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Seasonal physico-chemical characteristics assessment and primary production in the planktonic community of Godavari River water, Nashik (Maharashtra)

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Abstract

The physico-chemical characteristics influence the planktonic population whereas primary productivity depends upon the photosynthetic activity of phytoplankton. The productivity is nothing but the amount of organic matter produced by phytoplankton under a unit area of water surface thus influenced by physico-chemicals parameters. The present paper deals with seasonal variations (winter, summer, monsoon) of parameters like Temp, Turbidity, pH, Free CO_2, DO, Nitrates, Phosphates, Planktonic community, along with primary production of Godavari river water at Nashik during November 2002 to October 2003. It was observed that the abiotic parameters are in direct correlation with the biota of an aquatic ecosystem. The planktonic community showed direct correlation with primary productivity i.e. maximum in the summer and minimum in the winter.

Keywords: *Godavari river, Physico-chemical, Planktonic community, Primary production*

Introduction

The Godavari river originates near Trimbak in Nashik, Maharashtra. The river is 1465 kms. long and joins the Bay of Bengal in Andhra Pradesh and has a catchment area of 3,12,813 sq. km. of which 69.3 % lies in Maharashtra and is nearly 10% of the total geographical area of the country. The Godavari is the most celebrated largest river of the Peninsular India, inspite of its massive catchment area, the discharge is not very impressive because of moderate annual average rainfall. On account of high concentration of population, industries, towns and cities in the basin, large quantities of domestic and industrial wastes are discharged into the river besides this waste water from agriculture, animal care, domestic and industrial use also reaches the river by leaching; drainage and surface wash off during the monsoon. Numerous aspects of river pollution such as physico-chemical properties of different river water (Mitra, 1982; Raina *et al*., 1984) and changes in biological composition of rivers with respect to impact of pollutants (Bhatt *et al*., 1985; Nandan, 1985; Shukla, 1994) have been reported in India. Some investigation has also been conducted on physico-chemical and biological aspects of river Godavari at different places (Sanap *et al*., 2006, Deshmukh *et al*., 2006). As the quality of Godavari river water is getting deteriorated day by day and there is paucity of data on the pollution status, therefore the present study was undertaken to find out the pollution in terms of various physico-chemical and biological aspects of Godavari river water in and around Nashik area.

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Materials and Method

For physico-chemical analysis of water samples were collected from three different sites (Site 1 – Near Someshwar temple, Site 2 – Ramkund, Site 3 – Tapovan). Water samples were collected once in a month during the period Nov. 2002 – Oct. 2003. Samples were collected in cleaned plastic containers. Temperature and pH were measured in the field itself using digital thermometer and pH meter respectively. While remaining parameters were analyzed in the laboratory following the standard methods given by APHA (1989),Trivedy and Goel (1986). The investigation period was

divided into three seasons i.e. Winter (Nov – Feb), Summer (Mar – June) and Monsoon (July – Oct).

Results and Discussion

The observations recorded during different seasons at different sites 1, 2, 3 during the year Nov. 2002 – Oct. 2003 are shown in Table 1 and Fig.1 respectively. Minimum (20.10^0C) temperature was recorded at Site-1, during the winter season and maximum (28.85^0C) at Site-2 and Site-3 during the summer season. Lower temperature recorded during winter and monsoon may be due to extreme cold and shorter sunshine period. Similar findings were observed by Swarnlatha and Narsing Rao, 1991. Turbidity plays an important role in the energy dynamics of an aquatic ecosystem. Turbidity values were highest in summer (163.25 NTU) followed by monsoon (142.59 NTU) at Site-3 and minimum in winter (95.25 NTU) at Site-1, Mathew *et al.* (1972) observed the same order of turbidity. Maximum pH (7.80) was recorded in summer at site-3 and minimum pH (7.49) recorded in winter at site-1. The observation indicated that water was alkaline throughout the study period. Free carbondioxide may be produced in water through biological oxidation of organic matter, particularly in polluted water. Maximum free CO_2 (7.82 mg/l) was reported at Site 3 in summer and minimum (3.16 mg/l) in summer at Site 1. Higher free CO_2 in water samples in summer reason was due to discharge of domestic waters, inflow of sewage and mostly due to decomposition of organic wastes. Similar observations were observed by Chakraborty and Asthana (1984), Mehta (1999) and Khanna and Bhutiani (2003).

