Applying Artificial Intelligence to Studies on Water Quality and Phytoplankton Diversity of Eachnur Tank,Tiptur,Tumkur-District,Karnataka,India

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Abstract: A possible reason for the slow progress in AI is that the computational complexity of general intelligence may be exponentially hard. The field itself, and the evolution of natural Water is basic pre-condition for life. Water of good drinking quality is of basic importance to human physiology and the existence of human being is very much depends on its availability.The assessment of Eachnur tank water quality for suitability for drinking and domestic purpose was carried out during November 2020 to August 2021 and evaluate the water quality status through its physicochemical parameters such as AT, WT, PH,TDS,EC,TA,TH Ca++Mg++ , Cl-,DOM , SALINIITY, DO ,BOD,Na+, K+, PO4, SO4 and Fe.The results were compared with BIS Standard [1991]and WHO [1993] drinking water standards. The results revealed that most of the parameters were in normal range and indicated suitability for drinking purposes, and Artificial Intelligence applied for processing the samples with attributes and parameters with the test set. A total of 37genera of phytoplankton were recorded,of which Chlorophyceae and diatoms were found to be dominant among four classes. Four protozoa were recorded.

Key words:Eachnur tank, water quality,Human physiology,physicochemical parameters, suitability, BIS and WHO, Phytoplankton oligotrophic, Artificial Intelligence.

I. INTRODUCTION

Water is indispensable and one of the precious natural resources of our planet.Water is the precious gift graced by the nature to the human race.[Water pollution ,V K Berry] Water is one of the major constituents of life supporting system .water is essential for existence of life on earth .water ,indeed a wonderful medium ,which has unique properties of dissolving and carrying in suspension of huge varieties of materials .It is strongly believe that first life originated in the ocean ,Hence sea is called mother of life.2/3 of the earth surface is covered by water but is not suitable for the sustenance and perpetuation of land plants and animals. surface water is about 2% of the global water resources is most suitable for the very existence of all land plants and animals and out of this only 1% of freshwater is in river ,streams, lakes, ponds tanks and reservoirs is available to all forms of living beings [P K Goel 2006] Quality and quantity of water at a place plays a vital role in health,wealth and prosperity of the region .

The modern civilization, rapid industrialization, modern agriculture and increased population have led to rapid degradation of our water bodies.The study of water quality assessment is very essential and crucial to know its suitability for drinking and domestic purposes.

Lack of awareness,unscientific methods of waste disposal,improper water management and negligence damaged not only the aquatic systems but also its biological composition. According to W H O [1984] 30% to 40% of human diseases occurred due to impurities of water.

Any physicochemical characteristics of water not only alters its quality but also disturbs aquatic environment and affects aquatic life [pawar and panderkar 2011].The aquatic forms play an important role in the biosynthesis of organic matter[primary production] in aquatic ecosystem,which directly or indirectly serve all the living organisms of a water body as food .The planktonic study is a very useful tool for the assessment of water quality of a water body and also contributes to understanding of the basic nature and general economy of the tank .

Study Area: Tipturtalukis about 75 KM from Tumkur [Dist.] Karnataka .It is in southern peninsular India having east latitude of 13^0 23' degree and north longitude 76^0 29'degree at an altitude of 850 .3 m above sea level .It covers an of 758.5 sq Km .The Eachnur Tank is located 7 Km from Tiptur, spread over 250 acres .The tank hold 450 million gallon of water , not only the prime source of drinking water for Tipturians but to replenish the dreaded ground water in 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 carryout hydro chemical analysis of water quality of Eachnur tank so as to examine whether it is suitable for drinking and other domestic purposes or not.

II.   MATERIALS AND METHODS BY AI SAMPLING

Water samples were collected from Eachnur tank on monthly basis from November 2020 to August 2021 .samples were collected in two liter capacity polythene containers which were acid treated and dried previously . The parameters like AT, WT, P^H ,TDS ,EC were measured at the spot and samples were brought to the laboratory where other parameters were determined by following the standard methods of APHA [1995] and Trivedy and Goel [1986] .TDS and EC were measured using digital conductivity meter. Salinity and turbidity were analyzed using micro –controlled water analyzer Kit 371 and the data are processed with the algorithm to check the reliability and efficiency.

III. RESULTS AND DISCUSSION

The results obtained from analysis of Eachnur tank water are given in table 1 and 2 showing minimum, maximum and average of hydro chemical analysis of water parameters during the study period. The results were compared with W H O 1963, BIS 1991 drinking water standards.

