RESEARCH PAPER

Pollution of heavy metals in River Dor at Jama Khyber Pakhtunkhwa Pakistan

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Abstract

In the current examination conducted to explore the quantity of health hazard toxic metals in River Dor at Jama site Khyber Pakhtunkhwa, Pakistan. In the present investigation a detail research work was carried out for the detection of heavy metals in the three selected site of the River Dor at Jama sampling station. The toxic heavy metals (Zn, Cu, Cd, Pb, Cr and Mn) were under study in the present survey. The main objective of the present study was to find out toxic heavy metals in the selected sampling point. In the current analysis the concentration of the toxic heavy metals obtained was Zn 1.12-1.86 ppm; Cu 1.03-1.24 ppm; Cd 0.04-1.35 ppm; Pb 0.05-1.28 ppm; Cr 0.02-0.17 ppm and Mn 0.01-0.03 ppm respectively. In the current examination Cu, Cd, Pb and Cr found above the standard levels while the remaining toxic metals such as Zn 1.12-1.86 and Mn 0.01-0.03 were found within the standard levels.

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Introduction

The most common heavy metal pollutants are cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), lead (Pb), manganese (Mn) and zinc (Zn). Their source of entry into the aquatic system could either be single, identifiable or dispersed (often difficult to identify). The fact that heavy metals cannot be decomposed through biological degradation and have the ability to accumulate in the environment (Asaolu and Olaofe, 2005., Olowu *et al.,* 2010). After decades of rapid urbanization, population growth and industrialization, developing countries are now home to many of the world's most critical air, water and solid waste problems. Early studies have identified the rise in the pollution of particular heavy metals in freshwater systems around the world, particularly in rivers. The pollution has mainly been caused by industrial processes and industrial waste, typically from rubber and oil palm mills (Tariq *et al.,* 1996). Trace elements are chemical elements that are required in a very minute amount for the proper growth, development and human physiology. They are called heavy metals because their densities greater than 5g/cm3. However these essential trace elements be-come poisonous when their concentration becomes extreme (Dao *et al.,* 2008). Contamination of surface water by heavy metals is a serious ecological problem as some of them like Hg and Pb are toxic even at low concentrations, are non-degradable and can bio-accumulate through food chain. Though some metals like Fe, Cu and Zn are essential micronutrients, they can be detrimental to the physiology of the living organisms at higher concentrations (Kar *et al.,* 2008., Nair *et al.,* 2010).

Evaluation of heavy metals were carried out by Afridi *et al* 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 – 3.74 µg/g wet wt (Afridi, 2017). Measurement of heavy metals was conducted by Fawad *et al* 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 (Faad *et al.,* 2007). Amount of heavy metals were analyzed by Usman *et al. (2017*a*)* 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. Quantity of health hazard metals was detected by Usman *et al (2017*b*)* in natural waters of river Kabul, Khyber Pakhtunkhwa Province, Pakistan.

The concentrations of the metals recorded were in the range as: Pb 0.06-4.41 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.* (2017c) 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. Heavy metals were recorded by Usman *et al. (2017*d*)* 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 2.11-2.8 ppm; Cu 0.3-2.23 ppm; Cd 0.12-0.88 ppm; Pb 0.02-2.06 ppm; Cr 0.02-0.16 ppm and Mn 0.41.11 ppm respectively.

A study was conducted by Usman *et al. (2017e)* to analyze the concentration of toxic pollutant. 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. The aim of the current research work was to find out the pollution of Heavy metals in River Dor at Jama Khyber Pakhtunkhwa Pakistan.

Materials and methods

Study Area

The Jama station of River Dor is very close to the Tarbela Dam where River enter to the Dam. This point is rich of water bodies and hence found clean as compared to the other points along with the River Dor. Majority of fish fauna was recorded from this point due to water rich zone. Small stones were also found in the bottom of the river of this site. Furthermore, speed of the water was very fast in this site. Sidewise of this point grassy plains were also existing which were too much imported for grassing of castles.

Fig. 1. Map of River Dor at Jama site KP, 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 C1V1 = C2V2

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

In the present study carried out to find out the concentration of health hazard toxic metals in River Dor at Jama site KP, Pakistan. In the current survey a detail research work was conducted for the analysis of heavy metals. In the present study the concentration of the toxic heavy metals obtained was Zn 1.12-1.86 ppm; Cu 1.03-1.24 ppm; Cd 0.04-1.35 ppm; Pb 0.05-1.28 ppm; Cr 0.02-0.17 ppm and Mn 0.01-0.03 ppm respectively. In the current examination Cu, Cd, Pb and Cr found above the standard levels while the remaining toxic metals such as Zn 1.12-1.86 and Mn 0.01-0.03 were found within the standard levels.

Usman *et al. (2017f)* 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 0.010.16 ppm and Mn 0.00-0.00 ppm 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 (2017*g*)* 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 1.11-1.97 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. Analysis of heavy metals was determined by Usman *et al. (2017*h*)* to explore the amount of heavy metals in River Kabul at Khairabad water KP, Pakistan. Concentration of water samples was 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.* (2017i) to examine the concentration of health hazard toxic metals in in River Kabul at Khazana Suger Mill Peshawar, KP, Pakistan.

Heavy metals concentration obtained from the present study was Zn 1.13-201 ppm; Cu 0.55-0.9 ppm; Cd 0.02-1.22 ppm; Pb 1.231.84 ppm; Cr 0.21-1.2 ppm and Mn 0.02-0.05 ppm respectively. A research work was conducted by Usman *et al.* (2017j) to estimate the amount of heavy metals in River Kabul at Kond Marble factory KP, Pakistan.

The concentration of heavy metals obtained was Zn 1.2-231 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. 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 1.14-1.86 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 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. A survey was carried out by Rehmna *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.

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

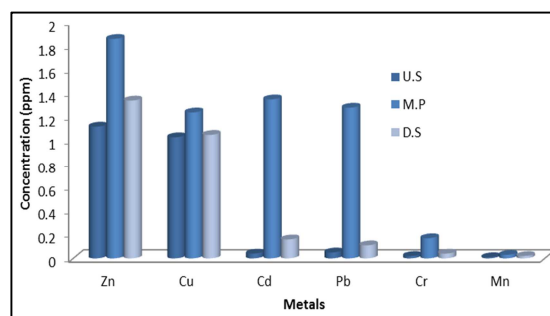| S.No	Metals	U.S	M.P	D.S	Permissible limits
1	Zn	1.12	1.86	1.34	5.0 mg/l
2	Cu	1.03	1.24	1.05	0.05 mg/l
3	Cd	0.04	1.35	0.16	0.05 mg/l
4	Pb	0.05	1.28	0.11	0.05 mg/l
5	Cr	0.02	0.17	0.04	0.05 mg/l
6	Mn	0.01	0.03	0.02	50-70 mg/l

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

Conclusion

The current survey was carried out in River Dor at Jama site Khyber Pakhtunkhwa Pakistan to explore the amount of heavy metals. From the results it can be concluded that water quality of this site was not suitable due to heavy metals toxicity.

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