PHYSICOCHEMICAL CHARACTERISTICS OF GROUND WATER/DRINKING WATER QUALITY OF HIRANAGAR TEHSIL OF KATHUA DISTRICT, JAMMU PROVINCE

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ABSTRACT

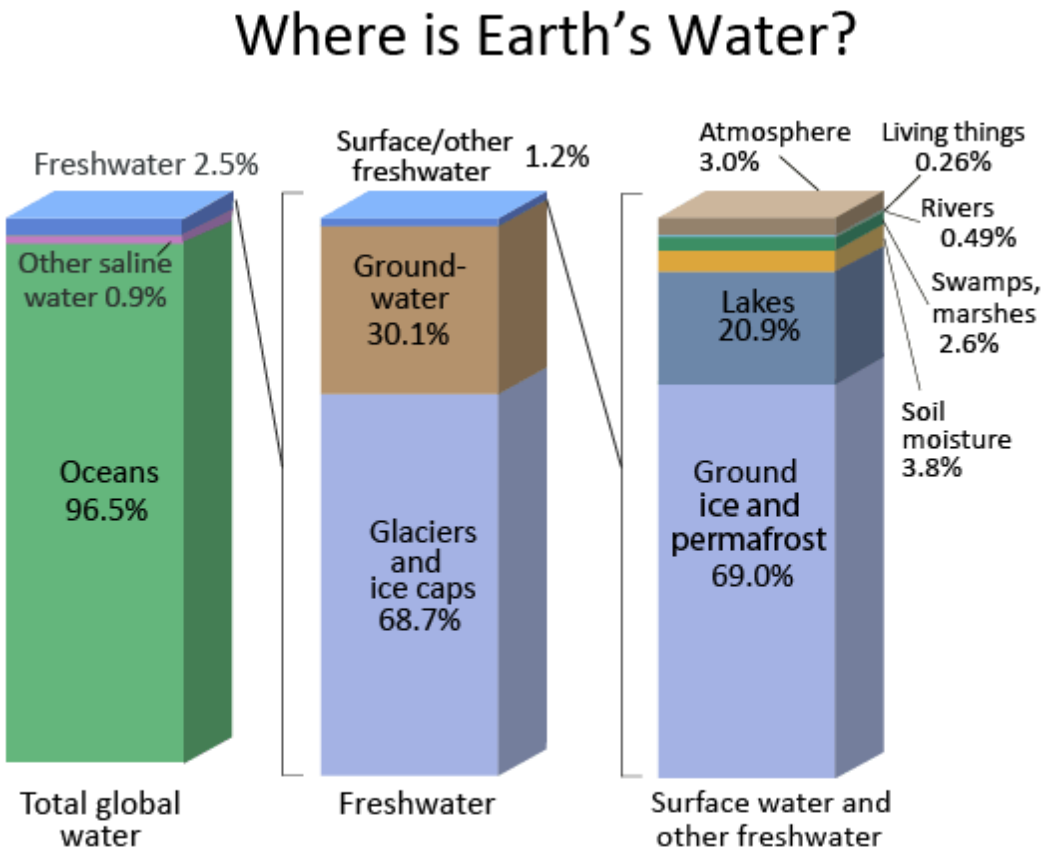
Today it is well known fact that that ground / drinking water quality is deteriorating day by day which is serious concern as poor quality water is threat to human health. The ground water quality was assessed for examining the various physical and chemical parameters. The present study shed light on drinking water quality suitable for drinking purpose or not. The present study was conducted to assess the drinking/ ground water quality of Hiranagar Tehsil. Twelve samples were collected from different locations hand pump, tube well and govt. supply water in the study area. The quality analysis has been carried out for physical and chemical parameters such as pH, Total Hardness, Electrical Conductivity, Total dissolved Solid, Total Alkalinity, Carbonate, hydroxide, Bicarbonate, Calcium, Magnesium, Nitrate, Chloride, fluoride, color, odour and turbidity . The result of the analysis was compared with Indian Standard IS 10500:1012. From the analysis it has found that there is slight fluctuation in the parameter among the entire sample. The study revealed that maximum parameters are found within the acceptable limit except some sample of Fluoride, Total Hardness and Total Alkalinity. The present study indicates that ground water/drinking water needs treatment for fluoride from the location Sherpur, Chakra, Hiranagar, Sanyal, Kattal Brahamana, Chapper and Chadwal which is being used for drinking purpose by the locals of Hiranagar Tehsil. The study also recommends the treatment for total alkalinity and total hardness from the common location such as Sherpur, Chakra, Haripur Brahamana, Sanyal, Chaan Morian and Dayala Chack to bring the values of this parameter under the acceptable range as listed in IS 10500:2012.

