Review Article

A Preliminary Limnological Study on Kothacheruvu (Tank), Nellore District, India

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Abstract: Present work has been conducted on Kothacheruvu (Tank) encircling the tomb of Kothacheruvu in Nellore District. The Pond water is mainly used for bathing, washing of clothes and for immersion of idols besides regular inflow of domestic waste water. The investigation on physico chemical characteristics at different sites revealed its alkaline nature, suitable for aqua culture practices. Significant site variations have been recorded due to the interference of Sewage and agricultural wastes. The physico-chemical and biological characteristics of the Kothacheruvu (Tank) reveal degrading condition of the ambient water. Which can be felt on account of its obnoxious smell and greenish appearance. The impact of high anthropogenic pressure as well as favorable environmental factors like temperature. Also the impact of global warming on zooplankton present in water bodies situated at Kothacheruvu (Tank) discussed.

Key words: Water quality, Degradation and Kothacheruvu (Tank)

Introduction

In the last three decades, there has been a growing necessity for conservation of our resources, especially water. At the same time, growing populations, progressive industrialization and intensification of agriculture have lead to increased pollution of surface waters, present limn logical work has been carried out to assess the current status of Kothacheruvu (Tank) around the pond for various domestic chores, zooplankton study is important as it could predict the productivity of fresh water aquatic ecosystem depend mainly on the physico-chemical properties of water pollution (Sreenivasulu *et al.,* 2014) of water bodies by different sources results in drastic change in zooplankton populations and thereby effects the production potential of the ecosystem it involves the assessment of physico-chemical parameters of water bodies, while the most sensitive species act as indicator of water quality (ogbogu, 2001 and Hasan, 1996) these, the present work aimed to assess the physico-chemical parameters of Kothacheruvu which is mainly used for irrigation purposes, commercial fishing practices and recreation.

The physico chemical characteristics of water is playing significant role to assess the quality of water for its best usage. Quality of notable water is as important as its quantity. Various physico chemical and biological factors are governing the quality of water. Richness in the productivity of aquatic eco system is due to the presence of nutrients. Phytoplankton's constitutes the basis of nutrient cycle of an eco-system. They play an important role in maintaining the equilibrium, between living organisms and abiotic factors. As water is precious, it is becoming more unfit to mention due to direct or indirect inference of human activity.

This induces ecological imbalances, deleterious for sustained development of fisheries resources which has necessitated the suspension of the beneficial uses of these water bodies in some Places.(Barbour, M.T, J. Gerresten, B.D. Synder and J.B stribbling 1999) Plankton are consider indicators of the different trophic status water body because of their specific qualitative features and their capacity to reproduce in large number under environmental conditions that are favorable to them and they used for pollution surveillance (Amer, 1939) The proverb that " Fresh water is a gift of god which would continue to be available in perpetuity and in abundance" is under challenge. Environmental factors such as temperature, pH and proper supply of O_2, CO_2, and essential elements like, Nitrate, Phosphate and chloride, Influence plankton diversity Suresh Kumar (2002), Ahmed SH and AK Singh (1993). While realizing the need of chemicals it should be ensured that they do not spoil our Environmental global chemical pollution which has been a matter of a great concern with increase in public awareness towards the Environmental problem. Important abiotic factors in an aquatic habitat are pressure, density, light, current temperature, oxygen, carbon dioxide, other gases, dissolved solids, microorganisms, benthos (bottom biodata) and nekton (active swims) (Maruthi et al., 2013)[5]. Finally this paper is determining overall role of Anthopogenic pressure on this glacial fed tanks. The Physico-Chemical charactericts of Kotha Cehruvu (tank) has been studied for monsoon, premonsoon and post monsoon in the year.

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Materials and Methods

Sampling procedure and laboratory Analysis

Water samples were collected from sampling stations (April 2011 to 2012, Monthly samples of sub-surface water in triplicate were collected during first week of each month in the early hours of the day (7 a.m. to 9 am). Iodine treated double Stoppard polyethethlene bottles were used for collection of water, Bottles were kept in ice bucket and brought to the laboratory for analysis as per A P H A 2005 Procedure.

Study area

Kothacheruvu is a village in Ozili mandal in Nellore district of Andhra Pradesh state. The famous Kothacheruvu tank surrounded by Naidupeta Mandal towards South, Chillakur mandal towards North, Kota mandal towards East. Kothacheruvu is a one of the major water body of central India. It is located 57 KM towards south from the district headquarters of Nellore and 474 KM away from the A.P state capital Hyderabad. Kothacheruvu is one of the major water bodies of central India total area of Kothacheruvu is 189 hectors presently the water body Kothacheruvu is used for irrigation and aquaculture practices. The present work is on physicochemical parameters of Kothacheruvu for the estimation of it's Zooplankton diversity as well as it's physico-chemical properties. This tank is a multipurpose tank used for different activities like supplying drinking water, irrigation, fisheries etc. Every year around 25 tons of fish is caught by fishermen from this tank.

