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Physico-chemical Parameters and Trace Metals for testing of underground drinking water at Jalalpur- A Review

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ABSTRACT

Samples of underground drinking water were collected from ten different India Marks-II handpumps of public places at Jalalpur block of Jaunpur district (U.P.). These samples were collected during pre monsoon period of year 2021, following standard methods of sampling. For the assessment of underground drinking water contamination status of the ten different sites, following water quality parameters and trace metals were analysed: pH, TDS, Turbidity, Total hardness, Total alkalinity, DO, COD, BOD, Chloride, Fluoride, Ca, Mg, Fe, Mn, Pb, Ni, Cd, Zn, Cr. The data was compared with the drinking water quality standards prescribed by W.H.O.

Keyword

Physico-chemical parameters, trace metal, underground drinking water. India Mark-II handpump, pre-monsoon period.

INTRODUCTION

Water is rightly said as 'elixir of life'. Water covers about 70% of the earth surface, approximately 97.2% of it is saline, just 2.8% fresh. Potable water is available in almost all polluted areas of the earth; although it may be expensive and the supply may not always be sustainable. Sources where drinking water may be obtained include ground sources such as ground water, springs, aquifers surface water such as rivers, stream, glaciers etc. Husam Musa Baalousha (2017). Due to growth of population, agriculture and industries demand for domestic water has increased many times during the last few years. Improper waste disposal and over exploitation of resources has affected quality, not only of tap water, but also of ground water (V. Nigam 2013). The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. Different types of impurities are introduced in to aquatic system by different ways such as weathering of rocks and leaching of soils, dissolution of aerosol particles from the atmosphere and from several human activities, including mining, processing and the use of metal based materials. (Adeyeye 1994). Due to use of contaminated water, human population suffers from various water born diseases. It is therefore necessary to check the water quality at regular interval of time.

pH is an important physico-chemical parameter which give various information related to quality of water, basically it measures the acidity. Alkalinity is a measure of buffering capacity (ability to resist change in pH) of water; since P_H has a direct effect on organisms as well as indirect effect on the toxicity of other pollutants in the water, the buffering capacity is

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important to water quality. Turbidity is an important parameter for characterising water quality. In most of the waters turbidity is due to colloidal and extremely fine dispersions. TDS denotes mainly the various kinds of minerals present in water. In natural water, dissolved solids are composed mainly of carbonates, chlorides sulphates, phosphates and nitrates of Calcium, Magnesium, Sodium, Potassium, Iron and Magnese.

Trace metals ingested by human body beyond tolerance limit can have serve consequences for health. Prabhakaran at al, 2005; Mishra and Pitre 2005). Excess Iron concentration causes staining of clothes and utensils. Copper in higher amount increases corrosive. Action of water lead poisoning affects the central nervous system. Jalalpur is a small block in Jaunpur district situated at the bank of river 'Sai'. Its height from sea level is 87M above. Its longitude is 82.8326145 and latitude is 25.6026747. Industrialization, population growth and some other different human activities are playing their roles in multiplying level of underground drinking water contamination.

MATERIAL AND METHOD

Ten underground drinking water sampling sites at Jalalpur block of Jaunpur district (U.P.) were selected in order to study the physico-chemical characteristics and trace metals of water samples for Pre-monsoon period. All the ten samples were collected from India Mark-II (IM-II) handpumps. All the samples were collected and preserved following standard methods and procedures. A brief description of sampling sites is presented in table first. The different physico-chemical parameters were detected by suitable laboratory techniques. The different trace metals wore estimated for all the ten samples by 1 CP-AES technique using Varian Liberty II 1 CP-OES, made in Australia (APHA, 1998; Kirkbright and Sargant 1974).

Table: Brief Description of sampling sites

Site No. and Name		Location of Site	Type of Source	Depth of Boring Ft.	Use of Water
1.	Bayalasi Inter College	100m West to Jalalpur Chauraha	IM-II Hand Pump Complementary Source	120 (Approx)	Drinking
2.	Primary Health Center	1 Km. East to site no.-1	IM-II Hand Pump Complementary Source	110 (Approx)	Drinking
3.	Thana Jalalpur	500m East to site no.-2	IM-II Hand Pump Complementary Source	100 (Approx)	Drinking
4.	Near Sai River	1 Km. North to site no.-3	IM-II Hand Pump Complementary Source	100 (Approx)	Drinking
5.	Block Jalalpur	1.5 Km. West to Jalalpur Chauraha	IM-II Hand Pump Complementary Source	120 (Approx)	Drinking
6.	Primary School Pradhanpur	1 Km. South to site no.-5	IM-II Hand Pump Complementary Source	120 (Approx)	Drinking
7.	Samhat Veer Baba	1.5 km. East to Jalalpur Chauraha	IM-II Hand Pump Complementary Source	100 (Approx)	Drinking
8.	Jalalpur Station	1 Km. South to Site no.-7	IM-II Hand Pump Complementary Source	120 (Approx)	Drinking
9.	Tube Well Jalalpur	1.5 Km. South to Jalalpur chauraha	IM-II Hand Pump Complementary Source	120 (Approx)	Drinking
10.	Village Mahimapur	1 Km. South to site no.-9	IM-II Hand Pump Complementary Source	120 (Approx)	Drinking

