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SEASONAL PHYSICO-CHEMICAL VARIATIONS OF TIRU RESERVOIR FROM UDGIR REGION DIST. LATUR (M.S) INDIA

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AUTHOR'S CONTRIBUTION

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

Tiru reservoir is 22 km away from town Udgir on the northwest side near village Adolwadi. Tiru reservoir is an earthen Dam of an area having a 690 ha water submergence area constructed on river Tiru in 1976, a tributary of Lendi river which empties in Godavari river situated in the southwest part of India and southeast of Maharashtra for irrigation and drinking purpose. Considering the significance of this reservoir for this region, it is important to study its water quality of it. From December 2020 to November 2021 seasonal variation in physicochemical parameters of the Tiru reservoir were investigated. During the present investigation, seasonal variation in physicochemical parameters recorded such as Temperature was found 22.50℃ to 31.5℃ with mean of 27.18℃, Transparency 38 to 90.50 cm with a mean of 72.62cm, pH 7.5 to 8.8 cm with a mean 8.41,Dissolved Oxygen 2.6 to 6.6mg/l with mean 4.01 mg/l, Free CO2 is Nil to 0.6mg/l with mean Free CO2 0.33mg/l, Total Alkalinity is 128 to 228 mg/l with mean 181.33mg/l, Total Hardness 172 to 240 mg/L with mean 193.83 mg/l, Calcium hardness 54.60 to 88.20mg/l with mean 73.67mg/l, Magnesium hardness 21.47 to 37.04mg/l with mean 29.31mg/l, calcium 21.88 to 35.35mg/l with mean 29.54mg/l, Chlorides 28.36 to 43.95mg/l with mean 38.92mg/l, Salinity 51.22 to 79.37 mg/L with mean 69.55mg/land TDS 270 to 370mg/l with mean 347.50mg/l were analyzed and recorded.

Keywords: Tiru reservoir; physico-chemical parameters; water parameters; seasonal variation in physico-chemical parameters.

1. INTRODUCTION

Surface water is the source of potable water and is used for irrigation. Disposal of various pollutants and effluents the surface water is highly vulnerable to pollution [1,2]. Inland resources in rural areas are an important source of food. To assure safe and stable water use for society evaluation of surface water quality is an important issue [3,4]. Life does not exist without water. But nowadays we are facing water-related problems like water contamination due to extensive anthropogenic emissions of nutrients and sediments. The most important component of the environment is the water required for all living organisms. Water used for drinking, industrial and most in the agricultural field. In the past few decades surface water quality is becoming worst due to the increasing urbanization population, agriculture, and industrialization. These water bodies are very useful to the local people in various ways [5,6]. The Tiru reservoir (Latitude.18.5555430 N Longitude 77.0736410 E) is present 22 km away from town

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Udgir on the northwest side near village Adolwadi. Tiru reservoir is an earthen Dam of an area having a 690 ha water submergence area constructed on river Tiru in 1976, a tributary of Lendi river which empties in Godavari river situated at the south-west part of India and south-east of Maharashtra for irrigation and domestic consumption purpose. So seasonal variation in physicochemical parameters of the Tiru reservoir was studied from December 2020 to November 2021.

2. MATERIALS AND METHODS

Physical parameters of Tiru reservoir like Temperature by using thermometer and Transparency by using Secchi disc were studied on reservoir site and chemical parameters like pH by using Digital pH meter and Total dissolved Solids by digital TDS meter were studied at the Tiru reservoir site. For Chemical Parameter estimation of the Tiru reservoir, Monthly water samples were collected in two-liter water bottles and brought to the Department of Zoology laboratory for further estimation. During transportation water bottles and kept in a dark place safely at normal temperature. Dissolved Oxygen, CO2, Total Alkalinity, Total Hardness, Calcium and Magnesium hardness, Calcium, salinity, and Chlorides were estimated by titration method in the laboratory given in "Methodology for water analysis" by Kodarkar et al. 1998 [7] and APHA (1985, 2005) [8,9].