Results and Discussion

Ecological status of any water body depends upon the healthy interaction of   abiotic and biotic components lentic water bodies, which are characterized by a continual movement of dissolved substances and suspended material result in dynamic interaction between components of eco system. Physico-chemical analysis is of immense importance to assess the quality of water for use in, drilling, bathing, fishing and industrial process, etc. The physicochemical characteristics of the four lentic water bodies have been analyzed and discussed as per their monthly and seasonal variations, their relationship etc. (Table 1 and 2).

Temperature

The temperature of water is one of the important physical parameter, which directly influences some chemical reactions in aquatic ecosystems and it is also an important parameter for fish substance and other organisms, the surface waters go in heat meanly by absorption of solar radiation and conduction from the atmosphere, despite temperature also influences the taste of water.

The present study of the atmosphere temperature in the selected tank fluctuated between yearly average of 26.20^0C (in monsoon), 31.1^0C (pre-monsoon) and 26.7^0C (in post monsoon) However slight lower temperature value were recorded during monsoon compared to other season and the correlation matrix polled were showed as 1.00.

The significant correlation between ambient temperature and water temperature was also observed by power and pulle (2005).

Table 1: Physico-Chemical Parameters at various season of Kothacheruvu

S. No	Parameters	Monsoon	Pre-monsoon	Post-monsoon
1	Air temperature	26.20	31.13	26.73
2	Water temperature	26.06	30.76	26.64
3	pH	7.7	6.84	7.78
4	Turbidity	36.48	25.82	20.55
5	Electrical Conductivity	65.03	92.41	53.22
6	Total Solids	804.66	1382.33	843.16
7	Total Dissolved Solids	36.06	57.23	39.52
8	Chlorides	16.66	19.96	15.97
9	Total Hardness	132.33	230.83	174.50
10	Total Alkalinity	363.16	424.50	402.33
11	Total Acidity	12.10	20.08	11.80
12	Nitrate	0.23	2.33	0.97
13	Sodium	16.50	29.55	8.14
14	Potassium	1.56	16.58	2.43
15	DO	4.65	3.93	7.53
16	BOD	2.07	2.81	2.20
17	Phosphate	0.14	0.34	0.25
18	Calcium	5.17	9.2	8.94
19	Magnesium	13.6	14.83	27.56
20	COD	498.66	156.85	70.01
21	Iron	0.13	0.32	0.02
22	Sulphate	179.94	285.68	105.93
23	Free CO2	9.98	16.52	10.30

Except pH and EC all parameters are in mg/l

pH

pH is an indicator of acid base equilibrium achieved by various dissolved compounds in water i.c if free H^+ are more it is expressed acidic (i.c pH < 7). The pH of the pond water is influenced by the monsoon, temperature and soil conditions.

The present study of the pH in the selected tank fluctuated between yearly average of (7.70) (in monsoon), (6.84) pre-monsoon and (7.78) (in post monsoon). However slightly lower temperature value where recorded during pre-monsoon compare to other season and the correction matrix pooled were showed as table 2.

The statistical data revealed that pH exhibited significant positive (correlation matrix pooled) and with physico-chemical characteristics such as total alkalinity, phosphates nitrates and sulphates (correlation matrix pooled 0.05)

Electrical conductivity: Pure water is a poor conductor of electricity, conductivity (specific conductance) of a substance or isolation is the measure of its capacity to conduct electric current. Most of the salts in water are present in the ionic forms, capable of conducting electric current).

The present study of the electrical conductivities in the selected tank fluctuated between yearly average of 65.03μmhos/cm in monsoon, 92.41μmhos/cm in Pre-monsoon and 53.22μmhos/cm in post monsoon. However slightly monsoon compare other season value where recorded during monsoon compare other season and the correlation matrix pooled were should as similarly, similar result was reported in extension of higher values of EC which may be attributed to the agriculture run off entering these tanks, similar results were reported by pati *et al.,.* (1986) and sankaran unni (1985) who also concluded that conductivity was influenced by agriculture run off.

Total dissolved solids: The composition of salts present in natural water body mainly depends upon the nature of bedrocks and soil developed from it. The common lys occurring natural salts are carbonated, bicarbonate, chlorides, sulphates, phosphate and nitrates of calcium, magnesium, sodium, potassium etc. Excessive dissolved solids in drinking water may lead to objectionable taste, and correlation or encrustation in water distribution system. At concentrations approximately in water distribution system. At concentrations approximately greater than 1000mg/1, the taste of water becomes increasingly unpalatable.

