Ecological Studies of the Bhandham Cheruvu with reference to its Physico–chemical Parameters

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Abstract

The present work is to study on the impact of human activity on the process of eutrophication of a lake by the study of its physico–chemical parameters of the water and soil, which include Temperature, P^H, TDS, TSS, Total Hardness, EC, Chlorides, Sulphates, Nitrates, Phosphates, DO, BOD, COD, Ca^{++}, Mg^{++}, etc. As the lake is situated near by the Warangal city it is observed that the pollution of the lake is due to various anthropogenic activities which are taking their entry through various inlets in to the lake. The results of the physico-chemical parameters have shown the monthly as well as seasonal variations of the study period i.e., from June 2012 to May 2013 at four different sampling stations covering all the areas of the lake. The changes in the heavy metal content also are observed during the study period of the Ganesh idols. The idol immersion is a regular feature and every year around 3000 idols have been immersed every year during the festival of Ganesh chaturthi. It is a clear indication that the lake may be indicated as the eutrophicated as the values of almost all the physico-chemical parameters are recorded high. The present study indicates that the lake is highly polluted which is due to the various human activities.

KEYWORDS: Bandam Cheruvu, Physico-Chemical Parameters, Seasonal Variation, Eutrophication.

INTRODUCTION: -

Water is an indispensible resource given by the nature to us like a boon and one of the most needed factors for the existence of living organisms. The water is the one of the most essential component for the existence of life on the earth. According to (Kudesia and Kudesia, 1998) about 97%of earths water is found in ocean 2%is frozen as ice in poles and remaining1% is available to us in the form of fresh water in rivers, streams, lakes and ground water and which is used for human beings for their daily needs, agriculture, irrigation and factories. The environmental changes will affect the parameters like temperature, DO, BOD, and other parameters of lake (Patra2010 and Salanki, 2007).

Water is one of the important sources to sustain life and has long been suspected of being the source of much human illness. Source of surface water and ground water have become increasingly contaminated due to increased industrial, agricultural activites and by the release of the domestic sewage in many ways mainly by idol immersion during the time of festivals like Ganesh Chathurthi. Water is known to contain large number of chemical elements, the interaction of both physical and chemical properties of water play a significant role in composition, distribution and abundance of aquatic community. Lakes have a more complex and fragile ecosystem as they do not have a self-cleaning ability and therefore readily accumulate pollutants. Consequently, major changes in the physic-chemical water quality had

happened, even on the dynamism of the lakes and often transforms from clear to turbid water state.

Several studies have been made so far to understand the physico-chemical properties of lakes, ponds and reservoirs in India. (Jain et al., 1996; Srinivas et al., 1997; Mohanraj et al., 2000; Srinivas and Kotaiah 2000; Thorat and Masarrat 2000; Datt and Sharma 2001; Shastri and Pendse 2001).

The Water quality is used to describe the condition of water, including its chemicals physical, and biological characteristics, usually with respect to its suitability for a purpose i.e. drinking, swimming or fishing etc., (Diersing,2009).Water pollution has however threatened to reduce the quantity available in ponds, lakes, rivers and reservoirs due to disposal of sewage, industrial water and due to other human activities (Trivedy and Chandrasekhar,1999).Deterioration of water quality, loss of biodiversity and fast depletion of water resources are the main challenges which need urgent attention. Though thorough study of all wet lands in the country has not been done, several past studies gives us the degree of deterioration of these resources (Kodarkar, 1999, Tekale and Kodarkar, 1999 and Diwan and Kodarkar, 2000).

The Physico-chemical study could help in understanding the structure and function of particular water body in relation to its habitants. The proper balance of physical, chemical and biological properties of water in ponds, lakes and reservoirs is essential for limnological study. Abundance of particular element might suggest the type of organism that may be found as well as indication of ecologically unstable or unfavorable ecosystem which can have negative or positive impact on the population i.e. high concentration of nitrate or phosphate is indicative of “Eutrophication”. Eutrophication is a global phenomenon associated with nutrient enrichment of aquatic ecosystem. Assessment of Eutrophication is based on physical, chemical and biological data (Karadzic et al, 2010; Kitsiou and Karydis, 2011 and 2000). In natural course it is slow process of lake aging ultimately lead to succession. The Physico-Chemical Properties, biological will not remain same all the time.Thus the present study has been undertaken to determine the physic-chemical characteristics of water samples in order to assess the water quality status of Bhandham Cheruvu.

Material methods:

Study area: The Bhandam Cheruvu is situated 17^0–8`-58``latitude and longitude $79^0$-32`-34`` in the city of Warangal of Telengana State. This lake receives the domestic sewage from the city in various ways.

