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Research Article

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Assessment of drinking water quality in around Chitrakoot region Tehsil Majhagwan, District Satna, Madhya Pradesh, India

Ashok Kumar Tiwari*, Manoj Kumar Tripathi and Neelesh Dwivedi. Pawan Kumar Ahirwar, Sharda Prasad Tripathi, Sourabh Pathak and Aakanksha Tiwari

Ayurveda Sadan, JRD TATA Foundation for Research in Ayurveda & Yoga Science, Arogyadham, Deendayal Research Institute, Chitrakoot, Satna, Madhya Pradesh

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ABSTRACT

Water represents the basic elements supporting life and the natural environment, a primary component for industry, a consumer item for humans and animals, and a vector for domestic and industrial pollution. Much of ill health that affects humanity, especially in the developing countries can be traced to lack of safe and wholesome water supply. There can be not state of positive health and well being without water. The study was aimed at examining the various samples of drinking water and the quality of the groundwater as it relates to public health. Ten groundwater samples were taken from hand pump were analyzed for pH, electrical conductivity (EC), chloride, total alkalinity, total dissolved solids (TDS) and total hardness. The results were compared with WHO and IS: 10500 standards. The usefulness of these parameters in predicting ground water quality characteristics were discussed. Thus an attempt has been made to find the quality of ground water in around Chitrakoot region Tahsil Majhagwan suitable for drinking purposes or not.

Keywords: Drinking water quality, Conductivity, Hardness alkalinity, chloride.

INTRODUCTION

Water is one of the most significant and precious gift of nature. 3/4 parts of our earth are covered by water, but only approximately 1.0 % of the total water is fresh and useable for drinking, bathing, irrigation and other domestic purposes. Water is an essential natural resource and an absolute necessity for sustaining life. Water is not only the most valuable constituent of all animals, plants and other organisms but it is also pivotal for the survivability of the mankind in the biosphere. It is the lifeblood of the environment. Human beings solely depend upon the availability of fresh water for living and livelihood and in its natural state it is a ‘savior of life’. One can hardly live without water even for a few days. Today, by ignoring these facts, man is indiscriminately polluting water and unknowingly providing nature a complex situation.

Ground water quality depends on the quality of recharged water atmospheric precipitation inland surface water and sub-surface geochemical processes. Temporal change in the origin and constitution of the recharged water, hydrologic and human factors may cause periodic change in ground water quality. Water pollution not only affects water quality but also threats human health, economic development and social prosperty. Ground water is a source of drinking water and even today more than half of the word population depends on ground water for survival. The assessment of water quality is very important for knowing the suitability for various purpose. Assessment of ground water for drinking and irrigation has become a necessary and important task for present and future ground water quality monitoring and

evaluation for domestic and agricultural activities around the world. Water is prime need for human survival ad industrial development. For many rural and small communities ground water is the only source of drinking water [1-2]. Studied the ground water quality in down town Srinagar, Kashmir and reported that the temperature of tube well waters ranged from 17^0C to 21.4^0C [3].

A lot of work on drinking water quality and ground water quality of different parts of India has been carried out by various workers viz. [4 -7].

EXPERIMENTAL SECTION

Study area

Chitrakoot (the 'Hill many wonders') is indeed a gift of nature and the gods and located on the bank of river Mandakini and falls in the northern Vindhyan range of mountains spread over the Uttar Pradesh and Madhya Pradesh. The Chitrakoot region is included in the district Chitrakoot of Uttar Pradesh and the district Satna of Madhya Pradesh. Chitrakoot Parvat Mala included Kamad Giri, Hanuman Dhara, Lakshman Pahari and Devangana are famous religious mountains[8-9]..

It is town of religious, cultural, historical and archeological importance, situated in Bundelkhanda region and sounding on north, northwest and northeast by Karwi (Chitrakoot) district of Uttar Pradesh and west by Panna District of Madhya Pradesh. It is lies between 80^0 52' to 80^0 73' N latitude and 25^0 10' to 25^0 52' E longitude, covering an area of 1584 sq km. The general topography is hilly, precipitation and undulating cut off by numerous reveres and rivulets. Mandakini, Chakara and Jhuri rivers drain the region. The Mandakini (a offshoots of the Ganga) is Holy river that is also know as Paisuni river in Chitrakoot region. [10-11].

Sampling stations

Twenty sampling stations were selected for the study which were Khodari, Degarahat, Tedhi, Patwaniya, Amaha, Puranakher, Paldev, Jugulpur, Bansipur, Naubasta, Paushalha, Sejwar, Bhagda, Lalapur, Raghauvan, Naiduniya, Chhaihan, Chouvepur, Rajoula and Pathara. Details of the sample stations are given in table 1.

