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PHYSICO-CHEMICAL AND MICROBIAL CHARACTERISTICS OF KRISHNA RIVER WATER IN SATARA DISTRICT

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ABSTRACT

Seventy two water samples were collected from six sampling sites over a period of 12 months from Krishna river in Satara district. Physico-chemical and microbial analysis of the water samples were carried out. The influence of physico-chemical characteristics on the microbial flora with special reference to actinomycetes was evaluated.

INTRODUCTION

Krishna river is a major river in satara district. The river water is affected by enormous human activities like washing of clothes and utensils, swimming and bathing, and discharge of domestic and industrial wastes.

The origin of Krishna river lies in the hills of Kshetra Mahabaleshwar in Satara district of Maharashtra. It originates between 17°50' north and 73°38' east at a height 1,220 meters. From here Krishna river flows in Satara district having a length of 176 km. The water is used by farmers for agriculture. It is also used for drinking purpose extensively after treatment by many Municipalities and Grampanchayats.

Considering the use of Krishna river water, and its pollution by human and industrial activities, the physico-chemical and microbiological analysis of the river water was carried out for 1 year from January 2002 to December 2002. Six different sampling sites were selected at various towns as:

1. Kshetra Mahabaleshwar
2. Wai
3. Bhuinj
4. Kshetra Mahuli, Satara
5. Karad
6. Rethare

MATERIALS AND METHODS

Collection of water samples: Water samples were collected from the sampling sites in sterile 500mL BOD bottles. 72 water samples were collected from six sampling sites over a period of 12 months. Samples from all the sites were collected by lowering sterile closed BOD bottles and opening them at a depth of about 2 ft. for filling the water. The samples were brought to the laboratory in an ice box and stored at a temperature between 6°C and 10°C. The samples were used within 24 hrs for analysis.

Physico-chemical analysis of water: The water samples were analysed for the physico-chemical parameters such as pH, suspended solids, turbidity, sulphates, chlorides, calcium, total alkalinity,

hardness, dissolved oxygen (DO), BOD and COD by the methods given by Trivedy & Goel (1984).

Microbiological analysis of water

Preparation of samples: The water samples were serially diluted in physiological saline aseptically. The dilutions were used for enumeration and isolation of microorganisms. The enumeration of the various microorganisms was done as follows:

Enumeration of actinomycetes: One mL aliquots of 10^{-4}, 10^{-5} and 10^{-6} dilutions were inoculated by standard plate method on nutrient medium glycerol asparagines agar (GAA). Nystatin, an antifungal antibiotic, 50µg/mL, was incorporated in the medium to inhibit fungal growth (William & Davies 1965). Three plates were employed for each dilution. The plates were incubated at room temperature for 5-6 days. The actinomycetes were expressed as cfu/mL.

Enumeration of bacteria other than actinomycetes: One mL of aliquots of 10^{-5}, 10^{-6}, 10^{-7} dilutions were inoculated on nutrient agar by standard plate count method. The plates were incubated at room temperature for 48 hrs. The colonies developed on the plates were counted as cfu/mL.

Enumeration of fungi : One mL of aliquots of 10^{-3}, 10^{-4}, 10^{-5} dilutions were inoculated on Sabourauds agar by standard plate count method. The plates were incubated at room temperature for 4-5 days. Colonies developed were counted as cfu/mL.

RESULTS AND DISCUSSION

The results of the physico-chemical analysis of Krishna river water are given in Table 1. Table 2 represents average values of microbial parameters of Krishna river water, and Table 3 correlation coefficient of actinomycetal population with various physico-chemical characteristics:

Physico-chemical analysis of water: The average values of pH in the river ranged from 7.09 to 7.95, dissolved oxygen from 3.4 to 5.92 mg/L, BOD from 5.75 to 37.94 mg/L, COD from 7.81 to 40.59 mg/L, suspended solids from 3.03 to 41.23 mg/L, turbidity from 1.92 to 3.75 NTU, alkalinity from 63.5 to 232.83 mg/L, sulphates from 9.43 to 97.95 mg/L, chlorides from 29.63 to 84.67 mg/L, nitrates from 0.75 to 23.37 mg/L, hardness from 62.3 to 229.75 mg/L and calcium from 20.08 to 80.57 mg/L.

From the data, it was observed that Krishna river water was clean at the origin, but gets slowly polluted as it flows towards Satara and Karad city and highly polluted at the last sampling site at Rethre. At the bank of river there are number of sugar and other industries discharging their effluents in the Krishna river water. Municipal wastewater at Wai, Satara and Karad also enters the Krishna river increasing organic load in the water. Due to wastewater discharge from different sources, there was substantial increase in BOD, COD, suspended solids and turbidity at the last sampling site, Rethre.

Microbial analysis: The average true bacterial population in the river ranged from 17.07×10^5 to 36.26×10^5, fungal population from 0.25×10^5 to 0.61×10^5, and actinomycetes from 3.84×10^5 to 10.25×10^5 during different months of the year. The proportion of the bacteria was maximum followed by actinomycetes and fungi. It was also noted that microbial population was lowest at first sampling site Kshetra Mahabaleshwar and was highest at the last sampling site, Rethare.

To reveal the status of actinomycetal population in relation to total microbial population of the Krishna river, the percentage of the groups of organisms, viz., actinomycetes, bacteria and fungi

Table 1: Average values of different parameters at various sampling sites for 12 months (2002).