3. RESULTS AND DISCUSSION

3.1 Physical Parameters

3.1.1 Temperature (℃); By standard centigrade thermometer, the surface water temperature was recorded in℃. Monthly values of Seasonal variation in Tiru reservoir water temperature are mentioned in Table 1 and presented in Graph 1 and I. During the study period, the water temperature of Tiru reservoir ranges between 22.5℃ to 31.5℃ with a mean of 27.18℃, the minimum water temperature value is 22.5℃ in the month December 2020 whereas the maximum water temperature value is 31.5℃ recorded in June 2021.

3.1.2 Transparency; Transparency of reservoir water was measured by a Secchi disc. Monthly values of Seasonal variation in Tiru reservoir water Transparency is mentioned in Table 1 and presented in Graphs 1 and II. During the study period, water transparency of the Tiru reservoir ranges between 38 to 90.50 cm with a mean of 72.62 cm, The minimum water transparency value is 38 cm recorded in June 2021 whereas the Maximum water transparency value of 90.50 cm was recorded in the month April 2021.

3.2 Chemical Parameters

3.2.1 pH

pH values were recorded by a digital pH meter. Monthly values of Seasonal variation in Tiru reservoir water pH are mentioned in Table 1 and Presented in Graphs 1 and III. During the study period, the water pH of the Tiru reservoir ranges between 7.5 to 8.8 cm with a mean of 8.41, The minimum water pH value of 7.5 was recorded in December 2020 whereas the Maximum pH of 8.8 was recorded in July 2021.

3.2.2 Dissolved oxygen (mg/l)

Water samples collected from the Tiru reservoir were brought into the laboratory and dissolved oxygen was estimated by Winkler's method. Monthly values of Seasonal variation in Dissolved oxygen of Tiru reservoir water are mentioned in Table 1 and presented in Graph 1 and IV. During the Study period, water Dissolved oxygen of the Tiru reservoir ranges between 2.6 to 6.6mg/l with a mean of 4.01 mg/l, The minimum water Dissolved oxygen value was 2.6 mg/l in June 2021 whereas the Maximum water Dissolved oxygen value of 6.6 mg/l was recorded in month October 2021. Dissolved oxygen values found increased after July 2021 in Tiru reservoir as there was no rain in the catchment area till July 2021 of Tiru reservoir.

3.2.3 Free CO2 (mg/l)

Monthly values of Seasonal variation in Free Carbon di-oxide of Tiru reservoir water is mentioned in Table 1 and presented in Graph 1 and V. During the Study period Free Carbon di-oxide (CO2) of Tiru reservoir ranges between Nil to 0.6 mg/l with a mean 0.33mg/l, The CO2 value was Nil in April and May 2021 whereas Maximum CO2 value 0.6 mg/l recorded during January, February, September and November 2021.

3.2.4 Total Alkalinity (mg / l)

Monthly values of Seasonal variation in Total alkalinity of Tiru reservoir water are mentioned in Table 1 and presented in Graph 1 and VI. During the Study period Total alkalinity of the Tiru reservoir ranges between 128 to 228 mg/l with a mean of 181.33mg/l, The minimum Total alkalinity value is 122 mg/l in August 2021 whereas the Maximum Total alkalinity value is 228 mg/l recorded in February 2021.

3.2.5 Hardness (mg/l)

Monthly values of Seasonal variation in Total Hardness of Tiru reservoir water are mentioned in

Table 1 and presented in Graph 1 and VII. During the Study period, Total Hardness of the Tiru reservoir ranges between 172 to 240 mg/l with a mean of 193.83 mg/l. The minimum Total Hardness value is 172 mg/l in months June and August 2021 whereas the Maximum Total Hardness value of 240 mg/liter was recorded in the month May 2021.

3.2.6 Calcium hardness

Monthly values of Seasonal variation in Calcium Hardness of Tiru reservoir water are mentioned in Table 1 and presented in Graph 1 and VIII. During the Study Period, the Calcium Hardness of the Tiru reservoir ranges between 54.60 to 88.20 mg/liter with a mean of 76.61 mg/l, The minimum Calcium Hardness value was 54.60mg/l in October 2021 whereas the Maximum Calcium Hardness value was 88.20 mg/l was recorded in the month May 2021.

3.2.7 Magnesium hardness

Monthly values of Seasonal variation in Magnesium of Tiru reservoir water are mentioned in Table 1 and presented in Graph 1 and IX. During the study period, the Magnesium Hardness of the Tiru reservoir ranges between 21.47 to 37.04 mg/l with a mean of 29.31mg/l, The minimum Magnesium Hardness value of 21.47 mg/l was recorded in June 2021 whereas the Maximum Magnesium Hardness value of 37.04 mg/l was recorded in the month May 2021.

