SURVEY OF HEAVY METALS (Fe, Cr& Cu) IN DRINKING WATERS OF MUSLIM BAGH AREA OF BALOCHISTAN.

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ABSTRACT: *To cater to the drinking water needs and the supply of water for agricultural activities in the Balochistan province demand the quality of water to be ascertained from time to time. In continuation of our previous work, the main objective of this study is to report the detailed facts of the presence of heavy metals (Fe, Cr, and Cu) pollution of drinking water by the effluents of Chromite ore processing in the proximity of Muslim Bagh in Balochistan.*

Keywords: Heavy Metals, Atomic Absorption Spectroscopy &Drinking waters

1. INTRODUCTION

Balochistan is the largest province of Pakistan considered to be short of public services like health facilities, nutritional facilities, hygienic, educational, portable water, and sewerage system. Balochistan is the province that has the lowest population and density rate as compared to other provinces of Pakistan.

The survey, this time, pivots around to determine the presence of heavy metals in the vicinity of the city Muslim Bagh previously called Hindu Bagh, of the district Killa Saifullah, Balochistan, Pakistan. The Muslim Bagh city has a population of 78,597 according to the census of 2017 remains short of drinking water like other areas in Balochistan.

Muslim Bagh and Kan Mehtarzai cities are prominent because of heavy snowfall and temperatures are about -7 C to -10 C, yet, short of drinking water

A general geological map of Muslim Bagh is given below in Fig.1:

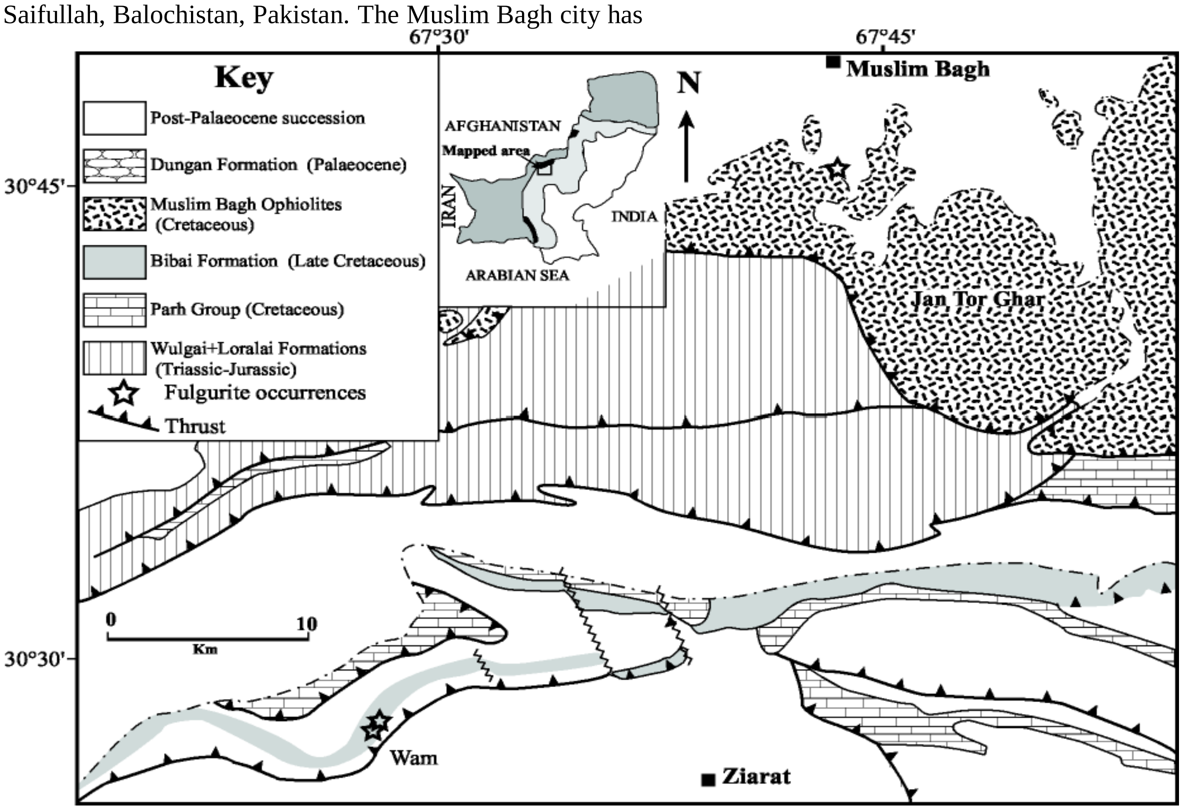

Fig.1. Geological map of Muslim Bagh

The lack of water mostly portable water has one of the greatest issues in the Muslim Bagh and its surroundings.

