INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 13, No. 1, p. 249-255, 2018
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

Assessment of heavy metals in River Kunhar at Naran Khyber Pakhtunkhwa, Pakistan

Khalid Usman*[1], Zaib-un-Nisa[2], Sadaf ijaz[2], Shabina Gull[2], Sajid Rashid Ahmad[2], Hameed Ur Rehman[3], Khalid Pervaiz[4], Inayat Ullah Malik[5], Wali Ullah[6], Muhammad Naveed Akhtar[6]

[1]*Department of Zoology, Hazara University, Mansehra, Khyber Pakhtunkhwa, Pakistan*

[2]*College of Earth and Environmental Sciences, University of the Punjab, Pakistan*

[3]*Department of Chemistry, Kohat University of Science & Technology, KUST, Kohat, KP, Pakistan*

[4]*Fisheries Research & Training Institute, Government of the Punjab, Lahore, Pakistan*

[5]*Department of Biological Sciences, Subcampus Mianwali, University of Sargodha, Pakistan*

[6]*Department of Biochemistry, Hazara University, Mansehra, Pakistan*

Article published on July 30, 2018

Key words: River, Kunhar, Naran, Assessment, Heavy metals, Khyber Pakhtunkhwa

Abstract

The present assessment was carried out to explore the amount of heavy metals in River Kunhar at Naran sampling station Khyber Pakhtunkhwa, Pakistan. In the current research three sampling sites (Upstream, Mid Point and Downstream) were selected in River Kunhar at Naran sampling station which were away from one another 100 meter distance. The main goal of the current investigation was find out health hazards heavy metals such as Zn, Cu, Cd, Pb, Cr and Mn in the River Kunhar at Naran sampling station. In the current research the amount of toxic metals obtained were Zn 1.14-1.85ppm; Cu 1.04-1.26ppm; Cd 0.05-1.34ppm; Pb 0.05-1.29ppm; Cr 0.04-0.17ppm and Mn 0.05-0.09ppm respectively. The present survey reviled that Cu, Cd, Ob and Cr was found exceeded the permissible limits while Mn Zn were within the permissible range.

