



RESEARCH PAPER

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Heavy metals contamination in River Siranat Shinkiari Khyber Pakhtunkhwa, Pakistan

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Article published on November 15, 2018

Key words: River, Siran, Shinkiari, Water, Contamination, Hazards.

Abstract

A survey was carried out to find out the concentration of health hazard heavy metals in River Siran at Shinkiari Khyber Pakhtunkhwa, Pakistan. In the present research health hazard heavy metals such as Zn, Cu, Cd, Pb, Cr and Mn were analyzed from the selected sampling station in river Siran at Shinkiari. The heavy metals obtained in the current research were in the range of Zn 1.14-1.85 ppm; Cu 1.04-1.25 ppm; Cd 0.02-1.35 ppm; Pb 0.05-1.27 ppm; Cr 0.03-0.16 ppm and Mn 0.03-0.08 ppm respectively. Cu, Cd, Pb and Cr were found exceeded the permissible ranges while Zn, and Mn were found within the permissible limits.

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Introduction

Apart from the natural sources, several anthropogenic ones also contribute to metal concentrations in the environment. In recent times, industrial and mechanical activities have raised natural concentrations causing serious environmental problems. Aquatic environment is one of the receiving ends for pollutants, particularly heavy metals which are ploughed back into the food chains through bioaccumulation in plankton and invertebrates to fishes and finally biomagnified in man. Heavy metal concentrations in aquatic ecosystems are usually monitored by measuring their concentrations in water, sediments and associated biota (Camusso *et al.*, 1995). Because waters generally have low heavy metals levels, even when high concentrations are found on the bottom, food is a significant source of these elements for fish (Javed and Hayat, 19996; Clearwater *et al.*, 2000). Metals tend to accumulate in water and move up through the food chain. So, studies to ascertain the level of heavy metals in environment and determine potentially hazardous levels for human are necessary. It is well known that this metal easily accumulates in fish tissues such as bones, gills, kidneys, liver and scales (Dalas and Day, 1993). On account of their high level of toxicity chromium, lead, mercury, arsenic and cadmium, rank among the priority metals that are of great health significance. These metallic elements are viewed as systemic toxicants that are known to incite numerous organ damages, even at lower levels of exposure. Among other organic and inorganic pollutants our aquatic systems may extensively be contaminated with heavy metals (Velez and Montoro, 1998; Conacher *et al.*, 1993). There is a considerable concern about the human health aspects of metal cycling in polluted water bodies that are in proximity to human settlements. The importance of water to human has resulted in the sitting of most rural communities and industries as well as individual homes along the river course (Egborge, 1982). Trace metals enter in river from variety of sources; it be can be either natural or anthropogenic (Bem *et al.*, 2003; Wong *et al.*, 2003; Adaikpoh *et al.*, 2005; Akoto *et al.*, 2008).

A research work was conducted by Usman *et al.* (2017b) 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. The evaluate of the heavy metal pollution load in the environment, it is usually not sufficient to measure only total concentrations, but also to establish the proportions of heavy metals present in various soluble fractions, which are commonly quantified by a sequential extraction procedure (Tessier *et al.*, 1979; Horowitz, 1985; Forstner and Wittman, 1991; Chester and Hughes, 1997; Stamatis *et al.*, 2006). Large amounts of water consumed by humans are mainly from surface waters, which include rivers, streams, lakes, wetlands and ground water (Thurman and Foulkner, 1998). 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. Quantity of health hazard metals was detected by Usman *et al.* (2017c) 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. A study was design to find out concentration of heavymetals 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 (Usman *et al.*, 2018o). Concentration of heavy metals was analyzed by Usman *et al.* (2017d) 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.

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. 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. Evaluation of heavy metals were carried out by Afridiet *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. The aim of the current research work was to detect heavy metals contamination in River Siranat Shinkiarri Khyber Pakhtunkhwa, Pakistan

Materials and methods

Study area

Shinkiarri is situated at River Siran Khyber Pakhtunkhwa, Pakistan (Fig.1). This site of the sampling is impure due to dense populated. In this site all the garbages of the main Shinkiarri market enter into the river as a result water quality of this site becomes polluted. In this site a very beautiful bridge is build which is the main passage to cross the river. Furthermore, domesticated waste is also discharge into the river which are badly affected on Ichthyo fauna and other aquatic life. This site is water rich zone that's why this site is also popular for fishing.



Fig. 1. Map of Shinkiarri site in River Siran 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 = 1000

mg/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

A research work was conducted to assess the amount of heavy metals in River Siran at Shinkiari Khyber Pakhtunkhwa, Pakistan. In the current investigation health hazard heavy metals such as Zn, Cu, Cd, Pb, Cr and Mn were analyzed from the selected sampling station in river Siran at Shinkiari. The heavy metals obtained in the current research were in the range of Zn 1.14-1.85 ppm; Cu 1.04-1.25 ppm;

Cd 0.02-1.35 ppm; Pb 0.05-1.27 ppm; Cr 0.03-0.16 ppm and Mn 0.03-0.08 ppm respectively. Cu, Cd, Pb and Cr were found exceeded the permissible ranges while Zn, and Mn were found within the permissible limits. An Investigation was carried out by Usman *et al.* (2018k) to explore the quantity of health hazard toxic metals in River Dor at Jama site Khyber Pakhtunkhwa, Pakistan.

