



RESEARCH PAPER

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Contamination of heavy metals in River Indus at Thakot Khyber Pakhtunkhwa, Pakistan

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Abstract

Aquatic life needs proper safe environment for normal life survival. In case of contamination, disturbance occurs and declines the aquatic fauna and flora. The aim of the current investigation was to assess the concentration of the toxic metals such as Pb, Zn, Cu, Cr, Cd and Mn respectively. A study was design in River Indus at Thakot Khyber Pakhtunkhwa, Pakistan. Heavy metals concentration obtained from the present study was Zn 1.15-1.86 ppm; Cu 1.06-1.25 ppm; Cd 0.05-1.39 ppm; Pb 0.03-1.22 ppm; Cr 0.04-0.13 pm and Mn 0.02-0.06 ppm respectively. In this examination Cu, Cd, Pb and Cr were above the permissible limits. From the current study, it can be reviled that this site is contaminated by the anthropogenic activities.

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Introduction

The heavy metals are considered as critical toxic contaminants of aquatic ecosystems, due to their high potential to enter and accumulate in food chain (Olojo *et al.*, 2005). Due to their toxicity and accumulation in biota, determination the levels of heavy metals in commercial fish species have received considerable attention in different countries (Wariaghli *et al.*, 2013). Heavy metals are defined as metallic elements that have a relatively higher density in contrast to water (Fergusson, 1990). Pakistan is one of the countries facing fresh water pollution mainly due to untreated discharge of industrial wastes into rivers. According to ministry of environment and urban affairs in six cities of Pakistan, including Peshawar, a number of industries discharge their effluents without any treatment. Establishment of industrial estates in Peshawar resulted in the discharge of heavy loads of untreated waste water in a number of streams and rivers. For example, River Kabul in the Khyber Pakhtunkhwa province alone receives 80000 m³ industrial effluents every day causing a decrease in agricultural productivity as well as fish production (GPPP, 2010). Amount of heavy metals were analyzed by Usman *et al.* (2017a) 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.* (2017b) 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.* (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. 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 high concentration of heavy metals found in the sediment is due to the anthropogenic inputs and fishing activity. A study was conducted by Khan *et al.* (2017) to find out contamination of toxicological effect on environment as well as on public health and is an emerging problem in District Quetta. On average, the Antimony (Sb) (0.028±0.022 mg/L) was above the WHO standard limits while Arsenic (As) (0.006±0.0094 mg/L) was below the WHO standard limits. 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. Evaluation of heavy metals were carried out by Afridi *et al.* (2017) in the common carp (*Cyprinus carpio*) collected from two different water bodies the Tarbela dam, District Haripur, and River Soan District Rawalpindi Pakistan. Concentration of Mn, Ni, Cd, Cu, Pb, Se, Zn were determined in five tissues the gills, skin, kidney, liver and muscle. 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. 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.

Materials and methods

Study Area

Thakot sampling site of River Indus is very imported because often in summer peoples visit due to its natural beauty. This site is also imported because some fields are also irrigated from this water bodies. In this site of the river domestic waste are discharged

which badly affect the fish population. Water flow in this site is very high. The width of the river Indus at Thakot site is large.

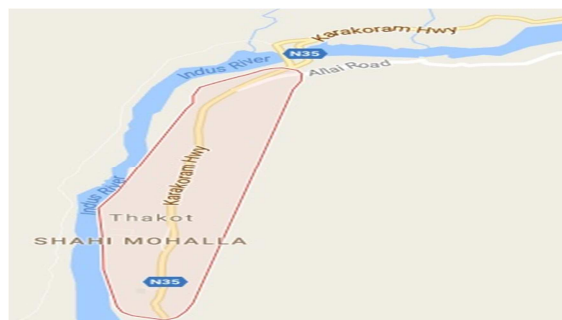


Fig. 1. Map of River Indus at Thakot site Khyber Pakhtunkhwa Pakistan.

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 discussions

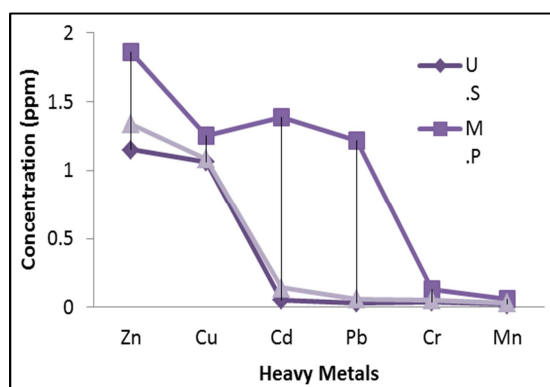
A study was design in River Indus at Thakot Khyber Pakhtunkhwa, Pakistan. Heavy metals concentration obtained from the present study was Zn 1.15-1.86 ppm; Cu 1.06-1.25 ppm; Cd 0.05-1.39 ppm; Pb 0.03-1.22 ppm; Cr 0.04-0.13 pm and Mn 0.02-0.06 ppm respectively. In this examination Cu, Cd, Pb and Cr were above the permissible limits. From the current study, it can be reviled that this site is contaminated by the anthropogenic activities. Aquatic life needs proper safe environment for normal life survival. In case of contamination, disturbance occurs and declines the aquatic fauna and flora.

The aim of the current investigation was to assess the concentration of the toxic metals such as Pb, Zn, Cu, Cr, Cd and Mn respectively.

Heavy metals were recorded by Usman *et al.* (2017d) 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 amount of heavy metals such as cadmium, chromium, copper, manganese, lead, and zinc were determined using atomic absorption spectrophotometer. The majority of the samples were found to exceed from the permissible limit recommended by WHO. 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 0.41-1.11 ppm respectively. A study was conducted by Usman *et al.* (2017e) 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. A research study was conducted by Farhan *et al.* (2016) to determine the concentration of some heavy metals (Fe, Ni, Cu, Cr, Cd, Pb and Zn) in water and soil samples of four different dams located in the area of Karak, KP, Pakistan. The results obtained showed that the average value of Fe and Zn in both water and soil samples were found to be higher than other metals. Assessment of heavy metals were carried out by Usman *et al.* (2017f) 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.* (2017g) 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.

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

S.No	Metals	U.S	M.P	D.S	Permissible limits
1	Zn	1.15	1.86	1.34	5.0 mg/l
2	Cu	1.06	1.25	1.08	0.05 mg/l
3	Cd	0.05	1.39	0.14	0.05 mg/l
4	Pb	0.03	1.22	0.06	0.05 mg/l
5	Cr	0.04	0.13	0.05	0.05 mg/l
6	Mn	0.02	0.06	0.03	50-70 mg/l

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

Conclusion

The main objective of the present study was to explore the heavy metals toxicity in River Indus at Thakot site Khyber Pakhtunkhwa Pakistan. Furthermore, the results obtained from the current study revealed that some heavy metals exceeded from their permissible range.

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