Table 1 : Seasonal variations in physico-chemical characteristic of Godavari river

Parameters	Site-1			Site-2			Site-3		
	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon
Temperature (^{0}C)	20.10	28.65	25.20	20.37	28.85	25.32	20.40	28.85	25.40
Turbidity (NTU)	95.25	143.50	131.75	104.00	149.75	134.50	107.50	163.25	142.50
pH	7.49	7.70	7.58	7.53	7.55	7.50	7.65	7.80	7.75
Free CO_2 (mg/l)	3.16	7.49	5.93	3.31	7.80	6.21	3.47	7.82	6.30
DO (mg/l)	7.48	4.40	4.93	7.20	4.13	4.65	6.93	3.90	4.58
Nitrates (mg/l)	2.55	0.63	1.51	2.73	0.67	1.59	2.87	0.69	1.65
Phosphates (mg/l)	0.83	1.45	0.98	0.88	1.48	1.03	0.89	1.52	1.03
Phytoplankton (unit/l)	326.50	2170.50	1230.25	310.00	2256.00	132.00	424.50	2365.25	1375.75
Zooplankton (unit/l)	203.75	884.00	370.00	214.75	880.75	375.50	222.50	908.25	377.25
GPP	115.74	270.31	129.73	118.36	285.20	132.18	121.63	290.95	134.12
NPP	85.76	214.34	102.14	85.51	227.09	103.47	85.12	231.18	104.20
CR	29.98	55.97	27.58	32.85	58.10	28.71	36.50	59.77	29.91

Dissolved oxygen in an important factor in an aquatic ecosystem which brings about various biochemical changes. Maximum DO (7.48 mg/l) was observed in winter at Site 1 and minimum DO (3.90 mg/l) in summer at Site 3. The low oxygen content during summer may be due to low water, high temperature and decay of macrovegetation. Mishra and Yadav (1978), Adebisi (1981) and Mitra (1982) also discussed seasonal averages and. fluctuations in dissolved oxygen. Nitrate is an important factor for controlling the occurrence and abundance of phytoplankton. Maximum Nitrate (2.87mg/l) observed in winter at Site - 3 and minimum (0.63mg/l) in summer at Site 1 during the study period. The observed maximum values of nitrates are in agreement with Prasad and Saxena (1980); Rana *et al*. (1991), Prasad and Karnawat (1993); Shrivastava and Chaudhary (1997) minimum concentration of nitrates during rainy season is also due to increased volume of water and flooding which dilutes nitrate concentration. Maximum phosphate values ranged

(1.52 mg/l) in summer at Site 3 while it was found minimum (0.83 mg/l) in winter at Site 1 during the study period. Singh *et al.* (1999), Jayaraman *et al.* (2003) observed that maximum phosphates values may be due to concentration effect, agricultural run off and high load of organic matter. Maximum phytoplankton (2365.25 unit/l) were observed during summer at Site - 3 and minimum (132.00 unit/l) during winter at site-1. Similar findings were reported by Trivedy *et al.* (1985), Haque *et al.* (1986, 1989). During the study period maximum zooplankton were found in summer (908.25 unit/l) at Site - 3 and minimum (203.75 unit/l) in winter at Site 1. In winters small growth of plankton may be due to low temperature. In the present investigation phytoplankton are more prominent than zooplankton. Jaya Raju *et al.*, (1994) and Khanna and Bhutiani (2003) reported similar findings. Primary productivity is limited by shortage of nutrients such as nitrogen, sulphur and

Fig. 1 : Graphical Representation of observed parameters

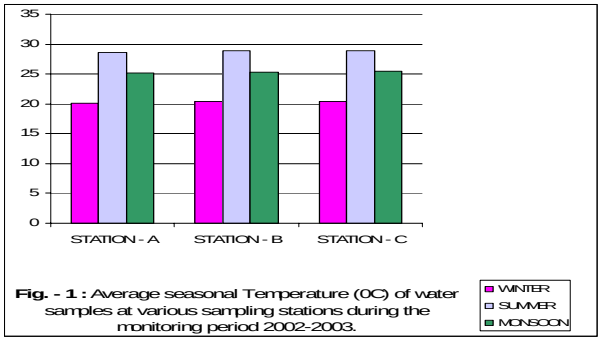

Fig. - 1 : Average seasonal Temperature (0C) of water samples at various sampling stations during the monitoring period 2002-2003.