Table 1 Details of sampling stations

S.N.	Name of Sampling Stations/ village	Sources
1.	Khodari	Hand Pump
2.	Degarahat	Hand Pump
3.	Tedhi	Hand Pump
4.	Patwaniya	Hand Pump
5.	Amaha	Hand Pump
6.	Puranakher	Hand Pump
7.	Paldev	Hand Pump
8.	Jugulpur	Hand Pump
9.	Bansipur	Hand Pump
10.	Naubasta	Hand Pump
11.	Paushalha	Hand Pump
12.	Sejwar	Hand Pump
13.	Bhagda	Hand Pump
14.	Lalapur	Hand Pump
15.	Raghauvan	Hand Pump
16.	Naiduniya	Hand Pump
17.	Chhaihan	Hand Pump
18.	Chouvepur	Hand Pump
19.	Rajoula	Hand Pump
20.	Pathara	Hand Pump

Sample collection

Water samples from the selected sites were collected in pre-cleaned blue or black coloured carbuoys of 2 liter capacity with necessary precautions during January 2014-June 2014. The samples after collection were immediately placed in dark boxes and processed within 6 hours of collection.

All the analysis was done according to APHA [12], NEERI [13] and Saxena [14].

RESULTS AND DISCUSSION

The present investigation deals with the assisment of drinking wter quality of 20 different hand pumps in Chitrakoot region Tahsil Majhagwan, District Satna, Madhya Pradesh, India. Experimental results of the samples analyzed in all the ten different locations covering from January 2014-June 2014 were tabulated parameter wise, location wise. The parameters are discussed below.

The results of the physical analysis of the groundwater of the area show a wide variation in different individual parameters (Table 2). All the water samples were colourless. The colourless may be due to the presence of dissolved or colloidally dispersed organic maters. All the water samples were odourless. The temperature of the samples was found between 26.0^{0}C - 32 ^{0}C. The turbidity of the water samples were found between 2.0 - 10.0 NTU. The turbidity may be due to clay slit, organic matter and micro organism.

The total dissolved solids (TDS) in the present study ranged from 312.0 mg/l to as high as 733.0 mg/l specification of BIS [15] and WHO [16] for TDS in drinking water standards are 500 mg/lit as permissible limit and 1000 mg/lit as excessive limit. The water in many sites studied in the present work was far higher than the desirable limits and in some sites it exceeded the excessive limit also. High content of TDS in drinking water can change the taste of water [17-18]. The variation of TDS values are shown in Table 2 and Fig.1.

