

Physico-Chemical Characteristics of Ground Water Quality in District Hamirpur (UP)

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ABSTRACT

Water as a universal solvent has the ability to dissolve many substances be it organic or inorganic compound. With this outstanding property, nevertheless it is almost impossible to have water in its pure form since it cannot be held up in a vacuum. Hamirpur is a town and district in the state of Uttar Pradesh India. It is a town of religious culture, historical and archaeological important Situated in the Chitrakoot region. Hamirpur is a city in northern India, and a municipal corporation in Hamirpur district in the state of Uttar Pradesh. It is the administrative head quarters of Hamirpur district. The work done on ground water of Hamirpur district covering various inorganic non metallic constituents covered are pH, TS,TDS,TSS, TH, DO, BOD, COD, Alkinity, Conductivity . The temperature changed between 25 to 31, pH 7.10 to 8.59, TDS 160 to 580 mg/l, DO 4.20 to 5.68, BOD 4.10 to 5.90, COD 6.66 to 29.00, Alkinity 2.1 to 4.0 mg/l, Conductivity 810 to 2200 mhos.

Key Word: Inorganic, Physicochemical, Universal Solvent, Non-metallic constituent

I. INTRODUCTION

The quality of ground water depends on various chemical constituents and their concentration, which are mostly derived from the geological data of the particular region[1]. Groundwater is the major source of drinking water in both urban and rural areas. The importance of groundwater for the existence of human society cannot be overemphasized. Besides, it is an important source of water for the agricultural and industrial sector. Water which occurs below the water table is referred to as groundwater, it supports; drinking water supply, livestock needs, irrigation, industrial and many other commercial activities[2].

Recently, the WHO reports that 65% of rural and 36% of urban Indians was without access to pure drinking water. There is a huge variation in the concentration of different species due to factors like depth, different land, underground water conditions, rain conditions, and industrialization etc.[3,4] Ground water is one of the most useful water sources. Water is second to oxygen as being essential for life[5-8].

Groundwater contamination is nearly always the result of human activity; in areas where population density is high and human use of land is intensive, groundwater is especially vulnerable.¹⁰ The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. Natural water contains 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[9-12].

Water is an essential component of the environment and it sustains life on the earth. Human beings depend on water for their survival. Water is also a raw material for photosynthesis and therefore, is important for crop production[13-16]. The cause of ground water gets pollute and create health problems. As the water is very an important ecosystem. Any imbalance in term of amount it can be harm to the whole ecosystem. Hence there is always needed for concern over the protection and management of groundwater quality[17]. Good drinking water quality is essential for the well being of all people[18].

Water pollution affects plants and organisms living in these bodies of water. In almost all cases the effect is damaging not only to individual species and populations, but also to the natural biological communities. As we see around the earth, there is plenty of water. Infact 70% of earth is covered with water. A number of contaminants are responsible for ground water contamination including a wide variety of chemicals and pathogens. Most these lead to reduction in normal oxygen content in water and hence make it unfit for consumption[19,20]. It is believed that groundwater must possess purity and it should be free from chemical contamination and micro organisms. But the rapid increase in population and industrialization together with the lack of wisdom to live in harmony with nature has led to the deterioration of good quality of water resulting in water pollution[21].

Study Area:

Hamirpur is a town and district in the state of Uttar Pradesh India. It is a town of religious culture, historical and archaeological importance. Situated in the Chitrakoot region. Hamirpur is geographically located at coordinates 24.16° N latitude & 80.83° longitude. Total area is 7,502 Km² and population 22, 28, 619 census (2011) of Hamirpur district. Hamirpur is a city in northern India, and a municipal corporation in Hamirpur district in the state of Uttar Pradesh. It is the administrative head quarters of Hamirpur district.

