



## Assessment of heavy metals in River Dor at Dobandi Khyber Pakhtunkhwa, Pakistan

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### Abstract

The current exploration was made to find out the concentration of heavy metals in River Dor at Dobandi site Khyber Pakhtunkhwa, Pakistan. In this study three sampling stations (Upstream, Mid Point and Downstream) were selected in River Dor at Dobandi site which were away from one another 100 meter distance. The aim of the present research was to analyze heavy metals (Zn, Cu, Cd, Pb, Cr and Mn) in the River Dor at Dobandi sampling site. In the current examination the concentration of hazard heavy metals recorded were Zn 1.15-1.89 ppm; Cu 1.05-1.27 ppm; Cd 0.07-1.39 ppm; Pb 0.06-1.27 ppm; Cr 0.03-0.19 ppm and Mn 0.03-0.05 ppm respectively. In the present investigation Cu, Cd, Pb and Cr were above the permissible limits while Mn 0.03-0.05 and Zn 1.15-1.89 were found within the limits.

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## Introduction

Because of the importance of sediments to the overall quality of aquatic systems, sediment analysis is often included in environmental assessment studies (Adekola and Eletta, 2007; Li *et al.*, 2006; Jain *et al.*, 1995; Horsfall and Spiff, 2002). Environmental pollution is a worldwide problem, heavy metals belonging to the most important pollutants. The progress of industries has led to increased emission of pollutants into ecosystems. Manzala Lake is one of the most important aqua systems, which receives disposal of industrial chemicals from many drains (such as Bahr El-Bakar) and agricultural pollutions (from Bahr Hadose). In addition, it was contaminated by Cairo and Delta sewage drainage system (Dawoud *et al.*, 2009). Fish lie at the top of the aquatic food chain and may concentrate large amounts of some metals from the water. Heavy metals enter the body of fish through the skin or gills via the dissolved phase and through the digestive tract via the food (Pourang, 1995; Sarnowski, 2003). Many factors enhances their detrimental effect and may involve the age of particular species, sex of an individual, concentration of dose, route of exposure as well as various biological and physiological adaptations perform an essential part (Verkleji, 1993). Developing countries are facing the problem of water pollution due to rapid spread of industrialization and civilization. These industries produce large amount of polluted products especially heavy metals that are constantly drained untreated into nearby rivers. The impact of heavy metals on water ecosystem has turned out to be a global concern (Yousafzai *et al.*, 2008). Rapid urbanization and industrial development during last decade have provoked some serious concerns for the environment. Heavy metals contamination in river is one of the major quality issues in many fast growing cities, because maintenance of water quality and sanitation infrastructure did not increased along with population and urbanization growth especially for the developing countries (Sundaray *et al.*, 2006; Karbassi *et al.*, 2007; Akoto *et al.*, 2008; Ahmad *et al.*, 2010). Usman *et al.* (2017a) 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.* (2017b) 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.* (2017c) 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.* (2017d) 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.* (2017e) 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 Rehman *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  $53.17 \pm 0.2 \text{ mg/L}$  (Gomalzam dam soil sample) and  $46.12 \pm 0.1 \text{ mg/L}$  (Gomalzam dam water sample), Pb  $5.53 \pm 0.32 \text{ mg/L}$  (Gomalzam dam water sample) and  $5.097 \pm 0.17 \text{ mg/L}$  (Gomalzam dam soil sample), Cu  $6.05 \pm 0.11 \text{ mg/L}$  (Gomalzam dam water sample) and  $3.50 \pm 0.01 \text{ mg/L}$  (Barganatu dam soil sample), Zn  $3.38 \pm 0.03 \text{ mg/L}$  (Damai stream soil sample) and  $2.27 \pm 0.01 \text{ mg/L}$  (Baran dam soil sample), Ni  $0.77 \pm 0.01 \text{ mg/L}$  (Baran dam water sample) and  $0.54 \pm 0.01 \text{ mg/L}$  (Baran dam soil sample), Cd  $0.67 \pm 0.01 \text{ mg/L}$  (Damai stream soil sample) and  $0.23 \pm 0.02 \text{ mg/L}$  (Damai stream water sample), Cr  $0.12 \pm 0.01 \text{ mg/L}$  (Barganatu dam soil sample) and  $0.08 \pm 0.03 \text{ mg/L}$  (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. The aim of the research work was to find out assessment of heavy metals in River Dor at Dobandi Khyber Pakhtunkhwa, Pakistan.