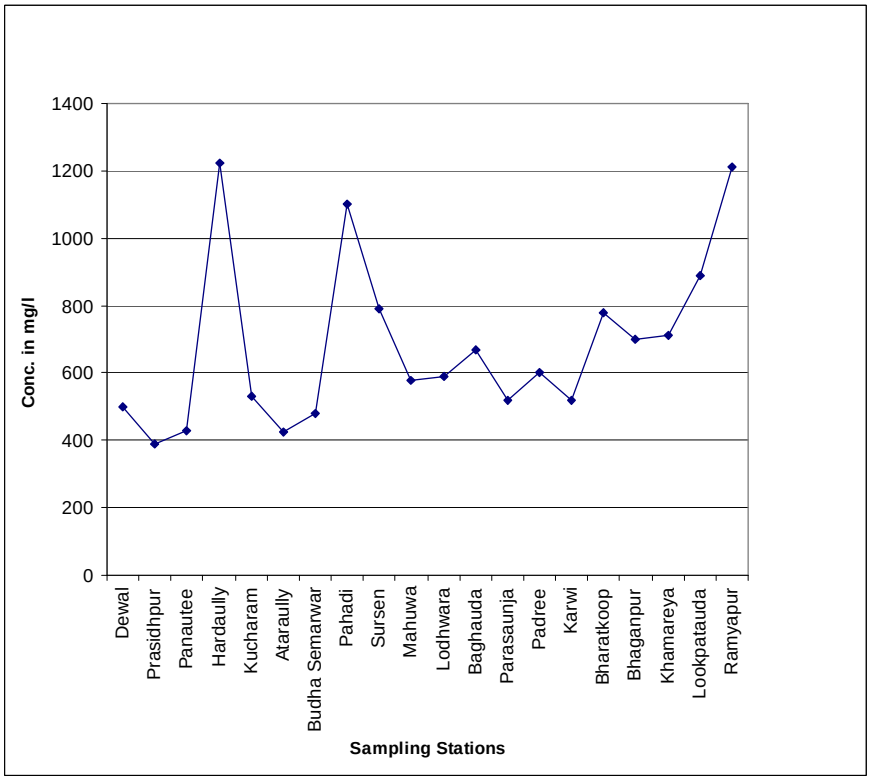

Fig. 1 Total dissolves solid concentration in different sampling stations

Table 2 Physical water quality of around Chitrakoot region

S.N.	Name of Sampling Stations	Physical Parameters					
		Ambient Temp ^{0}C	Water Temp^{0}C	Colour	Odour	Turbidity (NTU)	TDS (mg/l)
1.	Khodari	36.0	29.0	Clean	Odour less	5.0	415.0
2.	Degarahat	37.0	26.0	Clean	Odour less	3.0	584.0
3.	Tedhi	35.0	29.0	Clean	Odour less	5.0	426.0
4.	Patwaniya	35.0	30.0	Clean	Odour less	5.0	334.0
5.	Amaha	37.0	26.0	Clean	Odour less	5.0	332.0
6.	Puranakher	35.0	28.0	Clean	Odour less	3.0	320.0
7.	Paldev	37.0	29.0	Clean	Odour less	3.0	396.0
8.	Jugulpur	35.0	30.0	Clean	Odour less	3.0	319.0
9.	Bansipur	35.0	30.0	Clean	Odour less	3.0	364.0
10.	Naubasta	36.0	29.0	Clean	Odour less	2.0	493.0
11.	Paushalha	35.0	26.0	Clean	Odour less	10.0	347.0
12.	Sejwar	37.0	30.0	Clean	Odour less	3.0	401.0
13.	Bhagda	37.0	32.0	Clean	Odour less	5.0	395.0
14.	Lalapur	37.0	32.0	Clean	Odour less	3.0	404.0
15.	Raghauvan	35.0	30.0	Clean	Odour less	5.0	408.0
16.	Naiduniya	36.0	30.0	Clean	Odour less	5.0	437.0
17.	Chhaihan	37.0	29.0	Clean	Odour less	3.0	312.0
18.	Chouvepur	36.0	32.0	Clean	Odour less	3.0	512.0
19.	Rajoula	35.0	29.0	Clean	Odour less	3.0	553.0
20.	Pathara	36.0	29.0	Clean	Odour less	3.0	733.0

The results of the chemical analysis of the groundwater of the area show a wide variation in different individual parameters (Table 3). The pH value of groundwater samples ranges from 6.3 to 8.3. This shows that the groundwater in the study area is generally neutral to slightly alkaline. Although pH has no direct effect on human health, it shows close relationship with some other chemical constituents of water. The results are given in Fig. 2.

