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DIURNAL VARIATION OF PHYSICO CHEMICAL PROPERTIES AND PRIMARY PRODUCTIVITY OF PHYTOPLANKTON IN BHEEMA RIVER

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Introduction

The plankton occurs in all natural waters as well as in artificial impoundment like ponds, tanks, reservoir, irrigation channels etc. phytoplankton are Autotrophs and belonging to first trophic level. The primary production of organic matter is in the form of phytoplanktons which are more intense is reservoir, lake than in rivers.

The productivity of any aquatic water body depends on the amount of plankton present in the said water body (Guy, 1992). Westlake (1980) described plankton as all organisms (plants and animals) which live in water that have limited power of locomotion, largely move by means of flagella or various mechanisms altering their distribution by changes in buoyancy and are more or less passively drifted by waves and water currents. It is with this respect that Odiete (1993) disclosed that plankton (phytoplankton) growth and distribution depend on the carrying capacity of the environment and on the nutrients concentration both intracellular and extracellular. Ezra and Nwankwo (2001) observed that changes in plankton population in Gubbi Reservoir were influenced by physico chemical parameters. Physico-chemical parameters also affect plankton distribution, sequential occurrence and species diversity (Raymond, 1983). Plankton distribution and abundance are affected by season (Ezra and Nwankwo, 2001). Higher cell density of diatoms (phytoplankton) was recorded in the dry season while lower cell density was recorded in the wet season for green-algae. Diversity and composition of algae in the Bheema river water bodies varies seasonally with peak in dry season. Phytoplankton biomass declines throughout the summer but increases in winter (Arigo and McClain, 1994; Smith *et al*., 1996; Asper and Smith, 1999). Seasonal variations affect the physico-chemical variables thus causing variation in abundance and diversity of plankton. Human activities (agricultural and industrial) going on along Bheema River introduce wastes into it which could affect the physico-chemical variables from season to season. These therefore cause seasonal variation in phytoplankton populations. There is no information on the seasonal abundance and distribution of phytoplankton as well as the water quality of this stream. The environmental variables such as temperature, pH and phosphate play a decisive role in altering the phytoplankton density. The diversity and seasonal fluctuation of phytoplankton observed in Bheema River during the study period. The present study attempts to provide such vital information for future references.

Description of study area

Gulbarga is the Divisional head quarter of five districts. It is situated in the northern part of Karanataka state (76° -04' to 77° - 42' Longitude, 16° -12' to 17°-46' Latitude). River Bheema is a Major tributary of Krishna River. It has its origin is from Bheema Shankar Hills in Western Ghats of Maharashtra State and flows along the common state border of Karnataka and Maharashtra for a length of an about 75km and enters Karanataka near Village Sheshgiri (near Agarkhed) and it flows 294 km entirely in Karnataka. Bheema river water supplied to Gulbarga city for drinking purpose. Location of river showing in the below map.

Flow map of Bheema River

Material and Methods

Physico – Chemical parameters of the surface water were analyzed according to APHA (1985) at 4

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hours intervals for a period of 24 hours (19th and 20th September 2009). The Primary production at the surface was estimated insitu using light & dark bottle technique (Gaarder & Gran. 1927) Productivity measurements were also taken at 4 hours intervals from 6 am to 6 p.m. The rate of gross primary productivity (GPP) Net primary productivity (NPP) and community respiration(C.R) were calculated according to Trivedy and Goel (1970) All the values were expressed as mean of 6- samplings. Temperature (air and surface water) was recorded on the spot using Centigrade Thermometer. The pH of the water samples was measured by using the gun pH meter on the spot. Physico-chemical analysis (pH , Dissolved oxygen , Free Co_2 ,alkalinity, Hardness, phosphate, calcium hardness, magnesium hardness, Amm-Nitrogen) of the sample was done according to standard methods (APHA,1985)(Table1).

Table 1: Diurnal Variation of Physico-chemical Parameters of Bheema River

Parameters	6 a.m.	10 a.m.	2 p.m.	6 p.m.	10 p.m.	2 a.m.
Transparency (cm)	35	33	32	-	-	-
Air temp. °c	26	26.5	28.0	23.5	20.0	19.5
Water temp. °C	20.5	20.1	23.5	19.0	18.0	20.8
pH	9.1	8.9	9.0	9.2	9.2	9.3
Dissolved oxygen (mg/lt)	5.8	6.0	7.3	6.8	6.0	5.8
Free Co2 (mg/lt)	6.9	4.6	5.8	6.3	7.3	7.5
Total Alkalinity (mg/lt)	19.8	18.8	18.2	22.6	20.1	18.6
Hardness (mg/lt)	278	276.4	273.4`	278.4	266.0	274.4
Calcium (mg/lt)	61.5	60.92	59.31	62.52	66.53	64.12
Magnesium (mg/lt)	29.82	27.28	29.23	27.28	27.28	34.59
Chloride (mg/lt)	81.24	81.24	86.92	75.56	73.62	78.76
Inorganic Phosphate (mg/lt)	0.72	0.75	0.83	0.78	0.52	0.46
Amm-Nitrogen (mg/lt)	1.22	1.39	1.54	1.48	2.01	2.24