II. MATERIAL AND METHODS

The sampling stations were chosen at different sites of the study area, water samples were collected from industrial area, residential area of Hamirpur district. The present study is focused on water quality assessment for the month of April 2016. For testing the water samples were collected in different sterile plastic bottles and Jerry cans from each station. After collection of the sample the bottles were tightly capped and were immediately transported to the laboratory to avoid any unpredictable changes in the physico-chemical characteristics. All the sampling locations are presented in **table-1**.

Discharge of heated effluents also brings about thermal changes in natural waters (thermal pollution). Temperature is basically an important factor for its effect on chemical and biological reactions in water. A rise in temperature of water accelerates chemical reactions, reduces solubility of gases, test and order and elevates metabolic activity of organisms. Temperature, pH, Acidity, Alkalinity, Conductivity, TSS, TDS, TS, Total Hardness, DO, BOD and COD are analyzed by standard methods.

Table-1. Name and Code of sampling locations

SN	Sampling location	Water Source	Depth in fit	Description of sampling location
1	Police station (RW-1)	Hand pump	240	Near by bharuaa sumerpur
2	Narayanpur village (RW-2)	Tube well	350	Near by bharuaa sumerpur.
3	Viladi village (RW-3)	Hand pump	250	Near by bharuaa sumerpur
4	State bank (RW-4)	Hand pump	300	Near by bharuaa sumerpur
5	Shri gayatri vidhya mandir girls inter collage (RW-5)	Hand pump	280	Near by bharuaa sumerpur
6	Para village (RW-6)	Hand pump	350	Near by bharuaa sumerpur
7	Pandari village (RW-7)	Tube well	400	Near by bharuaa sumerpur.
8	Prathamik Swathya kendra (RW-8)	Hand pump	300	Near by bharuaa sumerpur
9	Badanpur village (RW-9)	Hand pump	270	Near by bharuaa sumerpur.
10	My Home (RW-10)	Hand pump	500	Near by bharuaa sumerpur

III. RESULT AND DISCUSSION

Physico-Chemical Characteristics of Ground Water:

The ground water samples were analysed for some parameters like temperature, pH, TS, TDS, TSS, TH, DO, BOD, COD, alkalinity and acidity. All the results are presented in **table-2**, and drinking water standard values are presented in **table-3**. The present work identifies the ground water quality of Hamirpur District. The results of ground water quality of Hamirpur District are given below.

Temperature:

Temperature of the samples were found between 25°C to 31°C, the highest temperature was recorded 31°C at sampling station W9.

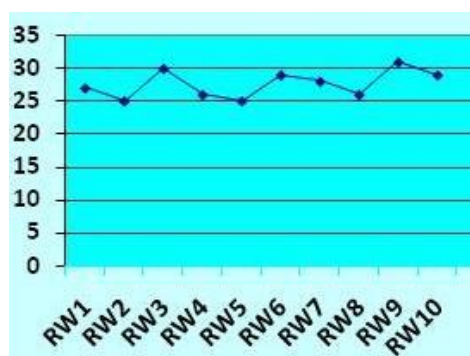


Fig-1. Temperature at various sampling stations of Hamirpur.

pH:

The pH values of drinking water samples are between 7.10 to 8.59. Low pH values are associated with a small amount of mineral acid from chloride source or with organic acids.

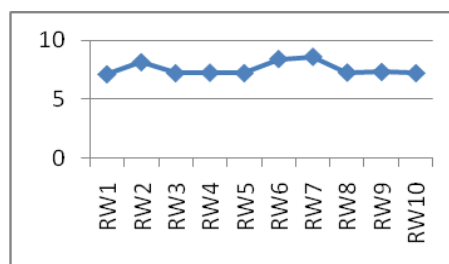


Fig-2. pH at various sampling stations of Hamirpur.

Total Dissolve Solid:

Total dissolved solid content of a water sample is important in deciding whether the water is suitable for drinking purposes or not. In the present study, the lowest value of TDS is 160 mg/l and the highest value is 600 mg/l. All the results were below the permissible limit prescribed by WHO (1984) as 600 mg/l.

