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Research Paper

QUALITY ASSESSMENT OF MUNICIPAL SUPPLIED WATER FOR DRINKING PURPOSE, DISTRICT HARIDWAR, UTTARAKHAND, INDIA

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Abstract

This research paper examines the fitness of municipal supplied water for drinking purposes of Haridwar district of Uttarakhand, India. Samples from five different sites were collected in the month of January to April 2015. The physio-chemical and biological data was analyzed with reference to IS: 10500:2012. During the study period various water quality parameters were analyzed viz, Odour, color, taste, conductivity, pH, turbidity, TDS, chloride, alkalinity, total hardness, calcium hardness, magnesium hardness, residual free chlorine, nitrate, iron, FC and TC. Among these parameters Alkalinity and Total Hardness $CaCO_3$ were found higher and recorded as 229.6±16 and 314±100 respectively which is beyond the Acceptable limit of IS: 10500-2012 at all the sampling sites. The present study concluded that the Alkalinity and Total Hardness $CaCO_3$ in water sample were above the Acceptable limit and below to the desirable limits of IS: 10500-2012 and rest all other parameters were within the limits.

Key words: Municipal supplied water, physio-chemical and biological and drinking water quality.

INTRODUCTION

Water is significant and fundamental element for our life-support system. In Haridwar and Dehradun districts of Uttarakhand state municipal supplied drinking water plays an important role as these districts enormous increasing population growth. Municipal supplied water forms the major source of water supply for drinking purposes in most parts of India. It is safe drinking water in urban areas, where the population is densely situated and the underground water does not exist, contaminated or water table found at low depth. With rapid increase in population and growth of industrialization, municipal supplied water quality is being increasingly threatened by demanding more and more water supply. The Haridwar district of newly created state of Uttarakhand has posed many challenges for the planners and policy makers because the strength of population and pilgrimages population pressures constantly affecting the water supply. It is notable that the two most populated districts of Uttarakhand i.e. Haridwar and Dehradun, contribute about 40% of the total rural and urban population of Uttarakhand and facing a big pilgrims, industrialization and urbanization problems. A large part of the state of Uttarakhand lies in the hills, where distribution of drinking water supply and its quality is a major problem needing immediate attention. In hills about more than 50% of the population of Uttarakhand region depends upon the natural springs for their daily water demand. However, due to population pressure, unplanned construction, garbage disposal and change in land use patterns, the water of these springs is becoming contaminated besides declining the discharge

of these springs. In context of the above scenario, an attempt has been made to analysis the quality of municipal water supply Haridwar District of Uttarakhand State (India). This study will provide a proper basis for legal management of municipal water supply schemes in this region. The data has been analyzed with reference to IS:10500:2012.

METHODOLOGY

Study area

The present study was conducted in Haridwar urban area the geographic coordinates of Haridwar district of Uttarakhand , India is Latitude: 29°56′52″ N Longitude: 78°09′36″ E Elevation above sea level: 295 m = 967 ft. The State of Uttarakhand is primarily a mountainous and terai region, consisting of thirteen districts of predominantly hill areas and lies from 200 to 7,800 m above mean sea level. The geo- graphical boundary of the state goes with Tibet in the north, Himachal Pradesh in the west and the north-west, Gangetic plains of Uttar Pradesh in the south and Nepal in the east. District Haridwar is situated in the Lower Himalayan range or in Shiwalik Himalaya and is located at average elevation of 2,084 m.

Collection of sample and their analysis

A total five municipal supplied water sampling sites including 20 samples from different five sampling sites of District Haridwar (Fig.-1 and table-1) during the January to April- month in the year 2015 (IS 10500 : 2012). The taps were continuously run prior to the sampling, to ensure municipal supplied water to be sampled was representative of municipal supplied water. The water samples for analysis were collected in plastic bottles and preserved by adding ultra pure nitric acid (5 ml/l) while samples for bacteriological analysis were collected in sterilized bottles covered with aluminum foils. All the samples were stored in sampling kits and brought to the laboratory for detailed chemical and bacteriological analysis. The physico-chemical analysis was performed following standard methods (APHA 1998 and IS:10500:2012). Total coliforms were determined by multiple tube fermentation technique using MacConkey broth. The collected water samples were inoculated into three sets of tubes each containing 10 ml MacConkey broth and 10, 1, and 0.1 ml each of water samples. All the tubes were incubated at 37 ^{0}C for 24 to 48 h. After incubation, all the tubes were observed for acid and gas production. The production of acid and gas indicates the presence of coli forms and is an indicative of positive test. Fecal coli forms were determined by multiple tube fermentation technique using EC medium at an incubation temperature of 44.5C.