The present study of the total dissolved solids in the selected tank fluctuated between yearly average of 39.52 mg/l in monsoon, 57.23 mg/l in pre-monsoon and 36.06 mg/l in post monsoon. However slightly lower T D S value where recorded during monsoon compared to other season and the correlation matrix pooled were showed as. This is in conformity's with the findings of sreenivasan (1969), Ashok varma and yashodara Sharma (2002)**.**

Turbidity

Turbidity in natural water bodies is mainly caused by sand, silt, clay, phytoplankton, microorganisms, and organic materials suspended or dissolved in it turbidity affects light scattering, absorption properties and aesthetic appearance in water bodies. The present study of the turbidity in the selected tank fluctuated between yearly average of 36.48 NTU in monsoon, 25.82 NTU pre monsoon and 20.55 NTU in post monsoon. However, slightly lower turbidity value where recorded during pre-monsoon compared to other season and the correlation matrix pooled were showed as table 2. This is in conformity with the findings or Meera and sultana (2004) & Mathivanam *et al.,* (2005).

Dissolved oxygen

The dissolved oxygen (DO) is one of the most important factors in any aquatic eco systems. All living organisms are dependent of Oxygen in one form or the other to maintain their biological process that produce energy for their growth and reproduction dissolved oxygen also plays a major role in dissolution and precipitation of inorganic substances in water. The main sources of dissolved oxygen are dissolution from atmosphere and the photo synthesis. The former depends on factors like temperature, salinity and density of phytoplankton.

The present study the turbidity in the selected tank fluctuated between yearly average of 4.65 mg/l in monsoon, 3.93 mg/l in pre monsoon and 7.53 mg/l in post monsoon. However, slightly lower dissolved oxygen value where recorded during pre-monsoon compared to other season, and the correction Matrix polled were showed as table 2. Swarnalatha and Narasinga Rao (1993) have pointed that polluted water bodies contain less amount of dissolved oxygen, while in the study are a witnessed similar results in vaddingare kere tank due to rapid depletion in water level and increased load of organic compounds**.**

Biological oxygen Demand

The biological oxygen demand (BOD) denotes the pollution strength of the water body it is a measure to know the organic load in the water. The presence study of the B O D in the selected tank fluctuated between yearly average of 2.07mg/l in monsoon, 2.81mg/l pre monsoon, and 2.20mg/l in post monsoon. However, slightly lower biological oxygen demand value was recorded during monsoon compared to other season and the correlation matrix pooled was showed as table 2.

As per the BIS standard 3mg/l of B O B is permissible in drinking water , considering this only Erannan Kere tank showed biological oxygen demand less than 3md/l, However all the other bodies exhibited BOD values more than 3mg/l, Hence these water bodies are considered to have comparatively more amount of organic matter.

BOD was recorded during the month of August and October and relatively high during April and May. This may be attributed to the highest biological activity at high temperature. Similar opinion was expressed by Ponday *et al.,* 1993 and Maruthi *et al.,* 2012 a, b & C.

Nitrate is the highly oxidized form of nitrogen compounds that usually in natural water nitrate is the end product of decomposition of organic nitrogenous matter. The source of nitrates are drainage from line stock feeds, chemical fertilizers from cultivated land, as well as from domestic and industrial sources, Natural waters in their un-polluted state contain only minute quantities of nitrates, perhaps high concentration of nitrates in drinking is harmful for infants because it causes methenoglobinemia but nitrate is also an essential nutrient for plants and planktons, which they convert in to cell protein.

The presence study of the nitrate in the saluted tank fluctuated between yearly average of 0.23mg/l in monsoon, 2.33 mg/l in pre-monsoon and 0.97 mg/l in post monsoon. However slightly lower temperature value where recorded during monsoon compared to other season and the correlation matrix pooled were shown as table 2.

Venkateswarlu (1969) also recorded comparatively higher values of nitrates during monsoon and post-monsoon, and lower concentration during pre-monsoon season, which is due to the nutrient demand of the growing planktons during pre-monsoon, a greater portion of nutrients could be absorbed by rapidly growing species making the water body nutrient poor, this seemed to be the reason why low concentrations' of nitrates and phosphates coin wide with high phytoplankton density during summer

Total Hardness

Traditionally water hardness is measured as the capacity of water to react with soap. Hard water require more amount of soap to produce leather than soft water, the hardness of water is predominantly caused by divalent cations such as calcium, magnesium and alkaline earth metals such as iron, manganese, strontium etc.

The present study of the total hardness selected tank fluctuated between yearly average of 132.33 mg/l in monsoon, 230.83 mg/l pre-monsoon and 174.50 mg/l in post-monsoon. However slightly lower temperature value were recorded during post-monsoon compare to other season and the correlation matrix pooled were shown as table 2.

