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A Preliminary Report on the Physico-chemical Nature of Water Pollution in and Around Erode Town, Tamil Nadu

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ABSTRACT

The pollutant samples ere collected from the drains of 11 stations each at the banks of River Cauvery and Kalingarayan canal to analyse physico-chemical characteristics. The data clearly revealed the pollution pattern and magnitude of pollutant load in the study area. The quality of pollutants and possible suggestions to minimize the pollution hazards have been discussed.

INTRODUCTION

A massive population explosion, industrialization, technological advancements and urbanization have resulted in the release of a large quantum of variety of chemicals into the environment every year. Though the deterioration of aquatic systems is as old as civilization, the industrial and agricultural development and urbanization have brought irreversible changes in such systems. There is no doubt that the developments of industries are essential for the growth of a nation but the side effects of industrial growth and urbanization have threaten the mankind in the form of pollution. The living beings are facing great health hazards due to the accumulation of pollutants in soil, water and food chain. The impact of pollutants will range from local effects to dreadful conditions resulting in the morality of the affected organisms. Therefore, it is of paramount to detect these substances in the ecosystem and to evaluate the harmful effects of the pollutants on life.

River Cauvery and Kalingarayan canal, a distributory of Bhavani River near Erode town receive waste waters at different places from industries along with domestic sewage. The present paper deals with a preliminary survey of waste waters discharged into the water bodies to assess their quality.

STUDY AREA

At a stretch of about 25km from Komarapalayam, the River Cauvery receives effluents from various such as dyeing and bleaching factories, tanneries and paper and pulp mill as well as domestic sewage and also Kalingarayan canal at a stretch of about 16km from Kalingarayanpalayam to Variapalayam. The drains at 6 stations along the North bank (Komarapalayam, Avathipalayam, Pallipalayam I and II, Vasantha Nagar and Pappanpalayam) and 5 stations along the South bank (Suriyampalayam I and II, Sunnambu Odai, B.P.Agraharam and Ventipalayam) of the river and 11 stations along the South bank (Kalingarayanpalayam, R.N. Pudur, sunnambu Odai, B.P.Agraharam I, II, III and IV and Variapalayam I, II and III) of the canal which discharge waste waters were selected for sample collection.

MATERIALS AND METHODS

Two litres of waste water prior to mixing with the water courses from each station were collected in thoroughly rinsed plastic containers, labelled and brought to the approved laboratory. The samples for the determination of DO were collected in BOD bottles to avoid aeration. The temperature was recorded by using mercury thermometer and the pH of the samples were measured by pH meter in the field itself. The samples were preserved in the laboratory at 4°C and various physico-chemical parameters were determined by adopting the standard methods given by APHA (1989).

RESULTS

Various physicochemical characteristics of the samples collected at different stations are shown in Tables 1 and 2.

The samples collected from all stations along the banks of the river and canal of temperature between 29°C and 34.5°C. In almost all stations, the pH of the samples was found to be alkaline in condition. Though the samples along the river banks had higher quantity of solids than the samples along the banks of the canal. The waste waters from all stations were characterized by having no oxygen content. In most samples, the free CO_2 was higher the maximum value was being in the

Table 1: Physico-chemical parameters of raw effluents collected from different stations along the banks of Kalingarayan canal.