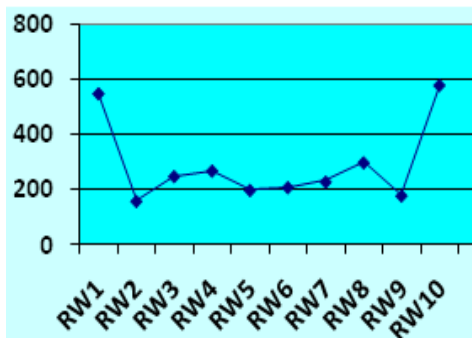


Fig-3. TDS at various sampling stations of Hamirpur.

Total Hardness:

In the present study the TH of water was found to be 320 to 760 mg/l. The highest value was found 760 mg/l at sampling location RW1 and lowest value was found 320 mg/l at sampling location RW2 most of sampling stations were found higher values of hardness.

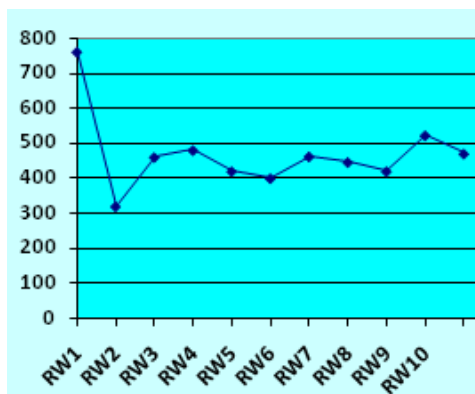


Fig-4. Hardness at various sampling stations of Hamirpur.

DO:

The DO value range from 3.90 mg/l to 5.92mg/l the highest DO was observed at(5.92mg/l) RW1 as show in Table-2 and lowest value was recorded at sampling station RW5.

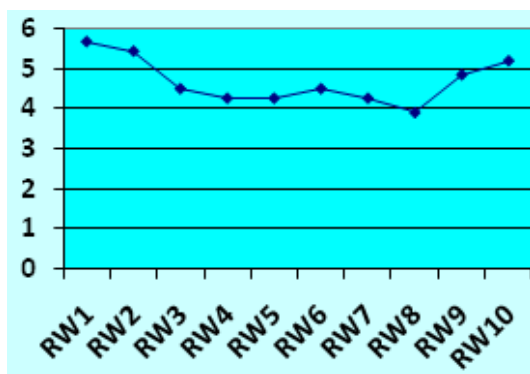


Fig-5. DO at various sampling stations of Hamirpur.

BOD:

The BOD value range from 3.95 mg/l to 7.02 mg/l, the highest BOD was observed (7.02 mg/l) at sampling station RW8 while lowest value was observed (4.10) at sampling station RW10.

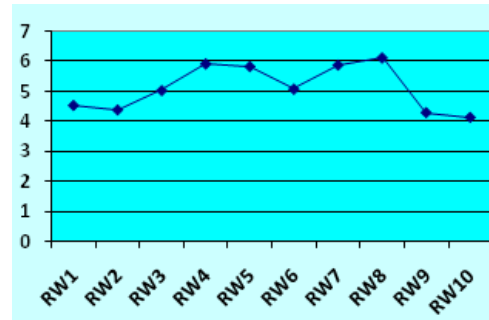


Fig-6. BOD at various sampling stations of Hamirpur.

COD:

The COD value range form 06.66 mg/l to 29.0 mg/l. As show in Table-2. The value of COD at sampling stations RW1 (17.33),RW2 (29.00), RW3 civil line (22.60), RW5 (25.38), RW6 (20.00), RW9 bus stand (16.00)and RW10 (28.00) are higher

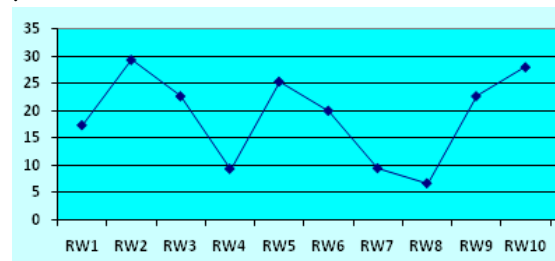


Fig-7. COD at various sampling stations of Hamirpur.

