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Detection of Physicochemical Parameters and Spectroscopic Analysis of Heavy Metals in Drinking Water of District Harnai

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Abstract

Water is very important for the life of living organisms on the planet earth. Therefore, it was felt necessary to check the quantity of heavy metals in the drinking water of district Harnai. This study aimed to analyze the water samples for the knowing of the quantity of some heavy metals through the atomic absorption spectrometer and some physicochemical parameters of the water samples. These water samples were taken from unlike areas of District Harnai. Physical and chemical parameters of the water samples such as pH, conductivity, Salinity, and the levels of heavy metals such as Fe, Mn, Cu, and Co were determined. However, nickel was not detected. The data obtained from the analyte was compared with acceptable values fixed by the World Health Organization. On the whole, the water from all the sites except Zardalo was found to be fit for drinking.

Keywords: Physicochemical Parameters, Drinking Water, Atomic Absorption Spectrometer

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INTRODUCTION

Reach to harmless drinking water is vital to human health it is a basic human right because it is sole source of life (Johnsen and Hallberg, 2005). Water is known as the medium of life since it is a crucial part of all living organisms and is the source from which life evolved and exists (Khan et al., 2010). Water is used in great quantity for drinking in the whole world. Water is also used in agricultural and industrial sector (Gianni et al., 2009).

The quality of groundwater not only depends on the lithology of the spring, but also on activities of human beings. These human activities may changes the hydrological cycle of water and may also contaminate the water with different means (Farooqi et al., 2007). There is a connection between interminable sicknesses and geologic conditions. Geochemical condition is to be sure a noteworthy factor in genuine medical issues. The science of drinking water usually has been referred to as a significant factor in numerous illnesses (Liang et al., 2011).

Environment has direct effect on the contamination of water. Environment can be polluted by human beings in various ways such throwing waste materials in the water areas etc. (Ayoob et al., 2006**)**. The water of rain passes via various channels such as the mining areas takes the contaminated particles to the streams, rivers, lakes, and dams etc. which are the main sources of drinking water. In this way, water is contaminated with heavy metals. In addition to above, the industrial wastage is also the main cause of contamination of drinking water (Huang et al., 2007**)**. These all wastage which are being produced by the activities of human beings on the earth enter the drinking water sources that results polluted water (Kazi et al., 2009).

The water used for drinking polluted with greater amount of heavy metals such as Cd, Hg, Se, Cr, Ba, Ag, Pb etc might be proved to be toxic or dangerous to human health (Maity et al., 2004).

Harmful metals like Cd (II) and Pb (II) are considered as a perilous poisonous component to nature and human wellbeing. Be that as it may, these overwhelming metals are gone into the human body by ingestion of defiled food, air, and water, to make the helplessness of imperative organs of the human body, for example,

liver, kidney tissues, and cerebrum. Cadmium may cause kidney harm and bone debasement since it influences calcium digestion (Zhang et al., 2011). Zinc has been accounted for to cause comparable indications of disease as lead, and can undoubtedly be erroneously analyzed as lead harming. Metals like Fe, Cu, Zn, and Mn are basic metals since they assume a significant job in organic frameworks, while Pb and Cd are unimportant metals as they are poisonous even in follows. The fundamental metals can likewise deliver harmful impacts when metal admission is unnecessarily raised (Shah et al., 2003).

One of the significant side effects of synthetic poisonousness is by all accounts a breakdown of the resistant framework, which opens the entryway for a wide range of infections in the body. Likewise, another significant indication is by all accounts harm to the sensory system and expanded anxiety. Instances of constant wellbeing impacts incorporate malignancy, birth abandons, organ harm, fluorosis, carcinogenesis, zero derma, hepaticas, skin ailments, kidney disappointment, hypertension, and circulatory strain, issue of the sensory system, diarrhea, and harm to the resistant framework. Pb, Zn, Cu, Mn, Hg, As, Ca, Co, Ni, Cd, Cr, and Mo are toxigenic and cancer-causing. The experts consistently found as pollutants in human drinking water provisions in many areas far and wide (Baig et al., 2009).

The current study aimed to determine some physicochemical parameters and the quantity of some heavy metals in the drinking water of District Harnai and later, compared the results with acceptable values for the drinking water given by the World Health Organization.

MATERIAL AND METHODS

Reagents and solutions

The analytical grade reagents and standards were used during the analysis. All the apparatus were bathed with acids with (20% HCl) and later, washed with de-ionized water. A blank solution used during the analysis was 0.5 M nitric acid. Standards for Iron, Nickel, Copper, Manganese, and Cobalt were prepared from atomic absorption standards of 1000 ppm by serial dilution with 0.5 M nitric acid.