Sampling:

Water samples were collected every month regularly during the morning hours before 8 A.M in 2 liters of sterilized plastic bottles for the period of one year and immediately the temperature, p^H, E.C are checked at the site itself and D.O bottles is also fixed and con.HCl is added to the collected sample as not to alter the physic-chemical parameters and taken to the laboratory for the analysis.

Analytical Methods:

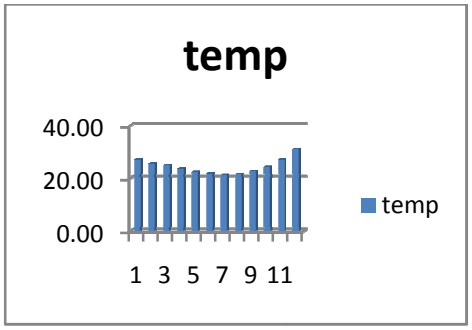
The p^H and temperature of the water were measured at the sampling site with the help of digital p^H meter and centigrade thermometer respectively. Other parameters were analyzed as per the methods described by APHA (2006).Standard preservative

methods were adopted to preserve same till it was used for the final analysis in laboratory.

RESULTS AND DISCUSSION:-The average values of qualitative analysis of various physico-chemical parameters were presented in Table-1.

Table:1 Average Seasonal Variations Of BDM For The Period Of 2012-13

para	jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Mean	min	max	S.D.
temp	27.00	25.57	24.99	23.68	22.46	21.80	21.35	21.60	22.70	24.40	27.08	31.13	24.48	21.35	31.13	2.89
pH	7.38	7.03	7.55	7.70	7.40	6.78	7.09	7.19	7.23	7.30	7.50	7.58	7.31	6.78	7.70	0.26
