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Ground water quality in relation to Health hazards in Shivamogga Taluk of Karnataka

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Abstract

The present observation deals with the ground water quality in relation to health risks in Shivamogga taluk of Karnataka. pH values found to be 6.8 to 8.9. The values of electrical conductivity ranged 100 µmhos/cm to 1750 µmhos/cm. TDS values from 99 mg/L to 1010 mg/L Total hardness varied from 90 mg/L to 830 mg/. While, calcium values ranged from 82 mg/L to 450 mg/and magnesium values from 10.4 mg/L to 190 mg/L. Chloride values fluctuated from 40 mg/L to 780 mg/L. Total alkalinity values deviated from 123 mg/L to 775 mg/L. Fluoride values varied from 0.5 mg/L to 1.8 mg/L. The groundwater of Shivamogga taluk had many threats such as anthropogenic activities, deterioration by agricultural activities and over exploitation and also of continuous drought circumstance. The consequences of all the findings are discussed in info which reflect the existing reputation of the groundwater high-quality of the studied place. Groundwater is extraordinarily important to the destiny economic system and boom of rural India. If the resource is to remain available as high exceptional water for destiny generation it's miles important to guard from feasible infection. Hence, it is recommended that suitable water quality management is essential to avoid any in addition contamination.

Groundwater is an important resource all over the globe. The term groundwater is usually reserved for the subsurface water that happens under the water desk in soils and geologic formation which can be completely saturated. It helps ingesting water supply; farm animals wishes irrigation, commercial and many business activities[31]. Groundwater is typically less susceptible to infection and pollutants while as compared to surface water our bodies. In India, where groundwater is used intensively for irrigation and industrial purposes, a ramification of land and water primarily based human activities are causing pollution of this precious resource[29,32].

Water is one of the fundamental necessities of human beings. Groundwater is an vital source of water deliver for the duration of the arena. The groundwater high-quality is

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usually characterized by one of a kind physico-chemical traits. These parameters change widely due to the diverse varieties of pollution, seasonal fluctuation, groundwater extraction, and many others. Hence, a continuous monitoring on groundwater will become mandatory on the way to minimize the groundwater pollution and have manage at the pollutants-caused agents. The quantity and the suitability of groundwater for human intake and for irrigation are determined via its physical, chemical and bacteriological profiles[8,13].

Rural India is based mainly on groundwater for drinking and agriculture. Villages once trusted assets like wells, lakes, ponds and streams for their water wishes. Contamination of most surface water sources has rendered them not worthy for consumption. And additionally increase in water demand via an increasing populace has necessitated resource to tapping groundwater. Unsustainable withdrawal of groundwater has caused the spectra of depleting the trouble of water shortage. Every human society, be it rural or urban, industrially or technologically advanced, disposal of waste exceeds the limit of natural scavenging or elimination system, they may be certain to effect the regular functioning of the ecosystems and therefore they undergo an unfavorable impact at the biota[14,15].

Water is an universal essential commodity after air and shows important role in the biosphere of animal and plant kingdom, atmosphere and lithosphere. Water is used for consumption, hygiene, washing, fisheries, recreation and industrial usages[4,19].

Unsustainable withdrawal of groundwater has brought about the spectra of depleting the trouble of water scarcity. The to be had groundwater excellent isn't most effective infected by way of risky pathogenic germs and anthropogenic substances but also geological materials is adversely affect the water deliver of many areas.Supplying inhabitants with secure and easy consuming water is one of the maximum common issues in developing nations like India, especially in arid and semi-arid regions. The to be had groundwater high-quality isn't handiest contaminated by means of unsafe pathogenic germs and anthropogenic substances however also geogenic materials are adversely influences the water supply of many regions. The groundwater of Shivamogga taluk had many threats which include anthropogenic factors, fine deterioration by agricultural activities and over exploitation and additionally patience of non-stop drought condition .With this historical past an attempt has been made to recognize the quality of groundwater in Shivamogga place.

Study area :

Shivamogga taluk is located at 13° 55' 18" N Latitude and 75° 34' 12" E Longitude in heartland of Karnataka state, situated on the banks of the river Tunga. According to the Shivamogga town Municipal Corporation, this place has a total area of about 50 km^2 or 19.31 square miles. Climate of Shivamogga is similar to tropical wet and dry. This means the post monsoon and the early part of pre monsoon are typically dry periods. Majority of the rainfall occurs between June and early October. Shivamogga is a part of Malnad region of Karnataka. The precipitation and distribution of rainfall in have a look at region is surprisingly erratic.

