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Assessment of heavy metals in River Harrow at Saral site Khyber Pakhtunkhwa, Pakistan

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Abstract

The main objective of the present research was to explore the concentration of heavy metals in River Harrow at Saral site Khyber Pakhtunkhwa, Pakistan. For this purpose a brief study was designed to for the evaluation of six selected heavy metals in River Harrow at Saral sampling station. The concentration of heavy metals obtained in the current study was in the range of Zn 1.18-1.73 ppm; Cu 1.04-1.23 ppm; Cd 0.06-1.35 ppm; Pb 0.05-1.24 ppm; Cr 0.04-0.18 ppm and Mn 0.06-0.09 ppm respectively. The current research summarized that Cu,Cd, Pb and Cr were above the standard levels while Zn and Mn were within range. The current research reviled that this site of the river was contaminated by the heavy metals.

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Introduction

Evaluated heavy metals concentration in river systems are often considered indicators of anthropogenic influence and they are potential risk to the natural environment. Therefore, it is important to assess and track the abundance of these heavy metals. It is well known that the metals toxicity and bioavailability depends on other speciation, either in water or sediment. Heavy metals are distributed in sediments in four fractions, as exchangeable bound, iron– manganese oxide, organic matter and residual species (Dean *et al*., 2002). Therefore, monitoring these metals is utmost necessary for safety assessment of the environment and human health in particular. Biologically or chemically these metals cannot be degraded, and thus may either accumulate locally or be transported over long distance (Batayneh, 2012). The main sources of heavy metal pollution of the agriculture, industry and metropolitan cities, the bioaccumulation of toxic heavy metals in fish species from different aquatic systems is dependent on their foreign polluted substances. The distribution of heavy metals in water, sediments and fish play a key role in detecting Sources of heavy metal pollution in aquatic ecosystem (Forstner and Wittman, 1981). Heavy metals have been listed by the US Environmental Agency (USEPA) based on their potential for human exposure and health risk (Birungi, 2007).According to Nazir *et al.* (2015) 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. Another study was carried out by Ullah *et al.* (2016) to estimate 96hr LC50 value of Cadmium sulphate for the fish, *Labeo rohita*. The results showed that the median lethal concentration (LC_{50}) of Lead Nitrate for the fish, *Labeo rohita* is 24 mg/l. The susceptibility of *Labeo rohita* to the lethal effect of Cadmium sulphate was dependent on duration as well as on concentration. The mortality of the fishes is directly proportional to the concentration. 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. 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. 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.

Materials and methods

Study Area

Sarral site of the River harrow is very beautiful and over here greenery are found. This site having plenty of water. This site is surrounded by beautiful plants and it's a good spot of picnic. Wild fauna is rich and this site of the river is affected by the deforestation And anthropogenic activities.

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.

Fig. 1. Map of River Harrow at Sarral site KP, Pakistan. Blue arrow show sampling point of the site.

Method for preparation of stock solution

The stock solution was prepared as 1000 ppm = 1000 mg/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

The main goal of the current survey was to assess the concentration of heavy metals in River Harrow at Saral site Khyber Pakhtunkhwa, Pakistan. For this purpose a brief study was designed to for the evaluation of six selected heavy metals in River Harrow at Saral sampling station. The concentration of heavy metals obtained in the current study was in the range of Zn 1.18-1.73 ppm; Cu 1.04-1.23 ppm; Cd 0.06-1.35 ppm; Pb 0.05-1.24 ppm; Cr 0.04-0.18 ppm and Mn 0.06-0.09 ppm respectively. The current research summarized that Cu, Cd, Pb and Cr were above the standard levels while Zn and Mn were within range. The current research reviled that this site of the river was contaminated by the heavy metals. Fawad *et al.* (2017) to find out 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. 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. 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.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. Analysis of heavy metals was determined by Usman *et*

al. (2017g) 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. 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.

A survey was carried out by Usman *et al.* (2017f) to find out the concentration of heavy metals in Jhanjira Upper site of the River Kabul KP, Pakistan.

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

S.No	Metals	U.S	M.P	D.S	Permissible limits
1	Zn	1.18	1.73	1.31	5.0 mg/l
2	Cu	1.04	1.23	1.08	0.05 mg/l
3	Cd	0.06	1.35	0.17	0.05 mg/l
4	Pb	0.05	1.24	0.09	0.05 mg/l
5	Cr	0.04	0.18	0.09	0.05 mg/l
6	Mn	0.05	0.09	0.07	50-70 mg/l

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. Assessment of heavy metals were carried out by Usman *et al.* (2017e) 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.* (2017d) to estimate the amount of heavy metals in River Kabul at Kond Marble factory KP, Pakistan.

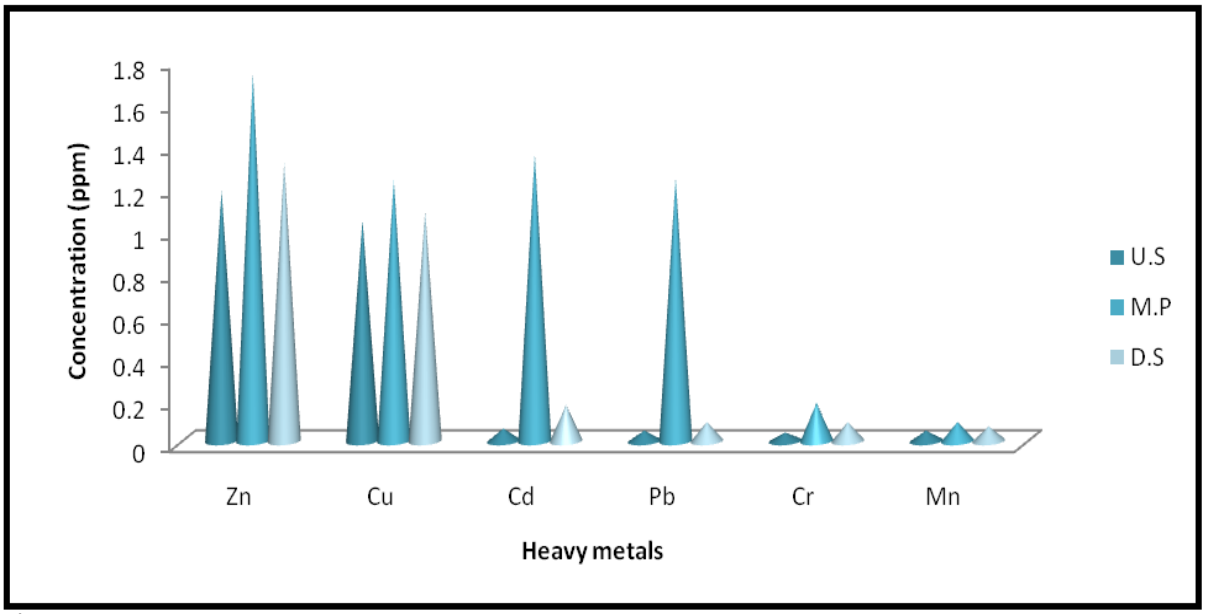

Fig. 2. Concentration of heavy metals (ppm) in River Harrow at Saral site KP, Pakistan. U.S (Upstream); M.P (Mid-point); D.S (Downstream).

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.

Conclusion

Results of the present study reviled that Cu,Cd, Pb and Cr were above the permissible limits while the remaining heavy metals Zn and Mn were within range. From the present investigation, it can be concluded that water quality of this point is not suitable because of heavy metals toxicity.

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