



## **Assessment of Water Quality of Eachnur Tank, Karnataka, India By Water Quality Index Method (WQI)**

**Prakasha<sup>1</sup>, J.Narayana<sup>2</sup>, S.B.Basavaraddi<sup>3</sup>, G.C.Mallikarjunaswamy<sup>4</sup>, M.B.Shylaja<sup>5</sup>.**

<sup>1</sup>Department of Botany, Kalpataru First Grade Science College, Tiptur.

<sup>2</sup>Dept. of P G Studies and research, Kuvempu University, Shankaraghatta.

<sup>3</sup>Dept. of Physics, Kalpataru First Grade Science College, Tiptur.

<sup>4</sup>Dept. of Zoology, Kalpataru First Grade Science College, Tiptur.

<sup>5</sup>Dept. of Chemistry, Kalpataru First Grade Science College, Tiptur.

### **ABSTRACT**

*The present work aimed assessing the water quality index [WQI] of the Eachnur tank water. This paper deals with the study on the influence of environmental factors on water body. Water quality index, is number indicating the overall water quality in number, offers a useful meaning for its purity water for public or for any intended use. This information can be used reduce the pollution load and in the water quality management. In the present study water quality index was determined on the basis of various physico- chemical parameters like p<sup>H</sup>, Electrical conductivity, Total dissolved solids, Total alkalinity, Total hardness, Calcium, Magnesium, Chlorides and Dissolved oxygen. It is computed that the water quality index varies between 74.14 and 93.3. It reveals that the water was good in quality for domestic use and drinking only after treatment.*

**Key words:** Eachnur tank, Pollution control, Physico chemical parameters, Quality of water for public, Water quality index.

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### **INTRODUCTION**

Water is one of the abundantly available substances in nature. Water is the precious gift graced by the nature to the human race. It is an essential constituent of all animals and plants. [1]. Among the planets, the unique one is Earth as it is being covered by water. The water available on the earth cannot be used for all the human activities, but only a small amount of water is useful for human and other living beings. The fresh water resource is very much limited, restricted to springs, streams, rivers, lakes, tanks and ponds. Though the source of freshwater is very limited, it is being polluted indiscriminately by human beings; as a result of this freshwater is going to become a key limiting factor. As a result the condition of the water bodies is pathetic. It is with this background, the present work was undertaken during the winter and summer season.

Water Quality Index [WQI] provides a single number that expresses overall quality at certain location and time based on several water quality parameters. The objective of the water quality index is to turn complex water quality data into information that is understandable and usable by the public. Water quality index based on some very important parameters can provide simple indicators of water quality. WQI is one of the most effective tools to communicate information on the quality of water to the concerned citizens and policy makers. It is, thus becomes important parameter for the assessment and management of surface water.

### **STUDY AREA**

Tiptur taluk is about 75 km from Tumkur, Karnataka. It is a southern peninsular India having East latitude 13°23' degree and North longitude 76°29' degree at an altitude of 850.3 M above sea level. It covers an area of 758.5 sqkm. The Eachnur tank is located 7 km from Tiptur, spread over 250 acres. The tank holds 450 million gallons of water, not only the prime source of drinking water for Tipturians but to replenish the dreaded ground water in and around the feeding area. Eachnur tank is one of the important major water supply resources to Tiptur and Arasikere towns for the human domestic and even for

drinking purposes. The present aim of the research work is to carry out physico chemical analysis of water quality of Eachnur tank so as to examine its suitability for drinking and other purposes or not.

## MATERIALS AND METHODS

Water samples were collected from Eachnur tank on monthly basis from November 2014 to April 2015. Samples were collected in two liter capacity polythene containers which were acid treated and dried previously. The parameters like pH, EC, TDS were measured at the spot and samples were brought to the laboratory where other parameters were determined by the following standard methods of APHA [2] and Trivedy and Goel [3]. pH, EC and TDS and were measured using digital meters.

## RESULTS AND DISCUSSIONS

In this study, the calculation of water quality index was done based on 10 important parameters like pH, Electrical conductivity, Total dissolved solids, Total alkalinity, Total hardness, Calcium, Magnesium, Chlorides and Dissolved oxygen using BIS [4] standards.

