



Heavy metals (Pb, Cd and Cr) in Water Collected From Gorgan Rood River, Iran

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ABSTRACT

In this study, concentrations of lead (Pb), chromium (Cr) and cadmium (Cd) were detected in water collected from 10 selected stations along Gorgan Rood River, during summer 2010. The heavy metals values were assessed using atomic absorption Spectrophotometer (AAS). The results of water analysis demonstrated that concentrations of Pb, Cd and Cr ranged from 119.28 to 148.33, 79.74 to 92.36, 92.00 to 104.47 µg/L, respectively. The results showed that the heavy metals values were arranged as follows: Pb > Cr > Cd. However, the observed heavy metal concentrations in water were below the recommended threshold limits. Data indicate that industrial and environmental pollution affects the ecosystem and food chain.

Key words: Heavy metals, Pollution, Water, Gorgan Rood River, and Iran

INTRODUCTION

Industrial progress and development of global population have led to an excessive contamination of ecosystems, particularly marine environment, by metals over the last three decades [1]. Pollution is discharged into rivers and lakes and leaches into the soil and ground water, or is emitted into air as particulate matter [2,3]. Metals tend to accumulate in water [4,5], but may be released under certain physicochemical conditions, moving up through the food chain [6]. Rivers play major roles to the community especially in the fishing industry and a source of water supply for people residing within the vicinity of the area. River contamination either directly or indirectly will affect humans as a final consumer [7]. The purpose of this study was to evaluate heavy metals contamination (lead, cadmium, and chromium) in water collected from Gorgan Rood River, during summer 2010.

MATERIALS AND METHODS

STUDY SITES

The area of sample collection is depicted in Figure 1. Water samples were collected from 10 sampling stations extending along Gorgan Rood River, which were chosen based on ecological settings and human activities in the area. Gorgan Rood River, with 325 km length, is one of the most important rivers of Caspian Sea basin, which is originated from Narchi and Bilikoo mountains. Gorgan Rood River irrigates the North area of Gorgan plain and flows to Caspian Sea.

SAMPLING COLLECTION AND PREPARATION

The half-surface, bottom and median depth water samples were collected at the stations on 3 specific times (8:00 a.m., 12:00 a.m. and 4:00 p.m.) using Eckman bottom sampler [8,9]. The samples were kept in a 5-l polyethylene jerrycans previously cleaned with acid (6M HNO) and rinsed with deionized water. The bottom water samples were also collected, 30 cm above the bottom to avoid disturbance of the sediments. At each station, the pH of water was determined before filtering, using a glass electrode. The three water samples (1 L) were mixed and wet digested; then, 25 ml of each sample was prepared with HCl 0.1N, following the method adjusted by American Society for Testing and Materials [8,10].

CHEMICAL ANALYSIS

Finally, all samples in triplicate were analyzed using a flame atomic absorption spectrophotometer (AAS) to evaluate Pb, Cd and Cr values.

STATISTICAL ANALYSIS

Heavy metal concentrations in the water were expressed as micrograms per liter ($\mu\text{g/L}$). All data were analyzed descriptively by means of ANOVA, followed by Student t-test ($P < 0.05$). All statistical analyses were done using Prism software ver.3.