***Corresponding Author:** Khalid Usman ✉ khalidusmankhattak1985@gmail.com

Introduction

Developing countries are facing the problem of water pollution due to rapid spread of industrialization and civilization. These industries produce large amount of polluted products especially heavy metals that are constantly drained untreated into nearby rivers. The impact of heavy metals on water ecosystem has turned out to be a global concern (Yousafzai *et al*., 2008). Rapid urbanization and industrial development during last decade have provoked some serious concerns for the environment. Heavy metals contamination in river is one of the major quality issues in many fast growing cities, because maintenance of water quality and sanitation infrastructure did not increased along with population and urbanization growth especially for the developing countries (Sundaray *et al*., 2006; Karbassi *et al*., 2007; Akoto *et al*., 2008; Ahmad *et al*., 2010). Fish lie at the top of the aquatic food chain and may concentrate large amounts of some metals from the water. Heavy metals enter the body of fish through the skin or gills via the dissolved phase and through the digestive tract via the food (Pourang, 1995; Sarnowski, 2003). Many factors enhances their detrimental effect and may involve the age of particular species, sex of an individual, concentration of dose, route of exposure as well as various biological and physiological adaptations perform an essential part (Verkleji, 1993). Environmental pollution is a worldwide problem, heavy metals belonging to the most important pollutants. The progress of industries has led to increased emission of pollutants into ecosystems. Manzala Lake is one of the most important aqua systems, which receives disposal of industrial chemicals from many drains (such as Bahr El-Bakar) and agricultural pollutions (from Bahr Hadose). In addition, it was contaminated by Cairo and Delta sewage drainage system (Dawoud *et al*., 2009). Because of the importance of sediments to the overall quality of aquatic systems, sediment analysis is often included in environmental assessment studies (Adekola and Eletta, 2007; Li *et al*., 2006; Jain *et a1*, 995; Horsfall and Spiff, 2002). Usman *et al.* (2017a) work on River Kabul at Cantt area Nowshera to evaluate heavy metals. The metals which were recorded in the present study were Zn 1.13-1.85ppm; Cu 1.02-1.21ppm; Cd 0.03-1.32ppm; pb 0.04-1.23ppm; Cr 0.010.16ppm and Mn 0.00-0.00ppm respectively. In a research study demonstrated by Usman *et al.* (2018) to estimate the amount of heavy metals in the water of River Kabul at Jehangira Lower Khyber Pakhtunkhwa, Pakistan. The highest concentration of the heavy metals was found Cu 0.2-1.66, Cd 0.06-0.96, Pd 0.02-1.1, Cr 0.01-0.06 while the lowest concentration was found Mn 0.11-0.23 and zinc 1.13-2.37 respectively. A survey was carried out by Usman *et al.* (2017b) to find out the concentration of heavy metals in Jhanjira Upper site of the River Kabul Khyber Pakhtunkhwa, Pakistan. The results obtained from the current study were in the range of Zn 1.11-1.97ppm; Cu 1.05-1.63ppm; Cd 0.11-0.89ppm; Pb 0.07-1.07ppm; Cr 0.01-0.11ppm and Mn 0.02-0.28ppm respectively. Analysis of heavy metals was determined by *Usman et al.* (2017c) to explore the amount of heavy metals in River Kabul at Khairabad water KP, Pakistan. Concentration of water samples was Zn 1.5-1.59ppm; Cu 1.15-1.94ppm; Cd 0.02-0.05ppm; Pb 0.15-0.73ppm; Cr 0.01-0.02ppm and Mn 0.07-0.21ppm respectively. Assessment of heavy metals were carried out by Usman *et al.* (2017d)to examine the concentration of health hazard toxic metals in in River Kabul at Khazana Suger Mill PeshawarKP, Pakistan. Heavy metals concentration obtained from the present study was Zn 1.13-201ppm; Cu 0.55-0.9ppm; Cd 0.02-1.22ppm; Pb 1.231.84ppm; Cr 0.21-1.2ppm and Mn 0.02-0.05ppm respectively. A survey was carried out by Rehman *et al.* (2015) on Bannu Dam's and Damai Stream during Breeding Season of Fishes. 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). Another research was conducted by Rehman *et al.* (2016) to evaluate heavy metal of Molluska Shell, Water and Soil Collected from Darmalak Dam, Tehsil Lachi District Kohat. The homogeneity, samples Cr not present. But tissue samples having the diverge the concentration as well as order. The high concentration of heavy metals found in the sediment is due to the anthropogenic inputs and fishing activity. A research study was conducted by Farhan *et al.* (2016) to determine the concentration of some heavy metals in water and soil samples of four different dams located in the area of Karak, KPK, Pakistan. Heavy metals analyzed in water and soil samples of all the four dam's indicated that among the seven heavy metals tested, Fe was maximum in concentration, followed by Zn, Cu, Pb, Ni, Cr and Cd. The sequence of heavy metals decreased in Zebi dam as Fe> Cu> Zn> Pb> Ni> Cr> Cd, in the sarki dam as Fe> Cu> Zn> Pb> Cd> Cr> Ni, in the sharki dam as Fe> Zn> Cu> Pb> Ni> Cd> Cr, and in the Changos dam as Fe> Zn> Pb> Cu> Cd> Cr> Ni respectively. Atlas *et al.* (2017) find out the amount of heavy metals in River Kabul at Sardaryab KP, Pakistan. The heavy metals analyzed in the present research were in the range of Zn 1.14-1.86ppm; Cu 1.03-1.22ppm; Cd 0.12-0.89ppm; Pb 0.08-1.08ppm; Cr 0.02-0.12ppm and Mn 0.03-0.29ppm respectively. A research work was conducted by Usman *et al.* (2017e) to estimate the amount of heavy metals in River Kabul at Kond Marble factory KP, Pakistan. The concentration of heavy metals obtained was Zn 1.2-231ppm; Cu 0.3-1.89ppm; Cd 0.13-0.75ppm; Pb 1.13-0.96ppm; Cr 0.01-0.02ppm and Mn 0.11-0.44ppm respectively. The aim of the current study was the assessment of heavy metals in River Kunhar at Naran Khyber Pakhtunkhwa, Pakistan.

