



## RESEARCH PAPER

## OPEN ACCESS

## Investigation of heavy metals in River Dor at Mankarai Khyber Pakhtunkhwa, Pakistan

Khalid Usman<sup>\*1</sup>, Hameed Ur Rehman<sup>2</sup>, Khalid Pervaiz<sup>3</sup>, Inayat Ullah Malik<sup>4</sup>, Sahibzada Muhammad Jawad<sup>5</sup>, Wahid Shah<sup>1</sup>, Arshad Mehmood<sup>6</sup>, Rafiq Hussain<sup>7</sup>, Faiz Ur Rehman<sup>7</sup>.

<sup>1</sup>Department of Zoology, Hazara University, Mansehra, Khyber Pakhtunkhwa, Pakistan

<sup>2</sup>Department of Chemistry, Kohat University of Science and Technology, KUST, KP, Pakistan

<sup>3</sup>Fisheries Research & Training Institute, Government of the Punjab, Lahore, Pakistan

<sup>4</sup>Department of Biological Sciences, Sub Campus Mianwali, University of Sargodha, Pakistan

<sup>5</sup>Department of Zoology, Islamia College University, Peshawar, KP, Pakistan

<sup>6</sup>Department of Zoology, Malakand University of KP, Pakistan

<sup>7</sup>Department of Zoology, Kohat University of Science & Technology, KP, Pakistan

**Key words:** Mankarai, Dor, Khyber Pakhtunkhwa, Water, Toxicity, Permissible

<http://dx.doi.org/10.12692/ijb/12.5.213-218>

Article published on May 30, 2018

### Abstract

Aquatic environment are badly affected by contamination via Heavy metals through various sources. These sources may be naturally weathering process or anthropogenic activities. Worldwide, heavy metals contamination is a serious problems facing to the current era. For evaluation of heavy metals, a research work was conducted in River Dor at Mankarai Khyber Pakhtunkhwa, Pakistan. Water samples were collected from the selected three sites of River Dor at Sarai Saleh point for the analysis of heavy metals. In this assessment, the concentration of heavy metals obtained was Zn 1.13-1.86 ppm; Cu 1.03-1.25 ppm; Cd 0.04-1.35 ppm; Pb 0.05-1.28 ppm; Cr 0.05-0.17 ppm and Mn 0.03-0.07 ppm respectively. The present study revealed that four heavy metals Cu, Cd, Cr and Pb were found exceeded from the permissible limits. From the present survey, it can be revealed that water chemistry of this site is affected by the toxic effect of heavy metals contamination.

\* **Corresponding Author:** Khalid Usman ✉ [khalidusmankhattak1985@gmail.com](mailto:khalidusmankhattak1985@gmail.com)

## Introduction

The main source of heavy metal pollution also comes in the form of deforestation, domestic or animal farming sewage, sand mining and agriculture (DOE, 2009). These elements have attracted particular consideration in the recent two decades and within the framework of environmental investigation. Pollution of the natural environment by trace elements is a worldwide problem. These metals are indestructible because of their resistance to decomposition in natural condition (Khan, 2011) [2]. The spatial study of heavy metals by producing heavy metal pollution index can be helpful in identifying and quantifying trends in water quality (Prasad and Kumari, 2008; Reza and Sing, 2010) and can provide the accumulated information and assessments in a form that resource management and regulatory agencies can use to evaluate alternatives and make necessary decisions. The levels of certain trace elements in river ecosystem have been found to be moderately, to very high polluted as a result of industrial discharges (Al-Masri *et al.*, 2002; Coker *et al.*, 1995). Heavy metal ions do not degrade into harmless end products and will be toxic to many life forms (Paulami and Banerjee, 2012). As a consequence of human activities like mining, improper waste disposal and fuel combustion, our environment is getting to be more and more contaminated with toxic heavy metals. The aquatic environment receives wastes and might be the ultimate depository for these anthropogenically remobilized heavy metals (Olsson *et al.*, 1998). According to Nazir *et al.*, Heavy metals are bioaccumulated and biotransferred both by natural and anthropogenic sources. Results showed that concentrations of cadmium, chromium, iron and lead in water were recorded above the permissible limits set by WHO while zinc and copper were recorded below the permissible limits and no concentration of nickel was recorded in water samples (Nazir *et al.*, 2015). Analysis of heavy metals was determined by Usman *et al.* (2017a) to explore the amount of heavy metals in River Kabul at Khairabad water KP Pakistan. The heavy metals recorded were Zn 1.5-1.59 ppm; Cu 1.15-1.94 ppm; Cd 0.02-0.05 ppm; Pb 0.15-0.73 ppm; Cr 0.01-0.02 ppm and Mn 0.07-0.21 ppm respectively.