An average values of hydro chemical parameters from Nov 2020 to August 2021Table -1

SL NO	MONTH/PARAMETER	14-Nov	14-Dec	15-Jan	15-Feb	15-Mar	15-Apr	15-May	15-Jun	15-Jul	15-Aug	15-Sep	15-Oct	AVERAGE	STD
1	AT	23.4	19.89	29.49	28.8	22.57	26.28	26.5	23.6	23.55	24	24.75	23.4	24.68583	
2	WT	24.34	24.8	26.4	26.39	26.73	26.8	26.9	27.3	25.5	25.8	25.6	24.5	25.92167	
3	PH	9	9.06	9.5	9.41	9.36	8.02	7.6	8.44	7.6	7.82	7.9	8.6	8.525833	
4	EC	70.625	81.31	91.125	92	119	144.2	141.69	151	176	172	170	70	123.2458	
5	TDS	34.8	40.31	45.25	45.56	59.75	68.81	71.38	76	91	91	84.9	34.3	61.92167	
6	TUR	0.615	0.72	0.378	0.751	3	4.28	4.28	3.1	3.35	3.17	2.95	0.653	2.270583	
7	SALINITY	0.049	0.06	0.0615	0.0675	0.08	0.09	0.1	0.128	0.112	0.295	0.24	0.164	0.120583	
8	ALKALINITY	61.25	63.44	78.93	62.75	63.13	79.06	91.88	73.12	90	95.5	88.8	66.81	76.2225	
9	TH	35.87	37.69	42.125	47.375	47.38	49.38	57.13	52.37	58.37	58.375	57.58	35.98	48.30208	
10	Ca	3.77	3.83	4.88	5.053	8.09	7.33	6.74	7.43	8	7.95	7.85	3.9	6.23525	
11	Mg	2.208	2	3.081	2.64	2.16	3.56	3.01	2.258	2.37	2.425	2.51	1.4268	2.470733	
12	CL	15.71	15.53	18.02	18.215	20.29	19.88	21.37	24	28.7	28.51	28.268	15.963	21.20467	
13	FREE CO2	6.91	7.49	12.57	13.075	7.76	7.74	14.3	12.37	12.05	10.65	11.15	7.19	10.27125	
14	DOM	1.88	2.02	2.53	1.92	2.88	3.13	3.38	4.28	3.6	5.15	3.51	2.07	3.029167	
15	DO	6.1	7.1	8.425	8.7	8.2	8.38	7.64	8.4	7.78	7.5	8.23	6.71	7.76375	
16	BOD	1.175	1.35	1.375	3.85	2.55	1.44	3.09	1.55	1.45	1.1	0.981	1.71	1.80175	
17	SO4	4.95	5.9	6.005	6.581	5.4	5.73	5.42	11.89	11.84	11.25	5.7	6.131	7.233083	
18	PO4	0.033	0.057	0.051	0.083	0.17	0.23	0.05	0.055	0.09	0.141	0.076	0.041	0.08975	
19	Na+	1.43	1.91	1.825	1.91	2	1.63	1.08	0.091	1.67	1.18	1.28	1.21	1.434667	
20	Fe++	0.41	0.16	0.375	0.392	0.13	0.06	0.4	0.122	0.068	0.1	0.1361	0.045	0.199842	
21	K+	1.23	1.54	1.363	1.91	2.1	1.04	0.21	0.51	0.371	1.703	0.265	0.701	1.078583	

All values are expressed in mg/L except P^H ,temperature [^{0}C] ,turbidity [N T U] and conductivity [μ mhos/cm]

Table 2

	AT	WT	PH	EC	TDS	TURBIDITY	SALINITY	ALKALINITY	T H	Ca	Mg	Cl	FreeCo2	DOM	DO	BOD	So4	Po4	Fe	Na	k
MIN	19.8	24.3	7.6	70	34.3	0.37	0.04	61.2	35.85	3.77	1.4	15.53	6.91	1.88	6.1	0.98	4.95	0.03	0.045	0.091	0.21
MAX	29.49	27.3	9.41	176	91	4.28	0.29	95.5	58.3	8.09	3.56	28.7	15.27	4.28	8.42	3.85	11.89	0.23	0.39	2	2.1
AVE	24.6	25.9	8.5	123.2	61.9	2.27	0.12	76.12	76.22	6.2	2.4	21.2	10.2	3	7.7	1.8	7.2	0.089	0.199	1.43	1.07
SD																					

Water temperature: Water temperature of the samples were varied from a minimum of 24.3^{0}C to a maximum of 27.3^{0}C with an average of 24.6^{0}C . Minimum temperature was observed in the month of December [winter] and maximum was observed in the month of January .