Table 1. Concentration of heavy metals (ppm) in River Siran at Shinkiari sampling.

S.No	Metals	U.S	M.P	D.S	Permissible limits
1	Zn	1.13	1.79	1.41	5.0 mg/l
2	Cu	1.04	1.25	1.09	0.05 mg/l
3	Cd	0.05	1.36	0.13	0.05 mg/l
4	Pb	0.08	1.24	0.06	0.05 mg/l
5	Cr	0.05	0.17	0.09	0.05 mg/l
6	Mn	0.03	0.04	0.02	50-70 mg/l

StationKP, Pakistan.

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. Assessment of heavy metals were carried out by Usman *et al.* (2017g) 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 1.13-2.01 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 survey was conducted by Usman *et al.* (2018l) to evaluate concentration of heavy metals in River Dor at Mankarai Khyber Pakhtunkhwa, Pakistan. In this assessment, the concentration of heavy metals obtained were 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. A survey was carried out by Usman *et al.* (2017h) 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.

A study was conducted to evaluate the concentration of heavy metals in River Indus at Biliyani site Khyber Pakhtunkhwa, Pakistan. The concentration of heavy metals such as cadmium, chromium, copper, manganese, lead, and zinc was recorded Zn 1.18-1.71 ppm; Cu 1.05-1.26 ppm; Cd 0.06-1.38 ppm; Pb 0.05-1.24 ppm; Cr 0.04-0.19 ppm and Mn 0.03-0.08 ppm respectively (Usman *et al.*, 2018m). Amount of heavy metals were analyzed by Usman *et al.* (2017f) 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. In a study carried out to assess concentration of heavy metals in River Indus at Pattan site Khyber Pakhtunkhwa, Pakistan. Water sampling was carried out from the three selected sites of the River at Pattan site like The Upstream, Mid-Point and Downstream. Heavy metals obtained in this study were Zn 1.16-1.89 ppm; Cu 1.04-1.25 ppm; Cd 0.56-1.32 ppm; Pb 0.07-1.27 ppm; Cr 0.02-0.18 ppm and Mn 0.04-0.09 ppm respectively (Usman *et al.*, 2018n).

Usman *et al.* (2017i) 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. 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.

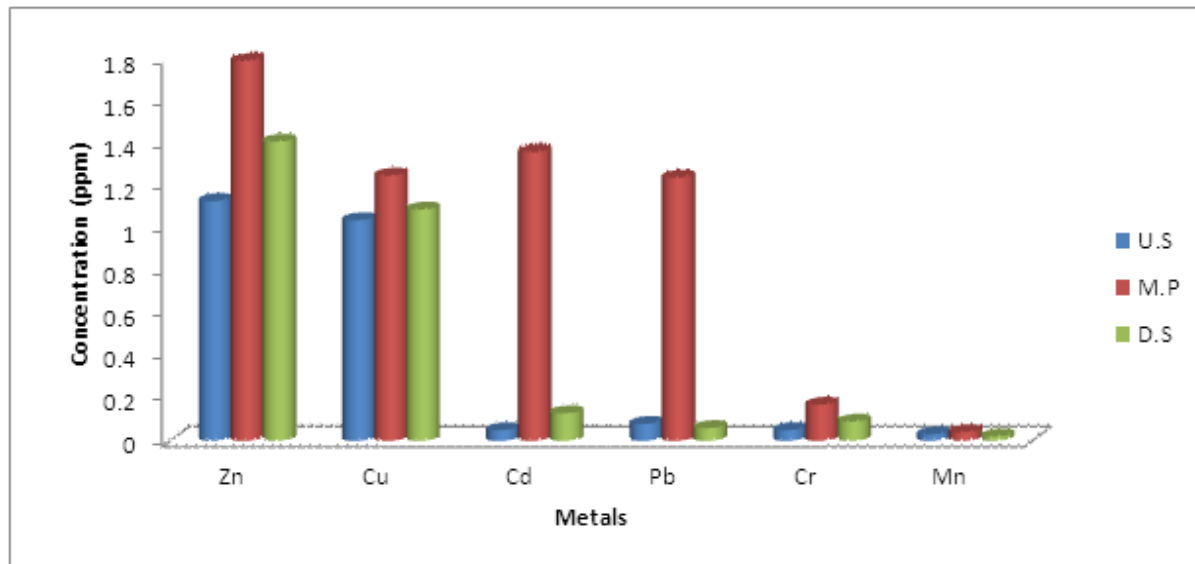


Fig. 2. Concentration of heavy metals (ppm) in River Siran at Shinkiyari sampling Station KP, Pakistan. U.S (Up stream); M.P (Mid point); D.S (Down stream).

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.* (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.

Conclusion

The present study conducted in River Siran at Shinkiyari sampling station Khyber Pakhtunkhwa Pakistan. The results revealed that only four health hazard heavy metals were exceeded from the permissible limits.

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 my research work.

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