**Table- 1 Water quality Index [WQI] and status of water quality**

WQ I Values	Water quality
< 50	Excellent
50-100	Good water
100-200	Poor water
200-300	Very poor water

### pH

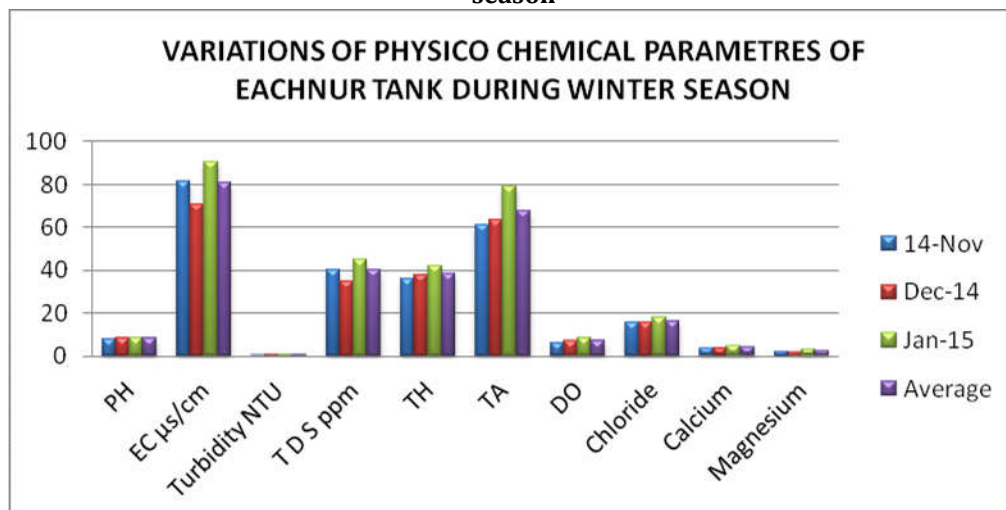
pH is important parameter which reflects on biochemical and chemical reactions in aquatic bodies. In the present study average pH during winter was 8.32 and in summer it was 8.2 indicating slightly base nature of the samples. pH was within the permissible limit of BIS [4] standards.

**Table -2 Results of physico-chemical parameters of Eachnur tank from Nov 14 to Jan 2015 [Winter season]**

Parameters	Nov14	Dec2014	Jan 2015	Average
pH	8.05	8.4	8.53	8.32
EC $\mu\text{s}/\text{cm}$	81.56	70.62	90.12	80.76
Turbidity NTU	0.61	0.72	0.77	0.7
T D S ppm	40.31	34.81	45.25	40.12
TH	35.87	37.68	42.12	38.55
TA	61.25	63.43	78.87	67.85
DO	6.1	7.1	8.42	7.20
Chloride	15.71	16	18.03	16.58
Calcium	3.77	3.82	4.88	4.15
Magnesium	2.2	2.06	3.08	2.44

**Note: All values expressed in mg /L except P<sup>H</sup> and otherwise stated.**

**Graph 1 showing Variations of Physico-chemical parameters of Eachnur tank during Winter season**



**Electrical conductivity**

Electrical conductivity is an important parameter of water and it depends on the nature and concentration of ionized salts. Pure water is a poor conductor of electricity. The conductivity is proportional to the amount of the salts dissolved in water. During investigation the average EC during winter season was 80.76  $\mu\text{S}/\text{cm}$  and during summer 101.34  $\mu\text{S}/\text{cm}$ . Results were within the permissible limits IS standards.

**Total dissolved salts**

Total dissolved salts are composed of carbonates, bicarbonates, chlorides, phosphates and nitrates of calcium, magnesium, sodium, potassium and organic matter. High values of TDS and sulphates in drinking water may affect those persons who are suffering from kidney and heart diseases [Gupta *et al*, 2004] analysis of solids is important in the control of biological and physico chemical treatment processes [2]. During investigation period the average TDS was 40.12 mg/l during winter and 58.04 mg/l during summer and falling within the desirable limits BIS.