$P^{H:}$Biochemical and chemical reactions occurring in water are determined by P^H.In the studied period sample P^H was from 7.6 to 9.4 with an average of 8.5 indicating slight basic nature of the samples.Anyhow P^H was within the permissible limit of BIS [1991][P^H 6.5 -8.5]

IV. ELECTRICAL CONDUCTIVITY :[E C]

Electrical conductivity is the important parameter of water and it depends on the nature and concentration of ionized salts .Electrical conductivity is used to measure the ability of water to carry an electric current. More the conductivity of water ,lesser in its resistance to electric flow ,there by indicating higher concentration of dissolved salts higher tropic status of the system [Kumar and siddique 1997] . Absolutely pure water is a poor conductor of electricity . water shows higher conductivity when dissolved salts are present .The conductivity is proportional to the amount of the salts dissolved in water.

During investigation, conductivity values were ranged from 70 µs /cm to176µs/cm andit is within the desirable limit 1500µs /cm of BIS [1991].

Total dissolved solids : In water ,total dissolved solids are composed mainly of carbonates ,bicarbonates ,chlorides ,phosphates and nitrates of calcium ,magnesium ,sodium ,potassium and organic matter ,salts and other particles .High values of T D Sand sulfates 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 physicochemical treatment processes [APHA 1995]

The drinking water containing more than 500 mg /l of TDS is not considered desirable and it can cause excessive scaling in water pipes, water heaters and house hold appliances.[Ashwin G Godghats et al may 2013] .During investigation ,TDS values of the samples were found in the range of 34.8 mg/l to 91Mg/l with an average of 61.91mg/l and falling with in the desirable limit [500mg/l] of BIS

V.   DISSOLVED OXYGEN

 D O is one of the important factors influencing the quality of water,therefore it is considered as one of the parameters to assess the quality of water. Dissolved oxygen is a remarkable indicator of pollution [S B. Basavaraddi etal.,2012] The concentration of the D O regulates the distribution of flora and fauna of the water body and it also reflects the physical and biological processes prevailing in the water. Oxygen saturated water has pleasant taste while the water lacking oxygen has an insipid taste. The un polluted water is normally saturate with D O ,while presence of oxygen demanding pollutants causes rapid depletion of D O. The D O value ranged from 6.1mg/l to maximum of 8.42 mg/l . In present study higher value of D O was observed in the month of February due to higher photosynthetic activities . In the present study the DO value is above the standard value of both W H O and B IS ie. 5 mg /l.

Biological oxygen demand:BOD is a parameter to assess the organic load in a water body.The amount of oxygen requiredby the aerobic decomposers for the biological breakdown of organic materials in water .It determines the strength of sewage effluents and other polluted water [Mahinda 1981] .High BOD indicates higher consumption of oxygen and a higher pollution in water . BOD values ranged from minimum of .98 mg/l to 3.85 mg/l .In the present study the values of BOD were within the permissible limits of B I S standardize 2 mg/l .

Salinity: The measure of the salt content of water is called salinity .It is an important factor in determining many aspects of chemistry of water and of biological process with in it. Salinity of water samples were ranges from .o4 ppt to .29ppt /l .

Total hardness:

Total hardness of water is the sum of concentration of alkaline earth metal cations such as $ca^{++}$and mg^{++}.It is the total soluble magnesium and calcium salts presents in water expressed as its $CaCo_3$ equivalent .The total hardness up to 200mg/l is desirable as per the standards set by BIS for drinking water. The hard ness beyond this limit cause encrustation of water supply structure and adversely affects the domestic use [Raghavendran 1992]

The hardness values of the samples were ranged from 35.85 mg/l to 58.3 mg/l with an average value of 76.22 mg/l and it was within the desirable limit [200mg/l] of BIS

As the hardness values of the water samples were in the range of 35.8 mg/l to76.22 mg/l and it could be under 'soft" class as per Handa's [1965] classification [S. B. Basavaraddi*et al.,*2014]

Calcium: content of water in the present study was found in the range of 3.77 mg/l to 8.09 mg/l with an average value of 6.2 mg/l .The value is well below the desirable limit [75mg/l] of BIS 1991 guideline .similarly,Magnesium content varied from 1.4 mg/l to 3.56mg/l with an average value of 2.4mg/l .

$Ca^{++}$and mg^{++} are both essential minerals for living organisms,both the minerals occur in all kinds of natural water with Mg^{++} concentration generally lower than the calcium [Jamrakarchirikashova April 2014].Magnesium is usually occurs in lesser concentration than calcium due to the fact that the dissolution of magnesium rich minerals is slow process and that calcium is more abundant in earth 's crust.