EC	1603.75	966.25	882.75	1032.75	945.75	920.00	689.25	766.00	947.25	960.00	1459.25	1561.25	1061.19	689.25	1603.75	305.48
COD	75.50	54.50	50.50	90.00	78.00	60.75	73.75	81.25	75.00	82.00	92.75	96.50	75.88	50.50	96.50	14.51
BOD	23.75	14.25	18.00	16.75	17.25	16.50	19.50	19.50	27.25	27.00	25.00	27.75	21.04	14.25	27.75	4.82
Chlorides	271.25	110.25	140.75	145.75	117.75	109.25	195.00	183.25	211.00	240.50	257.00	276.25	188.17	109.25	276.25	63.27
Sulphates	33.75	24.25	54.25	50.25	52.25	30.25	52.00	41.25	38.00	41.25	45.00	47.50	42.50	24.25	54.25	9.52
Nitrates	0.69	0.37	0.44	1.29	1.23	0.84	1.31	0.98	1.08	1.23	1.38	1.59	1.03	0.37	1.59	0.38
phosp	0.56	0.54	0.83	1.41	0.95	0.81	0.74	0.67	0.65	0.77	0.83	0.99	0.81	0.54	1.41	0.23
TS	929.75	771.75	862.00	754.50	696.75	556.00	517.75	679.00	613.25	695.50	926.50	947.50	745.85	517.75	947.50	146.60
TSS	23.25	13.50	13.00	17.75	15.25	12.00	13.50	16.75	16.00	18.50	17.50	16.50	16.13	12.00	23.25	3.06
TDS	916.00	760.75	1006.25	740.25	687.50	544.00	506.75	663.25	599.75	680.25	911.50	933.25	745.79	506.75	1006.25	163.31
DO	4.30	5.07	6.13	5.48	4.50	5.42	5.10	6.33	5.20	4.63	4.20	4.40	5.06	4.20	6.33	0.69
TH	93.00	73.00	83.50	94.50	88.75	90.00	83.75	101.00	109.00	99.50	113.25	126.75	96.33	73.00	126.75	14.72