Assessment of heavy metals were carried out by Usman *et al.* (2017b) to examine the concentration of health hazard toxic metals in River Kabul at Khazana Suger Mill Peshawar KP, Pakistan. Heavy metals concentration obtained from the present study was Zn 1.13-2.01 ppm; Cu 0.55-0.9 ppm; Cd 0.02-1.22 ppm; Pb 1.23-1.84 ppm; Cr 0.21-1.2 ppm and Mn 0.02-0.05 ppm respectively. A research work was conducted by Usman *et al.* (2017c) to estimate the amount of heavy metals in River Kabul at Kond Marble factory KP, Pakistan. The concentration of heavy metals obtained was Zn 1.2-2.31 ppm; Cu 0.3-1.89 ppm; Cd 0.13-0.75 ppm; Pb 1.13-0.96 ppm; Cr 0.01-0.02 ppm and Mn 0.11-0.44 ppm respectively. Another study was conducted by Masood *et al.* (2014) to find out heavy metals profile of *Barilius bendelisis*, plant (spirogyra), and water samples of the Shnebaye stream. The recorded level of the values of these heavy metals in plant (spirogyra) and soil were Cd>Ni>Cu>Zn and Cd>Ni>Cu>Zn respectively, while the values of selected heavy metals in surface, middle and startup water of stream were as follows; Ni>Cu>Cd>Zn (surface water), Ni>Cu>Cd>Zn (mid water) and Ni>Cu>Cd>Zn (startup water), respectively. Usman *et al.* (2017d) work on River Kabul at Cantt area Nowshera to evaluate heavy metals. The metals which were recorded in the present study were Zn 1.13-1.85 ppm; Cu 1.02-1.21 ppm; Cd 0.03-1.32 ppm; Pb 0.04-1.23 ppm; Cr 0.01-0.16 ppm and Mn 0.00-0.00 ppm 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 behavioral change occurs in the fish is that all the fingerlings of goldfish come to the corner of the aquarium and their appetite also decrease due to chemical effect. 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 KP, 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.* (2017e) to find out the concentration of heavy metals in Jhanjira Upper site of the River Kabul KP, Pakistan. The results obtained from the current study were in the range of Zn 1.11-1.97 ppm; Cu 1.05-1.63 ppm; Cd 0.11-0.89 ppm; Pb 0.07-1.07 ppm; Cr 0.01-0.11 ppm and Mn 0.02-0.28 ppm respectively. The aim of the current study was to investigate of heavy metals in River Dor at Mankarai Khyber Pakhtunkhwa, Pakistan.



**Fig. 1.** Map of River Dor at Mankarai Khyber Pakhtunkhwa Pakistan.

#### *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 1000 ppm = 1000mg/l. Then 100 ppm 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 250 ml of glass bottles and subjected to the atomic absorption spectrophotometer (Zn, Cu, Cd, Mn, Cr, Pb) at GC University Faisalabad lab.

#### **Results and discussion**

For evaluation of heavy metals, a research work was conducted in River Dor at Mankarai Khyber Pakhtunkhwa, Pakistan.

#### **Materials and methods**

##### *Study Area*

Mankarai site of River Dor are very plains comprising grassy lands. In this area invertebrates and vertebrates fauna are also found.

This site is very attractive and beautiful. In this site anthropogenic activities are too much which disturb water quality and change water Chemistry. In this site human population inhabiting which also polluted water.