Result and Discussion

Well marked diurnal variations have been recorded in all the physico-chemical parameters. Atmospheric and water temperature varied between 19.5 to 28.5°C and 18.0 to 23.5°C.The atmospheric temperature remained higher during the day hours, recording maximum at 2.pm and relatively lower during night hours recording 19.5°C (Fig. 1). Surface water temperature also followed similar trend. Transparency was Low at 2PM and high at 6 am ranging between 32-35cm. (Fig.2).

Fig. 1: Diurnal variation of air temperature. °C

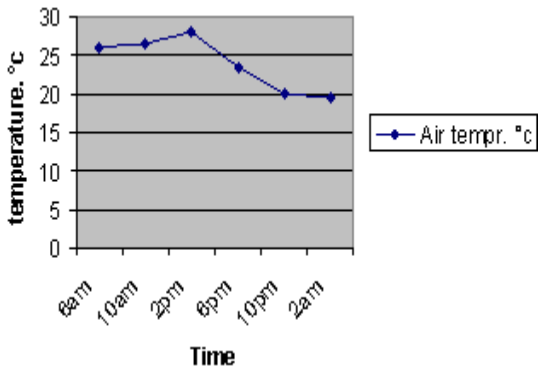
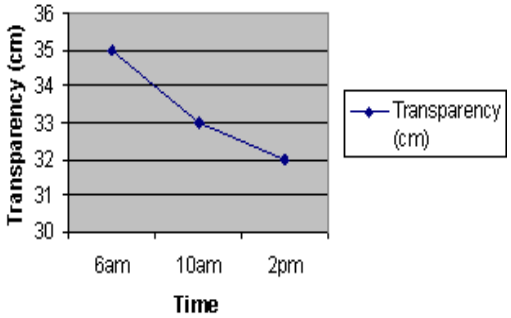


Fig. 2: Diurnal variation of transparency (cm)



The pH was 9.1 at 6 am and 9.3 at 2 am increased during night hours (Fig 3.). Dissolved oxygen varied between 5.8 to 7.3 mg /lt. maximum was recorded during 2 PM. Comparatively higher oxygen values were obtained during day than the night hours. The higher dissolved oxygen during the day hours was probably due to gradual accumulation of oxygen by the photosynthetic organism (Fig. 4).

Fig. 3: Diurnal variation of pH

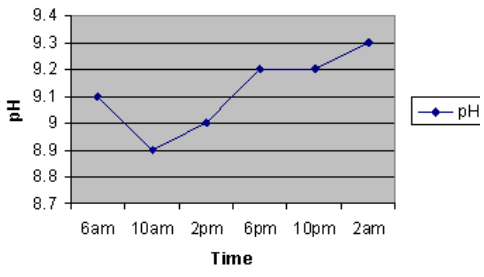
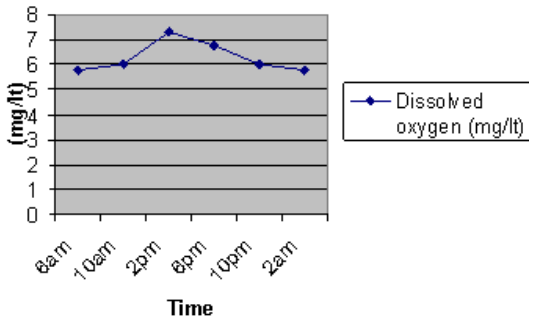


Fig. 4: Diurnal variation of dissolved oxygen (mg/lt)



Free Co_2 was higher during midnight and early morning hours compared to day hours; it gradually increased during the night hours recording a maximum value at 2. am which might be attributed to the community respiration of the aquatic organisms (Fig.5). In total hardness, the difference of concentration between time intervals was not significant (Fig.6).