Figure 1: Study area map of Shivamogga

Analysis of the samples :

The groundwater samples from the 10 sampling sites in industrial as well as rural areas had been collected and analyzed during September 2019. Groundwater samples from the sampling sites had been accrued from the bore wells. Initially the water changed into allowed to run for 15 minutes so that you can flush out desk bound water. Further, the sample bottles had been also flushed with water earlier than the samples have been accumulated. The parameters of water which includes, total dissolved solids, electric conductivity and pH have been analyzed immediately with the assist of water evaluation kit (Elico). The remaining parameters had been analyzed within the laboratory. Hence, the water carried to the laboratory in appropriate inert bottles. The samples had been analyzed the usage of analytical approach of APHA[1] and all analysis became achieved in triplicate.

Water analysis become executed, via taking 10 parameters, which might be very essential to recognise the water characteristics. The findings of the existing research are summarized in Figure 2 and it's been as compared with BIS[2] drinking water requirements.

In the existing have a look at, the turbidity values ranged between 0.3 and 70 NTU. The BIS[2] applicable restrict for turbidity is 25 NTU. It is proved from the present take a look at, overall range of samples go their permissible restrict with regards to the BIS[2] standards. It is determined from the effects that these parameters which crossed their permissible restriction have been undeserving for ingesting functions. It causes health issues like gastro-intestinal problems, headache and additionally related to respiration illnesses[12]. pH values found to be 6.8 to 8.9. The advocated price of pH for drinking purposes is between 6.5 and 8.5 [2]. In the existing examine all of the water samples analyzed are all properly within the safer limits besides in few sampling stations. However, higher values of pH hasten the scale formation in water warmers and decrease the germicidal ability of chlorine[18].

The values of electrical conductivity ranged 100 µmhos/cm to 1750µmhos/cm. Nevertheless, Higher the awareness of acid, base and salts in water, higher can be the EC. The variability of EC could be defined to the natural attention of ionised substances present in water[8]. However the higher values of electrical conductivity (>2000 µmhos/cm), may additionally be due to lengthy time and properly lithology. It is justified from the analytical report for TDS values ranges from 99 mg/L to 1010 mg/L and values indicates that were properly with in the permissible limit. However, groundwater chemistry changes because the

water flows through the subsurface and the increase in geological environment and dissolved solids and fundamental ions. Chebotarev[3], Ramababu and Rao[22], Joseph[7] and Rekha Choudhary and Mohan Naik[24] expressed the dissolution of soil particles containing minerals underneath slightly alkaline situation, favour the TDS concentration in groundwater. However TDS attention above the permissible limit (1500 ppm) causes gastrointestinal inflammation[27].

Total hardness varied from 90 mg/L to 830 mg/L. The BIS[2] appropriate restrict for total hardness is 600 mg/L. Owing to truth that better amount of hardness inside the take a look at place comes especially from the leaching of igneous rock and carbonate rocks (dolomite, calcite and limestone). Water containing the soluble salts of calcium and magnesium along with chlorides, sulphates and bicarbonates are also governs the fine of water[21] . The unfavorable effects of total hardness are formation of kidney stone and the coronary heart diseases[25]. Nevertheless, groundwater chemistry is controlled with the aid of the composition of its recharge components in addition to with the aid of geological and hydrological versions[20].

Present research reviews said for calcium values ranged from 82 mg/L to 450 mg/L, The BIS[2] ideal restriction for calcium is 200 mg/L. Presence of higher quantity of calcium within the study region can be because of groundwater receives the calcium minerals leached from the rocks and other deposits like limestone, dolomites, calcite, gypsum, amphiboles, feldspar, and clay minerals leaching or weathering of igneous rocks. Sewage and residence waste also are critical resources of calcium[16]. The magnesium values ranged from 10.4 mg/L to 190 mg/L. But, BIS[2] proper limit for magnesium is 100 mg/L and the most of the groundwater samples crossed the permissible range. Magnesium arises basically from the weathering of rocks comprise ferro-magnesium minerals and a few carbonate rocks. High attention of magnesium proves to be diuretic and laxative[26].

Chloride is also one of the critical parameter to recognize the nice of water. Anthropogenic sources of chlorides encompass fertilizer, salt, human and animal waste. Concentration of chlorides is considered to be a trademark of organic pollutants of animal beginning[10]. Here, Chloride values ranged from 40 mg/L to 780 mg/L. In this investigation, the values of chloride for all of the sampling websites are with inside the permissible variety as prescribed via BIS[2] drinking water requirements. However, dissolving of the soil elements had contributed the chloride into the groundwater and additionally the soil traits play an essential function in contributing the chloride content within the groundwater[28]. In the existing look at total alkalinity values ranged from a 123 mg/L to 775 mg/L. The BIS[2] perfect limit for total alkalinity is 600mg/L. When alkalinity of water exceeds the permissible limits, it is likely to provide incrustation sediment deposits, difficulties in chlorination, positive physiological effects on human systems and many others[23]. The constituents of alkalinity result from dissolution of mineral substances inside the soil and atmosphere contributes to alkalinity in groundwater[17].

