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Short Communication

Evaluation of water quality index for ground water in Dapoli, MS, India

H.N. Bhange[1*], P.K. Singh[2], P.M. Ingle[3] and B.K. Gavit[4]
[1]Dept of SWCE, CAET, DBSKKV, Dapoli, MS, India
[2]Dept. of SWE, CTAE, Udaipur, Raj, India
[3]DBSKKV, Dapoli, MS, India
[4]Dept of SWCE, CAET, Rahuri, MS, India
harshalbhange@gmail.com

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Abstract

In the present paper, ground water samples from different location of Dapoli block has been collected and analyzed for different physico-chemical factors. Water quality index of ground water supported on the basis of collected data from Dapoli block, were evaluated for factors viz. TDS, pH, Total Hardness, Cl, Nitrate and Sulphate, etc. The WQI calculate showed that maximum numbers of wells varies in between good to excellent class. A small number of water specimen came in the class fair to poor class representing that water was suitable. The WQI was excellent in the study area. It was concluded from the results obtained that ground water quality of Dapoli block is suitable for consumption purpose.

Keywords: Water quality index, groundwater, Dapoli.

Introduction

Ground water is a natural source with economic and ecological significance and having crucial value for supporting health, life, and truthfulness of ecosystems. This source is all the time more endangered by in excess of withdrawal which shows dangerous long lasting effects. Mishandling and shortage of ground water create a serious risk to sustainable growth and income. The accessibility of ground water is tremendously irregular, both in time, depth and space that will be the case in upcoming years. The irregular distribution of ground water in the State can be mostly attributed to greatly diversed lithology and regional deviation of rainfall[1].

Water is 'life'. It is one of the primary needs on the earth. Water is crucial for variety of uses to human beings in addition to flora and fauna. Its much use include drinking and other domestic purposes, irrigation, power generation, transportation, fishing, mining, industrial cooling and fire fighting.

In the civilization, water is only natural source to handle every one aspects of civilization from farming and trade enlargement to social and spiritual values implanted. Water Quality phrase normally used to state biological physical, or chemical properties of water. This in turn, may be connected to the suitability of water for a specific purpose.

An excellence of water generally described in terms of its, physico-chemical parameters[2]. As far as WQI considered to judge water is drinkable or not. WQI gives an entity that state overall water quality at particular place, based on a number of water quality factors[3]. Therefore, for any town, a ground water quality map will be an important factor for assessing portability. It is also used as preventive hint for possible environmental wellbeing problems[4]. The aim of the study is to evaluate ground water quality for Dapoli taluka, District Ratnagiri.

Study Area: The study area is a part of a coastal tract situated on the western part of Ratnagiri district, Maharashtra (Figure-1). It lies among Latitude 17°33'59.489"N to 17°56'22.54"N and Longitude 73°2'56.16"E to 73°23'7.915"E and covers an area of about 910 km^2. Average annual daily max. and daily min. temperature of study part ranges from 31°C to 23°C. The RH ranges from 70 – 75 % with annual rainfall was about 338 cm. Mainly rainfall takes place in the month of June to September. As an expansion of Dapoli Tahasil is going on at to a large extent, the colonies started makes use of ground water as a source of water supply for household use.

Methodology

Wells (dug and bore wells) situated inside location area used as sampling of ground water. The subsequent parameters were traced i.e. TDS, pH, Hardness, EC, Alkanity, Mg, Cl, Ca, F and SO_4. Figure-1 shows the study area.

Water quality index: Water Quality Index method offers combined effect of unit water quality factors on complete water quality for individual consumption[5]. Computation of Water Quality Index is vital practice of distinguish ground water quality and its appropriateness for consumption purpose[6]. The Water Quality Index suggestion is based on comparison of water quality parameter with respective to regulatory standards[7]. It gives sole number which express on the whole water quality

at particular place based on several water quality parameters[3]. Water Quality Index get better accepting of water quality issues by integrating multifaceted data. It producing a score that explained water quality grade and estimates water quality trends[8].