**Dissolved oxygen**

DO is one of the important parameters to assess the quality of water. Temperature plays an important role in determination of DO in aquatic environment. DO is an index of physical and biological process occurring in water. Low DO gives bad smell to water due to anaerobic decomposition of organic wastes. Lowering of DO is enhanced by high concentration of organic matter of the water bodies. Changes in the level dissolved oxygen in the aquatic body have a detrimental effect on aquatic biota. Dissolved oxygen is a remarkable indicator of pollution [5]. Therefore, analysis of dissolved oxygen plays an important role in water pollution control and waste water treatment process. The average DO during winter was 7.2 mg/l and 8.4mg/l in summer.

**Total hardness:**

It is the total soluble magnesium and calcium salts present in water expressed as its  $\text{CaCO}_3$  equivalent. The desirable range is up to 200 mg/l for drinking water but beyond this limits cause gastro-intestinal irritation. In Normal water, hardness does not pose any direct health problems. High concentration of hardness [150-300mg/l and above] may cause kidney problems. Here during investigation the average TH value during winter was 38.55 mg/l and 48.03 mg/l during summer and it was within the desirable limit.

**Total alkalinity:**

The high alkalinity imparts an unpleasant taste. Alkalinity itself is not harmful to human beings. The average value during investigation period was 67.85 mg/l in winter and 59.56 mg/l in summer and it was within the desirable limit of 200 mg/l of BIS standard.

**Chloride:**

Chloride is an important parameter in assessing water quality. It controls the salinity of water and osmotic stress on biotic communities. In the present study the chloride content was found within the permissible limit of 250 mg/l and it was 16.58 mg/l during winter and it was 18.86 mg/l during summer.

**Calcium and Magnesium:**

$\text{Ca}^{++}$  and  $\text{Mg}^{++}$  are both essential elements for living organisms, both the minerals occur in all kinds of natural water with  $\text{Mg}^{++}$  concentration generally lower than the Calcium [Tamrakar Chirika Shova, April 2014]. During investigation the average value of calcium was 4.15 mg/l during winter and 6.82 mg/l during summer and it was within the permissible limit [75 mg /l] of BSI [4] guideline.

**Calculation of WQI**

The water quality index [WQI] was calculated by using the weighted Arithmetic Index method. The quality rating scale for each parameter  $Q_i$  was calculated by using this expression

$$\text{Quality rating, } Q_i = 100 \left[ \frac{v_n - v_i}{v_s - v_i} \right]$$

Where,  $Q_i$ : quality rating of nth parameter

$v_n$ : Actual value of the water quality parameter

$v_i$ : the ideal value of this parameter

$v_i = 0$ , except for pH and DO.  $v_i = 7.0$  for pH,  $v_i = 14.6$  mg/L for D O.

$v_s$ : recommended standard of corresponding parameter.

Relative weight [ $W_i$ ] was calculated by a value inversely proportional to the recommended standard [ $S_i$ ] of the corresponding parameter:

**Relative weight,  $W_i = 1/S_i$** , Where  $W_i$ = Relative weight of  $n^{\text{th}}$  parameter,  $S_i$ = Recommended standard value of each parameter.

Generally, WQI are discussed for specific and intended use of water. In this study the WQI for human consumption is considered and permissible WQI for the drinking water is taken as 100. The overall WQI was calculated by using equation:

