

Heavy Metals Detection in Drinking Water of Barkhan District, Balochistan, Pakistan

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Abstract

The concentration of Heavy Metals (HM) such as Iron (Fe), Manganese (Mn), Lead, (Pb), Cadmium (Cd), Chromium (Cr) and Nickel (Ni) in drinking water sources: tube wells, rivers and springs respectively in Barkhan District of Balochistan province, Pakistan have been reported in this study. The concentration of trace metals present in drinking water have been compared with that of the standard range provided by World Health Organization (WHO). The concentration of Pb is found to be higher in tube well water samples than in spring and river water samples followed by Cd, Iron and Mn respectively, whereas Cr & Ni values recorded lowest in range. In this review, the overall physicochemical parameter of drinking water resources of District Barkhan, Balochistan Pakistan have been reported. Furthermore, heavy metals and their concentration in these drinking water resources have also been reported.

Keywords: Heavy metals, drinking water, rivers, ground water, surface water, Barkhan.

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WATER, A PREREQUISITE FOR LIFE

Life without water is impossible. More than one billion people do not have access to fresh and hygienic drinkable water; about 672 million people inhabit rural areas, whereas 185 million people are drinking polluted water. Contaminated water is currently threatening the lives of approximately 2.8 billion people in 31 countries of the world ^[1]. The General Assembly of United Nations in 2015, while presenting the Sustainable Development Goals (SDGs) and developing the Millennium Development Goals (MDG), emphasised on the consumption of clean, safe and sanitation debris free drinking water. The sixth objective of the SDGs was to “ensure availability and sustainable management of water and sanitation for all”, with planned observation of the population percentage using carefully managed drinking water facilities ^[2].

DOMESTIC SOURCES OF DRINKING WATER

The basic drinking water foundations situated on domestic places are defined as boreholes or tube wells, piped water, sheltered bore wells, secure springs and precipitation respectively. In the developed countries, such facilities are regulated by ensuring that these foundations of drinking water are free from all sorts of organic and faecal impurities added into it by anthropogenic activities ^[3]. However, adverse conditions have been observed in the developing countries such as Pakistan. In Pakistan, a limited population of only 20% has access to safe pure hygienic drinking water, whereas the remaining 80% of the population consumes hazardous drinking water somehow or the other because of limited pure drinkable water resources available in the country ^[4].

SOURCES RESPONSIBLE FOR CONTAMINATION OF WATER

The primary source of contamination is sewerage ,i.e., fecal which is extensively discharged into drinking water supply system. Low quality water is a key source of waterborne disease and their spread^[5]. Provision of pure , contaminant free , hygienic drinkable water to the masses is a pre-requisite for good human health could be

ensured since pure drinkable water provides some basic elements that are important for life. Water contaminated by unwanted materials and anthropogenic actions could be dangerous for our health because of the fact that it could cause numerous diseases such as sicknesses, teeth decline, kidney problems, adverse generative problems, nervous problems, different cancers and heart diseases [6].

PHYSICOCHEMICAL PROPERTIES OF DRINKING WATER IN DISTRICT BARKHAN BALOCHISTAN, PAKISTAN

Domestic water being consumed in district Barkhan at different places contain heavy metals and the water possesses different physicochemical properties which are normally compared with those of the standard values approved by World Health Organization.

Odour, Taste, Colour of Water

Physical parameters such as Order, taste, colour are harmonizing in the valuation of quality drinking water. The presence of decaying organic matter and iron (Fe) in water causes change in odour, colour and taste. Any changes in taste of water could be due to the presence of inorganic metals such as Fe, Zinc, particularly when they increase than 0.004 mg/L and 4-9 Mg/L. (WRC web).

Temperature and pH of Water

The pH is the hydrogen ion concentration in a solution. The pH of domestic water consumed at district Barkhan normally ranges between 7.7-8.2. Temperature is at key point as all the chemical and metabolic reaction, gas solubility, taste and odour are effected by its increase and decrease. The temperature ranges between 14-23 °C in surface water samples, while in ground water it ranges between 15-25 °C. The difference of temperature or fluctuation in water temperature is probably because of microbial and chemical reaction [6].