Collection and Preparation of Samples

The samples of water were collected from different areas of District Harnai such as Shahrigh Dam, Chunghi, Chushma, Nakus, Pari Chushma, Killi Tukkah Bala, Spintangi, and Zardalo. The samples of water were taken in polythene bottles to the lab of the Chemistry Department, University of Balochistan, Quetta. Later, these water samples were added a few drops of nitric acid to pH = 5 so that there is no precipitation and adsorption on the wall of polythene bottles. The bottles were capped tightly and then kept for further analysis.

Instrumentation

The samples of water were analyzed for the detection of Iron, Nickel, Copper, Manganese, and Cobalt by using the atomic absorption spectrometer. The machine was allowed to stabilize for 30 minutes. Later, the real analysis of the samples was conducted by running blank and standards (AOAC, 2000).

RESULT AND DISCUSSION

Chemical Parameters

The results obtained after analyzing the samples through the atomic absorption spectrometer are given in Table (1). While Table 3 shows the standard values of heavy metals given by the World Health Organization. According to Table 1, Iron was found within the range of WHO. While nickel was not detected in any sample of the water. Copper and Cobalt were both found below the set standards. The cobalt may enter the water via various sources such as forest fires, burning of fossil fuels, and wind-blown dust, phosphate fertilizers, processing of cobalt alloys, and industries that use or process cobalt compounds, etc (Barceloux, 1999). District Harnai is one of the most agricultural areas of the Baluchistan province that utilize various types of fertilizers and the number of sprays for the betterment of the crop growth. Applications of these sprays and fertilizers on large scale may contaminate the water with heavy metals such as cobalt etc. other major sources may be coal because Harnai is the place that is rich in coal and other minerals.

Table 1: Concentration of Heavy Metals in drinking water of District Harnai (ppm)

Heavy Metals	Fe	Ni	Cu	Mn	Co
Shahrigh Dam	0.1453	ND**	0.0124	0.0856	0.2047
Chunghi	0.1708	ND	0.0198	0.0861	0.1932
Chasma	0.1994	ND	0.0180	0.0845	0.2152
Nakus	0.2184	ND	0.0228	0.0812	0.2776
Pari Chushma	0.2455	ND	0.0262	0.1117	0.3247
Killi Tukka Bala	0.2383	ND	0.0215	0.0986	0.2773
Spintangi	0.2580	ND	0.0257	0.0989	0.2534
Zardalo	0.2576	ND	0.0119	0.0996	0.2862

ND** = Means Not detected.

Physical Parameters

Table 2 shows the results of the physical parameters obtained after analyzing the samples of water. Odor, taste, and color are not detected in any sample of the water. The range of conductivity is from 499 to 1256 µS/m. Conductivity of all the water samples are in the permissible limit set by NDWQS except Zardalo sample which has crossed the acceptable limit given by NDWQS. The obtained Salinity range is from 40 – 1000 ppm, and the pH range of water samples is from 7.2 – 8.14. PH of all the water samples is within the acceptable values given by WHO. The dissolved salts are particularly due to bicarbonates, carbonates, sulfates, and chlorides, etc.

Table 2: Conductivity, Salinity, and pH of water samples.

Locations	Conductivity µS/cm	Salinity (ppm)	PH
Shahrigh Dam	789	40	8.07
Chunghi	555.7	290	8.14
Chashma	631.3	290	7.8
Nakus	913	460	7.8
Pari Chushma	724.7	380	8.1
Killi Tukkah Bala	499	250	7.72
Spintangi	805.3	420	8.05
Zardalo	1256.3	1000	7.20

Table 3: Acceptable values for pH, Conductivity and some Heavy Metals in water

Physical Parameters	Standard values
pH	6.5 – 6.8 (WHO)
Conductivity (µS/cm)	1000 (NDWQS)
Heavy Metals	WHO's permissible limits
Fe	0.30
Ni	0.02
Cu	0.05
Mn	0.1
Co	0.05

CONCLUSION

The study of literature and organization related to the environmental figures revealed that the heavy metals are exceeding the maximum admissible concentration in drinking water of different areas. The human digestive system, nephron-kidneys problems, and liver diseases are mainly due to contaminated water with heavy metals. Therefore, the analysis of water samples taken from unlike regions of District Harnai were analysed and the results obtained in this study were related with tolerable limits given by the World Health Organisation. It showed that the pH and conductivity of all the water samples are in the permissible limit set by WHO and NDWQS respectively. However, the conductivity of the sample taken from Zardalo has crossed the acceptable limit given by NDWQS. Similarly, it was also found that all the determined levels of selected heavy metals were within the range of standard values. However, the nickel was not found in water samples of District Harnai. Thus, it concludes that the water concerning areas of District Harnai is fit for drinking.

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