In the present investigation, fluoride values various from 0.5 mg/L to 1.7 mg/L the BIS[2] perfect restrict for fluoride is 1.5 mg/L. In the present examination, 10% of overall water samples has crossed the permissible limits as prescribed with BIS[2] drinking water requirements. Degree of weathering and leachable fluoride in terrain is of first-rate significance for the fluoride found in ground-water than the mere presence of fluoride bearing minerals in rocks[11]. Intake of extra fluoride reasons dental, skeletal and non-skeletal fluorosis. The non- skeletal fluorosis may be discovered such as gastrointestinal lawsuits, intermittent diarrhoea and flatulence in expectant and lactating mothers hardworking young adulthood and children. Therefore, fluorosis has been taken into consideration as one of the incurable sicknesses. Hence, prevention is the most effective answer for the sickness[6].

Thirumala and Kiran[30] have analysed the seasonal variations in ground water in Davangere area of Karnataka. The water samples were compared with BIS standards .The ground water was moderately polluted and impact to health hazards. In their study, the water samples of Davangere town were quite good for irrigation due to elevated salinity.

Table-2. Classification of water of Shivamogga for irrigation purpose (Classification by United state salinity Laboratory; Mayur C. Shah *et al.* 2008).

Electrical conductivity µmhos/cm	Category of water	% sites
<250	Low salinity (Excellent)	10%
250-750	Medium salinity (Good)	20%
750-2250	High salinity (Fair)	70%
>2250	Very high salinity (Poor)	0

The classification of water quality of Shivamogga area for irrigation purpose is presented in Table-2. It suggests that water samples of 02 sites were good and 07 sites were quite good (fair) for irrigation purpose due to high salinity of ground water.

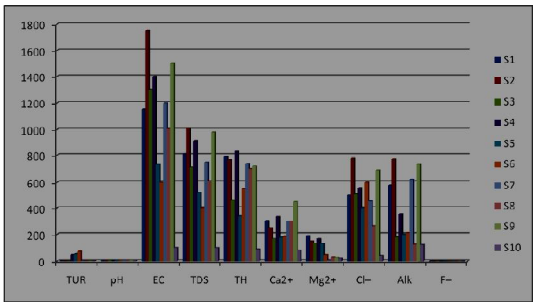

Figure 2. Physico-chemical parameters of Groundwater quality in Shivamogga area during September 2019

Figure 3. Dental fluorosis in the Study area

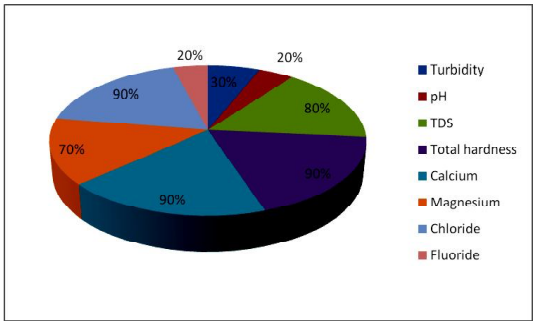

Figure 4. Percentage of ground water quality parameters exceeded the permissible limits of BIS standards in Shivamogga area

Table 1. Comparison of Groundwater quality data with Drinking water Standard (BIS, 1998)

Sl. No.	Parameters	BIS (1998)		Observed values	
		P	E	Mini-mum	Maxi-mum
1	Turbidity	5	25	0.3	70
2	pH	6.5	8.5	6.8	8.9
3	EC	-	-	100	1750
4	TDS	500	1000	99	1010
5	Total hardness	300	600	90	830
6	Calcium	75	200	82	450
7	Magnesium	30	100	10.4	190
8	Chloride	250	1000	40	780
9	Alkalinity	200	600	123	775
10	Fluoride	0.3-1.2	1.5	0.5	1.75

Note : P = Permissible limit, E = Excessive limit
All parameters are expressed in mg/L, except pH, turbidity (NTU) and electrical conductivity (mmhos/cm)

Currently carried research studies should provide more specific response on have an effect on of geomorphological circumstance than anthropogenic activities in the tested groundwater samples of the study vicinity. Local geological settings might also supports the growing concentration of physico-chemical character in groundwater. The factors like gradual stream, longer period of contact between aquifer and water, dissolving of minerals on the time of weathering, residential time, drainage sample and surface water link. Porosity of the soil and rock additionally alters the characteristics of the groundwater. The excessive contents of the parameters determined may be minimized if the groundwater is recharged with the to be had water within the rainy season. This no longer simplest dilutes the constituents of the groundwater however additionally increases the groundwater stage that depletes due to large-scale exploitation.

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