Key words: Drinking Water, Ground Water, Fluoride, Total Hardness, Total Alkalinity etc

INTRODUCTION

Water is the most important of all the natural resources present on the earth. It is a precious commodity. It is an important component of human body and is the need of life (Muhammad et al., 2012). All living beings need water for their survival and continuation of life. Water is required by all living organism, ecological system, human health, food production and economic development. In other words water is the life sustaining resources on the earth. The entire fabric is woven around it. Water is one of the nature′s five elements; **Pancha Maha - Bhuta's** air, earth, water, ether and fire) that support all life. Earth is water planet in our solar system characterized and shaped by abundant amount of liquid water which is the basis of life. The thing that made our planet special is the presence of liquid water. The earth is known as blue planet because it is covered with water and it seen as bright blue from space. Water is the fundamental of life, without this the existence of living beings would never possible. Water is transparent and colorless chemical substance which is the main constituent of Earth′s Ocean, lakes, streams and fluid of most living organisms. Without adequate quality and quantity of freshwater development is not possible. Water is universal solvent and unique in many physicochemical ways. Water is the medium of life. All cells contain some amount of water and all the metabolic reaction takes place in the medium of water. Nutrient and food transfer from cell to cell is through water. Water is the raw material of photosynthetic reaction for the manufacturing of carbohydrates Air which we breadth is oxygenated by dissociation of water during the process of photosynthesis in plants. Everything that we eat breadth and drink is the basis of life. There are approximately 1.385 million cubic km of water present on, above and in the earth. The ability of the country to collect clean and safe water and distribute to its users reflect the health of the country. There is direct correlation

between safe drinking water and GDP of the country. Water is the material cause of all things **(Thales 624-546 BC).** The United nation proclaimed the year 2005 - 2015 International decades for action on "water for life". **(UN 2005).** Water plays important role in economy of the country. It has been estimated that by 2025 more than half of the world population will be facing water based vulnerability. It has been estimated that more than one billion people with low and middle income countries lack access to safe and clean water for drinking, personal hygiene and domestic use (WHO 2004) .Out of this 1.1 billion people live in Asia. Although safe and clean water not provide calories and nutrients but still it required by all living beings.



Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources.
NOTE: Numbers are rounded, so percent summations may not add to 100.

PHYSICO - CHEMICAL PROPERTIES OF WATER

- Water is colorless, odorless and tasteless chemical substance.
- Water has high specific heat because it can absorb large amount of heat and then release slowly.
- Water has neutral pH in pure state; it means water is neither acidic nor basic.
- Water exists in liquid, form in range of temperature 0-100C.
- Water is universal solvent it enables to carry solvent nutrients in infiltration, ground water flow and runoff and living organism.

STATUS OF GROUND WATER IN J&K

- The occurrence of ground water in J&K is very complicated because of various hydrological parameter geological settings, topographical barriers and hydrological boundaries. The water resources of J&K is classified into five major zones based on geological settings
- Piedmont deposit of outer region of Jammu
- 2 Dune belts of outer Himalayas
- 3 Isolated valley fill deposits of lesser Himalayas
- 4 Fluvioglacial laccustrine deposits of Kashmir valley
- 5. Moronic and fluvial glacial deposits of ladakh. **(Central ground water board)**

WATER SCENARIO IN INDIA

Most of the population in India is depend on the surface water for the drinking purpose. The water quality of Indian rivers is degrading day by day due to discharge of industrial and domestic waste. They utilize annual surface water of the rivers of the country is 650km3. As the world is already staring at impeding water

crisis due to climate change, population increase and pollution a UN report has predicted that 3.4 billion people will be living in water score countries as 2050.

• There is annual per capita of H2O decrease from 6,042 cubic cm.

• 65% of rain water goes into the sea.

• 90% of waste disposed into the rivers.

Average annual potential of utilization quality of H2O (surface water 690 billion cubic cm) (ground water 433 billion cubic cm.

