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Detection of heavy metals in River Indus at Dasu Khyber Pakhtunkhwa, Pakistan

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Abstract

The main resources of water toxicity are Heavy metals which cause serious health problems. Ultimately aquatic life is badly affected. For the assessment of heavy metals a brief study was carried out in River Indus at Dasu Khyber Pakhtunkhwa, Pakistan. Overall six heavy metals (Pb, Cr, Zn, Mn, Cd, and Cu were detected. The Heavy metals recorded in the current study were Zn 1.15-1.87 ppm; Cu 1.07-1.21 ppm; Cd 0.04-1.33 ppm; Pb 0.05-1.27 ppm; Cr 0.02-0.18 ppm and Mn 0.05-0.09 ppm respectively. From the current research it can be summarized that that Cr, Cu, Cd and Pb were found above the standard values. So this point of the study area was found contaminated and not recommended for use of both aquatic life and land organism. It might be adversely affected on the inhabited peoples near to this point.

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Introduction

The aquatic systems deposition of contaminants, including heavy metals, can lead to elevated sediment concentrations that cause potential toxicity of the Aquatic biota (Yand and Rose, 2003; Heyvart *et al.*, 2000). Metal ions also damages DNA molecule and nuclear proteins that may possibly lead to carcinogenesis or apoptosis (Beyersmann and Hartwig, 2008). Nickel, a major environmental pollutant, is known for its clastogenic, toxic, and carcinogenic potential (Ross, 1985; Hartwig and Schwerdtle, 2002).

The carcinogenic potential of nickel compounds depends largely on their solubility. The particulate nickel compounds like Ni3S2 or NiO are strong carcinogens, whereas the soluble nickel (II) salts exert weaker effects (Dunnick *et al.*, 1995). This may be due to differences in bioavailability. Water soluble nickel salts are taken up only slowly by cells, while particulate nickel compounds are phagocytosed and, due to the low pH, are gradually dissolved in lysosomes, yielding high concentrations of nickel ions in the nucleus (Costa *et al.*, 1981). 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±0.022mg/L) was above the WHO standard limits while Arsenic (As) (0.006 ± 0.0094mg/L) was below the WHO standard limits. 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.

A survey was carried out by Usman *et al.* (2017a) 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.* (2017b) 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. Assessment of heavy metals were carried out by Usman *et al.* (2017c) 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.

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 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. 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. The objective of the current research work was to find out the detection of heavy metals in River Indus at Dasu Khyber Pakhtunkhwa, Pakistan.

Materials and methods

Study Area

Dasu site of the river Indus is not too much clear. In this site a huge turbidity was found. The main reason of the water turbidity is manmade activities and domesticated discharge in to the River. In this site various fields are irrigated by small canals systems. In this area often peoples visit for picnic.

Fig. 1. Map of River Indus at Dasu 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 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

Overall six health hazard metals (Pb, Cr, Zn, Mn, Cd, and Cu were recorded. The Heavy metals examined in the present research was Zn 1.15-1.87 ppm; Cu 1.07-1.21 ppm; Cd 0.04-1.33 ppm; Pb 0.05-1.27 ppm; Cr 0.02-0.18 ppm and Mn 0.05-0.09 ppm respectively. The main resources of water toxicity are Heavy metals which cause serious health problems. Ultimately aquatic life is badly affected. For the assessment of heavy metals a brief study was carried out in River Indus at Dasu Khyber Pakhtunkhwa, Pakistan. From the current research it can be summarized that that Cr, Cu, Cd and Pb were found above the standard values. So this point of the study area was found contaminated and not recommended for use of both aquatic life and land organism. It might be adversely affected on the inhabited peoples near to this point.

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

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

S. No	Metals	U.S	M.P	D.S	Permissible limits
1	Zn	1.15	1.87	1.38	5.0 mg/l
2	Cu	1.07	1.21	1.08	0.05 mg/l
3	Cd	0.04	1.33	0.13	0.05 mg/l
4	Pb	0.05	1.27	0.08	0.05 mg/l
5	Cr	0.02	0.18	0.06	0.05 mg/l
6	Mn	0.05	0.09	0.06	50-70 mg/l

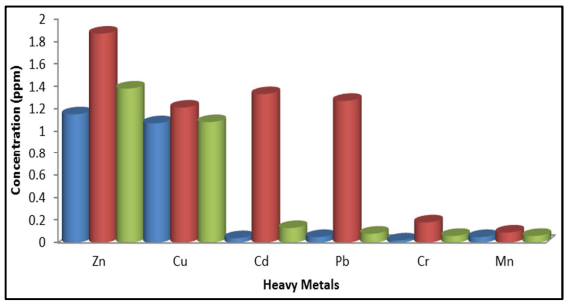

Fig. 2. Concentration of heavy metals (ppm) in River Indus at Dasu site KP, Pakistan. U.S (Up stream); M.P (Mid point); D.S (Down stream).

Conclusion

From the current research it can be summarized that that Cr, Cu, Cd and Pb were found above the standard values. So this point of the study area was found contaminated and not recommended for use of both aquatic life and land organism. It might be adversely affected on the inhabited peoples near to this point.

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