Total alkalinity :

The alkalinity of the water samples was ranged from 61.2 mg/l to 95.5 mg/l with an average value of 76.12 mg/l and were in the desirable limit level [200mg/l]of BIS

Chloride:

Chloride is often associated with sodium since Nacl is a common constituent of water .chloride is an important parameter in assessing water quality .it controls the salinity of water and osmotic stress on biotic communities .chlorides increases the level of eutrophication [Goel et al., 1980]

Chloride concentration higher than 200mg/l is considered as risky for human consumption and causes unpleasant taste of water. Chloride ion concentration of water sample is known to depend upon the characteristics of sediments and the pollution load of the water body [shivanna and Nagendrappa 2012].water quality can be assessed by its chloride content .low chloride content indicates pure water. High chloride content indicates polluted water.

In the present study the chloride content was found in the range of 15.53 mg /l to 28.7mg/l with an average value of 21.2mg/l .The values are well below the WHO guidelines for drinking water.[maximum permissible level 250 mg/l]

Free CO_2: It is an important aspect in aquatic environment .The CO_2 is highly soluble in water. $CO_2$is a byproduct of respiration and it also provides a carbon source for photosynthesis .Free CO_2 helps in buffering the aquatic environment against rapid fluctuation in acidity or a CO_2-alkalinity and also regulates biological process of aquatic communities [PrasannaKumari et al ., 2003] . Free CO_2 values ranged from 6.9 mg/l to 15.27mg/l with an average value of10.8 mg/l .

Dissolved organic matter :

D O M comprises of soluble organic materials derived from the partial decomposition of organic materials including soil ,organic matter ,plant residues and soluble particles released by living organisms including bacteria ,algae, and other plants .D O M provides carbon rich nutrients to microbes helps in nutrient cycle .DOM is measure of organic pollution .water bodies containing low D O M utilize less dissolved oxygen for decomposition .DOM values ranged from 1.88 mg/l to 4.28mg/l with an average value of 3 mg/l

Sulphate:

The sulphate ion is one of the major anions occurring in natural waters. Sulfate in water imparts offensive odour,objectionable taste and laxative effects. The values of sulfate were found between 4.95 mg/ to11.89 mg/l .The maximum value was recorded in the month of January and minimum value was recorded in the month of November .It is with in the permissible limit of 200mg/l .

Phosphates:

phosphate is considered as the most critical single element for biological productivity .Increased level of phosphate is taken up by phytoplankton ,which lead to algal blooms .phosphate content ranged from 0.03 mg/l [November] to .23 mg/l [April]with an average of .089 mg/l is very much less in the water body .

Iron:

Iron is the fourth abundant element by weight in the earth's crust and it is present in the ferric state in surface waters. The values of Iron were found between .o45 mg/l to .39 mg/l with an average value of .199 mg/l and it is with in the permissible limit of.3mg/l [BIS [1998]] .For drinking purpose ,Iron content should be less than 0.25 mg/l

Potassium : Potassium is one of the major cations in water and soil .In this study ,the concentration of potassium ions varied from as low as 0.21mg/l to ashigh as2.1 mg/l with an average of 1.07/l mg and it is with in the permissible limit. Boyd [1978] considered a concentration of 1.3 mg/l to be critical level of potassium in fresh water ponds .High clay and organic matter content of productive fish ponds soil [singh and Ram ,1974] , associated with alkaline P^H values usually tend to maintain moderate to good amount of potassium [K] in pond water . [chattopadhyay ,1995] However ,with increasing use of N and P fertilizers , potassium is gradually becoming the limiting nutrient [chattopadhyay ,1998] . Lower concentration of potassium cation leads to hypokalemia(lowered plasma $[K^+]$) and when level is raised leads to hyperkaliemia (increased plasma$[k^+]$) and hyperkaluria (increased urinary excretion of K^+)

Sodium : Sodium concentrations were found in between 0.091 mg /l to 2 mg /l with an average value of 1.43 mg/l and it is with in the permissible limit. The concentration of sodium present in the water body is more than potassium .sodium is the major cation of the extracellular fluid when its level is decreased ,Hyponatraemia is developed and hypernatraemiais developed when its level is raised.

Phytoplankton :The term plankton refers to those microscopic aquatic forms having little or no resistance to currents and living free –floating and suspended in natural waters. Phytoplankton occur as unicellular ,colonial or filamentous forms .