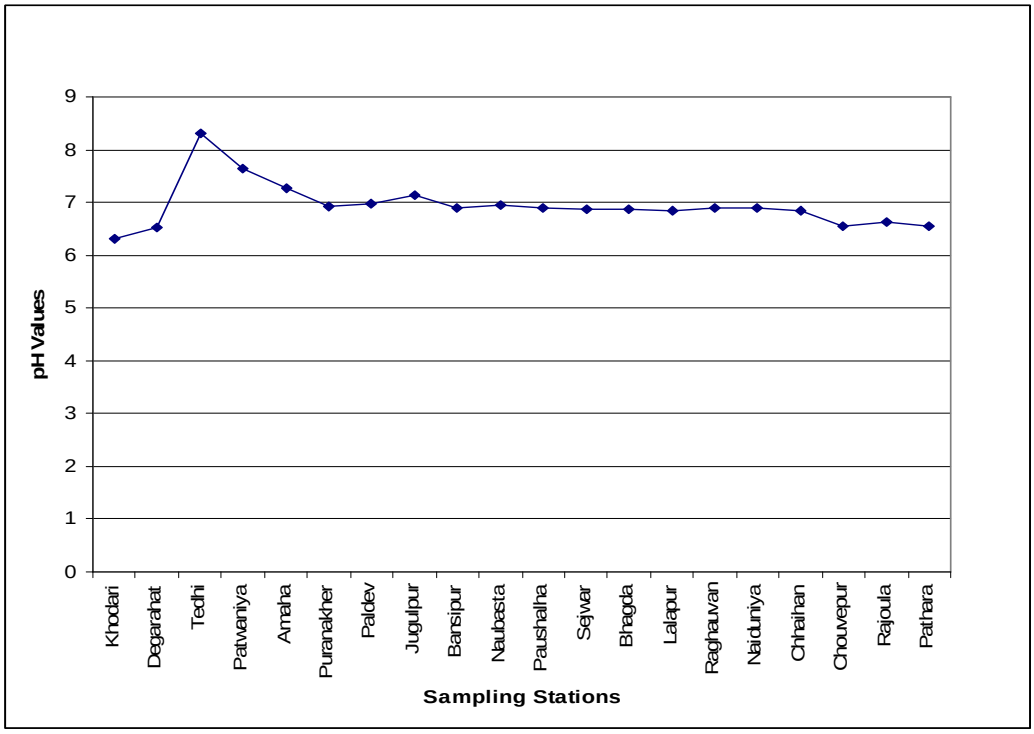

Fig. 2 Distribution map of pH

Table 3 Chemical Water quality of around Chitrakoot region

S.N.	Name of Sampling Stations	Chemical Parameters									
		pH	Total hardness mg/l	Ca hardness mg/l	Mg hardness mg/l	EC µS/cm	Chloride mg/l	Alkalinity mg/l	Fluoride mg/l	Nitrate mg/l	Iron mg/l
1.	Khodari	6.32	300.0	205.8	22.98	587.0	90.0	240.0	1.0	250.0	0.2
2.	Degarahat	6.53	502.0	420.0	20.0	424.0	165.0	312.0	0.3	100.0	0.2
3.	Tedhi	8.30	334.0	151.2	44.60	590.0	225.0	556.0	1.0	25.0	0.1
4.	Patwaniya	7.63	368.0	96.6	66.22	470.0	90.0	460.0	1.0	50.0	0.1
5.	Amaha	7.27	320.0	107.1	51.94	466.0	105.0	488.0	2.0	25.0	0.1
6.	Puranakher	6.93	340.	228.9	51.94	450.0	120.0	408.0	0.3	5.0	0.1
7.	Paldev	6.98	416.0	71.4	84.08	558.0	135.0	480.0	0.5	50.0	0.2
8.	Jugulpur	7.13	324.0	138.6	45.23	449.0	150.0	376.0	0.5	50.0	0.1
9.	Bansipur	6.90	312.0	197.4	27.96	513.0	180.0	512.0	0.5	10.0	0.1
10.	Naubasta	6.96	344.0	147.0	48.06	694.0	195.0	480.0	0.5	10.0	0.1
11.	Paushalha	6.90	296.0	100.8	47.62	490.0	120.0	680.0	0.3	100.0	0.2
12.	Sejwar	6.86	364.0	121.8	59.09	565.0	150.0	488.0	0.5	10.0	0.2
13.	Bhagda	6.88	336.0	138.6	48.16	556.0	135.0	472.0	0.4	10.0	0.1
14.	Lalapur	6.85	340.0	126.0	52.21	570.0	105.0	512.0	1.0	5.0	0.1
15.	Raghauvan	6.90	348.0	210.0	8.21	574.0	90.0	504.0	0.3	10.0	0.1
16.	Naiduniya	6.89	288.0	210.0	52.21	616.0	105.0	528.0	1.5	100.0	0.2
17.	Chhaihan	6.83	256.0	144.9	27.10	441.0	105.0	384.0	0.5	75.0	0.2
18.	Chouvepur	6.55	404.0	155.4	60.65	796.0	120.0	512.0	0.3	25.0	0.1
19.	Rajoula	6.62	448.0	142.8	74.46	780.0	120.0	544.0	1.0	100.0	0.1
20.	Pathara	6.56	736.0	155.3	131.93	1033.0	150.0	544.0	1.0	250.0	0.1

The total hardness is the measure of the capacity of water to precipitate soap. The hardness is more than 50mg/l will cause the Renal Calculi formation of kidney stone. The minimum and maximum values recorded were 296.0 and 736.0 mg/l respectively. The maximum level of total hardness is due to presence of carbonate and non carbonate hardness. The variation of total hardness values are shown in Fig.3.