Materials and methods

Study Area

Naran site of the river Kunhar is also important picnic spot. The land area of this site is very beautiful and attractive. Majority of tourists visit to this site because of great valley and green fields. The water quality of this area is also disturbed by the tourist=m activities. Naran is one of most expensive land area in the whole Mansehra. Economically it play very important role because national and international tourists visits.

Fig. 1. Map of River Kunhar at Naran site KP, Pakistan. Red arrow show sampling point.

Sampling of Water

Water samples were stored in clean and dry plastic bottles with screw caps and labeled. The freshly collected samples were analyzed for Heavy metals analysis at GC University Faisalabad lab by using atomic absorption

Method for preparation of stock solution

The stock solution was prepared as 1000ppm = 1000mg/l. Then 100ppm solution was prepared from stock solution using serial dilution equation of $C_1V_1 = C_2V_2$

Determination of heavy metals in water

The water samples were first filtered with the help of filter paper and then taken in 250ml of glass bottles and subjected to the atomic absorption spectrophotometer (Zn, Cu, Cd, Mn, Cr, Pb) at GC University Faisalabad lab.

Results and discussion

In the present research conducted in River Kunhar at Naran site three sampling sites (Upstream, Mid Point and Downstream) were selected which were away from one another 100 meter distance. The main aim of the present study was to explored health hazards heavy metals such as Zn, Cu, Cd, Pb, Cr and Mn in the River Kunhar at Naran sampling station. In the current research the amount of toxic metals obtained were Zn 1.14-1.85ppm; Cu 1.04-

1.26ppm; Cd 0.05-1.34ppm; Pb 0.05-1.29ppm; Cr 0.04-0.17ppm and Mn 0.05-0.09ppm respectively. The present survey reviled that Cu, Cd, Ob and Cr was found exceeded the permissible limits while Mn Zn were within the permissible range. Heavy metals were recorded by Usman *et al.* (2017i) to study the water quality of the River Kabul at Dalda Oil Mill Nowshera Khyber Pakhtunkhwa, Pakistan. Water samples were collected from three different sites along the course of the River Kabul at Dalda Oil Mill Nowshera. The ranges of the heavy metals obtained during the present research were Zn 2.11-2.8ppm; Cu 0.3-2.23ppm; Cd 0.12-0.88ppm; Pb 0.02-2.06ppm; Cr 0.02-0.16ppm and Mn 0.41.11ppm respectively. A study was conducted by Usman *et al.* (2017j) to analyze the concentration of toxic pollutant. In this study the amount of heavy metals recorded were Zn 1.19-1.7ppm; Cu 0.13-0.75ppm; Cd 0.02-0.32ppm; pb 1.01-0.03ppm; Cr 0.00-0.00ppm and Mn 0.01-0.03ppm respectively. The results mention above reviled that there was a little bit variation when compared with the current study. Quantity of health hazard metals was detected by Usman *et al.* (2017g) in natural waters of river Kabul, Khyber Pakhtunkhwa Province, Pakistan. The concentrations of the metals recorded were in the range as: Pb 0.06-4.41ppm; Zn 4.11-7.11ppm; Cd 0.42-1.46ppm; Cu 1.07-3.86ppm; Mn 0.06-2.11ppm and Cr 0.05-2.11ppm. Concentration of heavy metals was analyzed by Usman *et al.* (2017h) in the River Kabul Shah Alam tributary, Peshawar Khyber Pakhtunkhwa, Pakistan. The concentration of the heavy metals were Zn 1.2-2.0ppm; Cu 0.17-1.48ppm; Cd 0.2-0.69ppm; Pb 1.01-1.23ppm; Cr 0.04-2.01ppm and Mn 0.01-0.82ppm respectively. Measurement of heavy metals was conducted by Fawad *et al.* (2017) to know the rate of bioaccumulation of Chromium (Cr (III) in the gills, intestine, and skin and its acute toxicity to goldfish (*Carassius auratus*) fingerlings. The result shows that the rate of accumulation of chromium in Gills > Intestine > Skin of gold fish. Amount of heavy metals were analyzed by Usman *et al.* (2017f) in different sites of River Kabul on Rohu, *Labeo rohita* (Hamilton).