Fig. 5: Diurnal variation of Free Co_2

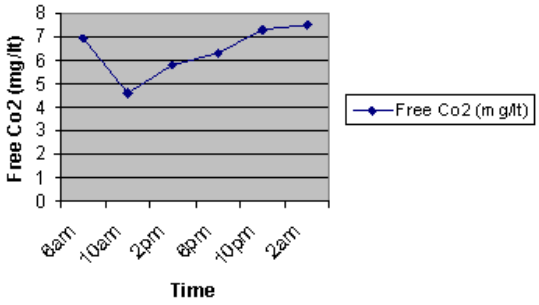
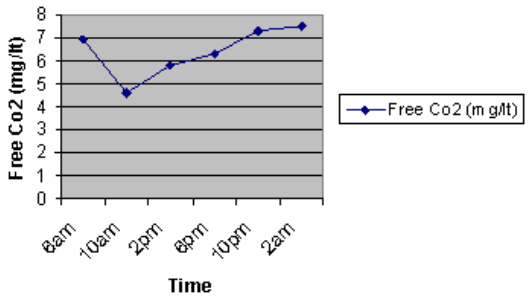


Fig. 6: Diurnal variation of hardness (mg/lt)



Chloride, phosphate, and Ammonical nitrogen also did not show significant diurnal variations, however, comparatively, higher values were observed during the day hours than night hours. Primary productivity measurement found to fluctuate through out the course of the day. (Fig. 7,8,9,10,11)

Fig. 7: Diurnal variation of total alkalinity (mg/lt)

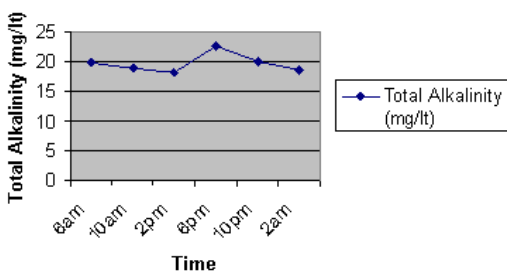


Fig. 8: Diurnal variation of calcium (mg/lt)

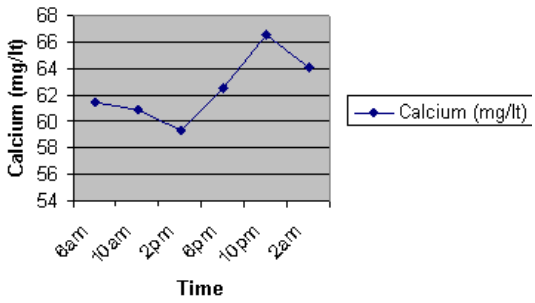


Fig. 9: Diurnal variation of magnesium (mg/lt)

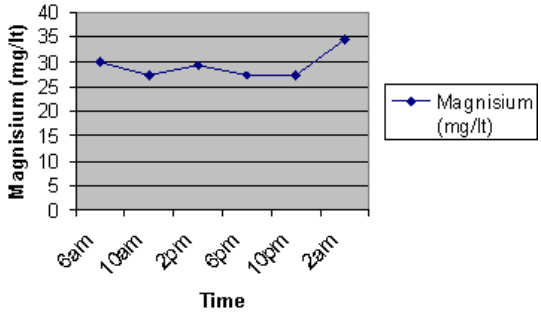


Fig. 10: Diurnal variation of chloride (mg/lt)

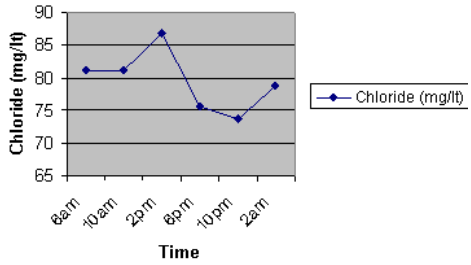
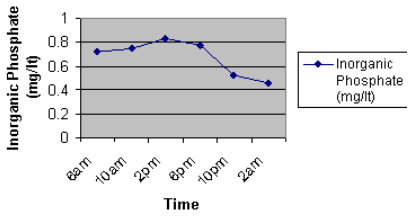


Fig. 11: Diurnal variation of inorganic phosphate (mg/lt)



The GPP depicted a decline trend from morning to evening ranging between 0.07 to 0.11 gc/m3/hr peaks values were observed during 6-10 am. The NPP also showed a similar pattern of day time variation like that of GPP with high value at 6-10 am (0.050 gc/m3/hr). The values of community respiration ranged from 0.023 to 0.025 gc/m3/hr (Table 2).

Table 2: Primary Productivity of Bheema a river during 12- hours (day time) in September (20th September 2009)

Parameter	Incubation Time Period		
	6 am - 10 am	10 am – 2 pm	2 pm – 6 pm
GPP gc/m3/hr	0.11	0.10	0.07
NPP gc/m3/hr	0.050	0.037	0.037
C.R. gc/m3/hr	0.025	0.025	0.023

Conclusion

From the result, we can conclude that the rate of photosynthesis was greater in the early hours of the day light and when it decreased markedly in the afternoon period of highest photorespiration rates under bright light condition The result of the present investigation on the physico-chemical characteristics and trophic status of the water body indicate the oligotrophic nature of Bheema river.

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