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Estimation of heavy metals in River Kabul at Cantt area Nowshera Khyber Pakhtunkhwa, Pakistan

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Abstract

To estimate the amount of heavy metals, a detailed study was design in River Kabul at Cantt area Nowshera. A total of sex heavy metals (Zn, Cu, Cd, Pb, Cr and Mn) were analyzed according to the study design. Time to time water sampling were carried out and run by the Atomic Absorption Spectrophotometer machine in the PCSIR laboratories Peshawar. 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 0.01-0.16 ppm and Mn 0.00-0.00 ppm respectively. From the present investigation it can be concluded that Zn, Cu, and Cd were exceeded from the recommended permissible limits. So this site of the study area was found contaminated and not recommended for use of living organisms. The peoples residents near to this sight are greatly in risk

Keywords: River, Kabul, Cantt, Nowshera, Heavy Metals, analysis

1. Introduction

Because of the importance of sediments to the overall quality of aquatic systems, sediment analysis is often included in environmental assessment studies [1-4]. 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 [5-9]. The levels of certain trace elements in river ecosystem have been found to be moderately, to very high polluted as a result of industrial discharges [10, 11]. Sediments conserve important environmental information [12] and increasingly are recognized as both carriers and possible sources of contaminants in aquatic systems [6]. 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 [13]. The aim of the research work was estimation of heavy metals in River Kabul at Cantt area Nowshera Khyber Pakhtunkhwa, Pakistan

2. Materials and Methods

2.1 Study Area

Cantt area Nowshera is one of the popular places in Khyber Pakhtunkhwa, Pakistan. Cantt area is situated on the main G.T road of Nowshera. This area is very clean and green due to PAK Army residential and offices. The whole cantt. area is 24 under the observation of PAK Army to avoid the chance of terrorism. This area is very safe as compared to other areas of The Nowshera. Almost domesticated sewages discharged into the River Kabul at cantt area as shown in the (Fig.1). This site of River Kabul is very sensitive. Furthermore, Cantt area is dense populated. This area is fully under the control of PAK Army.

2.2 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 PCSIR Peshawar by using sophisticated instruments especially atomic absorption [14].

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Fig 1: Effluent discharges of Cantt area Nowshera to River Kabul KP, Pakistan.

2.3 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 $C_1V_1 = C_2V_2$

2.4 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) (Model: Z-2000; Hitachi, Tokyo, Japan) which gives direct results of heavy metals on computerized system [14].

3. Results and Discussion

The purpose of the current study was to investigate the concentration of heavy metals in Tiver Kabul at Cantt area Nowshera Khyber Pakhtunkhwa, Pakistan. A detailed study was designed to analyze the selected heavy metals. The metals to be examined were Zn, Cu, Cd, Pb, Cr and Mn respectively. To achieve this goal, PCSIR laboratories Peshawar were used. The metals which were examined 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 0.01-0.16 ppm and Mn 0.00-0.00 ppm respectively. From the current study we can concluded that Zn, Cu, Cd and were found above the recommended permissible limits. This site was recommended highly risk for factors like skin diseases and other related diseases. From the current study we recommended that the cantt. area discharges should be treated for heavy metals otherwise in future it may be critically threaten for aquatic life and land as well. Another investigation was carried out by Usman *et al.* (2017) to find out amount of heavy metals in River Kabul, KP, Pakistan. The trace metals under observation were Pb, Cd, Zn, Mn, Cu and Cr. All these metals were examined by atomic absorption spectrophotometer. The amount of heavy metals recorded were 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 [14]. Another investigation was carried out by Hassan *et al.* (2012) to find out evaluate the concentration of pollutant such as heavy metals in the water of River Toi Kohat. For this purpose 6 months research work was conducted to analyze heavy metals. For this study 3 sampling sites were selected. The recorded heavy metals were in the range of lead (0.33, 0.40 and 0.55 mg/L), zinc (0.34, 0.60 and 0.53 mg/L), cadmium (0.03, 0.08 and 0.13 mg/L), arsenic (0.29, 0.63 and 0.51 mg/L), copper (0.04, 0.04 and 0.03 mg/L) and nickel (0.00, 0.01 and 0.01 mg/L), respectively. From this result, it can be concluded that the water of River ToiKohat is badly affected by various ways [15]. Another study was conducted by Khan *et al.* (2011) to examine the concentration of heavy metals

cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), manganese (Mn), lead (Pb) and zinc (Zn) in the surface water of the Shah Alam River. All the selected metals were assayed using an atomic absorption (AA) spectrophotometer and the results shown as mg of heavy metal/ L of fresh water sample (mg/L). The order of heavy metal concentration was $Ni > Mn \geq Zn \gg Cu > Cd \approx Pb \gg Cr$. The highest concentration of Ni determined was ≈ 30 times whereas Cd and Pb levels were ≈ 10 times higher than the permissible World Health Organization (WHO) established safe drinking water quality standards. The levels of Cu, Cr, Mn and Zn were within the prescribed limits [16]. The current study conducted in the Cantt area Nowshera Khyber Pakhtunkhwa, Pakistan results shows a little bit dissimilarity after comparing with the above mention previous studies. The current study obtained results 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 0.01-0.16 ppm and Mn 0.00-0.00 ppm respectively. From the current study we can concluded that Zn, Cu, Cd and were found above the recommended permissible limits. This dissimilarities reason may be due to various factors affected on the study areas.

Table 1: Concentration of heavy metals (ppm) in River Kabul at Cantt Area Nowshera site KP, Pakistan.

S. No.	Metals	U.S	M.P	D.S	Permissible limits
1	Zn	1.13	1.85	1.33	5.0 mg/l
2	Cu	1.02	1.21	1.04	0.05 mg/l
3	Cd	0.03	1.32	0.11	0.05 mg/l
4	Pb	0.04	1.23	0.09	0.05 mg/l
5	Cr	0.01	0.16	0.03	0.05 mg/l
6	Mn	0.00	0.00	0.00	50-70 mg/l

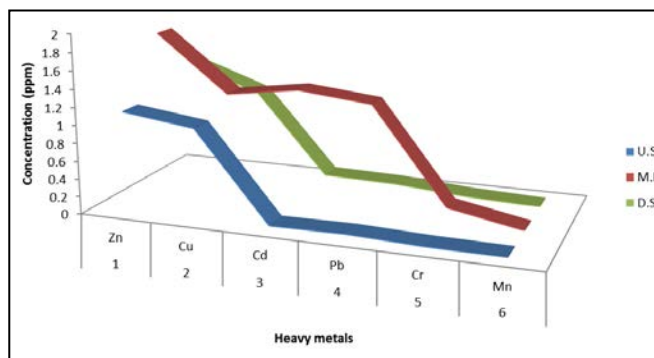


Fig 2: Concentration of heavy metals (ppm) in River Kabul at Cantt Area Nowshera site KP, Pakistan. U.S (Up stream); M.P (Mid point); D.S (Down stream).

4. Conclusion

The present investigation conducted in River Kabul at Cantt area Nowshera Khyber Pakhtunkhwa revealed that this Cantt area Nowshera site water is not suitable for agricultural and other uses. Furthermore, heavy metals treatment plants should be build up in the bank of River Kabul at Cantt area to stop this serious issue of contamination.

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