Pakistan faced high-level floods in 2010 in the history of the country and ten districts of Balochistan were affected out of thirty-one districts. In these districts, the water structures and resources were totally damaged by the flood. Hence, thousands of people were affected and used contaminated water unfit for human consumption. The restoration of damaged water structures and resources and the construction of new infrastructure was undertaken by the Government of Balochistan (GOB) and in collaboration with some international agencies like UNICEF. Furthermore, the United Nations International Children's Emergency Fund (UNICEF) received the relief of 1.6 million dollars from King Abdullah as a relief campaign for Pakistani Peoples (KARCPP) for rehabilitating seventy-six water supply projects in effected districts of Balochistan to step up the supply of drinkable water. United Nations International Children's Emergency Fund (UNICEF) also set the target to counter the scarcity of water after the flood. The agency rehabilitated and constructed one hundred and twelve various water supply schemes in the urban and rural areas of Balochistan and the King Abdullah Relief Campaign for Pakistani Peoples donated schemes to provide potable water to more than 116,000 affected peoples by flood via seventy-six restored portable water supply projects in ten affected districts of Balochistan.

Balochistan had the oldest systems of subsurface water which is known as Karez. The rainfall water is gathered in canals and ponds for human consumption under most unhygienic conditions. During prolonged dry spells, however, the canals are dried up resulting in a serious shortage of drinking water. Eventually, people carry out the digging of wells in search of subsurface water.

Furthermore, in the town of Muslim Bagh ten new tube wells were installed at a depth of 500 ft in collaboration with the King Abdullah Relief Campaign for Pakistani Peoples, UNICEF and the Public Health Engineering Department Balochistan further constructed water storage with the storage capacity of 100,000 gallons and 50,000 gallons respectively. Hence the restoration and newly constructed water storage tanks in Muslim Bagh increased the supply of water 350,000 gallons instead of 250,000 gallons.

The kind support of the UNICEF and the King Abdullah Relief Campaign for Pakistani Peoples with the association of Balochistan Public Health Department had managed to restore seventy-two safe portable water schemes in ten flood-affected districts of Balochistan. These schemes for the restoration of various water supply schemes have benefitted greater than 116,000 peoples have to access portable drinking water. These water supply schemes benefitted the rural women who before had to take water far-flung areas of the town and which was not fit for drinking.

It is pertinent to mention here that the Chromite is the potential source of Chromium which is commonly utilized commercially and plays a very important role in metallurgy as an alloying element. The huge deposits of Chromites are found in Muslim Bagh, Khanozai in district Killa Saifullah Balochistan. The Chromite reserves were also found in the mountainous range of Ras Koh and Wadh in district Khuzdar. When the regional reconnaissance surveys of the province were carried out by Vredenburg, then reserves firstly found in the Zhob district.

Chromite is widely mined by open-pit methods in Muslim Bagh, Ras Koh, and Wadh areas. Furthermore, underground mining is operated because of the podiform character of the Chromite.

Anthropogenic pressure and common process in surface water and sub-surface water quality-related to degradation

, suggested elsewhere[1]. In Ghana, the contaminated surface and subsurface water bodies have a gold mine community in Ghana [2-4]. In the Muslim Bagh mine areas, huge reserves of mine raw, ores stockpile, and wastes of rocks are massed around the plant life. The weathering of that exhausted wastes results in the liberation of harmful chemicals in the environment, particularly in aquatic bodies. Those dangerous metals free from mines tail include Hg, As, Pb, and Cd with others. Also in this study, heavy metals contamination with communities has been acknowledged [8-9]. Different applications of multi-variable static systems give the best ideas to understanding water quality to interpret the complex data set. Furthermore, a huge range of applications of various multi-variable static systems and sources have not fully adopted in surface and subsurface water studied in Muslim Bagh. The multi-variable static methods have been deeply adopted for assessment and source apportionment for checking water quality by the water bodies for ten years [10-12]. Therefore, data set on the surface and subsurface water in this study achieved from November 2015 from Bagh, Quetta, Balochistan.

The health and environmental interrelated issues become the main issues nowadays, and the Muslim Bagh area facing currently the severe issues regarding Arsenic and Chromium toxicity that contaminates the environments.

The chromium is the naturally occurring element found in soil, rock, and plants and the other source of chromium is the emission of chemicals, untreated, drained by industries. The chromium is basically found in the oxidation state in the ranges of chromium 2 to chromium 6. Naturally, it is a commonly found trivalent form. Every form of Cr has very toxic, while the hexavalent elements are too toxic than trivalent. Mostly, chromium is utilized in different industries, but hexavalent forms of chromates are widely used in industries especially in leather tanning. The biggest source of emission of chromium in the atmosphere cames from the wastes of tanning leather industries.