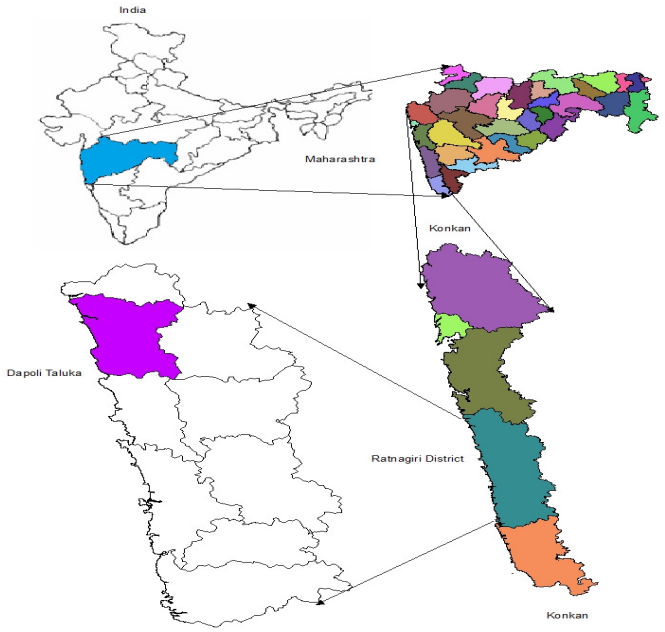

Figure-1: Study Area.

WQI is calculated to check decrease bulky quantity of information regarding water quality to unique algebraic number by following standards of consumption water recommended by BIS[9] and ICMR. WQI reveals combined effect of different water quality factors in general water quality. Water quality index classes are given in Table-1. WQI worked out depend on process given by Boyacioglu[8] and Sinha D.K. et al.[10] to find out appropriateness of ground water for consumption purpose as below,

$$WQI = \text{Antilog}\left(\sum_{i=1}^{n} W_i \log_{10} q\right) \quad (1)$$

Where, w_i = weightage factor of i^{th} parameter, q_i = quality rating of i^{th} parameter, w_i is calculated from the following equation, $w_i = k/s_n$

$$k = \frac{1}{\frac{1}{VS_1} + \frac{1}{VS_2} + ...\frac{1}{VS_n}} \quad (2)$$

Where, s_n = i^{th} parameter's standard value, q_i is designed as equation below,

$$q_i i = \left((V_i a - V_i i)/(V_i s - V_i i)\right) \times 100 \quad (3)$$

Where, v_a = actual value gained from analysis of i^{th} parameter, v_s = standard value of i^{th} parameter, v_i = ideal value (pH=7 and 0 for all parameters), $V_{standard}$ =BIS / ICMR standard (water quality parameter).

Table-1 shows standards related to groundwater quality factors. From Table-2 indicated values of 10 parameters. Value of WQI is work out by formulae given above. Classification is shown in Table 3 to make possible evaluation of ground water portability in study area.

Table-1: Water quality standard, and unit weightages assigned.

Parameters	Sn (Standard)	$1 / S_n$	K	W_n
EC	300	0.0033	1.1853	0.0039
Alkalinity	120	0.0083	1.1853	0.0098
pH	8.50	0.1176	1.1853	0.1394
TDS	500	0.002	1.1853	0.0023
Total Hardness	300	0.0033	1.1853	0.0039
SO_4	200	0.005	1.1853	0.0059
Mg	50	0.02	1.1853	0.0237
Cl	250	0.004	1.1853	0.0047
Ca	75	0.0133	1.1853	0.0158
F	1.50	0.6666	1.1853	0.7902
	Total	0.8436		1

Table-2: Water Quality Parameters.