3.2.8 Calcium

Monthly values of Seasonal variation in Calcium of Tiru reservoir water is mentioned in Table 1 and graphically presented in Graph 1 and X. During the study period Calcium of Tiru reservoir ranges between 21.88 to 35.35mg/l with mean29.54mg/l, The minimum Calcium value of 21.88 mg/l recorded in month October 2021 whereas Maximum Calcium value 35.35mg/l was recorded in the month May 2021.

3.2.9 Chlorides (mg/l)

Monthly values of Seasonal variation in Chloride of Tiru reservoir water are mentioned in Table 1 and graphically presented in Graph 1 and XI. During the Study period Chloride (mg/l) of the Tiru reservoir ranges between 28.36 to 43.95 mg/l with mean Chloride 38.52mg/l, The minimum Chloride value of 28.36 mg/l was recorded in June 2021 whereas the Maximum Chloride value of 43.95mg/l was recorded in the Tiru reservoir in month January 2021.

3.2.10 Salinity (mg/l)

Monthly values of Seasonal variation in Salinity of Tiru reservoir water are mentioned in Table 1 and graphically presented in Graph 1 and XII. During the Study period Salinity of the Tiru reservoir ranges between 51.22 to 79.37mg/L with mean Salinity 69.55 mg/l, The minimum Salinity value 51.22mg/l recorded in month June 2021 whereas Maximum Salinity value 79.37mg/l in month January 2021.

3.2.11 TDS(Total Dissolved Solids) (mg/l)

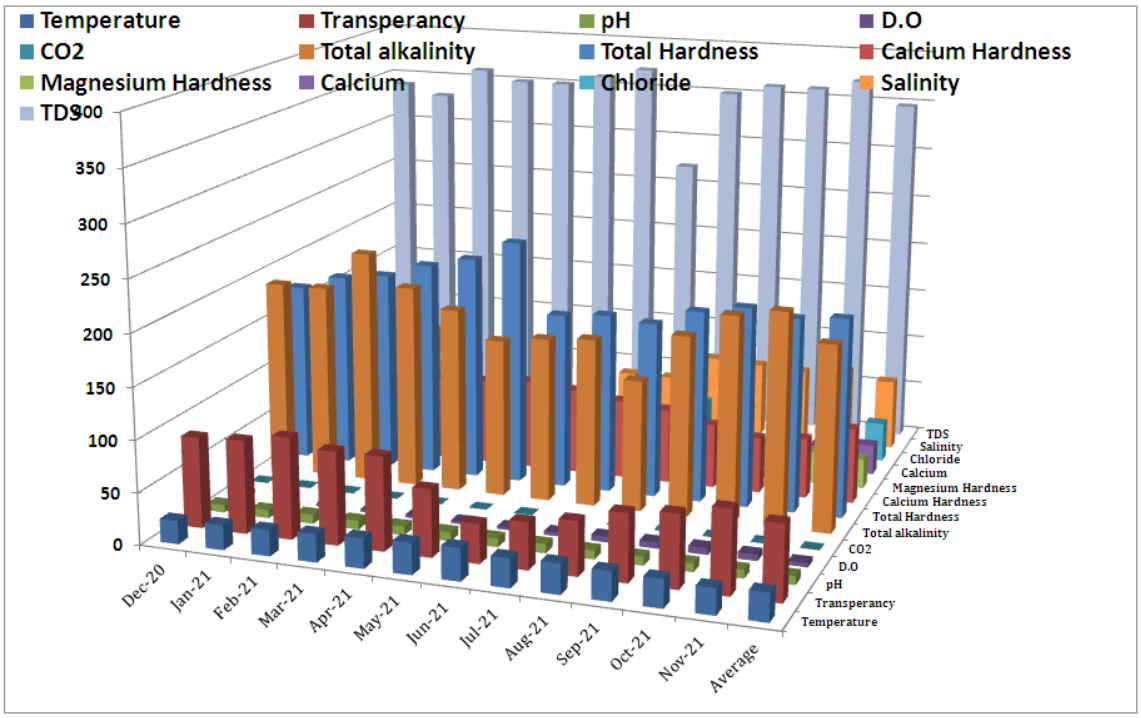
Monthly values of Seasonal variation in TDS of Tiru reservoir water are mentioned in Table 1 and presented in Graph 1and XIII. During the Study period TDS of the Tiru reservoir ranges between 270 to 370 mg/l with a mean TDS of 347.50 mg/l. The minimum TDS value 270mg/l was recorded in July 2021, whereas, the maximum TDS value was 370 mg/l in June and November 2021.