The toxic wastes openly affect the subsurface, surface water, air, and soil. Many people are affected openly and not directly with the waste of chromium from the industries.

The population of Muslim Bagh is dependent upon the subsurface water for domestic use like cooking and drinking purposes [13]. However, now the rural residents, mostly use basil leaves as an herbal medicine for different diseases like headaches and flue treatments. In recent days, the researchers are working hard to analyze the groundwater, soil, and herbals for determining arsenic toxicity in the rural areas of Muslim Bagh in Qilla Saifullah district.

The environmental researches by using Instruments Neutron Activation Analysis to determine the tracing and multi tracing elements. Pollutants have high potentials with relations to living beings' health and all elements concentrated with a traditional use for assessing the human health and environmental impacts.

A lot of other heavy metals like lead, chromium, zinc, cadmium, copper, and mercury have been a matter of serious concern if found in water for human consumption [14]. These metals are very vital and having the capability to lessen the productivity of crops because of the risk of bioaccumulation and magnification in the food chain and there are two risks of contamination in surface and subsurface water. The basic ideas of chemistry, environment, and health-related issues for these heavy metals are very important in knowing their bio-availability and necessary controlling chances. The destiny and transporting of heavy metals on topsoil layers depend on the chemical composition of the metals. Only in the soil heavy metals be absorbed with first rapid reactions followed by fewer adsorption reactions and further disseminated in various chemical compounds with different bioavailability, toxicity, and mobility [15-16]. The allocations are restricted with the reaction of heavy metals in the soil like that minerals precipitations and dissolutions, exchanges of ions, adsorptions, and desorption's, aquatic complexity, immobilization of biology, mobilization and plants up taking [17].

The following are the objectives of the study:

1) The natural and anthropogenic origination of contaminations in surface and subsurface water.

2) A possible source of contaminations,

(3) The assistance of probable source toward concentration of the explained characteristics in the Muslim Bagh area. The experimental work explains the data for the selected mines in Muslim Bagh that helps for assessing the height of contaminations while the mine effluents will discharge the wastes into the environment.

2. EXPERIMENTAL

Three samples have been obtained for chemical analysis by the standard methods [18] (APHA 1998). The collection of samples was so arranged as to make the samples the most representative of the whole study area. Samples were collected in 2.0 lit screw cap plastic containers. Specimens have been immediately obtained from the field and bring to the laboratory and maintained the temperature 4^0C. Analytical grade (A.R) chemicals will use in the preparation of reagents and standards. The concentrations of elements (Fe, Cr, and Cu) have been analyzed by Graphite Furnace Atomic Absorption Spectrophotometer and mercury concentrations were made and analyzed by *Atomic Absorption Spectrophotometer* (AAS). Also, the samples were measured on ICP and MS methods [19].

3. RESULTS AND DISCUSSION

Existence of heavy metals like iron, chromium, and copper in greater concentrations in subsurface water is able to cause bad effects on living beings and make the water unfit for drinking. The Chromite existing valley in Muslim Bagh, district Qilla Saifullah is very famous for its huge reserves of Chromite and considers richest areas for producing ninety percent chromite and nickel demands of the country [20]. Furthermore, this region is totally enclosed with ultrabasic rocks with bearing mineral deposits. The method of open cast mining is being used in this region for extracting the chromite ores.

The ores of Chromite and rocks waste are dumped in open land without knowing their impacts on the surroundings. During rainfalls, it is possible that the heavy metals can leach with surface water systems and subsurface water systems. In this region, the ultrabasic rocks are very weathered and metamorphism takes place for giving lateritic soil layer with a depth of above than twenty meters. The weathering of lateritic of ultrabasic rocks with secondary nickel concentrations have been taking place in various regions of the world. [21-24]. Banerjee [25] seen that the secondary dispersions patterns of chromium, nickel, and cobalt in the overburden of soil laterite. Chakraborty [26] has suggested that the nickel be out because of remaining weathering from primary minerals such as olivine, chromite, and precipitated in the profile of limonite within the acidic environment. James [27] revealed that the leaching and movement of metal by old mines tailing reserves from the subsurface water system. Meanwhile, Ibrahim [28] has revealed that the studies of acidic mines drainage by earth resistive measurement and he concluded that the contaminants in the aquifers systems. Various professionals explained that the geographical distributions of heavy metals concentrations in soils using statistic relation with properties of soil and usage of soil or derive the model for heavy metals parameter in soil, subsoil, and plant sections [29].