Ca++	70.25	52.25	62.00	69.00	66.00	66.50	62.25	80.50	86.75	73.25	78.00	83.75	70.88	52.25	86.75	10.06
Mg++	23.00	21.75	22.75	26.00	25.75	27.75	28.00	28.25	22.75	27.50	28.75	30.06	26.03	21.75	30.06	2.81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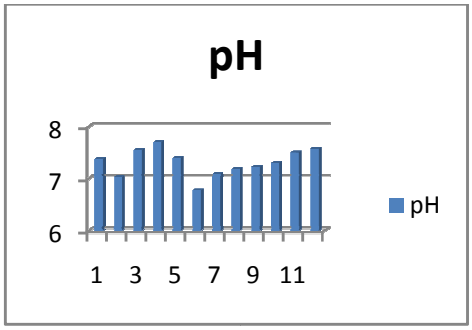
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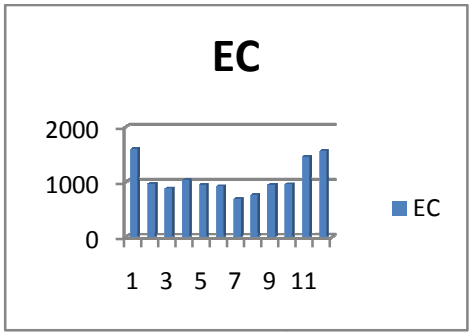
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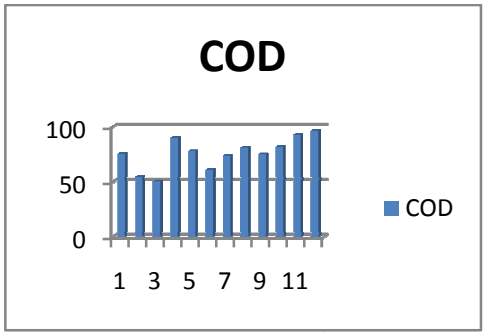
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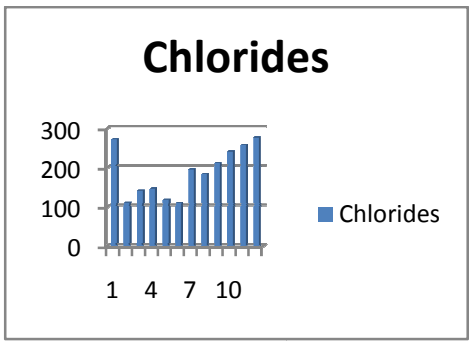
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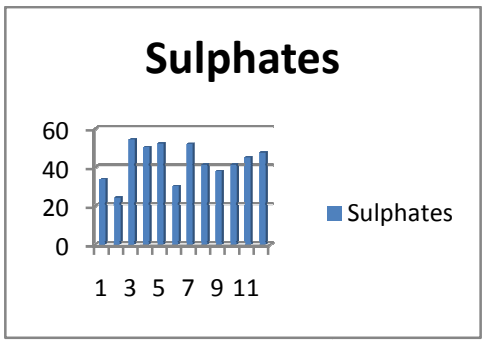
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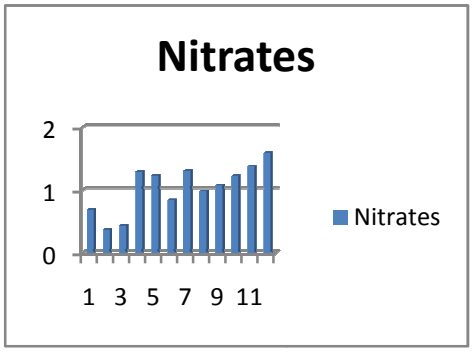
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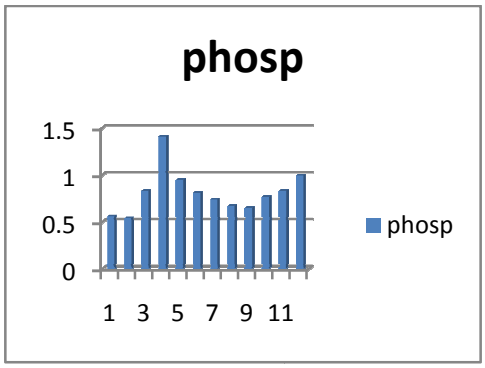
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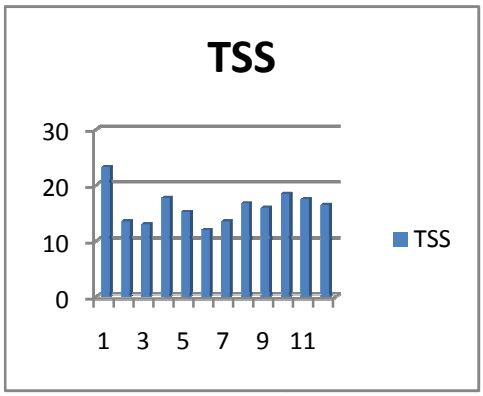
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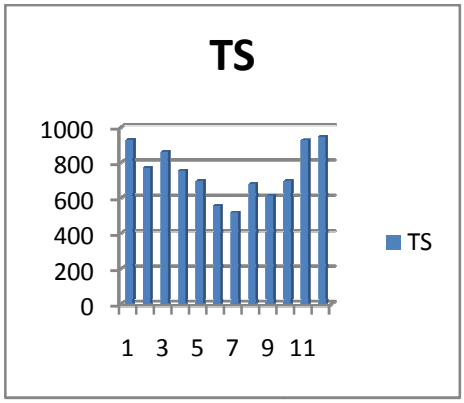
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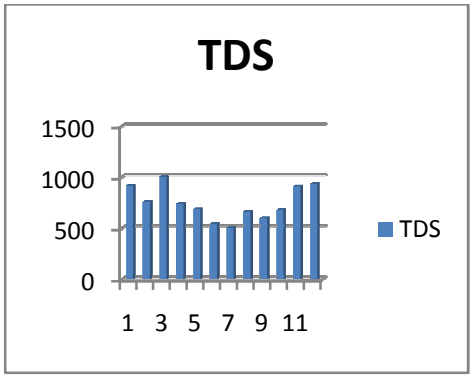
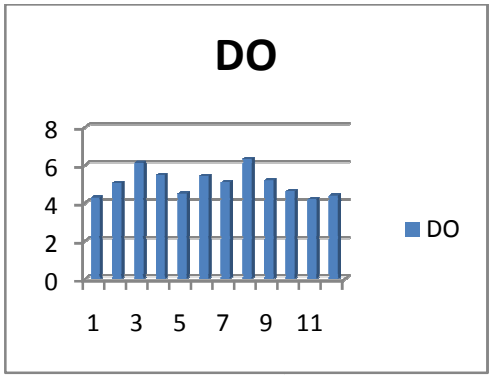
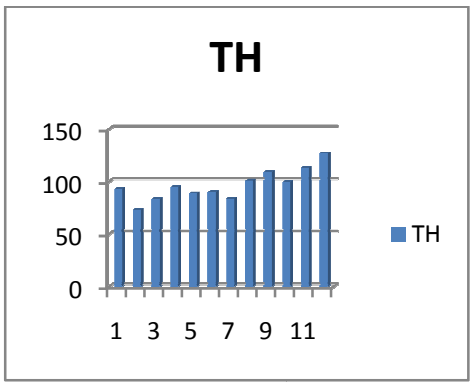
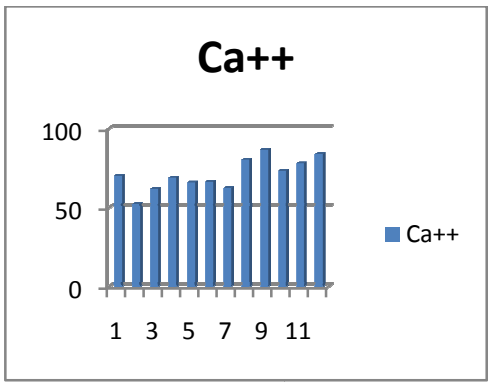
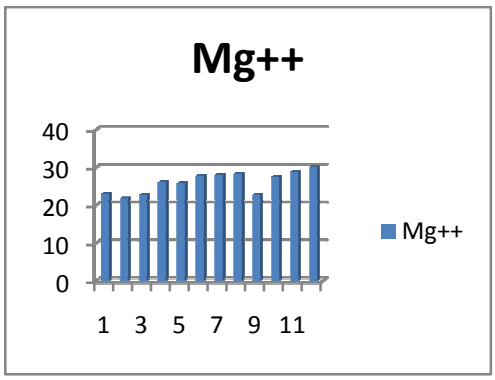










