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Assessment Of Water Quality Index For The Drinking Water In Huliginahole Village, Davanagere District, Karnataka, India

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ABSTRACT: The present work is carried out to determine the Water Quality Index (WQI) of drinking water for Huliginahole village, in Harihara taluk, Davanagere district, Karnataka. In order to find the quality of drinking water for public consumption the water quality index is used. This paper is mainly on the study of influence of environmental parameters on the water quality of drinking water. There are many ways to find the quality of water fit for drinking. Water quality index (WQI) shows the quality of water in terms of index number offers a useful representation of overall quality of water for public and also for any intended use like pollution abatement programmes and in water quality management. In this analysis water quality index is determined by various physico-chemical parameters like, pH, Total dissolved solids, electrical conductivity, total alkalinity, total suspended solids, total hardness, calcium, magnesium, chloride, nitrate, sulphate, biological oxygen demand (BOD) and dissolved oxygen.

KEY WORDS: drinking water, water quality standards, water quality index(WQI), water quality determination.

I. INTRODUCTION:

Water is one of the most essential source for all the plants, animals and human beings. Due to human advancement water source is getting polluted very rapidly. It is very hard to find the source for drinking purpose, almost all the surface water source is polluted in India due to various human activities. Although we have the water source we cannot utilise the water directly for drinking purpose, treatment before consumption is very essential. The fresh water is only available at the point of formation of water bodies only.

Huliginahole is a small village located in Harihara taluk, Davanagere district. The village is located near the bank of Tungabhadra river. Most of the people of this village are depending on agriculture. The treated water service is given from the nearest village called **nandgavi.** the water for this treatment plant is obtained from nearest river Tungabhadra. Another source of drinking water is the ground water.

The present work was carried out between April and May. Water quality index provides a single number, that shows the overall quality of water at the location and time, based on several water quality parameters. The main objective of the water quality index is to make complex water quality data into information that can be understandable and useable by the public's. However there are many ways to determine the quality of water. The water quality index is in based on most important parameters that provide a simple indicator of the quality of water.

II. STUDY AREA:

Huliginahole village lies in 14.4691° North latitude and 75.6819° East longitude. It is located in Harihara taluk, Davanagere district, Karnatake. It is situated 28km towards west from district head quarters davanagere and 12km from Harihara. Most of the people are dependent on ground water and treated water for drinking purpose.

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(fig,1.1: satellite map of study area).

For the present study the Huliginahole village was selected. Ground water and treated water from nandgavi are the source available for drinking purpose for this village. This village has a total GLSR of 13no's, in which three are used to store treated water and ten for bore water or ground water storage, each has a capacity of storing 2000 litres. Presently there is a undergoing jalashree project which is aimed to supply 24X7 treated water supply for every households.

(fig,1.2: GLSR Tanks)

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(fig,1.3: OHT for storing treated water).

III. METHODS AND METHODOLOGY:

The water samples from the source were collected at an interval of 30 days and analysed for 13 different important physic-chemical parameters by standard procedure as per NARI (National agricultural research institute) and APHA (2005). All the samples are collected in a polyethylene bottles and plastic bottles which are air tight and leak proof.

In this analysis, for the calculation of water quality index, thirteen important parameters were selected. The water quality index (WQI) has been calculated by using the standards of drinking water quality recommended by the Bureau of Indian standards (BIS), Indian council for medical research (ICMR), and world health organisation (WHO). The weighted arithmetic index method has been used for the calculation of water quality index (WQI) of the water source. Further, quality rating or sub index (Qr_x) was calculated using the following expression.

Where, W_x =Unit weight of x^{th} parameters.

K= proportionality constant and can also be calculated by using the following equation.

$$K = \sqrt{\frac{1}{\Sigma(\frac{1}{S_x})}}$$

$$Qr_x = \frac{(V_x - V_o)}{(S_x - V_o)} X\ 100$$

Where, Qr_x = quality rating or sub index corresponding to the x^{th} parameter (it is a number reflecting the relative value of this parameter in the polluted water with respect to its standard permissible value).

V_x =Value of the x^{th} parameter at a given sampling station.

S_x =Standard permissible value of n^{th} parameters.

V_o =Ideal value of x^{th} parameter in pure form of water (i.e, zero for all the other parameters and for pH and dissolved oxygen it is 7 and 14 respectively).

Unit weight was calculated by a value inversely proportional to the recommended standard value S_x of the corresponding parameter.

$$W_x = (\frac{K}{S_x})$$

The overall water quality index was calculated by aggregating the quality rating with the unit weight linearly.

$$WQI = \sum(Qr_x\ X\ W_x) / \sum W_x$$

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Table no 1. Water quality rating as per, weight arithmetic water quality index method as per NSFWQI (national sanitation foundation of water quality index).