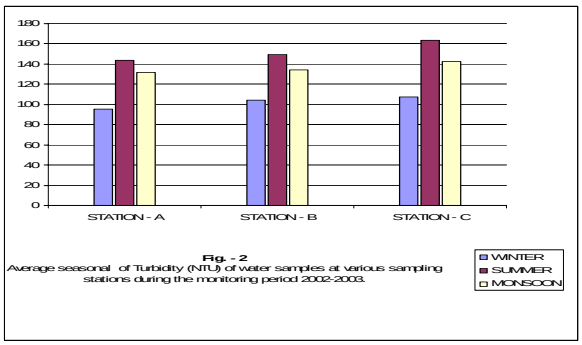

Fig. - 2
Average seasonal of Turbidity (NTU) of water samples at various sampling stations during the monitoring period 2002-2003.

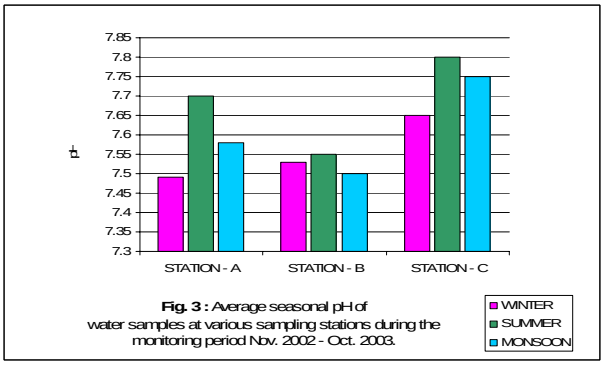

Fig. 3 : Average seasonal pH of water samples at various sampling stations during the monitoring period Nov. 2002 - Oct. 2003.

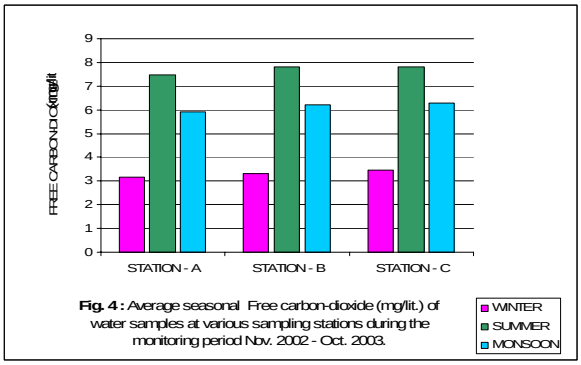

Fig. 4 : Average seasonal Free carbon-dioxide (mg/lit.) of water samples at various sampling stations during the monitoring period Nov. 2002 - Oct. 2003.

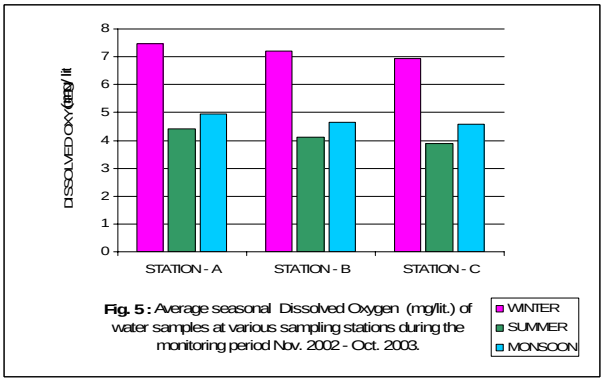

Fig. 5 : Average seasonal Dissolved Oxygen (mg/lit.) of water samples at various sampling stations during the monitoring period Nov. 2002 - Oct. 2003.