As a result of accumulation of heavy metals in fish bodies, various diseases occurred which ultimately declined their population. It is suggested that if the proper, timely remedial measures are not adopted, the situation will be aggravated and may cause the loss of precious fish diversity in the country. Hence, to overcome this serious problem industries discharge should be cleaned before entering to the River and properly time to time Fish fauna should be checked out. Evaluation of heavy metals were carried out by Afridi *et al.* (2017) in the common carp (*Cyprinius carpio*) collected from two different water bodies the Tarbela dam, District Haripur, and River Soan District Rawalpindi Pakistan. The concentration of detected metals found in different tissues of same species varied for Mn: 0.43-4.96, Ni: 0.49 – 1.60, Cd: 0.06 – 0.08, Cu: 0.36 – 0.81, Pb: 0.50 – 0.74, Se: 6.17 – 17.05, Zn: 0.59 – 3.74µg/g wet wt.

Table 1. Concentration of heavy metals (ppm) in River Kunhar at Naran site KP, Pakistan.

S.No	Metals	U.S	M.P	D.S	Permissible limits
1	Zn	1.14	1.85	1.33	5.0mg/l
2	Cu	1.04	1.26	1.06	0.05mg/l
3	Cd	0.05	1.34	0.15	0.05mg/l
4	Pb	0.05	1.29	0.15	0.05mg/l
5	Cr	0.04	0.17	0.08	0.05mg/l
6	Mn	0.05	0.09	0.07	50-70mg/l

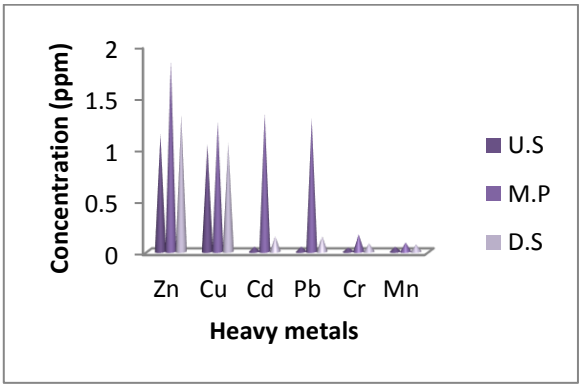

Fig. 2. Concentration of heavy metals (ppm) in River Kunhar at Naran site KP, Pakistan. U.S (Upstream); M.P (Midpoint); D.S (Downstream).

Conclusion

The current study carried out in River Kunhar at Naran site Khyber Pakhtunkhwa Pakistan revealed that this area is badly affected by the tourism

activities by various sources like tourist wash room's discharges and garbage's. Furthermore, heavy metals treatment plants should be build up in the bank of River Kunhar at Naran site to stop this serious issue of contamination.

Acknowledgement

Immense Thankful to Dr. Khalid Pervaiz and Dr. Inayat Ullah Malik. I am greatly thankful to Hameed Ur Rehman (Department of Chemistry). I am also thankful to my brother Dr. Wahid Raza (Department of Management Sciences ICUP) who helps me throughout in water sampling collection.

References

Adekola FA, Eletta OAA. 2007. A study of heavy metal pollution of Asa river, Ilorin, Nigeria; Trace metal monitoring and geochemistry Environ Monit Assess **125,** 157-163.

Afridi AJ, Zuberi A, Rehman HU, Khan A, Saeed K, Achakzai WM, Saddozai S, Usman K, Ateeq M, Akbar NU. 2017. Effect of the aquatic environment of different water bodies on metal contents of common carp (*Cyprinius carpio*) collected from two different water bodies. Journal of Entomology and Zoology Studies **5(1),** 388-399.

Ahmad MK, Islam S, Rahman S, Haque MR, Islam MM. 2010. Heavy metals in water, sediment and some fishes of Buriganga River, Bangladesh. Int. J. Environ. Res **4 (2),** 321-332.