Recent studies carried out by Som and Joshi on [30] various profiles of many regions in Sukinda valley of nickel found in rich amounts. The researchers obtained rock specimens at various depths. From that profile, one sample is carried out in this study and obtained the results that the vertical profile shows a change in mineralogy. Nickel was reacted with derolite, nepouite, with little bit serpentinite. Nickel concentrated with limited in the topmost division of weathering column.

In this study, three specimens of water were obtained in the post-monsoon season and analyzed for different chemical compositions like chromium, iron, copper, and nickel by adopting the ICP MS technique [19].

The specimens of water were too measured for iron, copper, and chromium and their results are explained well in table 1 and fig. 2. The results cleared that the samples of water occur in the permissible limit and concentrations of iron found greater in subsurface water as well as Nala of Muslim Bagh. According to standards the needed limit of iron is 0.3 milligram per liter and max. Permissible limit is 1.0 milligram per liter. Meanwhile, if water found above these limits gives metallic taste and different colors. Furthermore, it is totally unfit for cooking and drinking purposes. The concentration of copper exceeds from 0.016-1.8 milligrams per liter than forty-three percent of specimens are in the limit of permissible. According to the Indian standards, the required limits of copper are 0.05 milligram per liter and the limit of permissible is 1.5 milligram per liter. The higher concentrations of copper in water effects digested system, kidney and liver problems and the sources are industries or mine wastes, because of that if the quantity of copper is higher in water than water is not safe for drinking. The fig.2 showing that the occurrence of copper in greater quantity in subsurface water very near to the mines of chromite in the post-monsoon season. Data as shown in Table-1 and Figure-2 below.

Table-1. The level (mg/l) of heavy metals in drinking water of Muslim Bagh

S.NO	Name of site	Fe	Cr	Cu
1	Muslim Bagh Market	1.00	1.00	1.00
2	Muslim Bagh bypass Qilla Saifulla	0.05	0.50	0.02
3	Muslim Bagh bypass Kanmehterzai	0.35	0.60	0.01

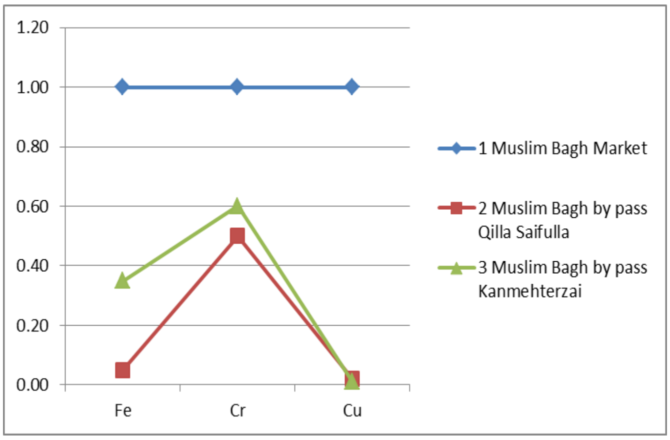

Figure-2 Level of heavy metals in milligram/ liter in portable water of Muslim Bagh

Furthermore, the amount of chromium differs from 0.002 to 0.39 milligram per liter in post-monsoon season and roundly twenty-eight percent of all specimens have been obtained above than the limit of permissible of chromium i.e. <0.05 milligram per liter in drinking water [31], and 0.012 to 0.451 milligram per liter pre-monsoon season. The higher amount of chromium from the limit in water gives allergy, ulcers, lung diseases, failure of the nervous system, and blood circulation system. Also, it effects on kidneys and liver. Hence, it indicates that the higher amount of chromium is found in subsurface water in different parts of the Muslim Bagh mines region.

4. CONCLUSION

The higher percent of copper, iron, and chromium have found in subsurface water which indicates that the water is not fit for drinking purposes. The surroundings of Muslim Bagh are highly affected with total dissolved and suspended solid particles in subsurface water and require a good process of filtration. Basic rock formations have been greatly metamorphosed and weathered gives laterite and limonite. Laterite occurs with a capping of different thicknesses and has less permeability, while subsurface water quality alarmed. The open spaces and cultivable lands have been prevented from contaminated water and it must be treated to minimize the percent of chromium.

5. RECOMMENDATIONS

- Further that the achieved results play a significant role in the awareness of living beings regarding the contaminated water with arsenic and chromium.
- Institutions should be established for the awareness and guidance of the public in the concerned areas of the chromite mines.
- Drinking water near the mines should be treated through purification plants before use by the public.

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