Ganie and Khan. (2012)[10] studied monthly basis seasonal Variations In Physico-Chemical Characteristics of Pahuj Reservoir, District Jhansi, Bundelkhand Region, Central India from August 2008 to July 2009.

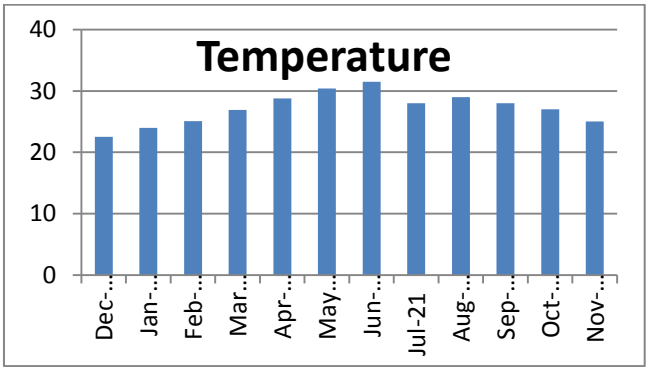
B. Elayaraj and M. Selvaraju (2015) [11] Studied Physico-Chemical Parameters of Sri Kamatchiamman Temple Pond Chidambaram from January to December 2014. Ramanathan and Amsath (2018) studied aquaculture pond at Puthukulam of Pudukkottai town, Tamilnadu state physic-chemical parameters and reported Temperature pH, D.O and Total hardness, maximum in summer and Turbidity, Alkalinity maximum during monsoon[12]. Chilgar and Jagtap (2018)[13] studied physico-chemical parameters of various water bodies like majalgaon, yeldari, siddheshwar, masoli and vishnupuri dams of Marathwada region, Maharashtra, india in relation to fish culture from January to February 2017 and reported that all reservoirs values were suitable for fish culture. Assessment of Physicochemical parameters of Surface Water of Wadhwana Irrigation Reservoir of Gujarat, India carried out during July 2016 to May 2017 by JignashaVankar et.al (2019) [14]. Monthly variations in Physicochemical characteristics of AksharVihar pond in Bareilly, U.P studied from July 2019 to June 2020 by S. Kumar et.al. (2021)[15]. Barot Chintan and Patel Vasant (2014) [16] reported comparative study of seasonal variation in Physico-chemical Properties of selected

Table 1. Values of Seasonal variation in Physiochemical parameters from December 2020 to November 2021 of Tiru reservoir of Udgir Taluka