Akoto O, Bruce TN, Darko G. 2008. Heavy metals pollution profiles in streams serving the Owabi reservoir. African J. Environ. Sci. Tech **2(11),** 354-359.

Atlas A, Usman K, Rehman HU, Khudadad S, Munawar A, Rab A, Khan MI, Gul M, Pervaiz K. 2017. Analysis of heavy metals in river Kabul at Sardaryab Khyber Pakhtunkhwa, Pakistan. Journal of Entomology and Zoology Studies **5(6),** 14-16.

Dawoud AS, Salem AH, Samah AS. 2009. Clinico Pathological Studies On The Impact of Heavy Metal Pollution on Catfish In River Nile In Damieta And Dakhlaia Governorayters. Egypt J Comp Path Clinic Path **23,** 37-61.

Farhan Rehman HU, Bibi I, Zakir M, Ullah N, Waheed MA, Haleem S, Zarin K, Yasin N, Nisa I. 2016. Heavy metal analysis of water and soil of district Karak dams during fish breeding season, KPK, Pakistan. Journal of Entomology and Zoology Studies **4(3),** 91-93.

Fawad M, Yousafzai AM, Haseeb A, Rehman HU, Afridi AJ, Akhtar NA, Saeed K, Usman K. 2017. Acute toxicity and bioaccumulation of chromium in gills, skin and intestine of goldfish (*Carassius auratus*). Journal of Entomology and Zoology Studies **5(1),** 568-571.

Horsfall M, Spiff AI. 2002. Distribution and partitioning of trace metals in sediments of the lower reaches of the new Carlabar River, Port Harcourt, Nigeria. Environ Monit Assess **78,** 309-326.

Jain CK, Singhal DC, Sharma UK. 1995. Metal pollution assessment of sediment and water in the river Hindon, India Environ Monit Assess, 2005 **105,** 193-207.

Karbassi AR, Nouri J, Ayaz GO. 2007. Flocculation of trace metals during mixing of Talar river water with Caspian Seawater. Int. J. Environ. Res **1(1),** 66-73.

Li Y, Yu Z, Song X, Mu Q. 2006. Trace metal concentrations in suspended particles, sediments and clams from Jiaozhou Bay of China. Environ Monit Assess **121,** 491-501.

Pourang N. 1995. Heavy metal bioaccumulation in different tissues of two fish species with regards to their feeding habits and trophic levels. See comment in PubMed Commons below Environ Monit Assess **35,** 207-219.

Rehman HU, Ismail M, Khan RU, Haq ZU, Farhan Zakir M, Zahoor B, Ahmad I, Awais S. 2015. Heavy Metals Analysis of Bannu Dam's and Damai Stream During Breeding Season of Fishes. World Applied Sciences Journal **33(12),** 1842-1845.

Rehman HU, Khan RU, Sajed M, Akbar NU, Rehman JU, Awais S, Ahmad I, Maqbool S, Ullah N, Andaleeb H. 2016. Estimation of Heavy Metal of Molluska Shell, Water and Soil Collected from Darmalak Dam, Tehsil Lachi District Kohat. World Journal of Zoology **11(1),** 01-05.

Sarnowski P. 2003. The effect of metals on yolk sac resorption and growth of starved and fed common carp (*Cyprinus carpio*) larve. Acta Sc Pol Piscaria **2,** 227-236.

Sundaray SK, Panda UC, Nayak BB, Bhatta D. 2006. Multivariate statistical techniques for the evaluation of spatial and temporal variation in water quality of Mahanadi river-estuarine system (India). A case study. Environ. Geochem. Health **28(4),** 317-330.

Usman K, Nisa ZU, Gul S, Gul S, Rehman HU, Asad M, Waqar M, Ullah, Ishaq HK. 2017h. Contamination of Heavy metals in River Shah Alam Peshawar: (A tributary of River Kabul) Khyber Pakhtunkhwa Pakistan. Journal of Entomology and Zoology Studies **5(5),** 510-512.

