



## RESEARCH PAPER

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## Estimation of heavy metals in River Indus at Pattan Khyber Pakhtunkhwa, Pakistan

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Article published on May 30, 2018

**Key words:** River, Indus, Pattan, Heavy metals, Toxicity, ppm

### Abstract

The main goal of the current study was to find out the concentration of heavy metals in River Indus at Pattan site Khyber Pakhtunkhwa, Pakistan. Water sampling were carried out from the three selected sites of the River at Pattan site like The Upstream, Mid-Point and Downstream. The amount of heavy metals obtained in the present study was 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. The present results revealed 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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## Introduction

Consequently, heavy metals have been listed by the US Environmental Agency (USEPA) based on their potential for human exposure and health risk (Birungi, 2007). 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). 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). 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. 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. 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 LC<sub>50</sub> value of Cadmium sulphate for the fish, *Labeo rohita*.

The results showed that the median lethal concentration (LC<sub>50</sub>) 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. The aim of the current research work was to find out the estimation of heavy metals in River Indus at Pattan Khyber Pakhtunkhwa, Pakistan.

## Materials and methods

### Study Area

The Pattan station of River Indus is very popular site of the River Indus. This point is rich of water bodies and hence found clean as compared to the other points along with the River Indus. Almost Ichthyofauna was recorded from this site due to water rich zone. This site is too much green and so also provide a recreation place for the tourists. Besides all these this site was clear.



**Fig. 1.** Map of River Indus at Pattan 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  $C_1V_1 = C_2V_2$ .

#### *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**

The amount of heavy metals obtained in the present study was 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. The present results revealed 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. The main goal of the current study was to find out the concentration of heavy metals in River

Indus at Pattan site Khyber Pakhtunkhwa, Pakistan. Water sampling were carried out from the three selected sites of the River at Pattan site like The Upstream, Mid Point and Downstream.

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. 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. 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.

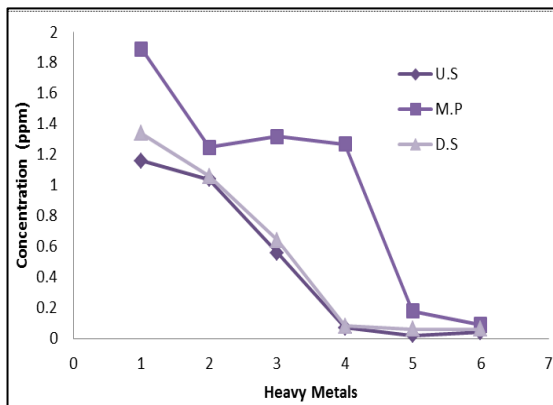
A study was conducted by Khan *et al.* (2017) to find out contamination of toxicological effect on environment as well as on public health and is an emerging problem in District Quetta. On average, the Antimony (Sb) ( $0.028 \pm 0.022$ mg/L) was above the WHO standard limits while Arsenic (As) ( $0.006 \pm 0.0094$ 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. 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.* (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. 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 (*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 – 3.74µg/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.

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

S.No	Metals	Metals	U.S	M.P	D.S	Permissible limits
1	Zn	Zn	1.16	1.89	1.34	5.0 mg/l
2	Cu	Cu	1.04	1.25	1.06	0.05 mg/l
3	Cd	Cd	0.56	1.32	0.64	0.05 mg/l
4	Pb	Pb	0.07	1.27	0.08	0.05 mg/l
5	Cr	Cr	0.02	0.18	0.06	0.05 mg/l
6	Mn	Mn	0.04	0.09	0.06	50-70 µg/l



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

**Conclusion**

The present results revealed 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.

**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.

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