Aquatic algae usually occur in ponds ,pools, ditches, streams, Tanks or in slow running rivers and are called fresh water forms .The free floating and free swimming microscopic algal forms together with other similar organisms constitute the planktons of the water bodies.

One of the remarkable aspects of the tank environment is the large number of phytoplankton species that are present at any given time .Such species diversity appears as a paradox [Hutchinson,1967].

Phytoplankton play an important role in the biosynthesis of organic matter [primary production] in aquatic ecosystems, which directly or indirectly serve all the living organisms of a water body as food .The planktonic study is a very useful tool for the assessment of water quality in any type of water body and also contributes to understanding of the basic nature and general economy of thetank .

The species composition and the density of the phytoplankton determine the productivity status of a water body.Phytoplankton are the principal producers in awater body .Based on the density of phytoplankton ,the water bodies are classified into nonproductive or oligotrophic and highly productive or eutrophic .oligotrophic water bodies support only a few species ,whereas eutrophic water bodies support large number of species .

Diversity can be measured by recording the number of species, by describing their relative abundance or by using a measure,which combines the two components .Diversity measures are more useful in tank ecosystem ,which harbor a large variety of algal species in general ,and species diversity within genera.The present study is based on the data collected over a period of one year on the distribution of algal biodiversity in the Eachnur tank.

Methods and materials

Phytoplankton were collected from the tank and 25 ml of 4% formaldehyde was added [Welch,1948]and sedimentation was done in glass column .The sediments were finally reduced to 20 ml by centrifugation and were preserved in glass vial .From each vial, sample was mounted on microscopic slide and a cover slip was carefully put over it and observed under microscope at both low and high power .These observations at random and were

repeated four times for each of the samples. The average counts of algae were determined as organisms /unit/per liter [o/u/I].

Plate 1. Diversity of Phytoplankton of Eachnur tank .

A total of 33 phytoplankton and 5 protozoans were identified .Among phytoplankton ,members of Chlorophyceae and Bacillariophyceae appear to be dominant as compared to other classes .

Lepocinclisovum,Lepocinclisacuta, Euglena acus ,Euglena gracilis and Verticellasp were noted among Protozoans .

Table -3   List of phytoplankton.

Phytoplankton

Class: Cyanophyceae :

Gloeotrichiasp , Spirulinanordatedtie , Merismopediatenuissima ,   Oscillatoria sp , Microcystiscrassa ,

Class: chlorophyceae   :Oocystisgigas ,   Spirogyra crassa , Bulbochaetaeangulosa   , Ulothri , Zygnemasp , Pediastrum   simplex   ,   Pediastrum   ,   Closteriumlumula   , CosmariumlundeliiCosmariummargaritatum ,   Tetraedroncaudatum , Tetraedronmutium , Desmidiumswartzii ,Desmidiumquadratum , Stegeocloniumsp , Scenedesmusquadricauda , Closteridium ,Schroederia sp.

class: Bacillariophyceae   :Naviculasphaerophora   ,   Nitzschiasp   , Gomphonemagracile , Cymbellacymbeliformis , Pinnulariagibba , Synedra ulna , Synedraacus , Surirellasplendida

