INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 13, No. 1, p. 263-267, 2018
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

Evaluation of heavy metals in River Indus at Jubda Khyber Pakhtunkhwa, Pakistan

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Article published on July 30, 2018

Key words: River, Indus, Upper Jubda, KP, Heavy metals, Concentration.

Abstract

Heavy metals are the main health hazard pollutants which contaminate aquatic life. These heavy metals accumulate in our food stuff and cause health problems by their toxicity. To explore the amount of heavy metals, a detail study was design to explore heavy metals in River Indus at Jubda site Khyber Pakhtunkhwa, Pakistan. Three sampling sites were selected in the present study. Heavy metals recorded in the present research were in the range of Zn 1.18-1.86ppm; Cu 1.06-1.26ppm; Cd 0.07-1.39ppm; Pb 0.06-1.27ppm; Cr 0.03-0.19ppm and Mn 0.03-0.07ppm respectively. Cd, Cd, Pb and Cr were found exceeding the standard level. The current survey demonstrated that the water is not good for any use like irrigation and animals.

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Introduction

There has been an increasing interest in the utilization of fishes as bio-indicators of the integrity of aquatic environmental systems in recent years (Tawari and Ekaye, 2007). Heavy metals influence cellular organelles and various enzymes involved in metabolic process, detoxification, and damage repair (Wong and Shi, 2001). The harmful effect of trace elements when consumed above the recommended limit can be toxic (acute, chronic or sub-chronic), and heavy metals can be neurotoxic, carcinogenic, mutagenic or teratogenic. The general symptoms of humans related to metal [e.g., Cd, Pb, As, Hg, Zn, Cu and aluminium (Al)] poisoning include vomiting, convulsions, paralysis, ataxia, hemoglobinuria, gastrointestinal disorder, diarrhoea, stomatitis, tremor, depression and pneumonia (McCluggage, 1991). Pollution of the environment by heavy metals is very prominent in areas of mining sites and reduces increasing distance away from these sites. Another contribution of anthropogenic metals of terrestrial origin is from industrial development and other activi-ties such as agriculture, metallurgy and transport from mining activities, ground water is most vigorously polluted (Abderahman and Abu-Rukah, 2000; Buccolieri, 2006).

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. 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 (6.00ppm) was found at Jehangera Upper site, Cu (3.05ppm) at Dalda Oil Mill Nowshera site, Cr (1.05ppm) at Jehangera Lower, Mn (2.00ppm) at Jehangera Lower, Pb (0.02ppm) at Dalda Oil Mill Nowshera site and Cd (3.0ppm) 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 0.06-4.41ppm; Zn 4.11-7.11ppm; Cd 0.42-1.46ppm; Cu 1.07-3.86ppm; Mn 0.06-2.11ppm and Cr 0.05-2.11ppm. 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 1.2-2.0ppm; Cu 0.17-1.48ppm; Cd 0.2-0.69ppm; Pb 1.01-1.23ppm; Cr 0.04-2.01ppm and Mn 0.01-0.82ppm respectively. The aim of the current study was to evaluate heavy metals in River Indus at Jubda Khyber Pakhtunkhwa, Pakistan.

Materials and methods

Study Area

Jubda station of River Indus comprising green fields and trees of pines. This site is greatly inhabited by invertebrates and vertebrates fauna. This area is also for hunting of wild fauna. Besides all these this site is very attractive and beautiful. In this site anthropogenic activities are too much which alter water Chemistry.

Fig. 1. Map of River Indus at Jubda 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 1000ppm = 1000mg/l. Then 100ppm 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

To explore the amount of heavy metals, a detail study was design in River Indus at Jubda site Khyber Pakhtunkhwa, Pakistan. Heavy metals are the main health hazard pollutants which contaminate aquatic life. These heavy metals accumulate in our food stuff and cause health problems by their toxicity. Three sampling sites were selected in the present study. Heavy metals recorded in the present research were in the range of Zn 1.18-1.86ppm; Cu 1.06-1.26ppm; Cd 0.07-1.39ppm; Pb 0.06-1.27ppm; Cr 0.03-0.19ppm and Mn 0.03-0.07ppm respectively. Cd, Cd, Pb and Cr were found exceeding the standard level. The current survey demonstrated that the water is not good for any use like irrigation and animals.

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 (LC50) of Lead Nitrate for the fish, *Labeo rohita* is 24mg/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.

Usman *et al.* (2017d) work on River Kabul at Cantt area Nowshera to evaluate heavy metals. The metals which were recorded in the present study were Zn 1.13-1.85ppm; Cu 1.02-1.21ppm; Cd 0.03-1.32ppm; pb 0.04-1.23ppm; Cr 0.010.16ppm and Mn 0.00-0.00ppm 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.* (2017e) 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 1.11-1.97ppm; Cu 1.05-1.63ppm; Cd 0.11-0.89ppm; Pb 0.07-1.07ppm; Cr 0.01-0.11ppm and Mn 0.02-0.28ppm respectively. Analysis of heavy metals was determined by Usman *et al.* (2017f) to explore the amount of heavy metals in River Kabul at Khairabad water KP Pakistan.

The heavy metals recorded were Zn 1.5-1.59ppm; Cu 1.15-1.94ppm; Cd 0.02-0.05ppm; Pb 0.15-0.73ppm; Cr 0.01-0.02ppm and Mn 0.07-0.21ppm respectively. Assessment of heavy metals was carried out by Usman *et al.* (2017f) to examine the concentration of health hazard toxic metals in River Kabul at Khazana Suger Mill Peshawar KP, Pakistan. Heavy metals concentration obtained from this study was Zn 1.13-201ppm; Cu 0.55-0.9ppm; Cd 0.02-1.22ppm; pb 1.231.84ppm; Cr 0.21-1.2ppm and Mn 0.02-0.05ppm respectively.

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

S.No	Metals	U.S	M.P	D.S	Permissible limits
1	Zn	1.18	1.86	1.38	5.0mg/l
2	Cu	1.06	1.26	1.08	0.05mg/l
3	Cd	0.07	1.39	0.19	0.05mg/l
4	Pb	0.06	1.27	0.07	0.05mg/l
5	Cr	0.03	0.19	0.06	0.05mg/l
6	Mn	0.03	0.07	0.05	2-70g/l

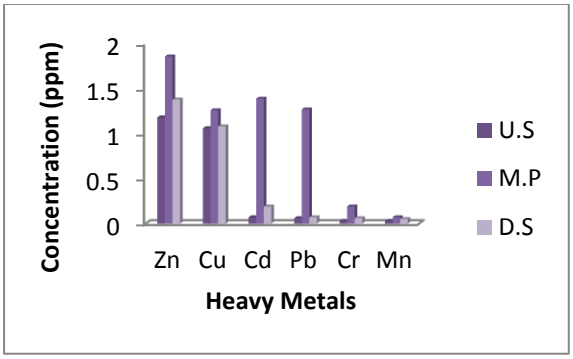

Fig. 2. Concentration of heavy metals (ppm) in River Indus at Jubda site KP, Pakistan. U.S (Up stream); M.P (Mid point); D.S (Down stream).

Conclusion

From this study it can be concluded that heavy metals are the main health hazard pollutants which contaminate aquatic life. These heavy metals accumulate in our food stuff and cause health problems by their toxicity. For this purpose a study was conducted to estimate the heavy metals.

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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