RESULTS AND DISCUSSION

During the study period various physio-chemical municipal supplied water quality parameters like Odour, color, taste, conductivity, pH, turbidity, TDS, chloride, alkalinity, total hardness, calcium hardness , magnesium hardness, residual free chlorine, nitrate, iron FC and TC were analyzed. Color contamination of water bodies is caused by metals, dye pollution, soil particles, and by the occurrence of water bloom. Offensive odor and taste of water are caused by metals and by microorganisms that produce musty odors, Fujimoto (2000). As per study the physical parameter Odour is agreeable, color is colorless and taste is also agreeable of different sampling sites within acceptable limit of IS:10500:2012. The conductivity of sampling site of the study area of Haridwar was found an average 483.6±140µmhos/cm. This is within permissible limit at all the sampling sites, similarly Kamboj *et.al,.* (2013) recorded the value of conductivity of water samples. As per study the average pH of different sampling sites was 7.062±223 which are within acceptable limit. Highest value (7.36) of pH was found at the S5 site while the minimum value was found at the 6.75site S3. Similar values trend have been observed by many other researcher (Fakayode 2005). It is very important to measure the turbidity of domestic water supplies, as these supplies often undergo some type of water treatment which can be affected by turbidity. High turbidity can quickly block filters and stop them from working effectively. High turbidity will also fill tanks and pipes with mud and silt, and can damage valves and taps. Where chlorination of water is practiced, even quite low turbidity will prevent the chlorine killing the germs in the water efficiently Kamboj *et.al,.* (2013). The turbidity of samples site of the study area of Haridwar was found to be an average 0.1±370 NTU. This is within the

permissible limit. Total dissolve solids (TDS) refers to matter suspended or dissolved in water or waste water with high content is inferior and may be polluted. In study it was found that the (TDS) of municipal supply water of Haridwar area average TDS is 373±110. Highest value 523 mg/l found in S4 site while the minimum value (239 mg/l) was found at the s2 site respectively. At the sampling site S4 recorded vale was found above the acceptable limit that of 500mg/l which may because of high concentration of dissolve solids (TDS) in water causes adverse effect in taste. Similarly, Alewunmi (2009) recorded the value of TDS and concluded that the various sources like household wastes effects the quality of surface and underground waters. High concentration of Chloride ions results in objectionable taste in water as per study it was found that the chloride level in water samples were found 21.86±2 mg/l, within the acceptable limits of IS:10500-2012 (250 mg/l). Highest value (26mg/l) of chloride was found at the S2 while the minimum value (19 mg/l) was found at the S4. Pathnaik *et al.* (2002) had observed that the chloride concentration was varied from 66 mg/l to 1250 rng/l. The alkalinity range of water in different samples in around Haridwar municipal supply water were found higher and recorded as 229.6±16.211. Highest value (249 mg/l) of alkalinity was found at the S4 while the minimum value (210 mg/l) was found at the S5. Which is beyond the acceptable limit but within the desirable limits of IS: 10500-2012 at all the sampling sites. Alkalinity in water comes from calcium carbonate, CaCO3, being leached from rocks and soil. As per study the average total hardness was found 314±100. Highest value (448 mg/l) of Hardness was found at the S4 while the minimum value (188 mg/l) was found at the S2. Which is beyond the Acceptable limit but within the desirable limits of IS: 10500-2012 at all the sampling sites. Mor *et at.* (2006) carried out a study observed that total hardness present in water was in the range 0296 *mg/l* to 1388 mg/l. Shiddamallayya and Pratima (2008) carried out a study on physico-chemical parameters of tank water in Bhalki town of Bidar of various parameters and hardness of water and find out the great increase in all the parameters due to the various activities of urban areas.