Water Quality Index [WQI] =  $\sum W_i Q_i / \sum W_i$

**Table-3 Water quality index of Eachnur tank (Winter season)**

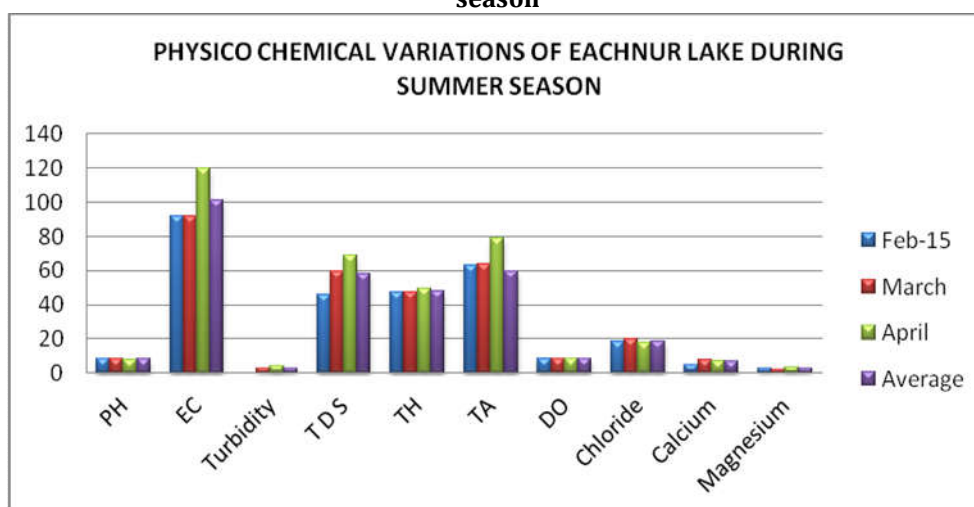
S.no	parameter	Average	Standard values	Relative weight $W_i$	Quality rating $Q_i$	Weighted Index $W_i \times Q_i$
1	P <sup>H</sup>	8.32	6.5 to 8.5	0.133	110.93	14.75
2	EC $\mu\text{s/cm}$	80.72	300	0.033	26.12	0.8883
3	Turbidity NTU	0.7	5	0.200	14	2.8
4	TDS ppm	40.12	500	0.0020	8.024	0.0160
5	TH	38.55	300	0.033	12.85	0.4240
6	TA	67.85	75	0.0133	90.46	1.2031
7	DO	7.20	5	0.2000	144	28.8
8	Chloride	16.58	250	0.0040	6.632	0.0265
9	Calcium	4.15	75	0.0133	5.53	0.0735
10	Magnesium	2.44	30	0.0333	8.133	0.2708
				$\sum W_i = 0.6649$		$\sum W_i Q_i = 49.25$
<b>WQI = <math>\sum W_i Q_i / \sum W_i</math>, <math>49.25 / 0.6649 = 74.14</math></b>						
Good water						

**Table 4 Results of physico-chemical parameters of Eachnur tank from Feb 2015 to April 15 [Summer season]**

Parameters	Feb 2015	March	April	Average
P <sup>H</sup>	8.41	8.18	8.01	8.2
EC $\mu\text{s/cm}$	92.12	92	119.9	101.34
Turbidity NTU	0.75	3	4.3	2.68
T D S ppm	45.56	59.75	68.81	58.04
TH	47.37	47.37	49.37	48.03
TA	62.75	63.75	79.18	59.56
DO	8.7	8.2	8.3	8.4
Chloride	18.21	20.29	18.08	18.86
Calcium	5.05	8.08	7.33	6.82
Magnesium	2.64	2.16	3.56	2.78

**Note:** All values expressed I mg/L except P<sup>H</sup> and otherwise stated.

**Graph 2 showing Variations of Physico-chemical parameters of Eachnur tank during summer season**



**Table 5 Water quality index of Eachnur tank summer season**

Sl no	parameter	Average	Standard values	Relative weight Wi	Quality rating Qi	Weighted index Wi xQi
1	PH	8.2	6.5 to 8.5	0.133	109.33	14.54
2	EC $\mu\text{s/cm}$	101.34	300	0.033	33.78	1.114
3	Turbidity NTU	2.68	5	0.200	53.6	10.72
4	TDS ppm	58.04	500	0.0120	11.608	0.0232
5	TH	48.03	300	0.033	16.01	0.5283
6	TA	59.56	75	0.0133	79.41	1.0561
7	DO	8.4	5	0.2000	168	33.60
8	Chloride	18.86	250	0.0040	7.544	0.0301
9	Calcium	6.82	75	0.0133	9.09	0.1208
10	Magnesium	2.78	30	0.0333	9.26	0.3083
				$\sum W_i=0.6649$		$\sum W_i \times Q_i=93.30$
<b><math>WQI = \frac{\sum W_i Q_i}{\sum W_i} = \frac{62.0408}{0.6649} = 93.30</math></b>						
Good water						

**CONCLUSION**

1. It is computed that the water quality index varies between 74.14 and 93.3. It reveals that the water was good in quality for domestic use and drinking only after treatment.
2. The study clearly indicates that the tank water can be used for public consumption.
3. There is no significant change in water quality in both the seasons, and most of the parameters in the study were well within BIS standards.

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