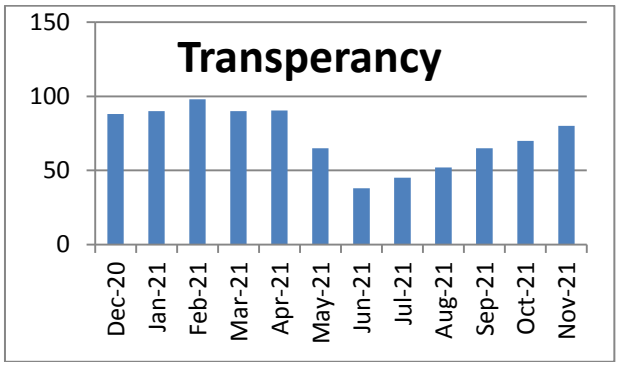
Month	Temp	Transperancy	pH	D.O	CO2	Total alkalinity	Total Hardness	Calcium Hardness	Mg Hardness	Calcium	Chloride	Salinity	TDS
Dec-20	22.5	88	7.5	3.4	0.3	190	176	67.2	26.54	26.93	42.54	76.81	340
Jan-21	24	90	7.8	3.2	0.6	190	190	73.5	28.43	29.45	43.95	79.37	330
Feb-21	25.1	98	8.8	2.8	0.6	228	196	77.7	28.87	31.14	42.54	76.81	360
Mar-21	26.9	90	8.6	2.8	0.2	198	210	81.9	31.26	32.82	39.7	71.69	350
Apr-21	28.8	90.5	8.6	2.8	0	180	220	84	33.18	33.66	36.86	66.56	350
May21	30.4	65	8.7	2.7	0	154	240	88.2	37.04	35.35	34.06	61.46	360
Jun-21	31.5	38	8.6	2.6	0.4	160	172	84	21.47	33.66	28.36	51.22	370
Jul-21	28	45	8.8	3.5	0.2	164	176	77.7	23.99	31.14	28.36	51.22	270
Aug-21	29	52	8.6	5.6	0.3	128	172	73.5	24.03	29.45	42.54	76.81	350
Sep-21	28	65	8.5	6	0.6	176	188	63	30.5	25.25	41.12	74.26	360
Oct-21	27	70	8.4	6.6	0.2	200	196	54.6	34.5	21.88	39.7	71.69	360
Nov-21	25	80	8.1	6.2	0.6	208	190	58.8	32.01	23.56	42.54	76.81	370
Average	27.18	72.62	8.41	4.01	0.33	181.33	193.83	73.67	29.31	29.54	38.52	69.55	347.5



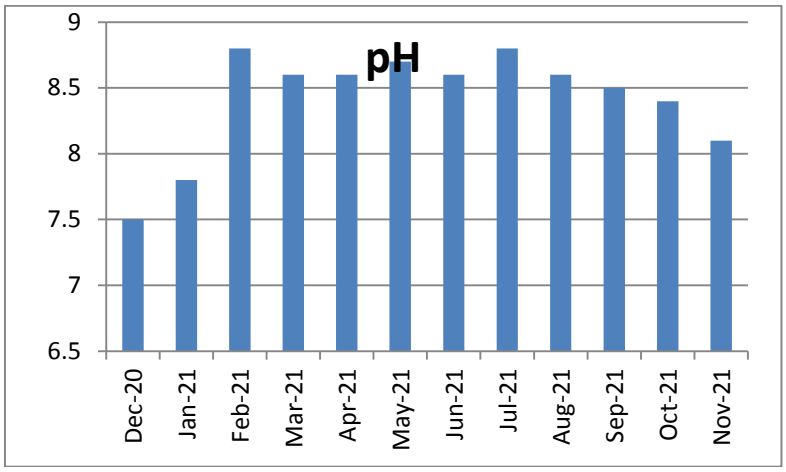
Graph 1. Monthly variation in Physiochemical parameters of Tiru reservoir of Udgir Taluka



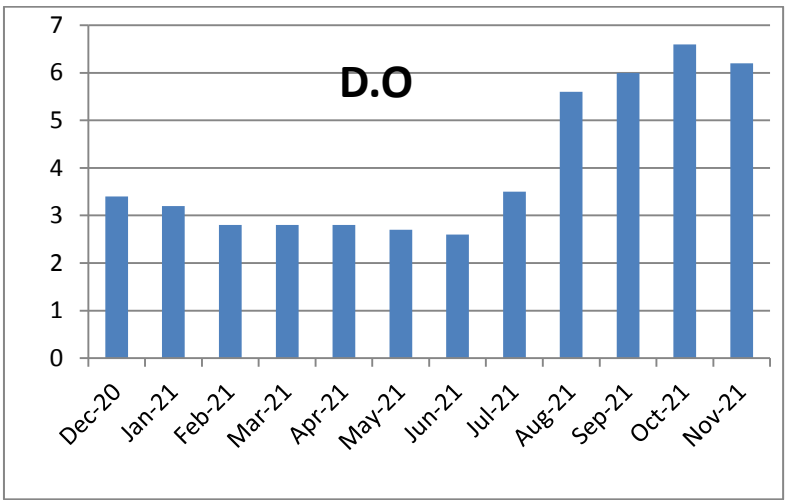
Graph I: Monthly values of Temperature in ℃