## Materials and methods

### Study Area

Bobandi site of the river Dor is not too much clear. In this point lot of turbidity is found. The main reason of the water turbidity is over all anthropogenic activities.

n this point various fields are irrigated by small canals systems. In this area often peoples visit for picnic.



**Fig. 1.** Map of River Dor at Dobandi 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  $1000 \text{ ppm} = 1000 \text{ mg/l}$ . Then  $100 \text{ ppm}$  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  $250 \text{ ml}$  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 present investigation was conducted to find out the heavy metals concentration in River Dor at Dobandi site KP, Pakistan. In the current survey three sampling stations (Upstream, Mid Point and Downstream) were selected in River Dor at Dobandi site which were away from one another  $100 \text{ meter}$  distance. The aim of the present research was to analyze heavy metals (Zn, Cu, Cd, Pb, Cr and Mn in the River Dor at Dobandi sampling site. In the current examination the concentration of hazard heavy metals recorded were Zn  $1.15\text{-}1.89 \text{ ppm}$ ; Cu  $1.05\text{-}1.27 \text{ ppm}$ ; Cd  $0.07\text{-}1.39 \text{ ppm}$ ; pb  $0.06\text{-}1.27 \text{ ppm}$ ; Cr  $0.03\text{-}0.19 \text{ ppm}$  and Mn  $0.03\text{-}0.05 \text{ ppm}$  respectively.

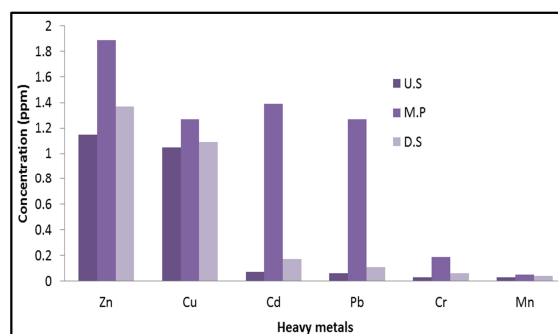
In the present investigation Cu, Cd, Ob and Cr were above the permissible limits while Mn 0.03-0.05 and Zn 1.15-1.89 were found within the limits.

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. 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 result shows that the rate of accumulation of chromium in Gills > Intestine > Skin of gold fish. Amount of heavy metals were analyzed by Usman *et al.* (2017f) 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.* (2017g) 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.* (2017h) 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.* (2017i) 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.* (2017j) 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 results mention above reviled that there was a little bit variation when compared with the current study.

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

S.No	Metals	U.S	M.P	D.S	Permissible limits
1	Zn	1.15	1.89	1.37	5.0 mg/l
2	Cu	1.05	1.27	1.09	0.05 mg/l
3	Cd	0.07	1.39	0.17	0.05 mg/l
4	Pb	0.06	1.27	0.11	0.05 mg/l
5	Cr	0.03	0.19	0.06	0.05 mg/l
6	Mn	0.03	0.05	0.04	50-70 mg/l



**Fig 2.** Concentration of heavy metals (ppm) in River Dor at Dobandi site KP, Pakistan. U.S (Upstream); M.P (Midpoint); D.S (Downstream).

**Conclusion**

The present investigation conducted in River Dor at Dobandi site Khyber Pakhtunkhwa Pakistan revealed that this area is not suitable for agricultural and other uses.

Furthermore, heavy metals treatment plants should be build up in the bank of River Dor at Dobandi site to stop this serious issue of contamination.

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