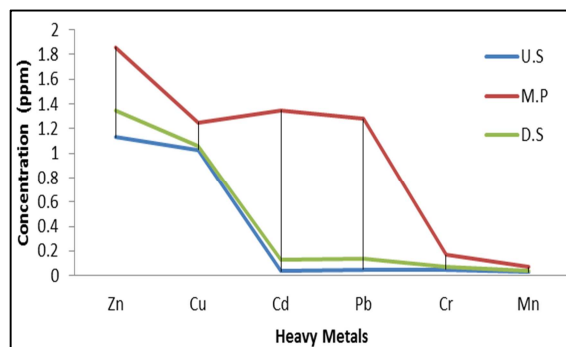
Water samples were collected from the selected three sites of River Dor at Mankarai point for the analysis of heavy metals. In this assessment, the concentration of heavy metals obtained was Zn 1.13-1.86 ppm; Cu 1.03-1.25 ppm; Cd 0.04-1.35 ppm; Pb 0.05-1.28 ppm; Cr 0.05-0.17 ppm and Mn 0.03-0.07 ppm respectively. The present study revealed that four heavy metals Cu, Cd, Cr and Pb were found exceeded from the permissible limits. From the present survey, it can be revealed that water chemistry of this site is affected by the toxic effect of heavy metals contamination.

Atlas *et al.* (2017) find out the amount of heavy metals such as Zn, Cu, Cd, Pb, Cr and Mn in River Kabul at Sardaryab Khyber Pakhtunkhwa, Pakistan. The heavy metals analyzed in the present research were in the range of Zn 1.14-1.86 ppm; Cu 1.03-1.22 ppm; Cd 0.12-0.89 ppm; Pb 0.08-1.08 ppm; Cr 0.02-0.12 ppm and Mn 0.03-0.29 ppm respectively. A study was conducted by Usman *et al.* (2017f) to analyze the concentration of toxic pollutant i.e. heavy metals (Zn, Cu, Cd, Pb, Cr and Mn) in River Kabul at Warsak Peshawar KP, Pakistan.

In this study the amount of heavy metals recorded were Zn 1.19-1.7 ppm; Cu 0.13-0.75 ppm; Cd 0.02-0.32 ppm; pb 1.01-0.03 ppm; Cr 0.00-0.00 ppm and Mn 0.01-0.03 ppm respectively. Amount of heavy metals were analyzed by Usman *et al.* (2017g) in different sites of River Kabul on Rohu, *Labeo rohita* (Hamilton). The highest concentrations of Zn (6.00 ppm) was found at Jehangera Upper site, Cu (3.05 ppm) at Dalda Oil Mill Nowshera site, Cr (1.05 ppm) at Jehangera Lower, Mn (2.00 ppm) at Jehangera Lower, Pb (0.02 ppm) at Dalda Oil Mill Nowshera site and Cd (3.0 ppm) at the Jehangera Upper site. Quantity of health hazard metals was detected by Usman *et al.* (2017h) in natural waters of river Kabul, KP Province, Pakistan. The concentrations of the metals recorded were in the range as: Pb 0.06-4.41 ppm; Zn 4.11-7.11 ppm; Cd 0.42-1.46 ppm; Cu 1.07-3.86 ppm; Mn 0.06-2.11 ppm and Cr 0.05-2.11 ppm. Concentration of heavy metals was analyzed by Usman *et al.* (2017i) in the River Kabul Shah Alam tributary, Peshawar Khyber Pakhtunkhwa, Pakistan. The concentration of the heavy metals were Zn 1.2-2.0 ppm; Cu 0.17-1.48 ppm; Cd 0.2-0.69 ppm; Pb 1.01-1.23 ppm; Cr 0.04-2.01 ppm and Mn 0.01-0.82 ppm respectively.

**Table 1.** Concentration of heavy metals (ppm) in River Dor at Mankarai site KP, Pakistan.

S.No	Metals	U.S	M.P	D.S	Permissible limits
1	Zn	1.13	1.86	1.35	5.0 mg/l
2	Cu	1.03	1.25	1.06	0.05 mg/l
3	Cd	0.04	1.35	0.13	0.05 mg/l
4	Pb	0.05	1.28	0.14	0.05 mg/l
5	Cr	0.05	0.17	0.07	0.05 mg/l
6	Mn	0.03	0.07	0.04	50-70 mg/l



**Fig. 2.** Concentration of heavy metals (ppm) in River Dor at Mankarai site KP, Pakistan. U.S (Up stream); M.P (Mid point); D.S (Down stream).

