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Physico-Chemical Analysis of Drinking Water Quality of Balh Tehsil, District Mandi Himachal Pradesh, India.

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Abstract

Physico-Chemical Parameters were used to illustrate the drinking water quality of ten water samples collected from five different locations of Tehsil Balh, District Mandi. Various Parameters such as colour, pH, odour, temperature, turbidity, conductivity, total dissolved solids, total suspended solids, total hardness were analyzed for each water sample adopting standard procedures suggested by the American Public Health Association (APHA). Results then compared with Indian Standard Drinking Water Specification IS: 10500-2012.The values observed for each parameter for different water bodies was found to be within the specified limits and therefore found suitable for human consumption.

Keywords: Balh Tehsil, water quality parameters, handpump water, tap water, physico-chemical parameters.

Introduction:

Water is one of the most important and precious natural resource [Ondor, S.T.; Addo, K.K.,2013]. It is essential of all living organisms from the simplest plants and microorganisms to the most complex living system known as human body [Sharma et al.2018]. Water a combination of hydrogen and oxygen atoms, with a chemical formula, H_2O is known to be the most abundant compound (71%) on earth surface [Reda, A.H.,2016, Upadhyay, M.; Chawla J.K,2014]. It is significant due to its unique physical and chemical properties [Onifade, A.K; Ilori, R.M,2008]. Water is very important gift of nature to all living things. A life without water

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cannot be imagined. Water is vital to our body system. We entirely depend upon water. Water is an important and essential chemical component in our body, comprising 60% of our body weight. Fresh water is essential for agriculture, industry, power generation, domestic and household purposes. The development of all living things is impossible without good quality and sufficient quantity of water[Kumar, N,1997]. Water covers 71% of earth's surface in the form of seas, oceans, rivers, wells, lakes, ponds etc. Nowadays pollution of fresh water resources has become a global problem. The pollution enhances bad taste, colour, odour, turbidity and causes hardness and frothing of water. It also increases the corrosive action of water towards different metals and alloys [Vollenweidre R.A.,1998]. Ground water is less susceptible to contamination as compared to surface water [Zaman, G.L.,2002]. Groundwater is one of the most abundant and valuable natural resources in India and is mostly used for domestic and irrigation purposes in rural as well urban areas[Chakraborti et al.,2011, Swarnendu, A.D. et al.,2020]. For the huge growing population in India, the demand of freshwater is increasing day by day as result the amount of groundwater being in a critical condition. Also India is the largest user of groundwater in the world [World Bank, 2012].

Various water samples were taken from different locations. The samples were analyzed for their physico-chemical parameters. The results were compared with drinking water standards of Bureau of Indian Standards (IS: 10500) and World Health Organisation Standards (WHO 2011) [Karthika, I.N.et.al,2018].

2. Study Area:

Mandi district is very populated and is located centre of Himachal Pradesh. Balh**,** a Tehsil of District Mandi, Himachal Pradesh, India is located 14 Km towards South from District Head Quarter Mandi, 69Km from State Capital Shimla towards South. It is in the 1189 m elevation (altitude). It is a beautiful valley across the Baggi Canal originated from Pandoh Dam. This valley is located at an elevation of 800m above sea level in Shivallik Hills. The valley stretches from Gutkar in North to SunderNagar in South, Baggi in East to Gumma in West. The maximum temperature in mandi district is reported as about 42 ^{0}C. In the present study Balh Tehsil is selected to analyze the quality of drinking water of IPH water supply and handpump water of 5 sampling sites.

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3. Materials and Methods:

All Drinking Water Samples of five sampling sites were taken from public tap and hand-pump sources. Samples were collected during morning hours in the summer season in pre-cleaned polythene bottles having capacity of 2 liters with precautions. Bottles were properly washed with deionised water before use. After sample collection bottles were tightly stoppered and labeled against their location and sources. Collected water samples were analyzed for the following physicochemical parameters such as colour, pH, odour, temperature, turbidity, conductivity, total dissolved solids, total suspended solids and total hardness. Standard methods of APHA, 2012 for physico-chemical quality parameters were followed for analysis of samples in laboratory.

Table 1: Sampling Sites of Balh Tehsil, Distt. Mandi, Himachal Pradesh, India

S.No.	Source of water Sample	Sampling location	Samples
1	Tap Water	Abhilashi campus Nerchowk	S-1
2	Handpump	Abhilashi campus Nerchowk	S-2
3	Tap Water	Near Govt.Sr.Sec. School Bhagrotu	S-3
4	Handpump	Near Govt.Sr.Sec. School Bhagrotu	S-4
5	Tap Water	Near Govt.Sr.Sec. School Kanaid	S-5
6	Hand-pump	Near Govt.Sr.Sec. School Kanaid	S-6
7	Tap Water	Near Bus Stop Lohara	S-7
8	Hand-pump	Near Bus Stop Lohara	S-8
9	Tap Water	Near Govt. Hospital Rati	S-9
10	Hand-pump	Near Govt. Hospital Rati	S-10

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4. Results and Discussion

The respective observed value of physico-chemical parameters of all tap water and hand-pump water of Balh Tehsil, Distt.Mandi were illustrated in Table-2. All the results are compared with desirable and permissible limit recommended by Indian Standard Drinking Water Specification IS: 10500-2012.depicted in Table-3. Statistical parameters of tap water and Hand-pump water of Balh Tehsil, Distt. Mandi are summerised in Table 4.

