

Health risk estimation for the Chromium exposure in local population of Muslim Bagh, Pakistan

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ABSTRACT

The water fitness for the human consumption was the main focus of the study. The estimation of most likely responsible heavy metals was done in the drinking blood, water, and soil samples. The well know chromite hub in Pakistan is Muslim Bagh. The area contains more than 325 underground mines & open cast, about more than 100 chromite dumps and 11 chrome plants. This study is the first inclusive investigation of the heavy metal contamination in the blood, soil and water in the study area. The outcome of the results is a benchmark data for future studies. The extensive mining in the area directly affect the local population. The local population is highly under contamination threat and experiencing many diseases. This can be assumed that the chromium is the basic cause of such diseases. The amount of Ni, Co, As, Pb, and Cr in the drinking water and soil of the mining area was at very high level. The data obtained for its physiochemical properties and heavy metal contamination showed that the water is unfit for the human consumption. From the same area Questionnaire data was also collected and observed very low level of metal contamination awareness in the area population.

Keywords: heavy metal, health effect, huma exposure

INTRODUCTION

With increase in world population the contamination problems are also increasing. The heavy metal contamination is one of the biggest concerns of this time. These heavy metals reach the human body via different means including soil, water, and air. There are some essential metals like Fe, Mn, Ni, Cu, Zn and Co their limited quantity is very much important for different human body functions and healthy life. Some heavy metals like Hg, Cd, Pb, Cr, and As is toxic and carcinogenic in nature even in a lower ranges (WHO 2004, 2008, Samuel et al., 2008). The presence of such toxins leads to a serious health issue even to death (Zeeshaur and Ved 2019).

MATERIAL AND METHODS

Sampling was performed using random sampling method. The physicochemical parameters were tested using standard STM protocols. Different health parameters were calculated using reported methods. Analysis was performed using ICP-MS, ion selective electrodes, flame photometer, pH meter, conductometer, spectrophotometer.

RESULTS AND DISCUSSION

The scatter plot of water can be observed from the following figure 1

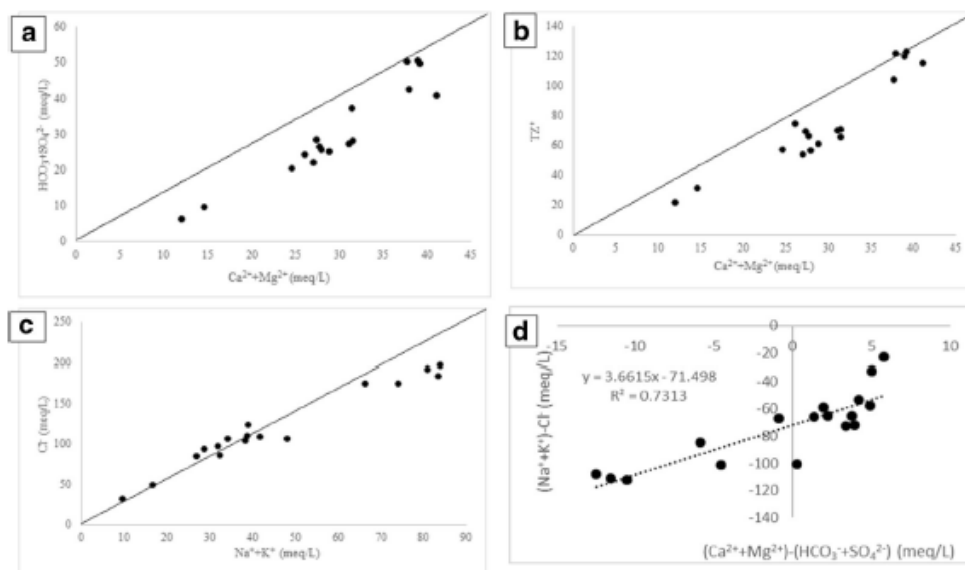


Figure 1. Scatter plot of different metals cause hardness in water.

Table 1. Hazardous quotation and chemical daily intake

Metal		Chemical daily intake (CDI)/mg kg day ⁻¹				Hazard quotient (HQ)/mg kg day ⁻¹			
		Mining area		Chrome plant		Mining area		Chrome plant	
		Children	Adults	Children	Adults	Children	Adults	Children	Adults
Cr	Ingestion	2.6×10^{-2}	2.8×10^{-3}	2.2×10^{-2}	2.3×10^{-3}	$5.1 \times 10^{+1}$	5.4E-00	$4.2 \times 10^{+1}$	4.5E+0
	Inhalation	$2.2 \times 10^{+1}$	1.2E+00	$1.8 \times 10^{+1}$	1.0	$4.3 \times 10^{+4}$	$2.0 \times 10^{+3}$	$3.6 \times 10^{+2}$	$2.0 \times 10^{+3}$
	Dermal contact	8.5×10^{-5}	3.7×10^{-4}	7.1×10^{-5}	3.1×10^{-4}	1.6×10^{-1}	7.2×10^{-1}	1.3×10^{-1}	6.0×10^{-1}
Co	Ingestion	2.2×10^{-3}	2.3×10^{-4}	2.4×10^{-3}	2.6×10^{-4}	$3.3 \times 10^{+1}$	3.5	$3.6 \times 10^{+1}$	3.9
	Inhalation	1.8	1.0×10^{-1}	2.1	1.2×10^{-1}	$2.8 \times 10^{+4}$	$1.0 \times 10^{+3}$	$3.1 \times 10^{+4}$	1.7×10^{-3}
	Dermal contact	7.1×10^{-6}	3.1×10^{-5}	7.9×10^{-6}	3.5×10^{-5}	1.1×10^{-1}	4.7×10^{-1}	1.2×10^{-1}	5.2×10^{-1}
Ni	Ingestion	2.4×10^{-6}	2.6×10^{-7}	2.0×10^{-5}	2.1×10^{-6}	4.0×10^{-3}	4.0×10^{-4}	3.2×10^{-2}	3.5×10^{-3}
	Inhalation	2.1×10^{-3}	1.2×10^{-4}	1.7×10^{-2}	9.5×10^{-4}	3.4	1.9×10^{-1}	$2.7 \times 10^{+1}$	1.5
	Dermal contact	8.1×10^{-9}	3.5×10^{-8}	6.5×10^{-8}	2.8×10^{-7}	1.3×10^{-5}	5.7×10^{-5}	1.1E-04	4.6×10^{-4}
Pb	Ingestion	1.0×10^{-5}	1.1×10^{-6}	2.8×10^{-5}	3.0×10^{-6}	1.1×10^{-1}	1.2×10^{-1}	2.9×10^{-1}	3.2×10^{-2}
	Inhalation	8.8×10^{-3}	4.9×10^{-2}	2.4×10^{-4}	1.3×10^{-3}	$9.4 \times 10^{+1}$	5.3E+00	$2.5 \times 10^{+2}$	1.4×10^{-1}
	Dermal contact	3.4×10^{-8}	1.5×10^{-7}	9.1×10^{-8}	3.9×10^{-7}	3.6×10^{-4}	1.6×10^{-3}	9.7×10^{-4}	4.2×10^{-3}

CONCLUSION

In this study, water and soil was found to be rich with contaminants particularly with Cr. The human health risk assessment for carcinogenic and non-carcinogenic were above the allowed limit.

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