Sample	pH	EC	Hardness	Alkanity	TDS	Cl	SO_4	Ca	Mg	F	WQI
1	7.5	287	100	101	184	25	6	21	12	0.05	5.25
2	7.2	241	52	40	154	16	5	14	4	0.05	4.51
3	7.3	220	56	47	141	18	9	8	9	0.05	4.74
4	7.4	186	120	86	119	14	8	30	11	0.05	5.09
5	7.1	149	36	32	95	4	3	8	4	0.05	3.94
6	7.4	246	20	11	157	6	5	6	1	0.05	4.57
7	7.6	348	68	72	223	10	4	13	9	0.05	5.26
8	7.1	218	116	115	140	6	10	21	16	0.05	4.36
9	7.2	284	56	65	182	4	3	10	8	0.08	6.29
10	7.4	279	8	7	179	12	0	2	1	0.01	1.24

Unit mg/l except conductivity and pH.

Table-3: Water Quality Status and WQI.

Status	WQI
Unsuitable	> 100
Very Poor	75.1-100
Poor	50.1-75
Good	25.1-50
Excellent	0.0 -25.0

Results and discussion

pH: is vital factor, which find out appropriateness for a range of uses. In this study, pH level fluctuates from 7.1 to 7.6 of water and is in acceptable limit i.e., 6.5 to 8.5 as given by the BIS/ ICMR. pH upto 7.5 representing all wells in study area was in allowable limits.

Electrical Conductivity: EC is ability of electrical current that passes through water. EC was straight way associated to concentration of ionized materials in water. It might be related to troubles of too much hardness. EC varies from 149 to 348 µm/cm in study area. The EC values were higher than 225 µm/cm observed in 40 % in study area.

Hardness: The safe limit of total hardness for drinking water is 300 mg/l of $CaCO_3$. Hardness of groundwater ranges between 8 to 120mg/l. This indicated that study area lies in allowable range.

Calcium: Ca is one of the copious materials in water. Magnesium and calcium are two general dissolved minerals in water that makes water hard. Calcium in the ground water which varies between 2.00 to 30 mg/l in the study area, which point out that whole study area, was in permissible limits.

Magnesium: Distribution of Mg in ground water of the study area varies in between 1mg/l to 16mg/l which specify that complete study area is in allowable limits.

Total Alkalinity: The pleasing limit of alkalinity of drinkable water is 120mg/l. Total Alkalinity in groundwater, it varies from 7 to 115 mg/l which show that whole study area lies in allowable limits.

TDS: TDS in groundwater could be due to natural sources viz runoff, sewage, and industrial waste[11,12]. According to ICMR and BIS, the allowable limit of TDS is 500mg/l. In the study area, TDS is varies between 95 to 223mg/l. TDS was found within allowable limit.

Sulphate: Sulphate concentrations are varied from 0 to 10mg/l. It was observed that samples of sulphate having value less than 200mg/l fall within permissible limit throughout study area.

Chloride: within portable water, the salty test is due to chloride concentrations. Cl is most vital parameter in evaluating water quality. High concentration of Cl indicated high level of organic pollution[3]. BIS recommended 250 mg/l as allowable limit of chloride in drinking water. Chloride is fluctuating within 4 to 25 mg/l. Lower concentration of Cl found within study area.

Fluoride: As per BIS, in drinking water permissible limit of fluoride is 1mg/l and tolerable limit is up to 1.50 mg/l. Water

intake having fluoride concentration above 1.5mg/l results in dental mottling, fluorosis and bone illness. In the study area, fluoride varies in 0.01 to 0.08mg/l range which came in desirable limit.

Water Quality Index: WQI was ranges between1.24 to 6.29. Entire study area 910 km^2 comes under excellent category. Entire area having potable groundwater; inhabitants can used the groundwater for consumption purpose.

Conclusion

The groundwater quality of Dapoli taluka, dist Ratnagiri has been evaluated for its household suitability purpose. The allocation of EC, pH, Ca, Hardness, and Mg were observed within allowable limit in study area. In the study area, fluoride, sulphate, TDS, and Cl concentration were in within the acceptable limit. The study area having WQI showed that 100 per cent area comes under excellent class. Thus, it was concluded that groundwater appropriate for consumption in study area.

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