, Stauroneisphoenicentrum.Fragilariasp
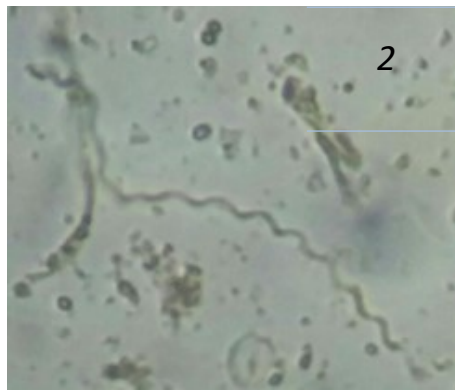
1. Gloeotrichiasp2.Spirulina nordatetii   3. Merismopediatenuissima
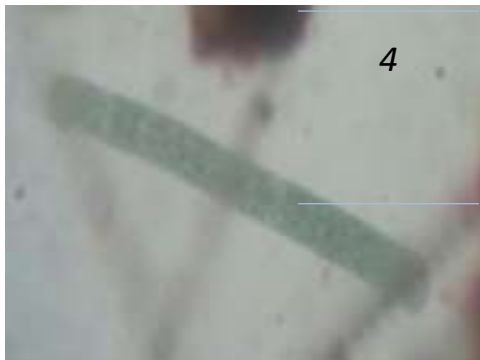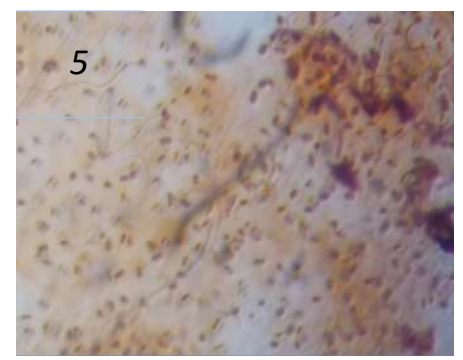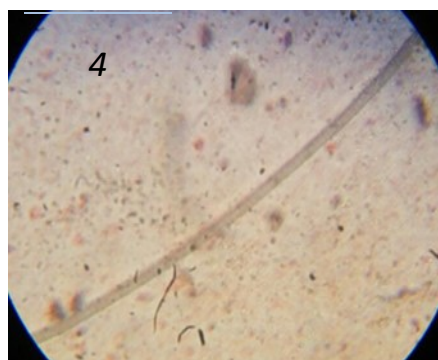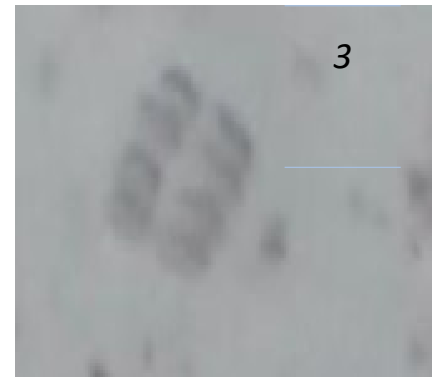
4.Oscillatoria
Oocystisgigas
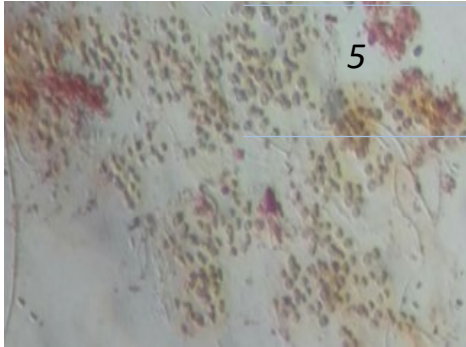
5.Microcystis crass
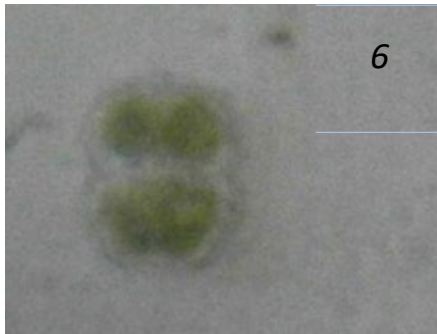
6.
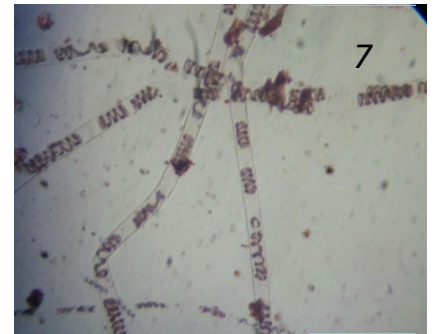
7.Spirogyra

