

Samples	Dams	Pb	Ni	Zn	Cd	Cr	Cu	Fe
Water	Barganatu dam	BDL	BDL	0.09±0.01	BDL	0.05±0.02	1.43±0.01	34.17±0.4
Soil	Barganatu dam	0.028±0.23	0.19±0.06	0.63±0.16	0.02±0.23	0.12±0.01	3.50±0.01	39.96±0.1
Water	Baran dam	5. 097±0.17	0.77±0.01	1.83±0.03	BDL	0.08±0.03	1.34±0.45	38.26±0.4
Soil	Baran dam	2.566±0.32	0.54±0.08	2.27±0.01	BDL	BDL	3.15±0.3	36.60±0.4
Water	GomalZam dam	5.53±0.38	BDL	0.54±0.01	BDL	BDL	6.05±0.1	46.12±0.1
Soil	GomalZam dam	4.84±0.52	BDL	0.16±0.02	BDL	BDL	1.56±0.2	53.17±0.2
Water	Damai Stream	BDL	BDL	0.15±0.08	0.23±0.002	BDL	0.97±0.3	1.43±0.5
Soil	Damai Stream	2.520±0.37	0.21±0.04	3.38±0.03	0.67±0.001	BDL	0.84±0.93	37.17±0.2

water supply system [16]. The maximum allowed concentration of iron in drinking water is 1.0 mg/L according to WHO report. It was found that the value of iron in all water and soil samples is higher than the permissible level. The iron levels were found in the range: 53.17 to 1.43 mg/L.

Zinc: In the present study the Zinc concentration varies from 3.38 to 0.09 mg/l.The maximum permissible concentration of zinc in drinking water is 5 mg/L according to WHO. The values of zinc content in all water and soil samples were found to be less than the permissible level. Zinc is very essential micronutrient in human being. High level of iron can harm plants, animals and cause health problems in humans [17].

Chromium: Chromium naturally occurs in rocks, animals, plants, soil and in volcanic dust and gases. The limit of chromium in drinking water is 2 μg/L according to Slottof, W[18].The values of chromium content in water and soil samples of barghanatu dam and soil sample of baran dam were found to be higher than the maximum permissible level. Chromium was present only in these three samples and found undetected in all other samples.

Nickel: The maximum permissible limit for Ni in water is 0.2 mg/l Concentration [19]. Nickel in water samples was found only in Baran dam in the range 0.77 mg/L which is above the permissible level. In the collected soil samples concentration of nickel ranged between 0.54 to 0.19 mg/L. In soil sample concentration of nickel was recorded above the maximum permissible limit set by WHO.

Cadmium: In the present study the Cadmium concentration range from 0.67 to 0.02 mg/L. high concentration of Cadmium was found in the soil sample of Damai stream which is higher than the permissible level. The maximum permissible limit of cadmium is 0.01 mg/l, beyond this limit, the water becomes toxic.

CONCLUSION

Quantitative analysis of heavy metals was conducted for water and soil samples of dam's and Damai stream in different regions of Pakistan. The studies reveal that different sampling sites have heavy metals in different concentrations. The concentration levels of certain heavy metals are alarmingly high in all the studied areas considered for sampling. Keeping in view the health risks involved due to the high levels of metals when they enter to the human metabolism, measures should be taken to minimize these levels in the potable waters to mitigate the imminent health risks.

REFERENCES

1. Cunningham William, P. and A. Cunningham Mary, 2003. Principles of Environmental Science: Inquiry and Applications. (2nd Ed.), Tata McGraw Hill Publ., New Delhi, 224: 253.
2. Mane, P.C., D.D. Kadam, R.D. Chaudhari and A.B. Bhosle, 2013. Spectrophotometric determination of chromium and copper content from Manjara Dam of Maharashtra, India. Int. J. Current Microbiology and Applied Science, 2(12): 338-348.
3. Mendil, D., Ö. Uluözlü, E. Hasdemir, M. Tüzen, H. Sari and M. Suiçmez, 2005. Determination of trace metal levels in seven fish species in lakes in Tokat, Turkey. Food Chem., 90(1-2): 175-179.
4. Alinnor, I.J. and I.A. Obiji, 2010. Assessment of trace metal composition in fish samples from Nworie River. Pakistan J. Nutr., 9(1): 81-85.
5. Tabinda, A.B., S. Bashir, A. Yasar and M. Hussain, 2013. Metals concentrations in the riverine water, sediments and fishes from River Ravi at ballokiheadworks. The Journal of Animal and Plant sciences, 23(1): 76-84.
6. Ghorade, I.B., 2013. Ecosustainability Assessment of Godavari River water for sustainable Utilization, Ph.D. Thesis, Dr. B.A.M. University, Aurangabad.
7. Patil, S.S., V.R. thakur and I.B. ghorade, 2014. Analysis of heavy metals in Jaikwadidam water,Maharashtra (india). International Journal of Research in Applied, 2(5): 69-74.
8. RuqiaNazir, Muslim Khan, Muhammad Masab, Hameed ur Rehman, NaveedurRauf, SurryaShahab, NosheenAmeer, Muhammad Sajed, MohibUllah, Muhammad Rafeeq and Zeenat Shaheen, 2015. Accumulation of Heavy Metals (Ni, Cu, Cd, Cr, Pb, Zn, Fe) in the soil, water and plants and analysis of physicochemical parameters of soil and water Collected from Tanda Dam Kohat. J. Pharm. Sci. and Res., 7(3): 89-97.
9. Ndeda, L.A. and S. Manohar, 2014. Determination of Heavy Metals in Nairobi Dam Water, (Kenya). IOSR Journal of Environmental Science, Toxicology and Food Technology, 8(5): 68-73.
10. GautamPatil and Irfan Ahmad, 2011. Heavy Metals Contamination Assessment of Kanhargaon Dam Water near Chhindwara City. ActaChim. Pharm. Indica, 1(1): 7-9.

11. Ahmed, M.S., Y. Aslam and W.A. Khan, 2011. Absorption and bioaccumulation of water-borne inorganic mercury in the fingerlings of grass carp, *Ctenopharyngodonidella*. The J. Anim. Plant Sci., 21(2): 176-181.
12. Ali Muhammad Yousafzai, AbdurRehman Khan and A.R. Shakoori, 2008. Heavy Metal Pollution in River Kabul Affecting the Inhabitant Fish Population. Pakistan J. Zool., 40(5): 331-339.
13. Kanwar, K.C. and S. Sharma, 1987. Lead and its Toxicity, Science Reporter, pp: 586.
14. World Health Organization (WHO), 1975. International Standard of Drinking Water, Geneva
15. Krishna, A.K. and P.K. Govil, 2004. Heavy metal contamination of soil around Pali industrial area, Rajasthan, India. Environmental Geology, 47: 38-44.
16. Vigneshwaran, S. and C. Visvanathan, 1995. Water treatment processes: Simple options, (p.11) New York: CRC.
17. Hassan, A.A.S., 2012. Ground water quality of Aurangabad Industrial Area. Ph.D. Thesis Dr. B.A.M. University, Aurangabad.
18. Slooff, W., 1989. Integrated criteria document chromium. Bilthoven, Netherlands, National Institute of Public Health and Environmental Protection, (Report no. 758701002).
19. Zaigham Hassan, Zubair Anwar, Khalid Usman Khattak, Mazhar Islam, Rizwan Ullah Khan and Jabar Zaman Khan Khattak, 2012. "Civic Pollution and Its Effect on Water Quality of River Toi at District Kohat, NWFP", Research Journal of Environmental and Earth Sciences, 4: 5.