Seasonal fluctuations of total hardness were recorded low during monsoon season and maximum during post-monsoon and pre monsoon seasons, however total hardness exhibited a bimodal annual charge with low values in monsoon season, Sunkad and Patil and Dilip Rathor *et al.,* (2006) also obtained similar results, whereas khabade and mule (2003) reported maximum hardness during summer season.

Table 2: Correlation Matrix pooled Physico-Chemical Parameters V/S Physico-Chemical Parameters of Kothacheruvu (tank)

	AT	WT	PH	EC	TDS	TUR	DO	BOD	FREE (CO2)	CL	CA	MG	TH	T.ALK	T.AGI	PO₄	NO₃	SO₄	NA	K
AT	1.00																			
WT	0.98	1.00																		
PH	-0.69	-0.76	1.00																	
EC	0.43	0.53	-0.57	1.00																
TDS	0.52	0.61	-0.52	0.56	1.00															
TUR	0.33	0.35	-0.10	0.62	0.53	1.00														
DO	-0.23	-0.18	0.37	-0.38	-0.27	-0.27	1.00													
BOD	0.78	0.76	-0.48	0.54	0.10	0.51	-0.12	1.00												
Free Co₂	0.64	0.64	-0.58	0.72	0.49	0.65	-0.48	0.23	1.00											
CL	0.48	0.47	-0.24	0.21	0.61	0.22	-0.32	0.48	0.68	1.00										
CA	0.34	0.32	-0.06	0.35	0.32	0.20	0,40	0.02	0.39	0.31	1.00									
MG	0.97	0.96	-0.76	0.97	0.52	0.45	-0.34	0.65	0.65	0.66	0.36	1.00								
TH	0.94	0.93	-0.73	0.88	0.46	0.28	0.28	0.66	0.66	0.43	0.52	0.94	1.00							
T.ALK	0.92	0.91	-0.51	0.80	0.33	0.14	0.29	0.91	0.70	0.33	0.58	0.87	0.97	1.00						
T.aci	0.87	0.46	-0.63	0.36	0.34	-0.06	0.65	0.64	0.64	0.23	0.46	0.90	0.93	0.94	1.00					
PO₄	-0.29	-0.22	-0.35	-0.21	0.53	0.42	-0.19	-0.36	-0.44	-0.36	-0.62	-0.22	-0.56	0.33	-0.22	1.00				
NO₃	-0.42	-0.22	0.21	-0.42	0.24	0.22	-0.29	-0.21	-0.42	-0.34	--0.61	-0.17	-0.51	0.32	-0.36	0.63	1.00			
SO₄	-0.60	-0.70	-0.50	-0.57	0.40	0.37	0.35	0.18	0.32	0.43	-0.16	-0.36	-0.09	0.26	0.43	0.38	0.06	1.00		
NA	-0.52	0.76	-0.58	0.09	0.48	0.30	0.73	0.19	0.39	0.49	0.56	-0.40	0.61	0.70	-0.35	0.25	0.34	0.15	1.00	
K	0.83	0.82	-0.29	0.84	0.47	0.60	-0.66	0.54	0.53	0.51	0.58	0.78	0.57	0.76	0.61	0.74	0.80	0.96	0.98	1.00

Sodium

The sources of sodium in natural waters are weathering of rocks and mineral assemblages in the surrounding areas, the principal one being rock salt - sodium chloride, sodium is a cationic composition of water.

The presence study of the sodium in the selected tank fluctuated between yearly average of 16.50 mg/l in monsoon, 29.55 mg/l premonsoon and 8.14 mg/l in post monsoon. However slightly lower temperature value where recorded during post monsoon compare to other season and the correction matrix pooled were shown as table 2.

Season wise the concentration of sodium was high during post-monsoon and low during monsoon season, Bala Krishna Reddy (1989) also observed similar trend

Potassium

Potassium is also a commonly occurring cationic natural salt and is the seventh most abundant element in order of its abundance and found lower than sodium.

The present study of the potassium in the selected tank fluctuated between yearly average of 1.56 (in monsoon). (16.58) pre-monsoon and 2.43 in post monsoon However slightly lower temperature value where recorded during monsoon .Compare to other season and the correlation matrix pooled were showed as table 2. Seasonally the concentration of potassium was low during monsoon and high during pre-monsoon season similar changes also observed by Khabade and Mule 2003

Conclusion

The physic-chemical characteristics of these water body was found to be well in the permissible limit of BIS (1998, except P^H, DO, BOD and turbidity in some seasons, which may be due to anthropogenic activities in the area, and input of nutrients and other organic and in-organic substances through run off water from agricultural fields.

Acknowledgement

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