8. Ulothrix sp

15.Tetraedron mutium 16.Tetraedroncaudatum 17.Desmediumswartzii 18.Desmidiumquadratum
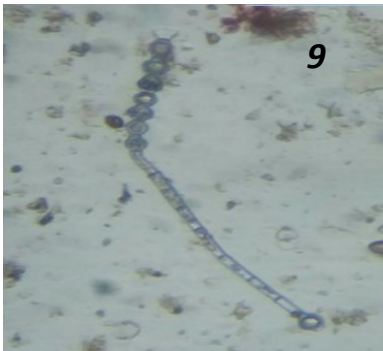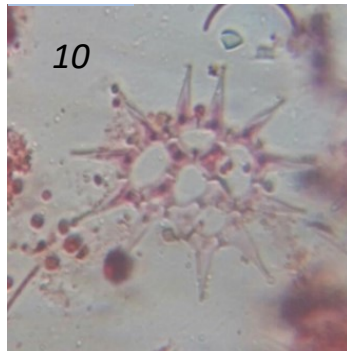
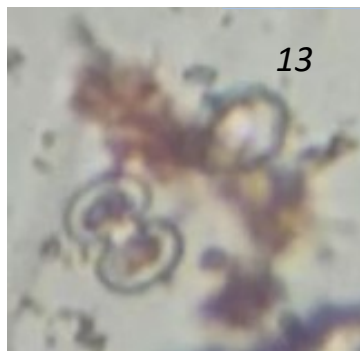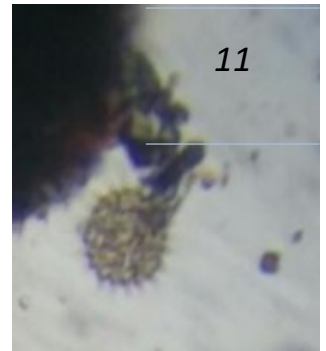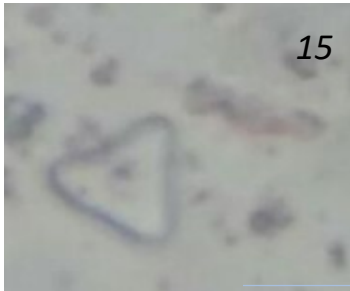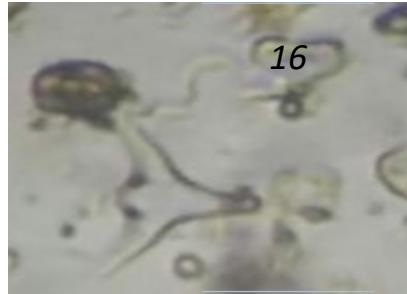9. Zygnema sp   10. Pediastrum simplex   11. Pediastrum duplex
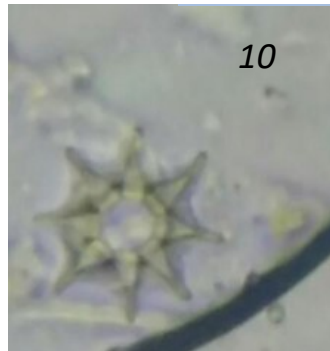
12. Closteriumlunula
Cosmariummargaritatum

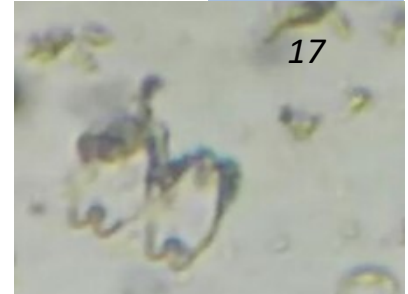**13.Cosmariumlumula**

14.

15.Tetraedron   mutium
17.Desmediumswartzii

16.Tetraedroncaudatum
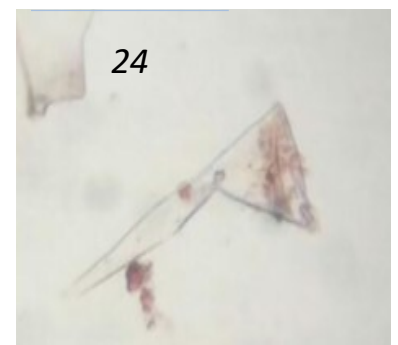
18.Desmidiumquadratum

19.Stegeoclonium
21.Schroederia

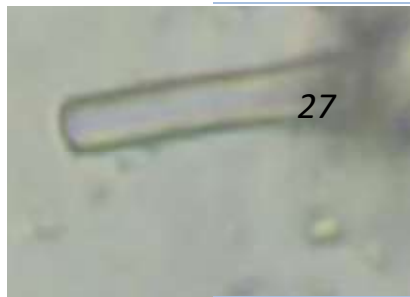20.Scenedesmusquadricauda

22. Naviculasphaerophora23 .Nitzschia

24. Gomphonemagracile
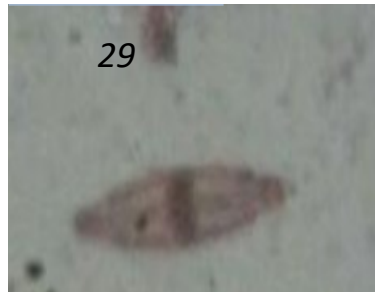**Pinnulariagibba**

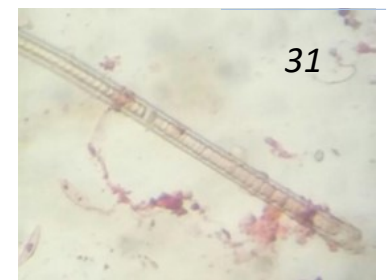**25 Cymbellacymbeliformis**
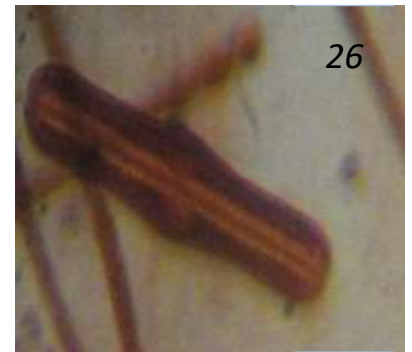
26.