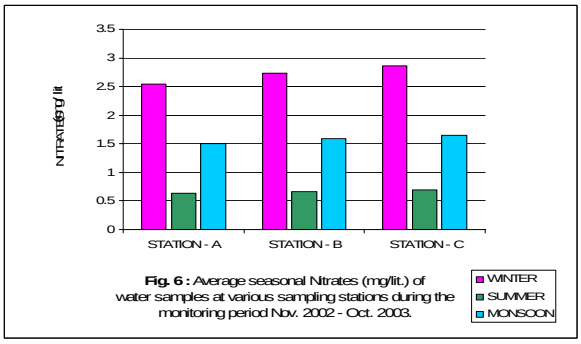

Fig. 6 : Average seasonal Nitrates (mg/lit.) of water samples at various sampling stations during the monitoring period Nov. 2002 - Oct. 2003.

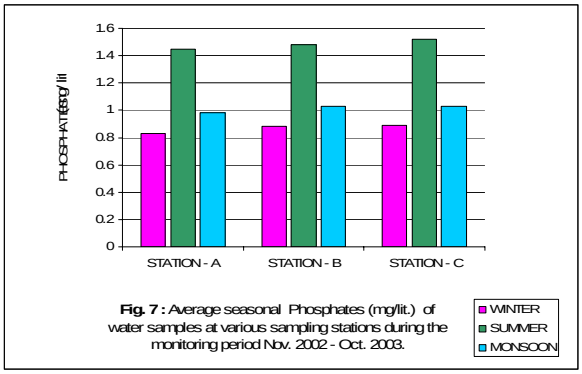

Fig. 7 : Average seasonal Phosphates (mg/lit.) of water samples at various sampling stations during the monitoring period Nov. 2002 - Oct. 2003.

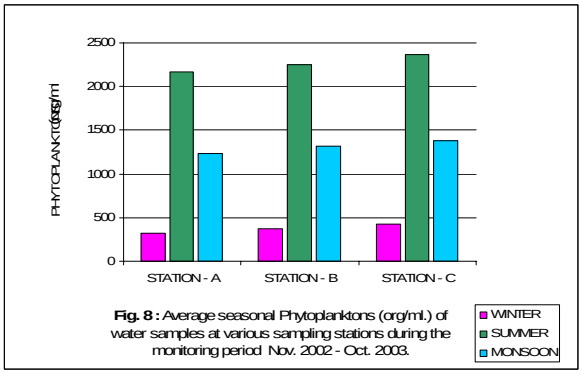

Fig. 8 : Average seasonal Phytoplanktons (org/ml.) of water samples at various sampling stations during the monitoring period Nov. 2002 - Oct. 2003.

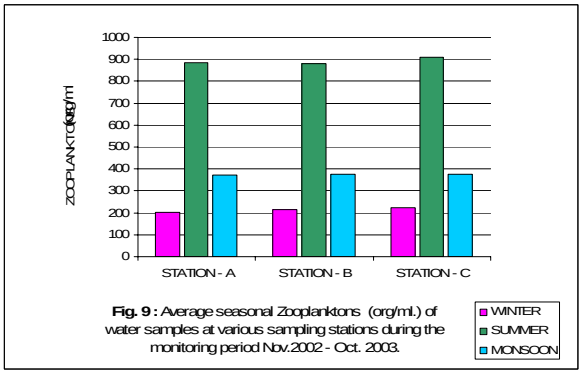

Fig. 9 : Average seasonal Zooplanktons (org/ml.) of water samples at various sampling stations during the monitoring period Nov.2002 - Oct. 2003.

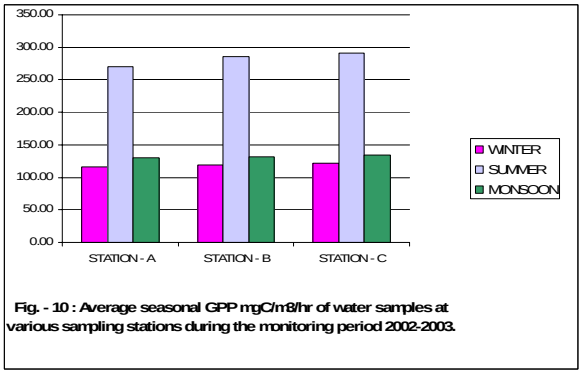

Fig. - 10 : Average seasonal GPP mgC/m3/hr of water samples at various sampling stations during the monitoring period 2002-2003.