Note: - Axis the numbers represents the Months from June-2012 to May-2013

The temperature is the basis of all the parameters as the temperature changes occur the physic-chemical parameters variations may occurs. The average annual minimum temperature was recorded as 21.35^{0}C were as the maximum was recorded as 31.13^{0}C. The mean and SD were recorded as 24.48^{0}C ±2.89^{0}C temperature. The average annual pH values range from minimum with 6.78 to the maximum value with 7.70.It is influenced with the increase in sewage from various ways in to the lake. The EC fluctuated yearly average between 689.25mhos/cm^2 which is minimum and the maximum EC value with 1603.75mhos/cm^2.The high EC values indicate the presence of salts and ions in higher concentration (Nidhi Bajpai *etal*., 2012).the means and SD of EC were recorded as 1061.19 ±305.48mohs/cm2.The COD values recorded were minimum in the monsoon period with 50.50 mg/lit and the maximum values were recorded in pre-monsoon with 96.50mg/lit. The higher values of COD indicate pollution due to oxidisable organic matter. The means and SD values of COD were recorded as 75.88±14.51mg/lit. The BOD is a measure of the degradable organic matter present in water sample. The BOD values fluctuated between minimum with 14.25mg/lit in the monsoon and the maximum values recorded in the pre monsoon

with 27.75mg/lit. The higher values of BOD are due to high concentration of dissolved and suspended organic matter in water (Jameel, 1998).the means and SD values were recorded as 21.04±4.82Similar results were coincided with (Avinash and Prabhaker, 2009).The chlorides values are recorded minimum with 109.25mg /lit in post-monsoon and the maximum values were recorded in the pre- monsoon with 276.25mg/lit. The means and SD values were recorded as 188.17±63.17mg/lit. These observations were done by (Sumitra *et al.*, 2007) in Lake Pichhola. The sulphates are recorded minimum in monsoon with 24.25mg/lit and maximum with 42.6954.25mg/lit in monsoon respectively. The means and SD values were recorded as 42.50±9.52mg/lit. The nitrates are recorded minimum in the monsoon with 0.37mg/lit and maximum with 1.59mg/lit in the pre-monsoon. The means and SD values were recorded as 1.03±0.38mg/lit. As a result of the dilution with rain water nitrates are low during monsoon. Generally higher values of nitrates exhibit by polluted organic matter. (Shanti et al., 2002);(Prasad 1990) pointed out that ammonical nitrogen increases during rainy season. Nirate nitrogen (no3-N) was higher in winter months and lower values were recorded in summer. (Ganapathi 1960) pointed out that the concentration of nitrate nitrogen is an (>150mg/lit) indicative of eutrophication and such the Wular lake falls a eutrophic category.

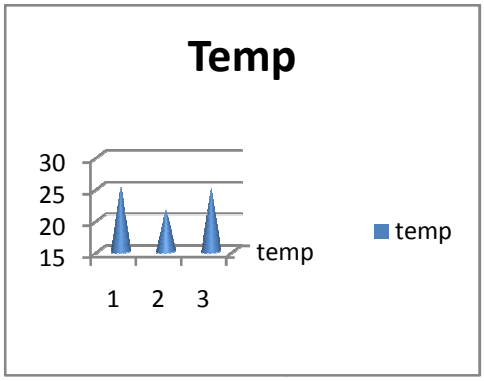
The phosphates are minimum in with 0.54mg/lit and maximum in pre-monsoon with 1.41mg/lit in monsoon seasons respectively. The phosphate concentration above 0.5mg/lit indicates pollution (Jain *et al*., 1996). The means and SD values were recorded as 0.81±0.23mg/lit. The total solids are minimum during pre-monsoon with 799.38mg/lit and maximum with 859.75mg/lit in monsoon season. The basic nutrient like nitrates and phosphates determines the productivity of the lake water. (Jain *et al*., 1996) have indicated that any amount in the excess of 0.5ppm of phosphate is an indicator of pollution.

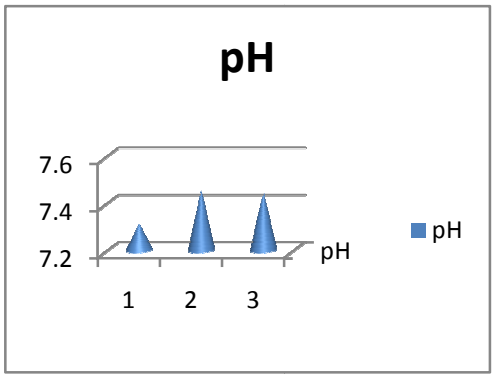
The TDS are recorded minimum in post-monsoon with 506.75mg/lit and maximum during the monsoon with 1006.25mg/lit. The means and SD values were recorded as 745.79±163.31mg/lit. The total Suspended Solids were recorded minimum with 12.00mg/lit in post monsoon and maximum TSS were recorded in 23.20mg/lit. The means and SD values were recorded as 16.13±3.06mg/lit. Higher values of TDS and TS are due to carbonates, bicarbonates, phosphates, sulphates, salts and ions (Nidhi and Bajpai *et al.*, 2012). The commonly occurring natural salts are carbonated, bicarbonate chlorides, sulphates, phosphetes, and nitrates of calcium, sodium, potassium etc.

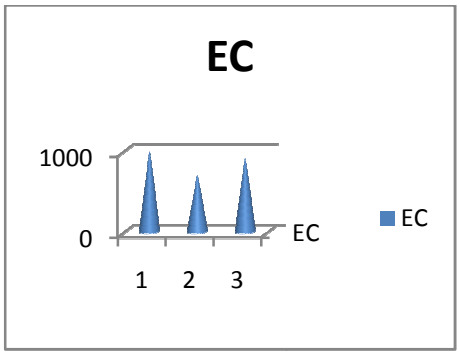
Table :2 Average Seasonal Variation of Physico-Chemical Parameters

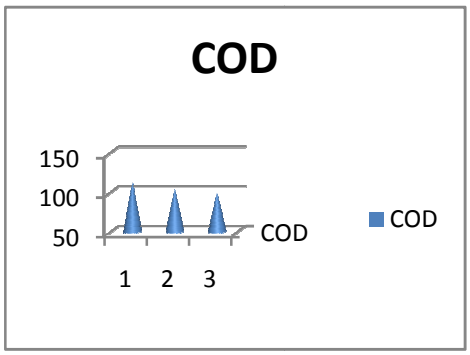
Parameters	**monsoon**	**Post monsoon**	**Pre monsoon**
	mean	**mean**	**mean**
Temp	25.30938	21.75375	26.32375
pH	7.39375	7.0875	7.4125
EC	1121.375	846.25	1231.938
COD	67.625	71.4375	86.5625
BOD	18.1875	18.5	26.75
Chlorides	167	150.25	246.1875