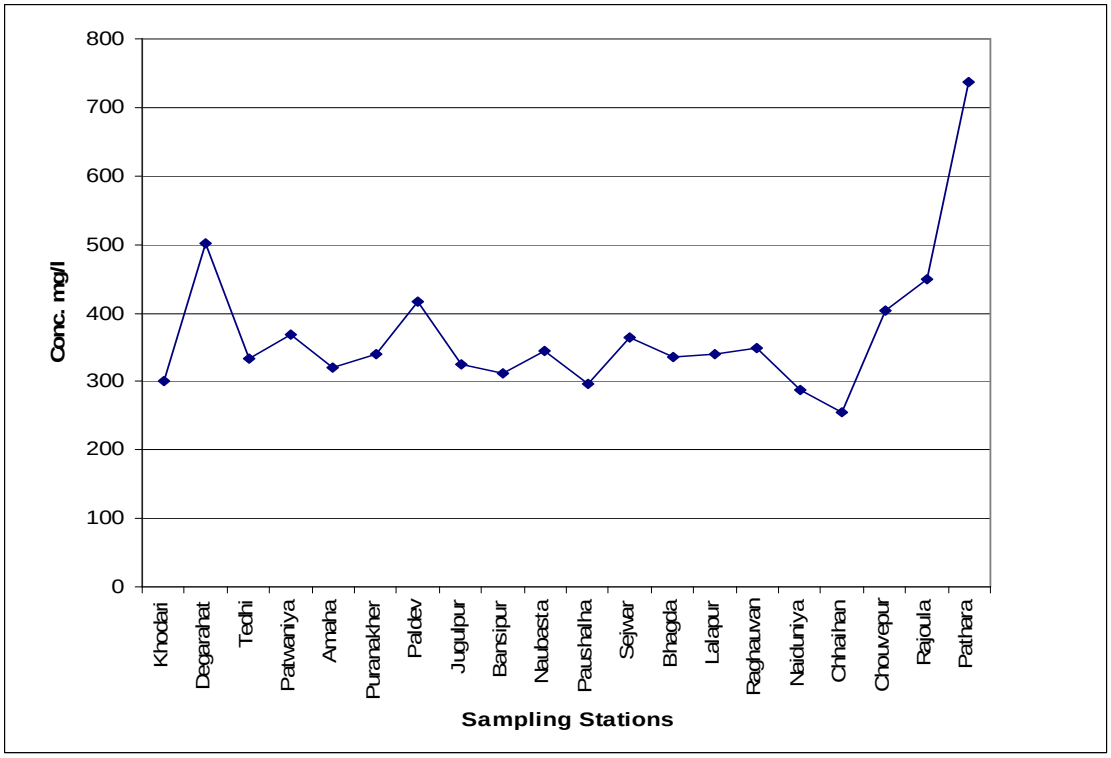

Fig. 3 Total hardness concentration in different sampling stations

In the present study the Electrical conductivity **(**EC) values were found higher at Pathara village (1033.0 µS/cm) and very low conductivity was found at Degarahat (424.0 µS/cm).EC values can be used to estimate the dissolved solids concentration which may affect the taste of water and suitability for various uses. Higher the conductivity values indicate higher the dissolved solids concentration in water [19]. Higher the concentration of acid, base and salts in water, more will be the conductivity. The variation of EC values are shown in Fig.4.

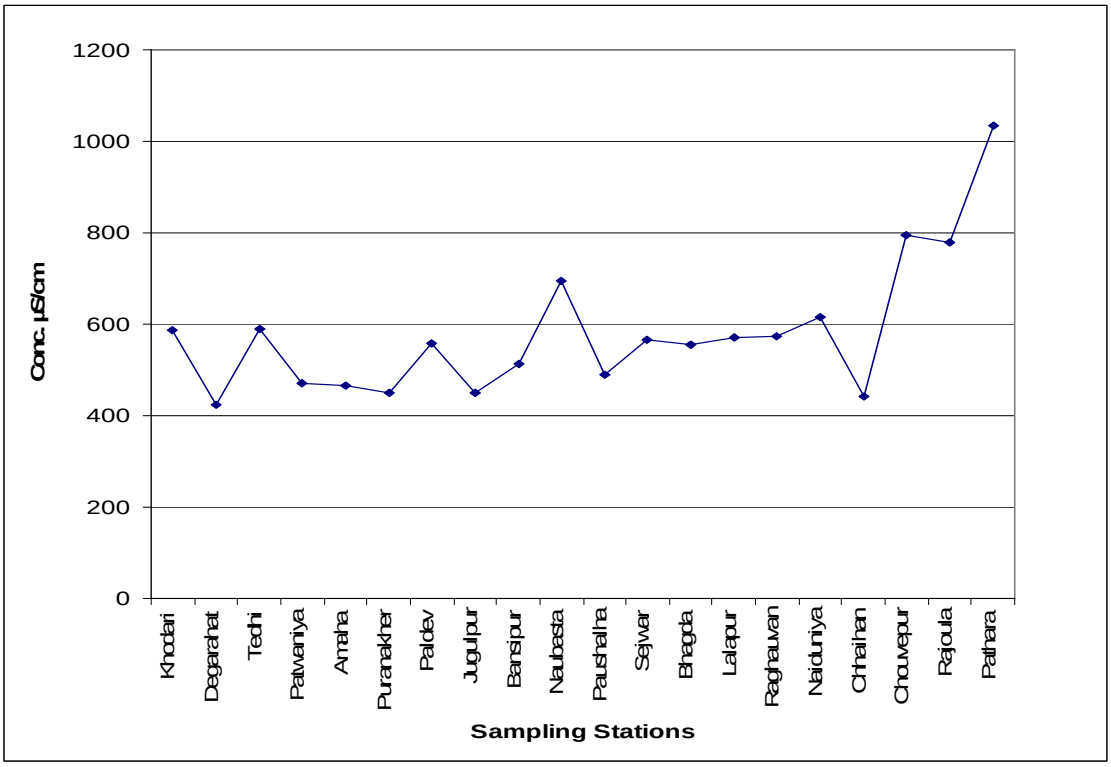

Fig. 4 Electrical conductivity in different sampling stations

Chlorides observed during month of January 2014-June 2014 were in the range of (90.0 - 225.0 mg/l). Chlorides show maximum fluctuation at village Tedhi in hand pump sample (225.0 mg/l). The manimum values are recorded at village Khodari, Patwaniya and Raghauvan in hand pump sample (90.0 mg/l) during rainy season. In all other locations chloride content were under permissible limit (250.0 mg/l). The results are given in Fig.5.

Total alkalinity ranges from 240.0 to 680.0 mg/l in the study area. Alkalinity of water is the capacity to neutralize acidic nature and is characterized by the presence of hydroxyl ions. Alkalinity around 150 mg/l has been found conductive to higher productivity of water bodies. The variation of alkalinity values are shown in Fig.6.

Fluoride is one of the main trace elements in groundwater, which generally occurs as a natural constituent. BIS has suggested permissible limit of fluoride in drinking water as 1.0 mg/l and tolerance range up to 1.5 mg/L. If fluoride concentration is more than 1.5 mg/l it may cause fluoride dental motling and bone diseases by WHO. In the study area, all the water sample falls within the permissible limit of BIS. The minimum and maximum value lies between 0.5 and 2.0 mg/l. The results are given in Fig. 7.

