



Assesment of Drinking Water of Irai River Using Water Quality Index

Pratiksha Tambekar¹, R.G. Weginwar² and R.J.Batra³

¹Shri sai polytechnic

²Guru Nanak College of Science, Ballarpur Chandrapur

³Ramdeo Baba College of Engineering and Management, Nagpur
morey_pratiksha@yahoo.com

Abstract:

To assess quality of water, measures of chemical, physical constituents are need to be specified, by using standard methods for reporting and comparing results of water analysis is important. Keeping it in view the present study was taken up to analyze the Irai river water sample of different localities. We calculate the water quality index (W.Q.I) with the help of physico chemical parameters for water of different localities. The estimated values show that some parameters are under the permissible limit and other shows marginal variations from the prescribed WHO standards. The value of W.Q.I also varies between the 80-200 so the water of these localities is unsafe for drinking and human consumption without purification.

Key words: Water Quality index, Chandrapur region, physico-chemical parameters, Assigned unit weight, quality rating.

Introduction:

Clean water supports are incredible diversity of plant and animal life and also it is a source of drinking water and food sustains human life. It is a valuable resource and for these, and many more reasons, the U.S. EPA, states and Indian tribes, carry out programs to protect the quality of nation's water.(1-2) Water quality is mainly based on the chemical, physical and biological characteristics of water.

Water is rated to be greatest importance, not only for living things but also occupies unique position in industries, agriculture, power generation and domestic purposes.

Surface water (flowing water) like streams, rivers, ponds, lakes and reservoirs is fairly constant in composition. It is generally clear but slightly acidic due to presence of dissolved CO₂ and of weak organic acids (3) which is corrosive in nature. River and canal water may be contaminated by sewage and industrial waste, which may require preliminary treatment prior to softening and sterilization. In the present investigation we have carried out physico-chemical analysis of Irai River water in order to assess water quality using water quality index calculations at different location in and around Chandrapur district and compared with WHO standards.(4-5)

Material and Methods:

For the analysis of water, we have collected the water samples of different localities of Irai River Chandrapur using standard procedure and technique for the estimation W.Q.I of different water samples of different localities (6-8). A brief description of sampling sites are given in table no. 1





Water Quality Index (W.Q.I) has been calculated on the basis of analytical values of physico- chemical parameters of water samples and compared with WHO standards. W.Q.I. has been regarded as one of the most effective way to communicate water quality (9-11). In order to calculate W.Q.I of water samples eleven quality physico- chemical parameters were used.

Water Quality Index is calculated by using the methods proposed by Tiwari and Mishra (12). Followings equations have been used for calculating the Water Quality Index.

$$(1) \quad \text{Quality rating } q_n = 100 [(V_n - V_i) / (V_s - V_i)]$$

Where

V_n = Actual amount of n^{th} parameter

V_i = the ideal value of this parameter

$V_i = 0$ Except for pH and DO

$V_i = 7.0$ mg/ liters for pH

$V_i = 14.6$ mg/ liters for DO

V_s = Its Standard values

(2) Assigned Unit Weight for various parameters is inversely proportional to the recommended standard (S_n) for the corresponding parameter.

$$W_n = K / (S_n)$$

$$\sum W_n = 1$$

$$n = 11$$

$$(3) \quad \text{W.Q.I} = \sum_{n=1}^{11} (SI)_n = \sum_{n=1}^{11} (q_n) W_n$$

$$= \text{Antilog}_{10} \sum_{n=1}^{11} W_n \log_{10} q_n$$

It has been assumed for WQI of water if-

W.Q.I < 50 than the water is fit for human consumption

W.Q.I < 80 than the water is moderately polluted

W.Q.I > 80 than the water is excessively polluted

W.Q.I < 100 than the water is severely polluted

Result and Discussion:

The data of physico- chemical water analysis is presented in Table 2 collected at different sites of Irai water in and around Chandrapur district.

A Critical analysis of data shows the negligible variation of all the values of different sites except some parameters. It is evident that the drinking water sample collected has lower W.Q.I values for all the parameters. (13-15)

When compared with WHO standards, all sites S1, S2, S3, S4, Temperature, PH, Chlorides, Nitrates, Total solids are in permissible limit. Turbidity in S1 is





slightly high, but S2, S3, S4 is below permissible limit. In site S1 and S4 Alkalinity is very high, S2, S3 are in limit Hardness is more than double fold for all stations. COD and Fluoride is within range.