Colour: The colour of drinking water results from the presence of organic substances (humic and peat materials [APHA et.al 2012], metals(Fe,Mn) or industrial waste[WHO,1984]. The present investigation reveals that all the water samples are found to be colourless.

pH: The pH of any aqueous system is the negative logarithm of hydrogen ion concentration more precisely hydrogen ion activity. It is the measure of the acidic and basic content of water. [Gupta, D.P.; Saharan J.P.,2009]. pH is measured on scale of the range 0-14.Water with pH value 7.0 means neutral, pH value less than 7.0 means acidic whereas pH above 7.0 it is alkaline. pH value is measured by pH meter. The present investigation reveals pH of the water samples are found to be in between 6.95-7-05.

Odour: Odour in potable water is indicative of pollution of water source, contamination of seepages, water treatment and distribution supply materials. [Michael J.S.,1982] The present investigation reveals all the water samples are found to be odour free.

Temperature : Temperature is a critical water quality parameter which directly affects the chemical reactions and the amount of dissolved oxygen available for aquatic organisms.[Kataria ,H.C,1996] The temperature of water samples carried out by using thermometer. The maximum permitted standard of drinking water is 25°C [Khalid ,A,2011, Haruna, R.,2005]. The present investigation reveals that temperature of hand-pump water supply is 22.2 and for IPH water supply is 24.4 in summer season.

Turbidity: The degree to which water loses its transparency exposed in light scattering and light absorption due to the presence of suspended particulate matter is termed as turbidity. Turbidity is measured by using Nephelometer. In the present investigation turbidity of all the water samples are found to be 1 NTU.

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Conductivity: Pure water does not conduct electricity. Higher the concentration of electrolyte in water, higher is its electrical conductivity. Electrical conductivity of water is affected by temperature and hence temperature is reported while measuring conductivity. The international standard temperature at which conductivity measurements are corrected is 25^0 C. The conductivity is measured in microsiemens per centimeter (μS/cm) at 25^0 C. In the present investigation, maximum and minimum conductivity for tap water was 312 mg/l and 251 mg/l and for handpump water 616 mg/l and 285 mg/l.

Total dissolved solids (TDS): Solids refer to matter dissolved or suspended in water. Solids may effect on water quality adversely in a number of ways.The TDS of all water samples were carried out at room temperature by using TDS meter. After each measurement, the TDS meter was washed with distilled water and was cleaned with tissue paper. In the present investigation, maximum and minimum TDS for tap water was 349 mg/l and 220 mg/l and for ha water 531 mg/l and 228 mg/l.

Total Suspended Solid(TSS): Solid in water refers as matter dissolved and or suspended in water. Total solid is the measure of all kinds of solids i.e. dissolved suspended and volatile solids. Total solid is determined as the residue left after evaporation at 105^0 C of the unfiltered water sample .The residue consists of Total Suspended Solid (TSS) and Total Dissolved Solid(TDS). In the present investigation, TSS for tap water was found to be 0.2 mg/l and for hand-pump water 0.4mg/l.

Total Hardness (TH): Hardness of water is the ability of water to precipitate soap. Total hardness of water samples were carried out by using titration method with EDTA solution. In the present investigation, maximum and minimum total hardness for tap water was 240mg/l and 90 mg/l and for handpump water 360 mg/l and 140 mg/l.

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Table2: Analysed Data of drinking water samples of Balh Tehsil, Distt. Mandi, Himachal Pradesh, India

S.No	Parameters	Unit	IPH water supply					Hand-pump water supply				
			S-1	S-3	S-5	S-7	S-9	S-2	S-4	S-6	S-8	S-10
1	Colour	Hazen	-	-	-	-	-	-	-	-	-	-
2	pH	-	6.96	7.05	6.98	6.98	6.96	6.96	7.02	6.97	6.95	6.95
3	Odour	TON	-	-	-	-	-	-	-	-	-	-
4	Temperature	^{0}C	24.1	24.4	24.3	24.4	24.1	22.6	22.3	22.3	22.3	22.2
5	Turbidity	NTU	1	1	1	1	1	1	1	1	1	1
6	Conductivity	µS/cm	312	293	387	251	308	460	497	285	616	371
7	TDS	mg/l	274	257	349	220	268	404	426	228	531	320
8	TSS	mg/l	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.2	0.4	0.4
9	**Total hardness**	**mg/l**	**130**	**120**	**240**	**90**	**124**	**280**	**320**	**140**	**360**	**242**

Table 3 : Standards values of drinking water (BIS: 10500-1991)

S.No	Parameters	Desirable Limit	Permissible Limit	Unit
1	Colour	5	15	Hazen
2	pH	6.5-8.5	No Relaxation	----------
3	Odour	Agreeable	Agreeable	TON
4	Temperature	----------	----------	^{0}C
5	Turbidity	5	10	NTU

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6	Conductivity	----------	----------	µS/cm
7	TDS	500	2000	mg/l
8	TSS	----------	----------	mg/l
9	Total hardness	300	600	mg/l

Table 4: Statistical data of drinking water samples of Balh Tehsil Distt. Mandi, Himachal Pradesh, India

S.No	Parameters	Unit	Minimum	Maximum	Average
1	Colour	Hazen	-	-	-
2	pH	-	6.95	7.05	6.98
3	Odour	TON	-	-	-
4	Temperature	0C	22.2	24.4	23.3
5	Turbidity	NTU	1	1	1
6	Conductivity	µS/cm	251	616	378
7	TDS	mg/l	228	531	333.67
8	TSS	mg/l	0.2	0.4	0.28
9	Total hardness	mg/l	90	360	204.6

Conclusion:

In the present study, ten water samples of Balh Tehsil ,District Mandi Himachal Pradesh were assessed for their physico-chemical parameters. The result revealed that all the parameters i.e. Colour, pH ,odour,Temperature , Turbidity, Conductivity, TDS, TSS and Total Hardness of water samples are within permissible limits of BIS: 10500-1991. The results reveals that all the water samples are found fit for drinking purpose.

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