Water quality index value	Water quality status	grading
>100	Excellent water quality	A
76-99	Good water quality	B
51-75	Poor water quality	C
26-50	Very poor water quality	D
0-25	Unsuitable for drinking purpose	E

Table no 2. Drinking water standards recommended agencies and their unit weights. (all values except pH and Electrical conductivity are in mg/ltr)

Sl no	parameters	standards	Referred agency	Unit weight
1	pH	6.5-8.5	BIS/ICMR	0.2190
2	Total dissolved solids	500	BIS/ICMR	0.0037
3	Total alkalinity	120	ICMR	0.0155
4	Total suspended solids	500	WHO	0.0037
5	Total hardness	300	BIS/ICMR	0.0062
6	Electrical conductivity	300	ICMR	0.371
7	Calcium	75	BIS/ICMR	0.025
8	Chlorides	250	ICMR	0.0074
9	Magnesium	30	BIS/ICMR	0.061
10	Nitrate	45	BIS/ICMR	0.0412
11	Sulphate	150	BIS/ICMR	0.01236
12	Dissolved oxygen	5.00	BIS/ICMR	0.3723
13	Biological oxygen demand	5.00	ICMR	0.3723

MERITS AND DEMERITS OF SELECTED WATER QUALITY INDEX METHOD

MERITS:

1. Incorporate data from multiple water quality parameters into a mathematical equation that rates the health of water body with number.
2. Less number of parameters required in comparison to all water quality parameters for particular use.
3. Useful for communication of overall water quality information to the concerned citizens and policy makers.
4. Reflects the composite influence of different parameters i.e. important for the assessment and management of water quality.
5. It describes the suitability of both surface and groundwater sources for human consumption.

DEMERITS:

1. WQI may not carry enough information about the real quality situation of the water.
2. Many uses of water quality data cannot be met with an index.
3. The eclipsing or over-emphasizing of a single bad parameter value
4. A single number cannot tell the whole story of water quality; there are many other water quality parameters that are not included in the index.
5. WQI based on some very important parameters can provide a simple indicator of water quality.

IV. RESULTS:

Table 3. calculation of water quality index for ground water.

Sl no	parameters	Observed values	Standard values	Unit weight(W_x)	Quality rating(Qr_x)	(W_x X Qr_x)
1	pH	7.8	6.5-8.5	0.2190	53.33	11.67927
2	Total dissolved	125	500	0.0037	25	0.0925

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	solids					
3	Total alkalinity	75	120	0.0133	62.5	0.83125
4	Total suspended solids	388	500	0.0037	77.6	0.28712
5	Total hardness	196	300	0.0062	65.33	0.405046
6	Electrical conductivity	270	300	0.371	90	33.39
7	Calcium	88	75	0.025	117.3	2.9325
8	Chlorides	90	250	0.0074	36	0.2664
9	Magnesium	42	30	0.061	140	8.54
10	Nitrate	36	45	0.0412	80	3.296
11	Sulphate	144	150	0.01236	96	1.18656
12	Dissolved oxygen	2.5	5.0	0.3723	50	18.615
13	Biological oxygen demand	20	5.0	0.3723	133.33	49.63876
				Σ=1.51	Σ=1026.39	Σ=131.1604
	$WQI = \sum Qr_x \, X \, W_x / \sum W_x$ =86.8612					

Table 4, calculation of water quality index for treated water.

sl no	parameters	observed value	standard value	unit weight	quality rating	wnqn
1	pH	6.8	6.5-8.5	0.219	13.33	2.91927
2	Total dissolved solids	500	500	0.0037	100	0.37
3	Total alkalinity	70	120	0.0133	58.33	0.775789
4	Total suspended solids	0	500	0.0037	0	0
5	Total hardness	175	300	0.0062	58.33	0.361646
6	Electrical conductivity	400	300	0.371	133.33	49.46543
7	Calcium	75	75	0.025	100	2.5
8	Chlorides	180	250	0.0074	72	0.5328
9	Magnesium	40	30	0.061	133.33	8.13313
10	Nitrate	55	45	0.0412	122.22	5.035464
11	Sulphate	150	150	0.01236	100	1.236
12	Dissolved oxygen	4.5	5	0.3723	90	33.507
13	Biological oxygen demand	28	5	0.3723	133.33	49.63876
				1.51		154.4753
			102.3015152			

V. CONCLUSION:

After studying the various physio-chemical parameters of the water source as in table no 3. The study on various parameters of ground water shows that the water is drinkable since its WQI value is 86.68% the quality of water is very good but there is more amount of hardness present in ground water in terms of calcium and magnesium, lime can be used to reduce the hardness in water with a very low cost treatment. All other parameters are just as required or within the limits given by the specified agencies. There are many softening technical process to reduce the hardness in water which can be implemented before use of water. Hardness in water means there is increasing in alkalinity also as per the study both hardness and alkalinity values are more.

2. For treated water:

After studying various physiochemical parameters the treated water is having good quality which means it is safe to drink no harm is caused by drinking these treated water the WQI of these water is 102.3% which means the treated water has excellent properties which is fit for drinking all the parameters are as per the desired limits specified by the BIS drinking water standard board so it can be consumed directly.

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