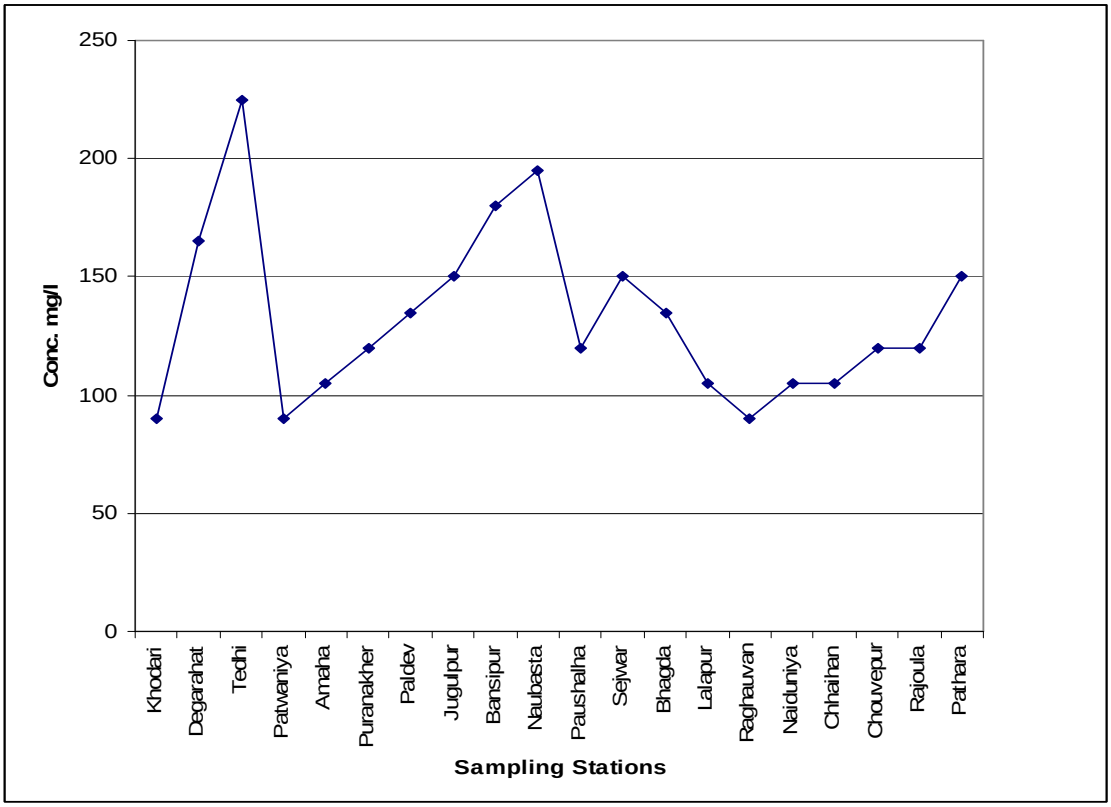

Fig. 5 Chloride concentration in different sampling stations

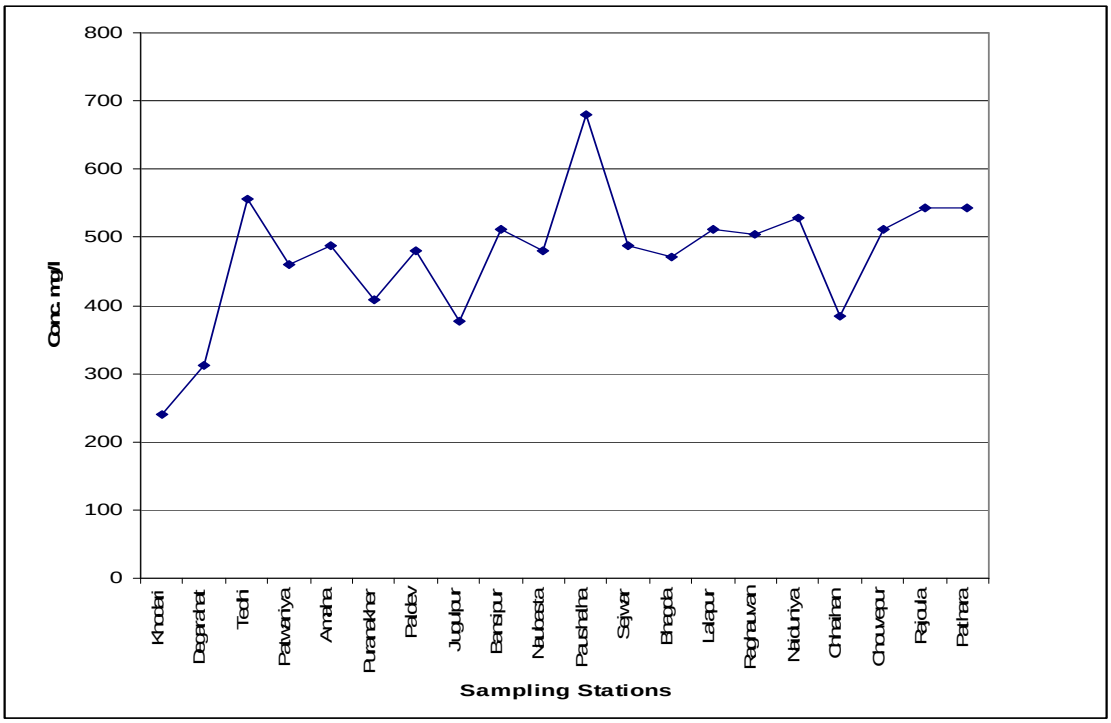

Fig. 6 Total alkalinity concentration in different sampling stations

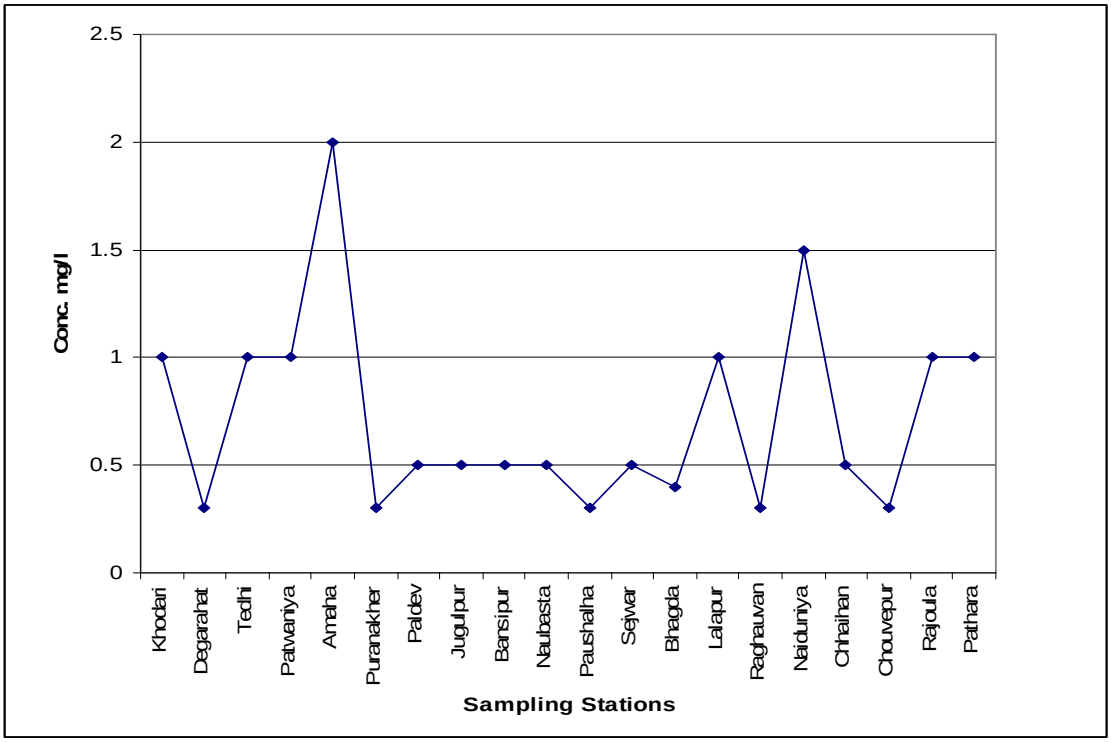

Fig. 7 Fluoride concentration in different sampling stations

The desirable nitrate value for drinking water prescribed by BIS is 100 mg/L. The values of nitrate for all water samples fall within the limit. The minimum and maximum value lies between 10.0 and 250.0 mg/l. The high concentration of nitrate in drinking water is toxic and causes blue baby disease/methaemoglobinaemia in children and gastric carcinomas [20-21]. Nitrogen in the form of nitrate is known to cause contamination of groundwater beneath agricultural lands [22]. The results are given in Fig. 8.