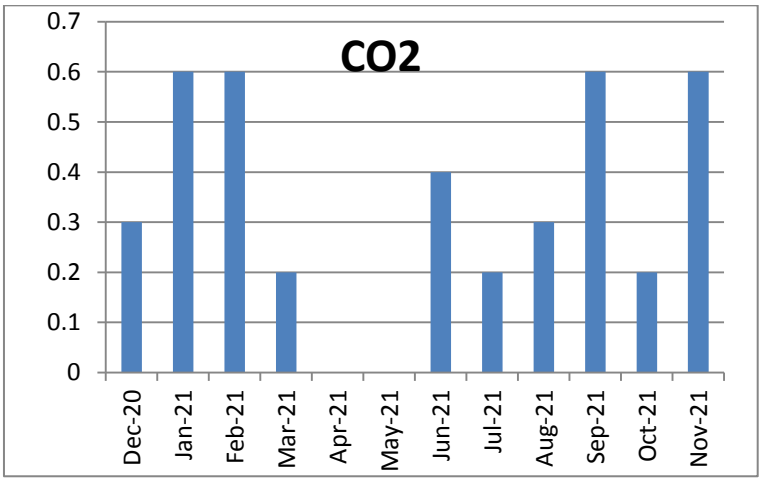
Graph II: Monthly values of Transparency in Cm



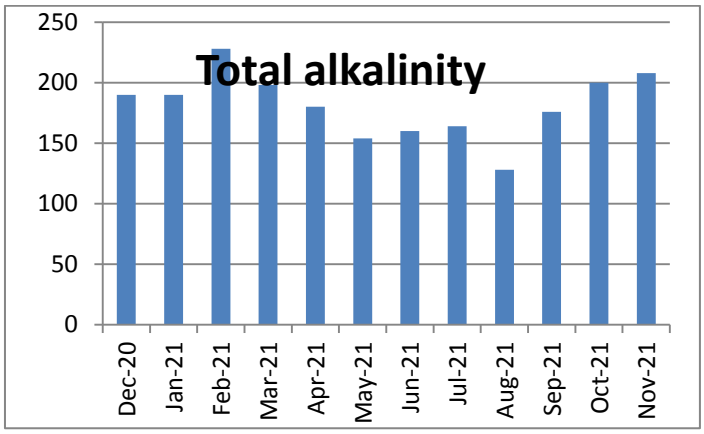
Graph III: Monthly values of pH



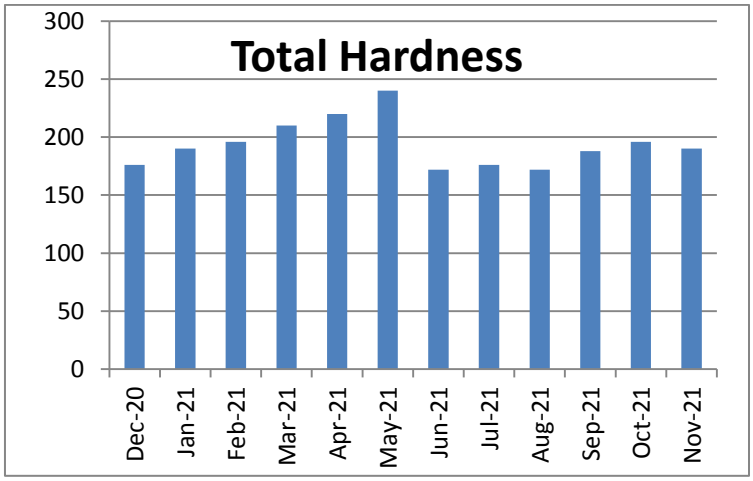
Graph IV: Monthly values of Dissolved Oxygen in mg/l