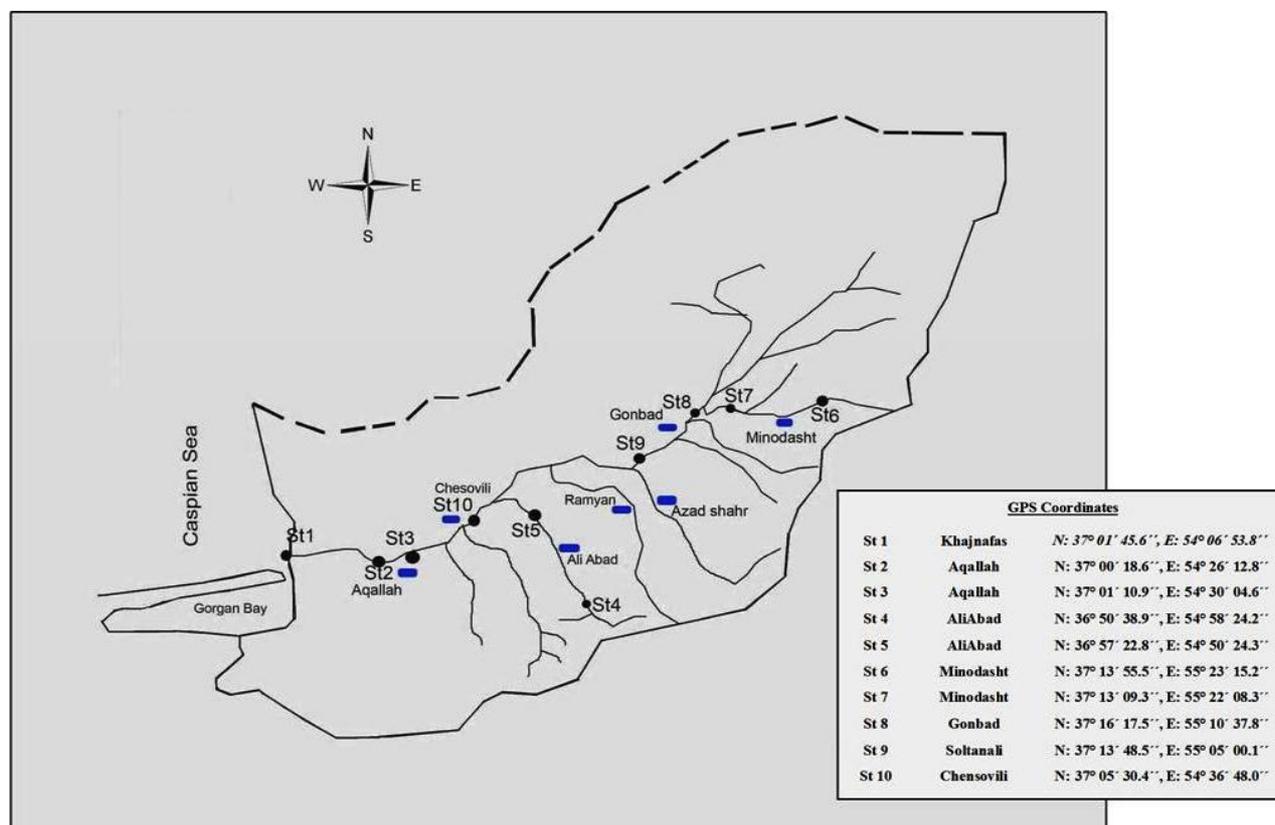


Fig 1: Study area in Gorganrud River, Iran.

RESULTS AND DISCUSSION

The heavy metals levels in water samples collected from the 10 stations are presented in Table 1. The results showed that mean concentration of lead in the water samples was significantly greater than cadmium and chromium levels ($P < 0.05$). The highest and lowest concentrations of Pb, Cd and Cr were recorded in stations 1 and 6, 1 and 3, and 1 and 6, respectively. The highest and lowest concentrations of Pb were detected at Khajnafas and Minodasht. In addition, the lowest and highest concentrations of Cd ranged from 79.74 ± 2.58 to 92.36 ± 1.06 $\mu\text{g/L}$ were determined at Khajnafas and Aqallah.

Gorgan Rood River is receiving organic matter in amount exceeding its natural purification capacity due to high population and industrial growth. The wastewater of industries is directly discharged to the river. The main sources of pollution of the river are urban, agricultural, and industrial wastewaters. In addition, the major sources of pollution in agricultural wastewater are fertilizers containing heavy metals such as Cd, Pb, Cr, Zn, and Ni [11]. The study showed that heavy metals concentrations in water samples decreased according to the rank order of metals $\text{Pb} > \text{Cr} > \text{Cd}$. Effluents from cadmium plating industries in the urban area of Gorgan Rood River are responsible for the presence of this metal in the river. In addition, Cr contamination is originated by plating companies located in urban of Gorgan Rood River.

Table 1: Comparison and concentration of heavy metals the water collected from 10 sampling sites of Gorgan Rood River, summer 2010

Stations	Lead	Cadmium	Chromium
1	148.33±6.02	92.36±1.06	104.47±2.69
2	145.16±3.65	81.28±0.86	99.45±1.93
3	138.5±4.32	79.74±2.58	94.16±3.25
4	141.03±8.11	82.15±3.17	98.36±4.72
5	127.47±1.08	88.49±2.64	101.48±0.96
6	119.28±3.46	83.91±1.59	92.00±1.18
7	132.09±1.92	80.26±0.92	97.59±2.98
8	129.48±5.25	85.52±3.37	95.67±3.76
9	137.28±7.81	89.73±2.26	100.30±4.08
10	135.74±8.27	80.33±1.09	93.83±2.61

* The concentrations are based on Mean±SD. ($\mu\text{g/L}$); Number of water samples (n=30)

CONCLUSION

The purpose of this study was evaluation of the heavy metals concentration in water samples collected from Gorgan Rood River. Then, the heavy metal values were compared with standard limits. The results showed that level of the heavy metals in the samples are in standard range. As a result, control and assessment of the metals concentration in water of Gorgan Rood River which was supplied by water used in agriculture, industries, quality of water of farmlands, and quality control of input and output water have widely importance. Also, guidance of farmers to use pesticides or fertilizers, control of house wastewaters spreading in rivers and crops, and establishment of reference laboratories should be performed [10,12,13].

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