27 .Synedra   ulna

28.Surirellasplendida

29 .Stauroneisphoenicentrum
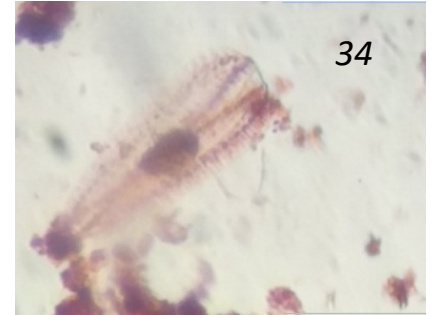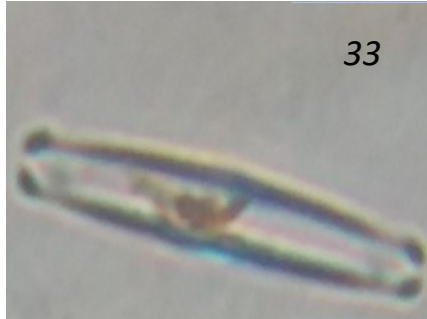
28.Surirellasplendida

29 .Stauroneisphoenicentrum
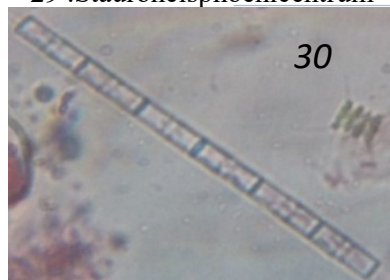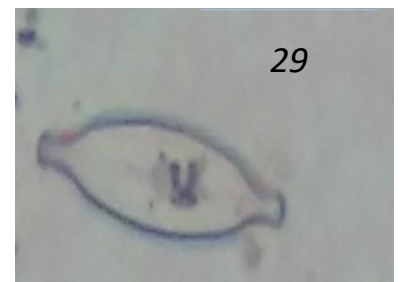
30. Melosiraislandica31.Synedraacus

32 .Nitzchiasublinearis 33.Fragilaria sp.   34. Auxosporeformationinpinnularia.
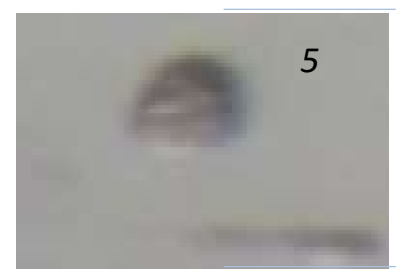
Zooplanktons inEachnur Tank

Protozoa:1.Lepocinclisovum 2.Lepocinclisacuta 3. Euglena gracilis4.Euglena acus 5.Verticella sp.
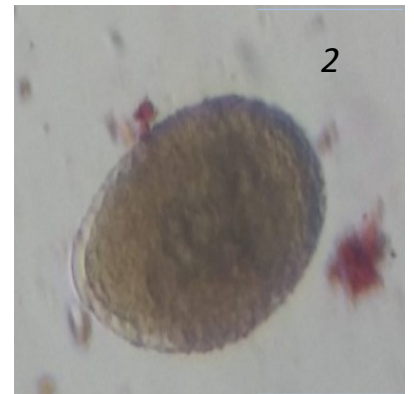
1] Verticella sp   2]

3] Lepocinclis ovum   4] Euglena acus   5] Euglena sp .

The presence of bioindicators of pollution [phytoplankton and protozoans]indicates the occurrence of organic pollution .

VI. CONCLUSION

Thus the Artificial Intelligence works better for analyzing the water and phytoplankton present in the water with the study area taken into consideration for our analysis.

1.The present investigation of water quality analysis reveals that Eachnur tank water is safe for drinking and domestic purposes as per standards set by BIS.

2. Analysis of tank water slight alkaline in nature, need of some treatment for minimizing the said parameter .

3.During study Period,it is learnt that grazing of animals inside the tank during summer season and other anthropogenic activities add some organic waste in to the tank , cause for pollution .

4.In the present study phytoplankton diversity was observed [bioindicators].

5. Along with some common Zooplanktons were also observed indicating pollution of water. Hencetank water requires treatment before use by municipal authorities.

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