OBJECTIVE OF THE STUDY

To determine the quality of drinking water/ ground water as safe drinking water is essential for maintaining the public health.

To characterized the quality of source water as it is untreated water from underground aquifer which is used to supply public drinking water

To protect the ground water sources as much as possible from contamination by harmful chemical.

To estimate the concentration of Fluoride, Nitrate, Chloride, Calcium, Magnesium, Total Alkalinity and TDS in ground water.

REVIEW OF LITERATURE

Pragya khanna (2019) studied some Physico-chemical parameters like electrical conductivity, bicarbonate, total hardness, calcium and nitrate as determined from the groundwater samples of Dist. Samba were above the limits set by WHO and BIS at certain places. The people residing in these areas are

therefore at high potential risk of contracting ailments/diseases related to higher level of such contaminants present in water.

Kuldeep Krishna Sharma et al (2013) – Studied physicochemical characteristics of ground water and surface water bodies of Bishnah tehsil of Jammu district to determine the average concentration of fluoride in ground and surface water. The ground water of this area was slightly alkaline in nature that favors dissolution of fluoride. It has been also found that ground water has higher concentration of fluoride than surface water in dune belter and change seasonally higher in the monsoon season than others. The concentration of fluoride in the ground water and surface water was 0.3 to 0.95mg/l and 0.018 to 0.070mg/l respectively. The concentration of calcium also more in the ground water as compared to surface water. The result of this was study that the concentration of fluoride within the acceptable limit but still some cases of dental fluorosis was found.

Kotwal Sumit et al (2015) – Studied the effect of industrial effluent on the ground water quality of Udhampur. The study revealed that water quality parameter in both source of ground water is exceeding the acceptable limit but within the permissible limit set by WHO and BIS, it may cross the permissible limit in the future if proper preventive measures are not taken. The analysis also revealed that calcium and bicarbonate were dominant cat ion and anion increasing as compared to study conducted by NIH. It indicates that industrial growth in Udhampur district affecting the ground water quality. Water quality index calculation shows that contamination was more in the monsoon season. EC, TDS and conductivity, BOD and phosphate but strong negative correlation between DO and BOD, free carbon dioxide and pH, free carbon dioxide and DO.

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Shahida Perween et al (2015) – Studied the physicochemical characteristics of ground water quality of Aligarh city. The result was that the pH was slightly alkaline in nature and the calcium hardness was found in higher quantity in the natural water exceeding the permissible limits. TS, total hardness, hardness as calcium, hardness as magnesium, total alkalinity, COD and DO exceeding the permissible limit for drinking water whereas TDS and TSS was found within the acceptable limit. Conductivity and TS exceed the standard ICMR/BIS. Overall it has been revealed that the drinking water quality is good for drinking purpose it does not observed any level of pollutant but it need treatment before consume.

K. Yoghananthan et al (2016) – Studied the physicochemical analysis of ground water in village Odthurai panchyat in erode district of Tamil Nadu. The study revealed that five water sample such as 1, 4, 7, 8, and 10 were exceed the permissible limit due to excessive use of fertilizer in the agricultural activity whereas remaining five samples were completely free from any impurities. The final result was that water quality of some location of the study area is suitable for consumption and quality of water other location is not suitable.

Sandeep Singh Bhatti et.al (2013) - Studied the physicochemical characteristics of ground water quality of village Jalalabad of district of tarn taran of Punjab. The samples were collected in the month of august 2013. The objective of this study was to evaluate the degree of contamination in ground water. The study revealed that parameter like pH, chloride, hardness, calcium, conductivity were within the permissible limit but concentration of alkalinity and magnesium were above the permissible limit as per BIS.

S. D Jadhav et.al (2011) - Studied the physicochemical characteristics of ground water quality of Ajara Tehsil of Maharashtra. This study was done to assess the bore well water quality for suitability for drinking and domestic purpose. Total 51 samples were collected from different villages of Ajara Tehsil during April 2011. The various parameters analyzed were pH, temperature, EC, total hardness, total alkalinity, calcium, mg, chloride, dissolved oxygen. The final result was compared with WHO, BIS and ICMR drinking water standard. Out of 51 samples the hardness of 48 samples were found within the permissible limit and safe for drinking purpose. The concentration of pH, EC, chloride was within the permissible limit. In case of DO out of 51 samples 43 were within the permissible limit as WHO while eight samples were exceeded the permissible limit.