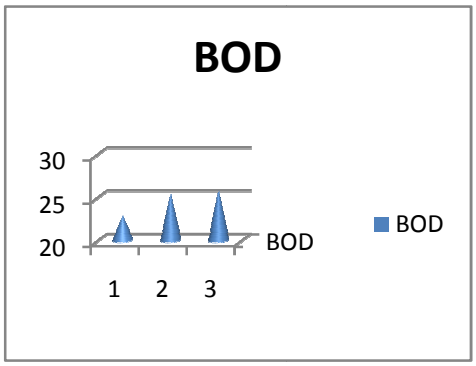
Sulphates	40.625	42.6875	42.9375
Nitrates	0.695688	1.066875	1.316875
Phosphates	0.833125	0.785625	0.80875
TS	829.5	612.4375	795.6875
TSS	16.875	13.8125	17.125
TDS	855.8125	600.6875	781.1875
DO	5.241875	5.38625	4.60625
TH	86	91.1875	112.125
Ca++	63.375	70.1875	80.4375
Mg++	23.375	26.8125	27.26563

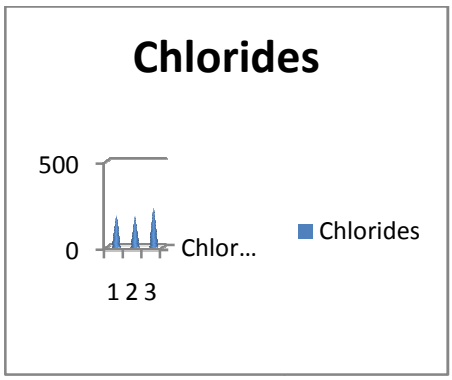


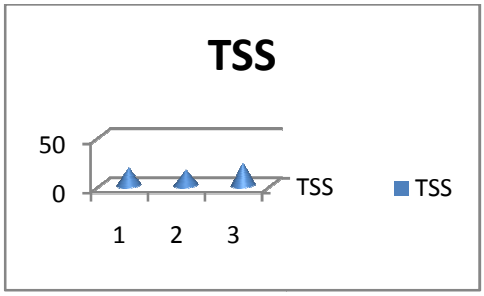


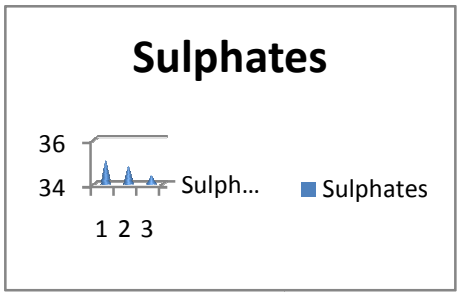




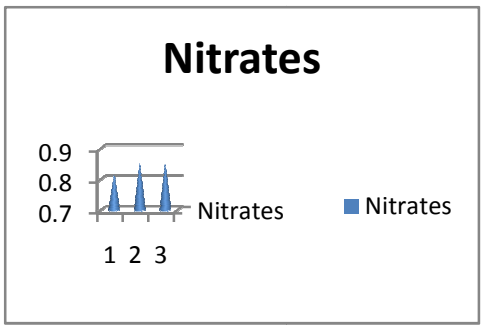


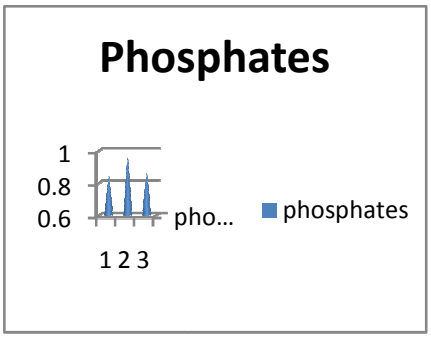


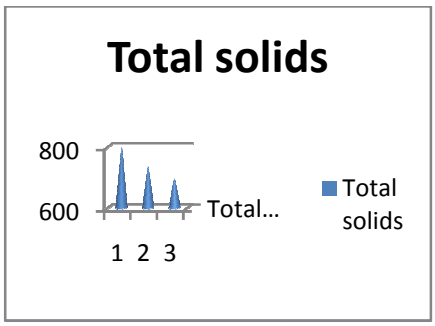


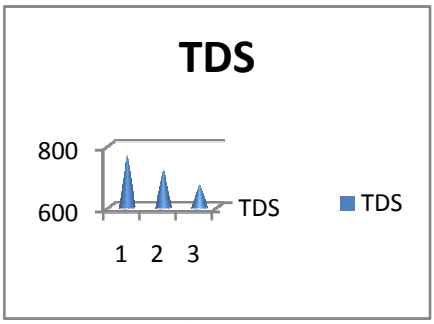


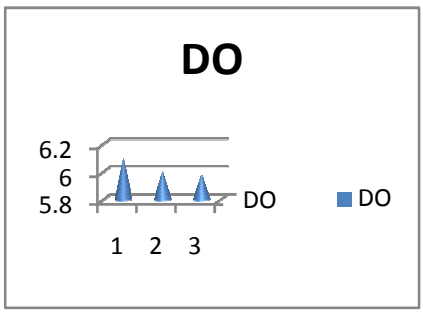
Note: Graphs 1, 2, 3 represent monsoon,post-monsoon,pre-monsoon seasons respectively.