During the study period calcium hardness was recorded 263.8±92. Highest value (387 mg/l) of calcium hardness was found at the S4 while the minimum value (148 mg/l) was found at the S2 which is within the Acceptable limit. In the study magnesium hardness was also analyzed and was observed 51±8. Highest value (61 mg/l) of magnesium hardness was found at the S4 while the minimum value (40 mg/l) was found at the S2. This is within the Acceptable limit. Chaurasia *et.al,.* (2014) also found higher values of calcium and magnesium hardness in the water samples. The value of calcium was found from 31 mg/I to 151 mg/I below the permissible limit of 2 00 *mg/l* of B IS in the study area. During the study period the residual free chlorine and iron was also analyzed but not detected in any sample. High concentration of Nitrite causes Methemoglobinia (blue baby) in infant's as per study the concentration of Nitrite was found 1.12±0.2. Highest value (1.52 mg/l) of Nitrate was found at the S5 while the minimum value (0.89mg/l) was found at the S2. This is within the Acceptable limit. The concentration of nitrate was found in water sample upto 54 mg/l .Chaurasia *et.al,.* (2014) also observed Total hardness; Calcium & Magnesium were also higher than permissible limit. Public water systems are required to deliver safe and reliable drinking water to their users. If the water supply becomes contaminated, users can become seriously ill. Water pollution caused by fecal contamination is a serious problem due to the potential for contracting diseases from pathogens. If coliform bacteria are present in your drinking water, your risk of contracting a water-borne illness is increased. Although total coliform can come from sources other than fecal matter, a positive total coliform sample should be considered an indication of pollution in your water. Positive fecal coliform results, especially positive *E.coli* results, should be considered indication of fecal pollution in your water (Choudhary *et al.* 2014). During the analysis the Fecal coliform and Total coliform was absent a negative total Coliform sample considered an indication of pollution free municipal supplied water.

CONCLUSION

It was concluded that the municipal supplied water for drinking purposes samples analyzed from different sites were collected in the month of January to April 2015 and the value of Alkalinity and Total Hardness $CaCO_3$ in water sample were above the Acceptable limit of IS:

10500-2012 and rest all other parameters were within the Acceptable limits. Most alkalinity in surface water comes from calcium carbonate, $CaCO_3$, being leached from rocks and soil. Alkalinity is as dangerous as acidity because they both cause nutritional imbalance. Alkalinity increases the risk for developing chronic disorders and produces a variety of symptoms, such as headaches, nausea, diarrhea, and more. Thus there is a need of scientific management of municipal supplied water for drinking purposes and the regular monitoring of the supplied water.

Table-1: GPS COORDINATE OF EACH SAMPLING SITE

site	Location	latitude	Longitude	elevation	Source	Water uses
S 1	**Hari ki pauri**	29^{0}57'18.36"N	78^0 10'31.61" E	11.95	Municipal supply water	Domestic + Drinking
S 2	**Ranipur more**	29^{0}55'53.05"N	78^0 08'33.62" E	11.96	Municipal supply water	Domestic + Drinking
S3	**Jagjeetpur**	29^{0}55'05.26"N	78^0 08'13.70" E	11.30	Municipal supply water	Domestic + Drinking
S4	**Bhagawatipuram**	29^{0}55'06.90"N	78^0 07'54.55" E	11.29	Municipal supply water	Domestic + Drinking
S 5	**G. K. university**	29^{0}55'24.98"N	78^0 07'34.89" E	11.33	Municipal supply water	Domestic + Drinking