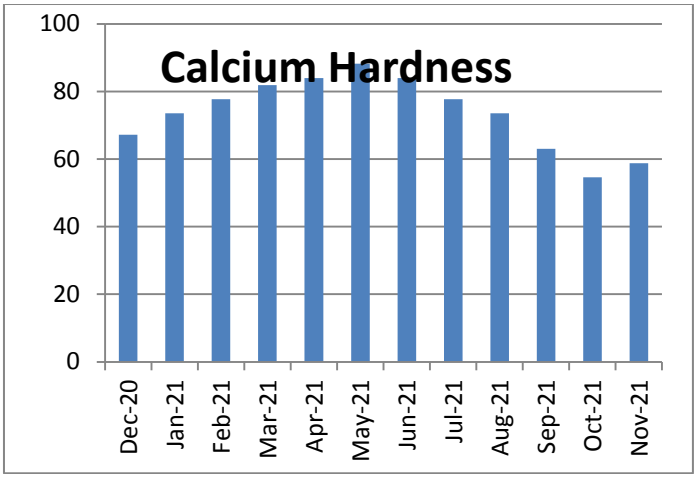
Graph V: Monthly values of CO_2 in mg/l



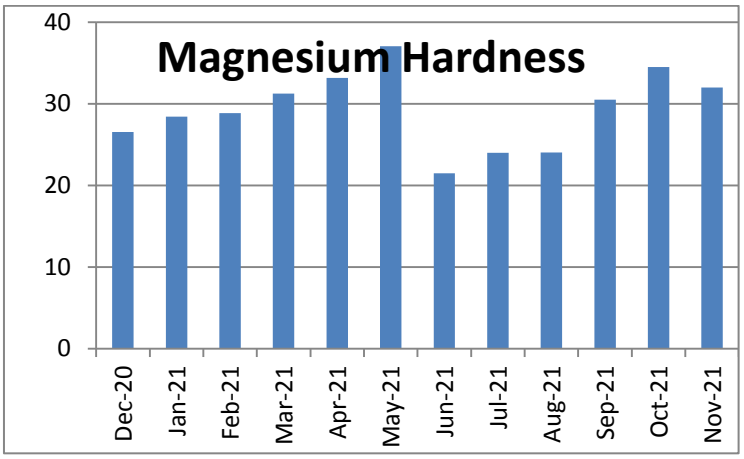
Graph VI: Monthly values of Total Alkalinity in mg/l



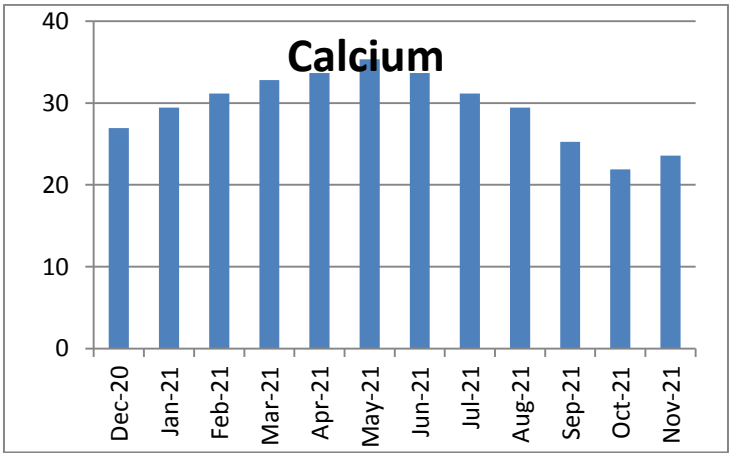
Graph VII: Monthly values of Total Hardness in mg/ l



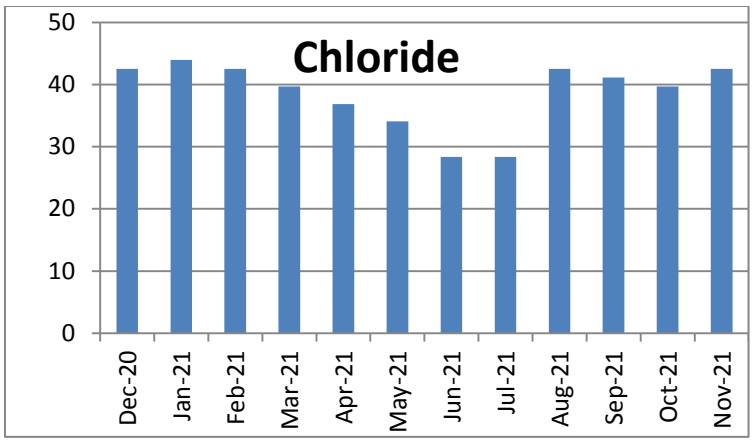
Graph VIII: Monthly values of Ca Hardness in mg/l