Manish Upadhyay et al (2014) – Studied the physicochemical characteristics to determine the quality of surface water of Shivnath River and ponds in drug and Rajnandgaon region of Chhattisgarh. The study was done to evaluate the surface water quality in drug and Rajnandgaon district. It was the comparative study in which both water sources such as river and pond water was compared by taking certain important parameters like pH, temp., TDS, alkalinity, DO, and chloride. This investigation determined that the maximum parameters were below the level of pollution. The result was that both the surface e water river and pond can be used for various purposes but community pond was highly polluted and unsafe for human use. Temple ponds were less polluted than community pond.

STUDY AREA

The present study was conducted for Hiranagar Tehsil in Kathua district in J&K, India. The Hiranagar Tehsil lies in the south western part of Kathua district of J&k

state. The geographic coordinate of the town is 32.45 N 75.27 S. The agricultural and industrial activity is common in this area. The ground water is the main sources of agricultural and drinking purpose. The study area falls in kathua district.

PHYSIOGRAPHY AND DRAINAGE

The physiography of the district is very much diverging. This region is occupied by valleys, gorges, canyon and hills and High Mountain. The Southern and Southern Western part is covered by gentle terrain called a outer plains. But the north and north east region are hilly and mountainous region with elevation of 500 to 2000 m amsl with intermountain valley called Dun Belt.

CLIMATE AND RAINFALL

The climate of the district is of subtropical type, characterized by well-defined three major seasons i.e. summer, monsoon and winter. May and June are the hottest month .the monsoon start in the beginning of July or the end June and continue up to September. Winter start from November and continue up to April. The climate in kathua region varies from subtropical to temperate and even alpine in higher region of bani and lohai malhar. There is lot of difference between two plain of tehsil kathua and Hiranagar with Tehsils of hilly region of kathua district .Most of hilly region experience a snowfall. The annual rainfall in the kathua district is 1672 mm. Rainfall in the winter and early summer is due to western disturbance and due to monsoon at the second week of July till September.

GEOLOGY

The rock formation present in the district age from Cambrian to Quaternary. The hilly and Mountainous terrain comprise of igneous and metamorphic rocks present in granitic intrusion and Panjal trap. Artesian aquifer is common in all sirowal belt

and transition zone. The two major thrust faults in the district are Murree Thrust and Main Boundary Fault.

HYDROGEOLOGY

The geological formation in the district are of three types consolidated, semi consolidated and unconsolidated. The northern and hilly region of the Kathua district is consisting of semi consolidated and consolidated whereas the southern region is comprised of unconsolidated material. The topography in the hilly region is much dissected, steep slope and consists of impermeable nature of rock resulting more surface runoff toward southern plain.

ANALYTICL TECHNIQUES AND METHDOLOGY

Total twelve Samples were collected from different location of study area. The water samples were collected from hand pump bore well, govt. supply and other sources of ground water source which is used for drinking purpose in the study area. The samples were collected in a polythene bottle with 2 liter capacity. All the bottles were washed with clean water and the rinse with distilled water. At the sampling site the bottles were rinsed three to four times by water sample which is to analyzed and then fill it completely. During sampling from hand pump the water was pumped to waste for 4- 5 minute and then sample was collected. The entire samples were labeled properly and then physicochemical analysis was done by following standard methods.

Methods used for analysis of water quality parameter are

S. No	PARAMETER	METHOD
1	pH	pH meter
2	Electric conductivity	pH meter
3	Color	Visual comparison method
4	Turbidity	Nephelometeric method
5	Total hardness	EDTA titration method
6	Calcium	Complexometeric titration method
7	Chloride	Argentometric titration method
8	Fluoride	SPANDS colorimetric method
9	Nitrate	UV-Spectrophotometric method
10	Alkalinity	Potentiometric titration method (methyl orange)
11	TDS	Gravimetric method
12	Carbonate	Calculate from alkalinity
13	Bicarbonate	Calculate from alkalinity
14	Hydrate	Calculate from alkalinity

RESULT AND DISCUSSION

Colour, Odor and Turbidity

The color of the groundwater samples were determined by using the protocol IS 3025 Part 4. 67% of the sample analyzed ranged between 2 and less than 5Hz. However the remaining 33% of the samples ranges between more than 5 and less than 10Hz. 100% of the water sample analyzed for the parameter color are within the permissible limit compliance with IS 10500:2012.