TABLE -2: AVERAGE DETAILS OF SAMPLING POINTS HARIDWAR

Parameters	**Sampling sites**					**Average +Standard deviation**	**Permissible Limit (IS10500-2012)**	
	S 1	**S 2**	**S 3**	**S 4**	**S 5**		**Acceptable**	**Desirable**
Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	**Agreeable**	Agreeable	agreeable
Colour	Colorless	Colorless	Colorless	Colorless	Colorless	**Colorless**	5 Hazen	15 hazen
Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	**Agreeable**	Agreeable	Agreeable
Conductivity (µmhos/cm)	480	358	704	512	364	**483.6±140.9567**	-	-
Ph	6.97	7.18	6.75	7.05	7.36	**7.062±223**	6.5-8.5	No relaxation
Turbidity (NTU)	0.1	0.1	0.1	0.1	0.1	**0.1±370.1**	1NTU	5NTU
TDS (mg/l)	307	239	434	523	363	**373±110.264**	500 (mg/l)	2000(mg/l)
Chloride (as Cl), mg/l,	21.3	26	23	19	20	**21.86±2.756**	250(mg/l)	1000(mg/l)
Alkalinity mg/l,	217	231	241	249	210	**229.6±16.211**	200(mg/l)	600(mg/l)
Total Hardness $CaCO_3$ (mg/l)	260	188	372	448	306	**314±100.216**	200(mg/l)	600(mg/l)
Calcium Hardness as $CaCO_3$ (mg/l)	214	148	321	387	249	**263.8±92.945**	-	-
Mg Hardness as $CaCO_3$ (mg/l)	46	40	51	61	57	**51±8.396**	-	-
Residual free chlorine	ND	ND	ND	ND	ND	**ND**	0.2(mg/l)	1.0(mg/l)
Nitrate (mg/l)	1.20	0.89	1.12	1.35	1.52	**1.12±0.2378**	45(mg/l)	No Relaxation
Iron s(mg/l)	ND	ND	ND	ND	ND	**ND**	0.3	No Relaxation
Fecal coli form	Absent	Absent	Absent	Absent	Absent	**Absent**	Shall not be detectable in any 100 ml sample	
Total coli form	Absent	Absent	Absent	Absent	Absent	**Absent**	Shall not be detectable in any 100 ml sample	

REFERENCES

1. Alewunmi, O. A., Ololade, I.A. and Adeleye, A. (2009). Effects of household wastes on surface and underground waters. I.J. Phy. Sci. 4(1): 22-29.

2. APHA (1998): In: *Standard methods for the examination of water and waste water.* American public health Association, 20th edition Fifteenth Street. NW, pp (1.1) - (10-150).
3. Chaurasia, S., Karan, R. and Nandini (2014) Assessment of ground water quality (hand pump) for some selected primary school in tehsil Atarra, dist. Banda U.P. *International Journal of Engineering, Science and Mathematics 3(4): pp 105-114.*
4. Choudhary, M., Paul Chinmoy and Kamboj, N. (2014). Potable water is a serious Environmental issue: A special study on Umiam area, of RI-Bhoi District, Meghalaya, India. *International Research Journal of Environmental Sciences,* 3(9): 37-42.
5. Fakayode, S.O. (2005). Impact Assessment of Industrial Effluents on Water Quality of the Receiving Al.aro River in Ibadan. Nigeria.*Ajeam-Ragee,* 10: 1-13.
6. Fujimoto, N. (2000) physical mechanical contamination of water, water quality and standards – vol. ii - Physical/Mechanical Contamination of Water
7. Kamboj, N. and Choudhary, M. (2013). Impact of Solid Waste Disposal on Ground Water Quality near Gazipur Dumping Site, Delhi, India. *Applied and Natural Science,* 5(2): 306-312.
8. Kamboj, N., Singh, J., Pandey, C.P. and Aswal, R.S. (2013). Physico-chemical Parameters of Industrial and Domestic Wastes at SIDCUL Area, Haridwar (Uttarakhand). *Sustainable Environmental Research*, 2(1): 125-131.
9. Mor, S . R.vindra. K. Dahiya, R.P. and Chandra, A. (2006). leachate Characterization and assessment of groundwater Pollution near municipal Solid Waste landfill site. *Environmental Monitoring and Assessment*, 118: 435-456.
10. Patnaik, K.N., Satyanarayana, S.Y. & Rout. S.P. (2002). A case study--water pollution from major industries in paradip area. *rulian L Environ. Health.* 44(3): pp 203-211.
11. Shiddamallayya, N., and Pratima, M. (2008). Impact of domestic sewage on fresh water body. *J. Env. Biol*. 29(3): 303-308.