Sampling Sites	pH	DO	BOD	COD	Suspended Solids	Turbidity (NTU)	Alkalinity	Sulphates	Chlorides	Nitrates	Hardness	Calcium
KM	7.10	5.92	5.75	7.81	3.03	2.32	63.5	9.43	29.63	0.75	62.30	20.08
WA	7.35	5.09	12.04	14.75	3.97	1.92	150.53	11.15	45.36	6.06	182.00	61.97
BH	7.46	5.02	17.32	19.90	5.73	3,75	232.83	30.58	84.67	11.48	278.17	73.65
KS	7.95	4.54	17.84	20.77	8.29	3.08	129.5	41.00	44.80	11.52	133.02	39.88
KA	7.80	4.40	19.83	29.88	26.52	2.33	146.73	36.90	49.14.	23.37	145.57	40.93
RE	7.09	3.40	37.94	40.59	41.23	5.16	184.83	97.95	64.75	16.39	229.75	80.57

All parameters in mg/L; except pH
KM =Kshetra Mahabaleshwar, WA= Wai, BH = Bhuinj , KS = Kshetra Mahuli, Satara , KA = Karad , RE = Rethre

Table 2: Average values of microbial analysis of Krishna river water for 12 months (2002).

Sr. No.	Months	Count × 10^5				% Distribution		
		Bacteria	Fungi	Actinom-ycetes	Total Microbes	Bacteria	Fungi	Actinom-ycetes
1	Jan	21.97	0.29	3.84	26.10	84.17	1.10	14.71
2	Feb	21.62	0.30	3.96	25.88	83.53	1.15	15.30
3	Mar	30.58	0.52	7.33	38.43	79.57	1.35	19.07
4	Apr	34.56	0.59	8.34	43.49	79.46	1.35	19.17
5	May	36.26	0.61	9.93	46.80	77.47	1.30	21.21
6	Jun	34.14	0.50	10.25	44.88	76.04	1.11	22.83
7	Jul	18.47	0.26	4.14	22.87	80.76	1.13	18.10
8	Aug	17.09	0.25	3.89	21.23	80.49	1.13	18.32
9	Sep	20.97	0.35	4.17	25.49	82.26	1.37	16.35
10	Oct	24.70	0.40	4.71	29.81	82.85	1.34	15.83
11	Nov	23.24	0.32	6.31	29.97	78.24	1.06	15.80
12	Dec	20.75	0.30	4.68	25.73	80.64	1.16	18.181

Table 3: Correlation coefficient of actinomycetal population with various physico-chemical characteristics of water.

Sr.No	Parameter	r
1	pH	- 0.40
2	DO	- 0.97
3	BOD	+ 0.94
4	COD	+ 0.86
5	Suspended solid	+ 0.97
6	Turbidity	+ 0.99
7	Alkalinity	+ 0.40
8	Sulphates	+ 0.95
9	Chlorides	+ 0.40
10	Nitrates	+ 0.42
11	Hardness	+ 0.45
12	Calcium	+ 0.63

were compared, and the percent population distribution of the three group of organisms varied from 14.71 to 22.83, 76.04 to 84.17 and 1.06 to 1.37 respectively. It is a well accepted fact that actinomycetal population lies intermediate to bacteria and fungi. Shejul (1998), Kulkarni (1999), Jadhav (2001) and Chougule (2006) also observed similar results.

Correlation coefficient of actinomycetal population actinomycetal population with various parameters was determined and presented in Table 3. Correlation coefficients of actinomycetal population with pH, DO, BOD, COD, suspended solids, turbidity, alkalinity, sulphates, chlorides, nitrate, hardness and calcium were -0.40, -0.97, +0.94, +0.86, +0.97, +0.99, +0.40, +0.95, +0.40, +0.42, +0.45 and +0.63 respectively.

Thus, it is clear that there is strong positive correlation between actinomycetal population and BOD, COD, suspended solids and turbidity. There is low positive correlation between actinomycetal population and hardness, nitrates, chlorides, pH, sulphate, calcium and alkalinity. However, it was also found that though there was significant positive correlation between sulphate, calcium and actinomycetal population, they do not play any significant role in increasing microbial population. It is well established that organic load and ultimately suspended solids promote the growth of actinomycetes. Particles in the aquatic environment concentrate nutrients and reduce grazing pressure which help bacteria to survive therein.

REFERENCES

Chougule V.C. 2006. Studies on Actinomycetes from Saline Soils of Sangali District, Ph.D. Thesis, Shivaji University, Kolhapur.

Jadhav A.R. 2001 Studies on Actinomycetes of Kalamba and Rankala Lakes of Kolhapur District, Ph.D. Thesis, Shivaji University, Kolhapur.

Kulkarni, S.W. 1999 Studies on Soil Actinomycetes of Solapur District, Ph.D. Thesis, Shivaji University, Kolhapur.

Shejul, M.S. 1998. Studies on Heterotrophic Filamentous Procaryotes from Aquatic Habitat, Ph.D. Thesis, Pune University, Pune.

Trivedy, R.K. and Goel, P.K. 1986. Chemical and Biological Methods for Water Pollution Studies. Environmental Publications, Karad.

William, S. J. and Davies, F.L. 1965. Use of antibiotics and enumeration of actinomycetes in soil. J. Gen. Microbiol., 38: 251-256.