We have also assess the water quality on the basis of W.Q.I (water quality index) [16] for calculating W.Q.I. assigned unit weight (W_n) for each parameter has been calculated and compared with the help of WHO standard for eleven physico-chemical parameters and the values are given in Table.3

The actual value and quality rating value of different physico- chemical characteristics of drinking water of different locations in Chandrapur region are presented in table no.4, 5, 6, and 7 respectively. [17-19]

The W.Q.I values of all the sites is less than 50 which indicates that water is safe for human consumption. Graphical representation of water quality index in this region also indicates that the water is safe for human consumption. (20)

Table. 1- A brief description of sampling sites of Irai River (In and around Chandrapur district)

Sr no	Sampling site	Sampling code	Physical appearance
1.	Padoli	S1	Turbid
2.	Dataala	S2	Clear
3.	Near Bimba gate	S3	Clear
4.	MardaShivni	S4	Clear

Table.2-A Comparativedata collecting for qualitative study.

Sr no	Parameters	S1	S2	S3	S4	WHO Standards
1	Temperature	30	32	31	30	
2	PH	7.43	7.65	7.40	7.30	7.5
3	Turbidity	8.08	0.46	0.42	0.37	5.0
4	Alkalinity	148	112	112	240	100
5	Total Solids	498	455	482	515	500
6	Chlorides	152	134	146	94	200
7	Hardness	200	200	232	244	100
8	D.O	8.3	9.2	7.4	3.5	5.0
9	Cod	11.4	12.6	10.2	11.3	10
10	Fluoride	1.12	1.11	1.10	0.65	1.0
11	Nitrates	2.39	1.86	7.90	23.47	45

Table.3- Calculated Assigned Unit Weight W_n for each parameter with their WHO standard

Sr no	PARAMETERS	WHO Standards	Assigned Unit Weight W_n
1	TEMPERATURE		
2	PH	7.5	0.0236563
3	TURBIDITY (NTU)	5.0	0.037850113
4	ALKALINITY (Mg/L)	100	0.001892505
5	TOTAL SOLIDS (Mg/L)	500	0.000378501
6	CHLORIDES(Mg/L)	200	0.000946252
7	HARDNESS(Mg/L)	100	0.001892505
8	D.O(Mg/L)	5.0	0.037850113
9	COD(Mg/L)	10	0.018925056
10	FLUORIDE (PPM)	1.0	0.189250567
11	NITRATES(Mg/L)	45	0.0042055





Table.4- Actual value (V_n), Quality rating (q_n) and calculated values of $W_n \log_{10} q_n$ for different parameters at padoli

Sr no	PARAMETERS	Actual value (V_n),	Quality rating (q_n)	$W_n \log_{10} q_n$
1	TEMPERATURE			
2	PH	7.43	86	0.04576
3	TURBIDITY (NTU)	8.03	160.6	0.08348
4	ALKALINITY (Mg/L)	148	140	0.004061
5	TOTAL SOLIDS (Mg/L)	498	99.6	0.0007563
6	CHLORIDES(Mg/L)	152	76	0.001779
7	HARDNESS(Mg/L)	200	200	0.00435
8	D.O(Mg/L)	8.3	65.625	0.0687762
9	COD(Mg/L)	11.4	114	0.038927
10	FLUORIDE (PPM)	1.12	112	0.387815
11	NITRATES(Mg/L)	2.39	5.31	0.00304938

Table no. 5: Actual value (V_n), Quality rating (q_n) and calculated values of $W_n \log_{10} q_n$ for different parameters at Dataala

Sr no	PARAMETERS	Actual value (V_n),	Quality rating (q_n)	$W_n \log_{10} q_n$
1	TEMPERATURE			
2	PH	7.65	130	0.0500080
3	TURBIDITY (NTU)	0.46	0.092	-0.0392207
4	ALKALINITY (Mg/L)	112	112	0.0038781
5	TOTAL SOLIDS (Mg/L)	455	91	0.000741490
6	CHLORIDES(Mg/L)	134	67	.001727926
7	HARDNESS(Mg/L)	200	200	0.0043547
8	D.O(Mg/L)	9.2	56.25	0.0662423354
9	COD(Mg/L)	12.6	126	0.039749631
10	FLUORIDE (PPM)	1.11	111	0.3870785334
11	NITRATES(Mg/L)	1.86	4.133	0.00259170

Table.6- Actual value (V_n), Quality rating (q_n) and calculated values of $W_n \log_{10} q_n$ for different parameters at Bimba gate