Usman K, Rehman HU, Adeel S, Shah NA, Shah A, Pervaiz K, Saeed N, Mussabeha. 2017f. Heavy Metals Accumulation in *Labeo rohita* (Hamilton) of River Kabul, KPK, Pakistan. Biological Forum- An International Journal **9(1),** 01-07.

Usman K, Rehman HU, Adeel S, Shah W, Pervaiz K, Ullah Z, Ullah R, Arsalan M. 2017g. An Investigation on the toxicity of some trace metals in river Kabul, Khyber Pakhtunkhwa Province of Pakistan. Biological Forum- An International Journal **9(1),** 95-99.

Usman K, Rehman HU, Khudadad HS, Pervaiz K, Khan MW, Ali SZUA, Maqsood MJ, Jawad SM, Ahmad A. 2017. Assessment of heavy metals in River Kabul at Warsak Peshawar Khyber Pakhtunkhwa, Pakistan. Journal of Entomology and Zoology Studies **5(6),** 1726-1728.

Usman K, Rehman HU, Khudadad HS, Pervaiz K, Ahmad N, Bilal M, Hussain ST, Jawad SM, Khan M, Akbar MU. 2017i. Concentration of heavy metals in River Kabul at Dalda Oil Mill Nowshera Khyber Pakhtunkhwa, Pakistan. Journal of Entomology and Zoology Studies **5(6),** 2395-2397.

Usman K, Rehman HU, Khudadad HS, Pervaiz K, Ali SZUA, Maqsood MJ, Jawad SM, Din AU, Ihtesham Y. 2018. Investigation of heavy metals in River Kabul at Jehangira lower Khyber Pakhtunkhwa, Pakistan. Journal of Entomology and Zoology Study **6(1),** 100-102.

Usman K, Rehman HU, Khudadad HS, Pervaiz K, Ali SZUA, Maqsood MJ, Jawad SM, Nazir R, Ihtesham Y. 2017d. Evaluation of heavy metals in River Kabul at Khazana Sugar Mill Peshawar Khyber Pakhtunkhwa, Pakistan. Journal of Entomology and Zoology Studies **5(6),** 2417-2419.

Usman K, Rehman HU, Khudadad HS, Pervaiz K, Ali SZUA, Maqsood MJ, Jawad SM, Nazir R, Ihtesham Y. 2017e. Exploration of heavy metals in River Kabul at marble factory Kond Khyber Pakhtunkhwa, Pakistan. Journal of Entomology and Zoology Studies **5(6),** 2272-2274.

Usman K, Rehman HU, Khudadad S, Pervaiz K, Ahmad N, Bilal M, Hussain ST, Jawad SM, Khan M, Ali M. 2017a. Estimation of heavy metals in River Kabul at Cantt area Nowshera Khyber Pakhtunkhwa, Pakistan. Journal of Entomology and Zoology Studies **5(6),** 2275-2277.

Usman K, Rehman HU, Khudadad S, Pervaiz K, Ahmad N, Bilal M, Hussain ST, Jawad SM, Khan M, Akbar MU. 2017b. Heavy metals analysis in River Kabul at Jhangira Upper Khyber Pakhtunkhwa, Pakistan. Journal of Entomology and Zoology Studies **5(6),** 2485-2487.

Usman K, Rehman HU, Khudadad S, Pervaiz K, Ali SZUA, Maqsood MJ, Jawad SM, Din AU, Ihtesham Y. 2017c. Measurement of heavy metals in River Kabul at Khairabad Khyber Pakhtunkhwa, Pakistan. Journal of Entomology and Zoology Studies **5(6),** 2263-2265.

Verkleji JAS. 1993. The effects of heavy metals stress on higher plants and their use as biomonitors In Plant as Bioindicators: Indicators of Heavy Metals in the Terrestrial Environment. Markert, B., editor. New York: VCH, 415-424.

Yousafzai AM, Khan AR, Shakoori AR. 2008. Heavy Metal Pollution in River Kabul Affecting the Inhabitant Fish Population. Pakistan Journal of Zoology **40(5),** 331-339.