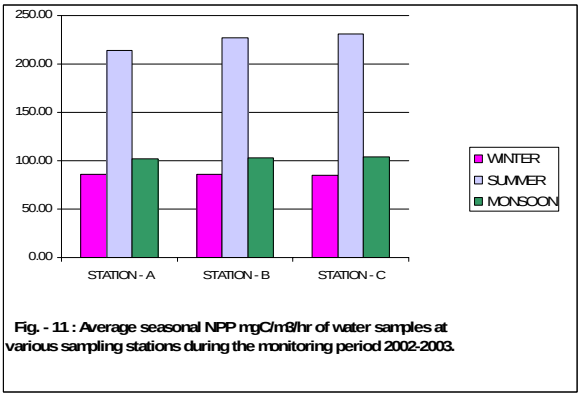

Fig. - 11 : Average seasonal NPP mgC/m3/hr of water samples at various sampling stations during the monitoring period 2002-2003.

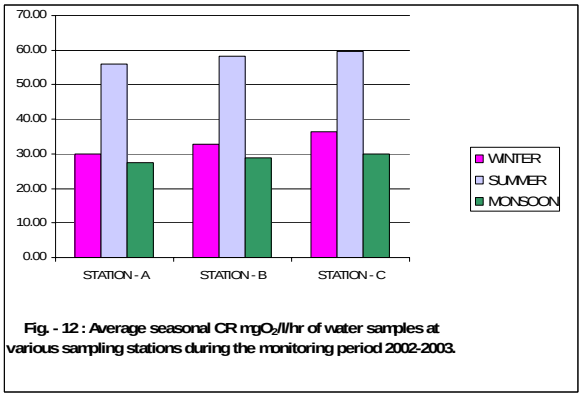

Fig. - 12 : Average seasonal CR mgO_2/l/hr of water samples at various sampling stations during the monitoring period 2002-2003.

other essential trace elements. Maximum GPP, NPP and CR (290.95, 231.18 and 59.77) are observed in summer at Site 3 and minimum GPP (115.74) in winter at site 1, minimum (85.12) NPP in winter at Site 3 and minimum CR (27.58) in monsoon at Site 1.

Conclusion

The overall study of physico-chemical and biological parameters during the three seasons indicate that there is much pollution load at Site 3 it may be due to release of huge quantities of sewage, effluents and more of the man made activities, as holy activities are being carried out thus affecting the quality of water at a faster speed. Thus, water quality is highly deteriorated and therefore stringent action must be taken by the municipal corporation for its cleaning and to prevent further deterioration and to protect the riverine ecosystem.

References

Adebisi, A.A.,1981. The physico-chemical hydrology of a tropical seasonal river upper Ogun river Nigeria. ***Hydrobiologia***, 79 (2): 157-165.

APHA, AWWA, WPCF, 1989. *Standard Methods for the examination of Water and Waste Water*,17th Ed., Washington D.C.

Bhatt S.D, Yashodhara B and Negi U., 1985. Hydrology and phytoplankton populations in river Koshi of western Himalaya (U.P.), ***Ind.Jr.Eco***. 12(1): 141-146.

Chakraborty, P and Asthana, A., 1984. Planktonic succession and ecology of a sewage treated pond in W. Bengal. ***Environ and E. Co.*** 7 (3): 549 - 554.

Deshmukh J.U, Ambore N.E. and Pulle J.S., 2006. BOD variations in Godavari river at Nanded city due to impact of industrial pollution***. Ecol. Env.Cons.***12(3): pp.533-534

Haque, N., Khan, A. A., Fatima, M., Toymth, A and Barbhuyan, S.L.,1986. Hydrobiological studies in a tropical freshwater polluted pond. *Proc. Nat. Symp.* ***Fish***, 56 - 61.

Haque, N., Khan, A.A, Fatima, M., 1989. *Composition and seasonal abundance of phytoplankton in a tropical freshwater pond*, Aligarh (India). Proc. Sec. Asian Fish Forum Tokyo (17- 22, April, 1989) : 3 (6) : 364.