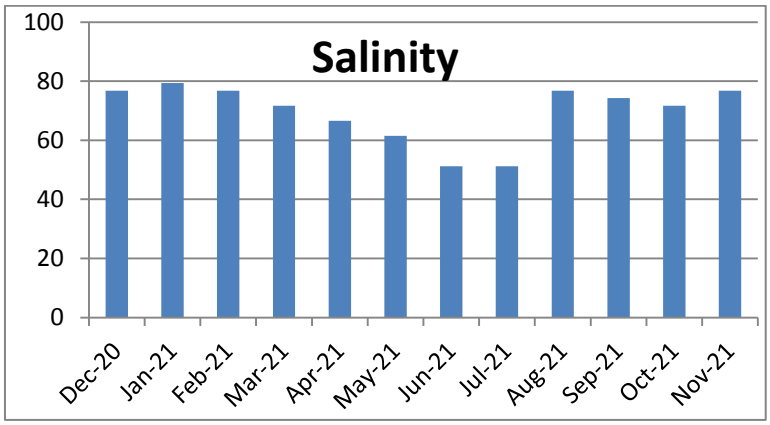
Graph IX: Monthly values of Mg Hardness in mg/l



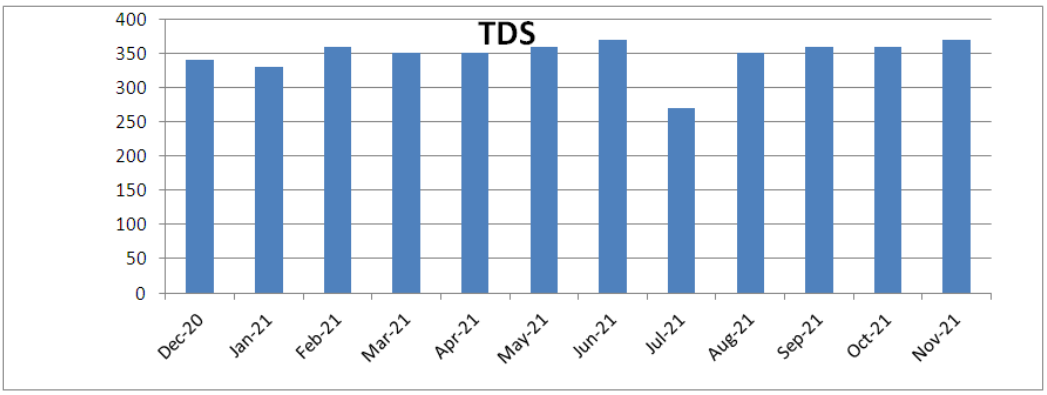
Graph X: Monthly values of Calcium in mg/l



Graph XI: Monthly values of Chloride in mg/l



Graph XII: Monthly values of Salinity in mg/l



Graph XIII: Monthly values of TDS in mg/l

Wetlands of Mehsana Districts, North Gujarat from March 2013 to February 2014.

For better conservation of groundwater in future ways the effective and protective way is regular checkup of groundwater condition [17]. Quality of groundwater reduces due pollution of water reservoir and water of reservoir become impure [18]. Rivers, reservoirs, Lakes and Dams physic-chemical characteristics were investigated by many researchers [19-29] and reported that majority of water bodies characteristics are under permissible limits and suitable for fish culture.

4. CONCLUSIONS

From December 2020 to November 2021 Physicochemical parameters of the Tiru reservoir were studied.

During the study period pH values of the Tiru reservoir were above than maximum limit of WHO and BIS during summer and monsoon season so water before use for drinking purposes must be treated. The pH of the Tiru reservoir is within the allowable limit in the post-monsoon and winter seasons.

Heavy fluctuation in oxygen concentration is a noticeable factor from this reservoir. During the investigation the Dissolved Oxygen is less from December to June (2.6-3.4 mg/l), CO2 is nil in summer, Alkalinity is very high during December to March and in post-monsoon October and November. Total Hardness, Calcium and Magnesium hardness, calcium, salinity Chlorides, and TDS were high from December to May due to heavy deposition of domestic sewage in Tiru reservoir whereas during monsoon to November 2021 all parameters are in normal range due to increased water level of Tiru reservoir. Physico-chemical analysis of the Tiru reservoir study shows that this reservoir water can be best utilized for fisheries.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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