## Conclusion

The present research was conducted in River Dor at Mankarai site Khyber Pakhtunkhwa Pakistan revealed that water quality of this site is not suitable for irrigation and animals use

## 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

- AL-Masri MS, Aba A, Khalil H, AL-Hares Z.** 2002. Sedimentation rates and pollution history of a dried lake: ALOteibeh lake. *Sci Total Environ* **(293)**, 177-189.
- 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.
- Coker WB, Kettles IM, Shilts WW.** 1995. Comparison of mercury concentrations in modern lake sediments and glacial drift in the Canadian Shield in the region of Ottawa/Kingston to Georgian Bay, Ontario, Canada *Water Air Soil Pollut* **80**, 1025-1029.
- Department of Environment (DOE).** 2009. Kelantan Environmental Quality Report Kelantan: Department of Environment.
- Fawad M, Yousafzai AM, Haseeb A, Rehman HU, Afridi AJakhtar 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.
- Khan AT.** 2011. Trace elements in the Drinking water and their possible health effects in Aligarh city. *Ind. J. Wat. Res. Prot* **3**, 522-530.

- Masood Z, Ullah A, Firdous N, Muntaha ST, Manzoor L, Naz S, Zaman S, Ahmad W, Ullah H, Rehman HU.** 2014. Heavy Metals Detection of a Carp Species, *Barilius bendelisis* (Family cyprinidae) Collected from the Shnebaye Stream of District Karak, Khyber Pakhtunkhwa Province, Pakistan. Int. J. Pharm. Sci. Rev. Res **28(2)**, 216-219.
- Nazir R, Khan M, Masab M, Rehman HU, Rauf NU, shahab S, Ameer S, Sajed M, Ullah M, Rafeeq M, Shaheen Z.** 2015 Accumulation of Heavy Metals (Ni, Cu, Cd, Cr, Pb, Zn, Fe) in the soil, water and plants and analysis of physico-chemical parameters of soil and water Collected from Tanda Dam Kohat. J. Pharm. Sci. & Res. Vol. **7(3)**, 89-97.
- Olsson PE, Kling P, Hogstrand C.** 1998. Mechanisms of heavy metal accumulation and toxicity in fish. Metal Metabolism in Aquatic Environments 321-350.
- Paulami M, Banerjee S.** 2012. Fate of metals in fish under variable sewage input in fish ponds. Int. J. Sci. Res. Pub. **2**, 1-13.
- Prasad B, Kumari S.** 2008. Heavy metal pollution index of ground water of an abandoned open cast mine filled with fly ash: A case study. Mine Water Environ **27(4)**, 265-267.
- Reza R, Singh G.** 2010, Heavy metal contamination and its indexing approach for river water. Int. J. Environ. Sci. with fly ash: Tech **7**, 785-792.
- Usman K, Nisa ZU, Gul S, Gul S, Rehman HU, Asad M, Waqar M, Ullah and Ishaq HK.** 2017i. 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.** 2017g. 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.** 2017h. 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, Ali SZUA, Maqsood MJ, Jawad SM, Nazir R, Ihtesham Y.** 2017b. 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.** 2017c. 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 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 Studie **6(1)**, 100-102.
- Usman K, Rehman HU, Khudadad HS, Pervaiz K, Khan MW, Ali, SZUA, Maqsood MJ, Jawad SM, Ahmad A.** 2017f. 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 S, Pervaiz K, Ahmad N, Bilal M, Hussain St, Jawad SM, Khan M, Ali M.** 2017d. 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.** 2017e. 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.** 2017a. Measurement of heavy metals in River Kabul at Khairabad Khyber Pakhtunkhwa, Pakistan. *Journal of Entomology and Zoology Studies* **5(6)**, 2263-2265.