Jaya Raju, P.B., Prasad Rao, G.D.V. and Sharma, S.V., 1994. Seasonal variations in physico-chemical parameters and diversity in the flora and fauna of the river, Munneru. A tributary to river Krishna, Andhra Pradesh - India. ***J. Aqua. Biol.*** 9 (l&2): 198 - 220.

Jayraman, P. R., Ganga Devi, T. Vasudevan, Nayar, 2003. Water quality studies on Karmana river, Tiruannthpuram, Dist. South Kerala, ***India. Pol .Res***. 22 (1): 89-100.

Khanna, D.R. and Bhutiani, R., 2003. Limnological characteristics of river Ganga at Haridwar (U.A.) ***Uttar Pradesh J. Zool.***, 23 (3): 179-183.

Khanna, D.R. and Bhutiani, R., 2003. Limnological status of Satikund Pond at Haridwar (U.A.) ***Indian Journal of Environmental Sciences***, 7(2): 131-136.

Mathew, V., Chauvan, A. and Naik, L.P., 1972. Hydrobiological studies of a domestically polluted tropical pond I, Physico chemical characteristics. ***Poll Res.,*** 11: 95 - 100.

Mehta, Vijay, 1999. *Eco-physiology and conservation of Kala Talav*. Ph.D. Thesis., Uni. - Mumbai.

Mishra,G.P.and Yadav,A.K.,1978 A comparative study of physicochemical characteristics of river and lake water in Central India. ***Hydrobiologia,*** 59 (30) 275 - 278.

Mitra, A.K., 1982. Chemical characters of surface water at a selected gauging station in the river Godavari ,Krishna and Tungbhadra. ***Indl. J.Environ. Hlth.***, 24 (2): 165 - 179.

Nandan S.N., 1985. Eutrophication in Vishwamitri river flowing though Baroda City (India***). Geobios.,*** 12(2) : 60-62.

Prasad, B.M. and Saxena, Manjula**,** 1980. Ecological study of blue green algae in river Gomti, India. ***J.Environ. Hlth*** 22 (2): 151 - 168.

Prasad, K.T., and Karnawat, Aruna, 1993. Physico-chemical analysis of water in the eastern industrial complex of Udaipur (Rajasthan), India. ***Poll. Res***., 12(3)145 - 149.

Rana, B.C., Vijayvegia, R.P. and Tiaglli, Y.D., 1991. Limnology of a eutrophic lake Udaisagar, Udaipur, India. ***Indian J. Ecol***., 18 (20): 161 – 165.

Raina V., Shah A.R. and Shakto A.R., 1984. Pollution studies on water quality. ***Indian J. Environ. Hlth***., 26(3): 187-201.

Sanap R.R., Mohite A.K., Pingle S.D and Gunale V.R, 2006. Evaluation of water qualities of Godawari river with reference to physico-chemical parameters, Dist. Nashik. ***Poll. Res.*** 25(4): 775-778

Singh H.P., Mahaver L.R. and Mishra J.P. **,**1999. Impact of industrial and sewage wastes on water qualities in middle stretch of river Ganga from Kanpur to Varanasi. ***J. Environ. Biol.,*** (3): 279-285.

Shrivastav, Rohit and Chaudhary, Bindu, 1997. Drinking water quality in an average Indian city a case study of Agra (U.P.). ***Poll. Res***., 16 (1): 63 - 66.

Shukla Ramesh, 1994. *Pollution load through heavy metals and organo chlorines in the river Ganga*, India INTELCOL, Manchester.

Swarnlatha, N. and Narsing Rao, A., 1991 Investigation of Saroornagar lake water pollution. ***J. Phytol. Res***. 4 (2): 121 - 129.

Trivedy, R.K., Garud, J.M. and Goel, P.K. **,**1985. Studies on chemistry and phytoplankton of few freshwater bodies in Kolhapur with special references to human activity. ***Pollution Research,*** 4 (1): 25 - 44.

Trivedy, R.K. and Goel, P.K. ,1986. *Chemical and biological methods for water pollution studies*. Environl. Pub., Karad (India).