Sr no	PARAMETERS	Actual value (V _n),	Quality rating (q _n)	W _n log ₁₀ q _n
1	TEMPERATURE			
2	PH	7.40	80	0.04502006
3	TURBIDITY (NTU)	0.42	8.4	0.0349807
4	ALKALINITY (Mg/L)	112	112	0.00387815
5	TOTAL SOLIDS (Mg/L)	482	96.4	0.0007509
6	CHLORIDES(Mg/L)	146	73	0.001763172
7	HARDNESS(Mg/L)	232	232	0.00447669
8	D.O(Mg/L)	7.4	75	0.0709712807
9	COD(Mg/L)	10.2	102	0.0380128
10	FLUORIDE (PPM)	1.10	110	0.38633472
11	NITRATES(Mg/L)	7.90	17.55	0.0052328

Table. 7- Actual value (V_n), Quality rating (q_n) and calculated values of W_nlog₁₀q_n for different parameters at Mardashivni

Sr no	PARAMETERS	Actual value (V _n),	Quality rating (q _n)	W _n log ₁₀ q _n
1	TEMPERATURE			
2	PH	7.30	80	0.04502006
3	TURBIDITY (NTU)	0.37	7.4	0.03290051
4	ALKALINITY (Mg/L)	240	240	0.0045045
5	TOTAL SOLIDS (Mg/L)	515	103	0.000761860
6	CHLORIDES(Mg/L)	94	47	0.00158222
7	HARDNESS(Mg/L)	244	244	0.0045181
8	D.O(Mg/L)	3.5	115.625	0.0780867417
9	COD(Mg/L)	11.3	113	0.03885462
10	FLUORIDE (PPM)	0.65	65	0.3430948
11	NITRATES(Mg/L)	23.47	52.155	0.007222088

Table.8- Calculated Values of W.Q.I for different sites

Sr no	Name of the sites	Values of W.Q.I	Assesment of Water
1	Padoli	34.70366905	Fit for human consumption
2	Datala	29.2975441	Fit for human consumption
3	Near Bimba gate	31.62086906	Fit for human consumption
4	MardaShivni	22.20760206	Fit for human consumption



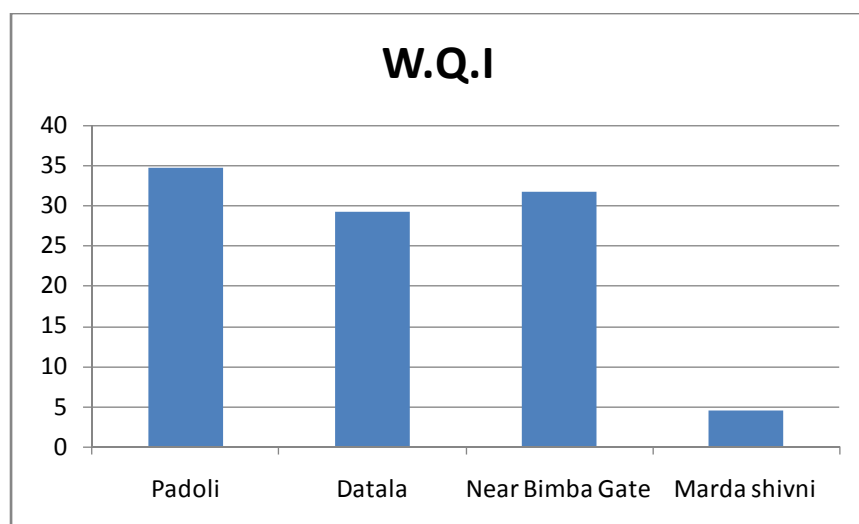


Figure. 1-showing variation of W.Q.I. for all the sites.

Conclusion:

Irai River is the main source of drinking water supply by Municipal Corporation to the Chandrapur city. As a curiosity, we have carried out analysis of different stations of Irai River water quality. On the basis of this study it is found that the drinking water of all the sites of Irai River is potable as far as W.Q.I is concern. No contamination or pollution is observed with reference to water quality index as well as the physico chemical parameters. Chandrapur city public is solely depending on this Irai River water for domestic purposes. Therefore from this study it is clear that Irai River water is safe for drinking purpose. Water quality index (W.Q.I) of all the sites is less than 50 i.e well below the permissible limit which indicates that water is safe for drinking purposes. In future we are planning to carry out microbial contamination study of this Irai River water in order to conform the biological pollution of water.

The more exhaustive analysis is necessary to give any concrete conclusion of water quality. In future we are also planning to carry out the analysis and detail investigations.

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