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Table No.-1: Site wise estimated amount of different physico-chemical parameter with their W.H.O. Standards

Physical Chemical Parameter	Site No.										WHO
	I	II	III	IV	V	VI	VII	VIII	IX	X	
pH	7.28	7.67	7.46	7.38	7.41	7.48	7.33	7.41	7.25	7.08	7-8.50
TDS (ppm)	749	1911	1142	906	765	758	780	898	956	789	500
Turbidity	2.20	5.87	1.14	1.18	2.05	1.40	1.37	1.52	2.65	1.30	5.0
Total Hardness (ppm)	262	542	312	260	248	180	284	27.4	320	218	100 ppm
Alkalinity	272	392	292	282	254	262	276	278	254	236	100 ppm
DO (ppm)	1.4	1.7	1.6	1.5	1.3	1.3	1.3	1.4	1.5	1.3	5.0 ppm
COD (ppm)	6.5	7.2	6.98	6.85	6.7	6.7	6.72	6.80	6.82	6.75	10.0 ppm
BOD (ppm)	5.8	6.0	5.9	5.6	5.7	6.0	5.5	5.4	5.2	5.1	6.0 ppm
Chloride (ppm)	112	432	162	88	86	86	124	116	114	76	250 ppm
Fluoride (ppm)	0.28	0.59	0.36	0.17	0.07	0.07	0.31	0.30	0.28	0.02	10 ppm

Table No.-2: Site wise estimated amount of different Trace Metal with their W.H.O. Standards

Trace Metal	Site No.										WHO
	I	II	III	IV	V	VI	VII	VIII	IX	X	
Ca (ppm)	52.80	41.60	45.60	48.80	49.60	36.80	36.0	37.60	38.40	50.40	100 ppm
Mg	32.50	109.50	49.50	34.50	31.00	22.00	48.50	45.00	50.00	23.00	30 ppm
Fe	1.15	2.0	1.45	1.16	1.14	1.10	1.35	1.25	1.80	1.10	0.50 ppm
Mn	<0.02	0.06	0.045	<0.02	<0.02	<0.02	0.044	0.043	0.05	<0.02	0.10 ppm
Pb	nd	0.10	0.04	nd	nd	nd	<0.02	<0.02	0.05	nd	0.10 ppm
Ni	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05 ppm
Cd	<0.02	0.04	0.03	<0.02	<0.02	<0.02	0.03	0.03	0.04	<0.02	0.05 ppm
Zn	2.1	2.9	2.1	2.3	1.8	1.0	1.2	2.2	2.5	1.2	5.0 ppm
Cr	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.05 ppm

nd = Not Detectable

RESULT & DISCUSSION

Water sample of the study areas were colourless clear and did not have any specific or characteristic odour. The pH of the underground drinking water samples lies within the range 7.08-7.67. The maximum PH value was observed at site No- II (Primary health centre). The PH values of all the samples were within the W.H.O. permissible limit (7.0-8.5). Total dissolved solids were observed within the range of (758-1911 ppm). Maximum value of TDS was recorded at site no.- II (primary health centre). All the samples were exceeded the maximum permissible limit of WHO which is 500 ppm. The alkalinity was recorded above the 250 ppm at almost all the ten sites. The maximum permissible value of W.H.O. for underground drinking water is 100 ppm. Water hardness is indicated by sum of Polyvalent cations soluble in water. Calcium and Magnesium are the most common cations, although

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Mn, Fe, and Sr may also contribute. The hardness was recorded in the range of (180-542 ppm). The maximum hardness was observed at site no.-II.

The data for trance metals obtained from ten different sites with their W.H.O. standards are enlisted in table-2 (W.H.O., 1971). The analysis of data enlisted in table-2 reveals following facts regarding the level of trace metals in underground drinking water at Jalalpur block of Jaunpur district. The observed range of Fe concentration at all the ten sites is 1.10 – 2.0 ppm. The maximum permissible limit of WHO for iron concentration is 0.50 ppm.

The concentration of Zn is found to be somewhat deficient at all the ten sites. The underground drinking water was found to be uncontaminated with chromium, Nickel, lead and cadmium at almost all the ten sites of study.

CONCLUSION

On the basis of above discussion, it may be concluded that the physico-chemical parameters are found to be within the permissible range of W.H.O. standards, except TDS, Total hardness and alkalinity. The underground drinking water was found to be uncontaminated with toxic trace, metals namely chromium, Nickel, Lead and Cadmium at almost all the ten sampling sites. The concentration of Zn in is not sufficient according to permissible limit of W.H.O. The underground drinking water of Jalalpur block was found to be severly contaminated with Fe (Iron) invariably at all the ten sites. With respect to physico-chemical parameters and trace metals, the underground drinking water of site no-II (Primary health centre) was found to be most contaminated. Water pollution occurs when a body of water become contaminated usually by chemicals or micro organisms. Water pollution can cause water to become toxic to humans and the environment.

A strong relationship between contaminated drinking water with trace elements and the incidence of chronic diseases such as renal failure, liver cirrhosis, hair loss and chronic anemia has been documented.

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