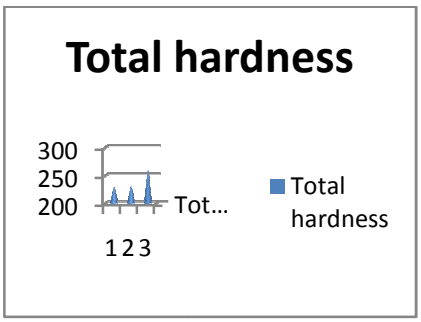


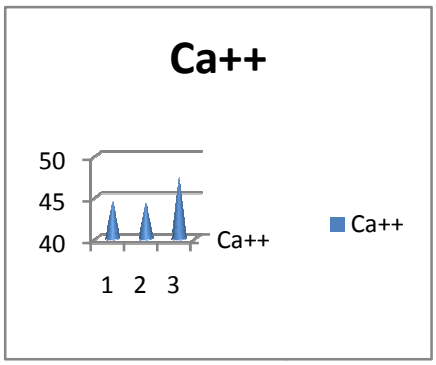


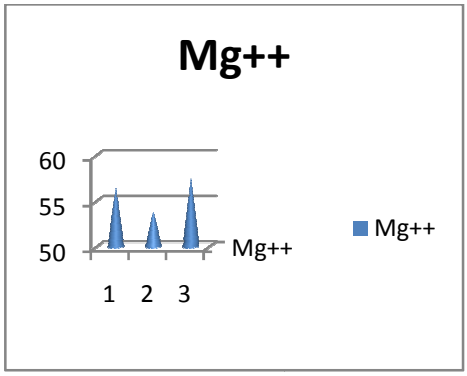












The dissolved oxygen was recorded minimum during the pre-monsoon with 4.20mg/lit and maximum in post-monsoon with 6.33mg/lit. .The means and SD values were recorded as 5.06±0.69mg/lit. It has showed an inverse relationship with temperature which might be due to oxidation of oxygen as reported by (Patil and Dongare, 2006). It is one of the most important factors in any aquatic ecosystem. All the living organisms' dependent of oxygen in one form or the other to maintain their biological process. It also plays a major role in dissolution and precipitation of inorganic substances in water. The total hardness was minimum in monsoon with 73.00mg/lit and maximum during the pre-monsoon with 126.75mg/lit. .The means and SD values were recorded as 96.33±14.72mg/lit. The Ca++ ions are minimum in monsoon with 52.25mg/lit and maximum in pre-monsoon with 86.75mg/lit. .The means and SD values were recorded as 70.88±10.06mg/lit. The Mg++ ions are minimum in monsoon with 21.75mg/lit and maximum during pre-monsoon with 30.06mg/lit. The means and SD values were recorded as 26.03±2.81mg/lit. (Katariya *et al*,.1996)have measured maximum value of alkalinity due to confluence of industrial and domestic waste.(Sakare and Joshi, 2003) found the alkalinity values from 672 to 1023 mg/lit in papnas in minor wet lands in tuljapur town, in maharastra.

CONCLUSION:

Present work suggests that the Bhandham Cheruvu is highly polluted going to become eutrophicated. The pollution this water body is due to the discharge of sewage in many ways from the city, hostels, hotels and other wastage, which cause to pollution and the eutrophication. The present paper focused on the eutrophic nature of aquatic body.

REFERENCES:

1. APHA:Standard methods for the examination of water and waste water,21st Edition ,APHA,AWWA,WPCF,Washington,DC,USA(2006).
2. Avinash, V.Karne and PrabhakerD.Kulkarni (2009): studies on physic-chemical characteristics of fresh water bodies in KhatavTahsil,Maharashtra.*Nature environment and pollution Technology.8(2) 247-251*.
3. Bandela N. N, Vaidya V.S, Lomte V and Shivanikar M.S (1999): The distribution pattern of phosphate and nitrogen forms and their inter relationships in Barul Dam water. *Pollution Research 18(4)411-414*.
4. Diersing N. 2009: Water quality: Frequently asked questions, Florida Keys National Marine Sanctuary, Key West, FL, and Available at: http://floridakeys.noaa.gov/scisummaries/wqfaq. Pdf.