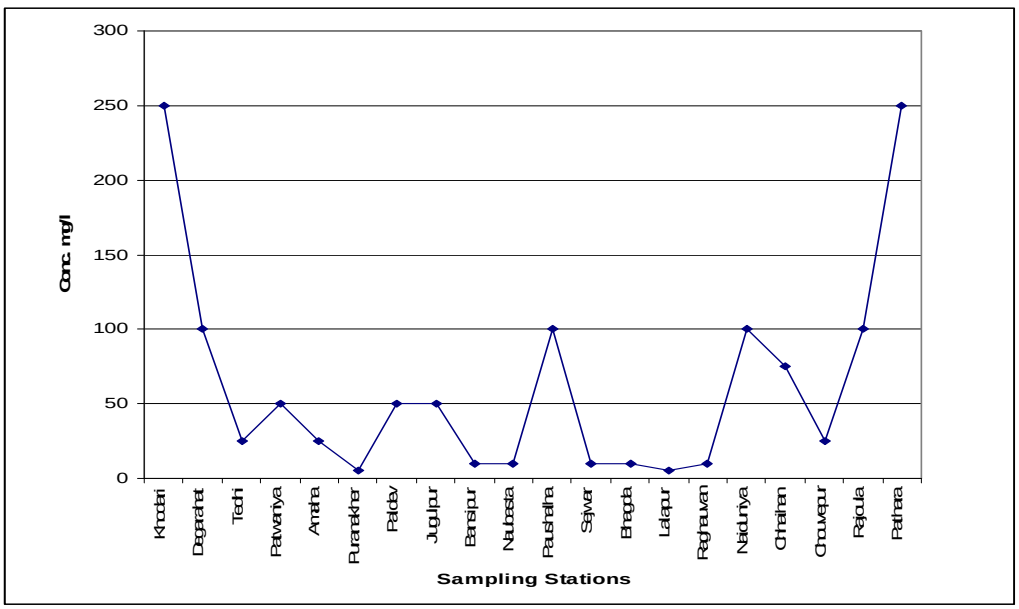

Fig. 8 Nitrate concentration in different sampling stations

Iron is biologically important element which is essential to all organisms and present in hemoglobin system. High concentration of iron causes slight toxicity. The values of iron for all water samples fall within the limit. The minimum and maximum value lies between 0.1 and 0.2 mg/l. The results are given in Fig. 9.

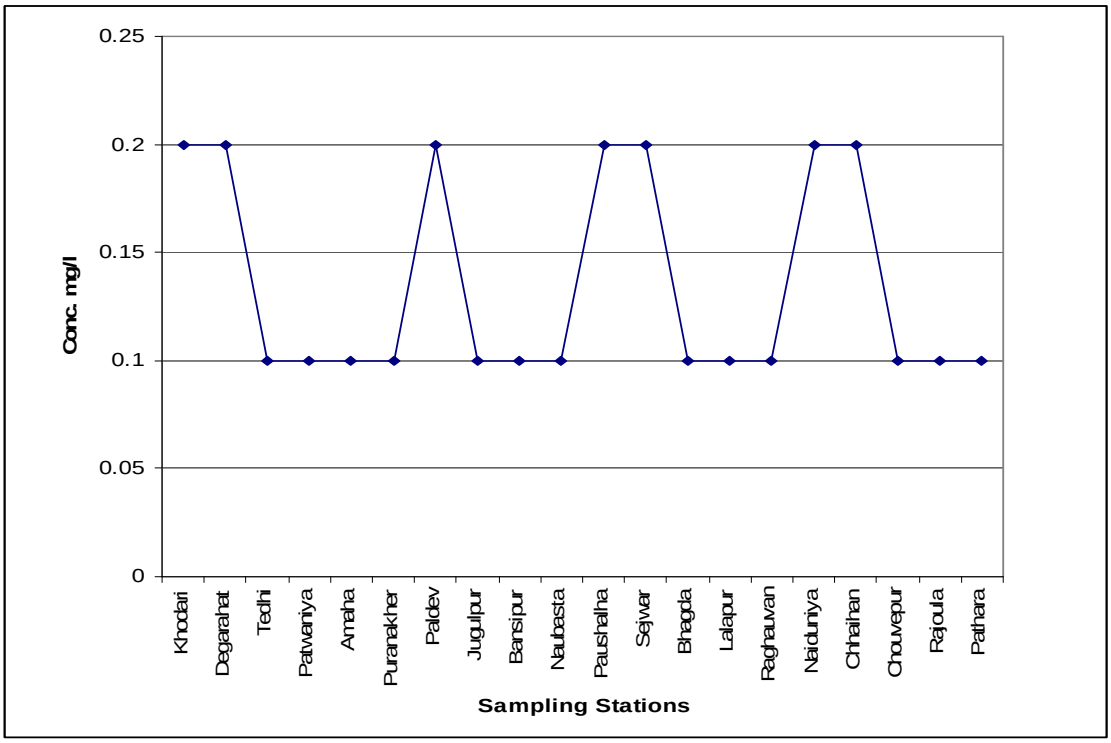

Fig. 9 Iron concentration in different sampling stations

CONCLUSION

Twenty groundwater samples collected for drinking water quality in physico-chemical analysis of water samples of around Chitrakoot region Tahsil Majhagwan, District Satna, Madhya Pradesh, India. Physico-chemical parameters are out of the highest desirable limit or maximum permissible limit set by IS: 10500. Hence, these sample water cannot be absolutely fit for directly drinking. Some essential treatment needed to convert in drinkable water. In conclusion, from the results of the present study it may be said that the people in these rural areas are therefore at higher potential risk of contacting water-borne and/or sanitation related diseases. Both villages water is not absolutely fit for directly drinking purpose need treatments to minimize the contamination. It is recommended that water analysis should be carried out from time to time to monitor the rate and kind of contamination.

It is need of human to expand awareness among the people to maintain the cleanness of water at their highest quality and purity levels to achieve a healthy life.

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