Total Dissolved Solids (TDS)

Total Dissolved Solids (TDS) is the combination of dissolved minerals, inorganic salts and trace amount of organic matter in water solution [6]. The maximum value of total dissolved solids of all collected sample was 850 µ gram/L in ground water, whereas 578 µ gram/L in surface

water as in the range of Environmental Protection Agency (EPA) and WHO. The ideal drinking water has TDS level of below 300, while the water having TDS level of 150-1200 is said to be drinkable according to the recommendation put forth by Environmental Protection Agency and WHO.

Heavy Metals

The concentration of heavy metals such as Pb are reported to be higher in ground water sample than that of the World Health organization standard values for drinking water, while lower in surface water (spring and rivers). Cadmium concentration values are found higher as compared to those of Iron and Mn, while Cr & Ni have been reported as negative. The major source of water for drinking in Barkhan district is surface water and ground water. Scientist have estimated that ground water makes up 95% of all fresh water available for drinking purpose [7].

In ground water Cadmium (Cd) has a high concentration as compared to World Health Organization standard of drinking water in all samples. The hierarchy as follows : $0.0449 > 0.0375 > 0.0302 > 0.0274 > 0.0246 > 0.0201$ μ gram/L in ground water of Rakhni, Naharkot, Eshani, Barkhan, Baghow, and Rarkhan respectively.

The concentration of iron (Fe) is said to be below than that of the WHO criteria of water used for drinking in all areas of the district. The uppermost values of Iron was in Rarkhan valley (0.0201 μ gram/L) and lowermost in Rakhni i.e. (0.0118 μ gram /L). Manganese (Mn) concentration in ground drinking water is recorded below than that of the prescribed principles of WHO, the maximum range in Rankhni and minimum in Rarkhan i.e 0.0449 and 0.0356 μ gram/L respectively. Lead (Pb) contamination is reported to be very high in ground water.

(Mebrahtu & Zerabruk, 2011) . Nickel and Chromium are below than that of the quality guidelines of WHO in the district. Ni concentration is reported to be lower than that of Chromium in the district.

In surface water value of Cd has been recorded as highest (0.0382 μ gram/L) in Naharkot valley and lowest in Barkhan (0.0259 μ gram/L). The main reason of this fluctuation in concentration valued is because of the fact that the source of surface water is from earth

crust. Fe, Mn concentration have been reported as very low in all valleys of the district as compared to WHO guidelines. Lead has been reported to be the most toxic metal with a concentration range of (0.0201 μ gram/L) in Rakni valley and in Barkhan valley (0.0191 μ gram/L) respectively. The lowest concentration of Pb have been in Eshani valley [8].

The toxic risk of cadmium (Cd) in ground water is reported to be higher as per calculated health risk directorie. Furthermore the consumption of this water for agriculture farming, domestic use, livestock and fruit gardening may cause health problems and disorder amongst the inhabitants of the area. It has been revealed that the uppermost concentration of Cd in ground water is (0.0449 μ gram/ L) and in surface water is (0.0363 μ gram/ L) and the lower in ground and surface water respectively as (0.0201 - 0.0259 μ gram/ L).

Lead (Pb) is about 13 micro g/kg in crust of Earth. It is the most common heavy element. It naturally has many isotopes, including, ^{204}Pb , ^{206}Pb , ^{207}Pb and ^{208}Pb . Pb is present in tap water. The Pb is very poisonous element producing variety of effects at low dose. Mind destruction, kidney defective, reproductive difficulties, and gastric effects are seen from severe contact to high levels of lead in human being [9] [10].

CONCLUSIONS

General value of drinking water of Barkhan district is currently showing quite satisficing situation despite the enormous usage of fertilizer and chemical may cause the contamination of ground water. The physical parameter including taste, color, odour, pH, temperature have been reported and the surface water is found suitable for intake and other routine works; however, ground water contains higher Pb concentration, which is hazardous to human health. Further investigation is required to find out the far-reaching presence of Pb in ground water.

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