5. Ganapathi, S.V (1960): Ecology of tropical water. In proceeding of symposium on Algology ICAR, New Delhi 214_218.
6. Hassan and kathim, Effect of chemical and physical properties of river water in Shatt Al-hilla on phytoplankton communities, *ISSN pub, 4(2), PP 323- 330 (2008*)
7. Jain SM,Sharma M and thakur(1996),: Seasonal variation in physic-chemical parameters of Halali reservoir of Vidisha District,India.*Journal of Ecobiologia.*(3)181-188.*
8. Jain, S.M., Sharma, M and Thakur R. (1996): seasonal variations in physic-chemical parameters of Halai reservoir of Yidisha District.India.*J. Ecobiol.8(3):181-188.*
9. Jameel, A.1998.Physicochemical studies in Vyyakondan channel water of Cauvery.*Poll.Res. 17:111-114.*
10. Karadzic V,Subakov-Simic G,Krizmanic J,Natic D(2010):Phytoplankton and Eutrophication development in the water supply reservoirs Garasi and Bukulja (Serbia*).Desalination 255(1-3):91-96.*
11. Kataria HC, SA Iqbal and AK Shandilya (1996):Limno-chemical studies of Tawa Reservoir. *IJEP.16 (11):841-846.*
12. Kitsiou D,Karydis M (2000):Categorical mapping of marine eutrophication based on ecological indices.*Sci.Total Environ.255(1-3):113-127.*
13. Kitsiou D,Karydis M (2011): Coastal marine eutrophication assessement :A review on data analysis.Environ,Int.37(4):778-801.
14. Kodarkar,M.S.(1999):Conservation of water bodies in urban areas.Souvenier of Nat. conference cum workshop on wetland conservation.Problems,prospectus and challenges in next millennium,23-25,October 1999 at R.A. Arts,M.K. Comm. And S.R. Rathi Sci.College,Washim, Maharashtra, pp.26-37.
15. Kodarkar,MS(1995):*Conservation of lakes*. Indian Association of Aquatic Biologists(IAAB), *Hyderabad Publication 3 1-82.*
16. Nidhi Bajpai, Jaishree Sikka and Reena Sharma (2012). Effect of the Khan River Water on Chlorophyll Content, Carotenoids and Enzyme Activities of Ipomoea fistulosa and Polygonum barbatum. *Nature Environment and Pollution Technology.Vol. 11 No. 2 pp. 319-323.*
17. Patil, D and Dongare,M(2006):studies on physic-chemical characteristics of water bodies of Aundh of southern Maharashtra with reference to the stress of human activities.*Indian journal of Environmental Protection.8*(3)509-514.
18. Patra A P.,*World Journal of Fish and Marine Science,(2010),2(2),pp.109-11.*
19. Sakare and joshi 2003.Environmental aspects of lake water and its quality management.
20. SalankiV.R.,*Nature Environment and Pollution Technology,(2007),6(4),pp-623-628.*
21. Shanthi K, Ramaswamy K and Lakshmanaperumalsamy P (2002). Hydrobiological study of Singanallur Lake at Coimbatore, India. *Nature Environment and Pollution Technology 1 87 – 92.*
22. Shastri Y and Pendse DC (2001). Hydrobilogical study of Dahikuta reservoir. *Journal of Environmental Biology 22(1): 67 – 70.* Jain,S.M.,M.Sharma and R.Thakur.1996.Seasonal variations in physic-chemical parameters of Halali reservoir of Vidisha District,*India.J.Ecobiol.8(3):181-188.*

23. Shastri,Y. and D.C.Pandse.2001.Hyrobiological Study of Dahikhura Reservoir.*J. Of Environmental Biology 22(1):67-70.*
24. Sreenivasulu,KKaizarHossanandT.Daoodharam.(2014):Physico-chemical characteristics of fresh water of RamannaTank, Nelloredistrict,India.*Advances in Applied science Research.5(2):59-65.*
25. Srinivasa,G.S. and B.Kotaiah.2000.Seasonal Variation of water quality in tropical Kalyani reservoir,near Tirupati.*Indian J.Environmental Protection 20(6):452-455.*
26. Tekale,N.S. and M.S.Kodarkar(1999):Idol immersion in Masunda lake, Thane City, Maharashtra –A critical analysis and remedial measures.*J.Aqua.Bid, 14(1and2):115-117.*
27. Thorat,S.R. and S.Masarrat.2000.Pollution status of Salim Ali lake, Aurangabad (M.S). *Poll.Res.19 (2):307-309.*
28. Trivedy,R.K. and Chandrasekhar T.R.(1999):Sediment Characteristics of freshwater bodies, Manglore,Karnataka.*J.Ecobiol,11(1):59-64.*