The odor of all twelve drinking water sample were judged agreeable. However for the parameter turbidity 100% of the samples values were within the permissible range (5 NTU) of IS 10500:2012.

PH, Electrical Conductivity and Total Dissolved Solids

The pH of the water samples from all the location were recorded between 6.5 and 7.85. The water sample collected from location Kootah, Chaan Morian, and Mela are slightly acidic in nature where pH was reported below 7 representing 33% of the water sample. However for all other eight locations water samples reflected slightly alkaline which corresponds to 67% of water samples.

The electrical conductivity values ranges between 180 μS /cm to 490 μS/cm .The conductivity of the water sample collected from the Sanyal was maximum and was recorded to be 490 μS/cm. However, water sample collected from Mela govt. supply water showed least conductivity value at the level of 180 μS /cm.

The value of Total Dissolved Solids (TDS) ranges between 155 mg/l to 370 mg/l. The sample of Mela Govt. supply water showed lowest value of Total Dissolved Solids (TDS). However, water sample collected from the Sanyal showed highest

value of Total Dissolved Solids (TDS) .The level of Total Dissolved Solids (TDS) in all the 12 locations is within the acceptable limit (500mg/l) complying with the Standard 10500:2012.

Calcium, Magnesium, Total Hardness and Total Alkalinity

The value of Total Hardness for all water sample collected from twelve different locations are within the permissible limit (600mgl). However, 33% of the water sample analyzed reflected the value above the acceptable range (200mg/l). The locations identified showing the value above acceptable limit Chaan Morian, Dayala Chack Sanyal and Sherpur hand pump water.

Chloride, Nitrate and Fluoride

The level of Chloride is well within the acceptable range (250 mg/l) for all the ground water/ drinking water samples analyzed collected from hand pump/tube well/PHE supply of Hiranagar Tehsil .The value of Chloride ranges between14.2 mg/l to 28.4 mg/l.

However, level of Nitrate was also reported to be within the acceptable limit (45 mg/l) and was complying with the IS 10500:2012. The value of Nitrate ranges between 8.16 to 31.03 mg / l. 92% of the water sample analyzed for the parameter Nitrate reflected the value of nitrate below 31mg/l.

The level of Fluoride in the Ground water sample ranges from 0.749 mg/l to 1.35 mg/l. 58% of the sample analyzed showed the level of Fluoride above the acceptable range (1.0 mg/l) but well within the permissible limit (1.5 mg/l). The water sample from the location Haripur Brahamana, Kootah, Chapper Govt. supply water, Mela Govt. Supply water and Dayala Chack are falling within the acceptable limit (1mg/l) and rest other location studied needs the treatment for fluoride where the values were above the acceptable limit an indicating the local

Geology (rock type, structure and composition) is responsible for the contribution of fluoride in the Ground water /Drinking water of Hiranagar Tehsil.

CONCLUSION

• In general the value obtains for parameters such as color, odor and turbidity the results are within acceptable limit complying with the Indian standard IS 10500:2012 making it fit for drinking.

• The level of total dissolve solids (TDS) was above the acceptable limit (500 mg/l) for all the 100% of the water sample analyzed. Thus total dissolve solids (TDS) is also well within the acceptable limit (500mg/l) as per IS 10500:2012.

• The chemical parameters such as Total Hardness, was above the acceptable limit (200mg/l) for the 33% of the water sample analyzed. However calcium is reported to be well within the acceptable limit (75mg/l) for all the 100% of the water sample analyzed.

• The level of Magnesium exceeded the acceptable limit (30mg/l) for 16% of the water sample from the locations Chapper and Sherpur.

• However the 42% of the water sample exceeded the acceptable limit (200mg/l) for the parameter alkalinity and the locations identified are Sherpur, Chakra, Haripur Brahamana and Sanyal.

• Hydroxide and Carbonates was altogether absent in all the ground water/ drinking water samples analyzed giving an indication that only Bicarbonates ions are solely responsible for controlling the Total Alkalinity.

• The Chloride and Nitrate was within the acceptable limit for all the 12 Ground water/ drinking water samples analyzed from twelve different locations of

Hiranagar Tehsil indicating minimal level of contamination and pollution for local agricultural practice.

• The level of fluoride was above the acceptable limit for 58% of the sample analyzed collected from hand pump/ tube well /PHE supply water.

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