Sulphate:

The sulphate value ranged from 50 mg/l to 148mg/l. All the sulphate values were recorded with in the permissible limit prescribed by WHO (1984) as 250mg/l.

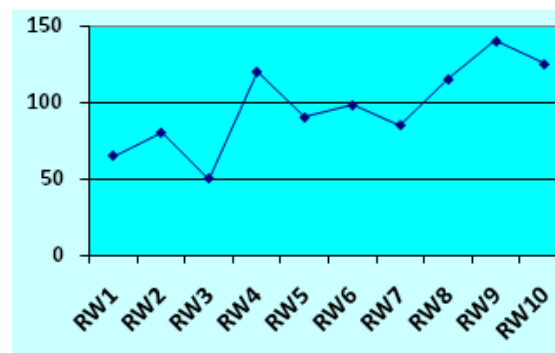


Fig-8. Sulphate at various sampling stations of Hamirpur.

Table–2. The physico-chemical characteristic of ground water at different points of Hamirpur Region.

Sampling Stations	Temp (°C)	pH	TDS	Total Hardness	DO	BOD	COD	Alkalinity	Conductivity	TS	TSS	Sulphate
RW ₁	27	7.10	550	760	5.68	4.50	17.33	2.1	810	0.27	0.22	65
RW ₂	25	8.13	160	320	5.44	4.35	29.00	4.0	880	0.35	0.30	80
RW ₃	30	7.19	250	460	4.50	5.00	22.60	2.6	970	0.03	0.02	50
RW ₄	26	7.24	270	480	4.26	5.90	09.32	2.9	730	0.06	0.04	120
RW ₅	25	7.20	200	420	4.20	5.81	25.38	3.2	840	0.03	0.01	89
RW ₆	29	8.40	210	400	4.60	5.05	20.00	2.5	1400	0.02	0.02	100
RW ₇	28	8.59	230	462	4.30	5.86	09.44	3.0	2200	0.02	0.01	85
RW ₈	26	7.25	300	446	3.90	7.02	06.66	2.1	1200	0.05	0.03	110
RW ₉	31	7.33	180	420	4.85	4.26	16.00	2.1	1200	0.27	0.02	148
RW ₁₀	29	7.20	580	522	5.20	4.10	28.00	4.0	880	0.35	0.23	125

All the parameter is expressed in mg/l except pH, temperature and conductivity.

Table-3. WHO guideline for drinking water quality (1984)

Parameter	Standard value
Temperature	25 ⁰ C to 35 ⁰ C
pH	8.5
TDS	500 mg/l
TS	500 mg/l
TSS	500 mg/l
Total Hardness	300-600 mg/l
DO	4 mg/l
BOD	6 mg/l
COD	10 mg/l
Sulphate	250 mg/l

IV. CONCLUSION

Present work done on ground water of Hamirpur district covering various inorganic non metallic constituents covered are pH, TS,TDS,TSS, TH, DO, BOD, COD, Alkinity, Conductivity etc. The temperature changed between 25 to 31, pH 7.10 to 8.59, TDS 160 to 580 mg/l, DO 4.20 to 5.68, BOD 4.10 to 5.90, COD 6.66 to 29.00, Alkinity 2.1 to 4.0 mg/l, Conductivity 810 to 2200 mhos. High pH value associated with small amount of mineral acid from carbonate source or with inorganic acid. Most of the sample TDS and COD are higher than the permissible limit prescribed by WHO (1984) as 500 mg/l and 10 mg/l. TH of all the water sample are higher than the permissible limit prescribed by WHO as 300 mg/l. Sulphate of all the result within the WHO recommended values as 250 mg/l. it is concluded that the ground water of Hamirpur district are not highly contaminated, but there is an indication of increasing pollutant due to discharge of industrial effluents on land and surface water bodies.

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