Parameters	Stations										
	I	II	II	IV	V	VI	VII	VIII	IX	X	XI
Colour	Green	Light Grey	Violet	Pink	Violet	Brown	Yellow	Light Grey	Pink	Violet	Violet
Odour	Putre-sible odour	Foul odour	Foul odour	Foul odour	Disagr-eeable odour	Foul odour	Foul odour	Disagr-eeable odour	Foul odour	Disagr-eeable odour	Foul odour
Temperature	30.0	29.5	32.5	34.0	29.5	29.0	29.0	28.0	31.0	33.0	34.0
pH	7.5	7.5	8.0	7.0	9.5	8.5	5.5	7.5	8.0	9.0	9.0
TSS	10985	1690	1160	640	1320	5640	2360	1465	1215	1960	1720
TDS	2920	1510	6015	1280	2280	12120	2640	1240	1720	3520	3140
BOD	292	180	310	385	196	896	196	168	266	182	164
COD	1224	263	1310	590	645	1750	584	384	615	581	496
DO	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Free CO_2	44.0	88.0	0	35.2	52.8	79.2	281.6	79.2	17.6	26.4	0
Salinity	0.44	0.44	3.91	2.27	4.72	2.4	2.07	.85	5.74	1.66	3.9
Total Alkalinity	40	50	100	5	40	180	50	60	30	80	140
Total Hardness	280	380	180	450	520	750	910	980	580	380	460
Chlorides	667.4	227.2	1158.4	749.6	1512.4	1136.4	736.1	344.4	454.4	908.8	1504.3
Sulphides	1.0	1.0	1.5	2.0	1.5	16.5	1.0	0.5	1.0	0	7.5
Sulphate	7.5	7.0	49.0	18.0	14.5	115.0	31.5	12.6	14.6	9.7	44.6
Chromium	0.14	0.14	0.28	0.21	0.21	2.08	0.56	0.14	0.28	0.17	0.63
Calcium	68	100	24	88	68	60	200	92	120	92	80
Magnesium	26.84	31.72	29.28	56.12	61.00	146.40	100.04	183.00	68.32	36.60	63.44
Phosphate	16.67	23.33	63.33	26.67	73.33	140.0	76.67	30.00	73.33	11.67	103.33
Nitrate	1.58	3.94	44.15	10.25	28.39	72.54	47.31	89.88	28.38	10.39	39.42
Silicate	3.25	8.00	31.00	23.00	50.00	87.50	40.00	5.50	50.00	1.75	67.5
Oil + grease	40	40	20	10	20	30	10	20	20	30	40
Tannin & Lignin	0.9	1.0	1.00	1.40	0.80	16.00	0.80	2.80	3.00	0.70	2.40

The values in mg/L except temperature and pH, BOD (5 days at 20°C)

Table 2: Physico-chemical parameters of raw effluents collected from different stations along the banks of river Cauvery.

Parameters	Stations										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Colour	Black	Violet	Green	Violet	Violet	Brown	Black	Whitish yellow	Brown	Brown	Black
Odour	Putre-sible odour	Foul odour	Putre-sible odour	Disag-reeable odour	Disag-reeable odour	chemical odour	Disag-reeable odour	Foul odour	Foul odour	Foul odour	Putre-sible odour
Temperature	32.0	31	29.5	31	32	34.5	32	31	31.5	32	33
pH	8.5	8.5	8.5	8.5	8	8	9	7.5	9	8	9
TSS	11200	9000	8840	2840	1760	1200	7000	2980	4480	3600	6630
TDS	4380	7200	5580	3120	3240	1840	9300	2820	8500	7100	5400
BOD	281	248	301	205	210	108	278	225	978	695	262
COD	1418	1211	1322	520	480	312	989	665	1860	1365	512
DO	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Free CO_2	61.6	40	30	100	0	40	44	0	210	50	100
Salinity	2.48	1.46	1.66	2.07	7.58	1.46	3.09	2.27	12.07	3.09	1.05
Total alkalinity	140	40	80	70	210	50	90	104	120	130	60
Total hardness	740	270	390	1650	500	840	240	152	1230	440	390
Chlorides	1352	995.2	1108.8	979.2	1289.6	795.2	1404.6	624.8	1702.4	1408.6	868.6
Sulphides	0	0	0	1	0	0	1	0	20	28	1
Sulphate	111.11	8.6	9.7	9.14	11.43	34.3	30	28.8	100	44.6	12
Chromium	.38	.14	.17	.28	.56	.21	.97	.35	4.51	1.25	0.10
Calcium	62.4	60	92.18	200	104	276	60	48	88	80	76
Magnesium	142.5	29.28	39.04	280.6	58.56	36.6	21.96	7.81	246.44	58.56	48.8
Phosphate	166.67	10	13.33	28.33	15	16.67	60	8.33	17.	130	36.67
Nitrite	63.08	5.59	26.15	26	56	13.4	47.31	14.26	52.04	42.58	97.77
Silicate	28	1.75	1.5	12	2	4	12.5	2	50	70	7.5
Oil + grease	8	10	20	20	40	2.6	20	10	60	20	20
Tannin & Lignin	1.44	0.11	0.67	0.78	3	41	1.78	3	47.33	43.67	1

The values in mg/L except temperature and pH, BOD (5 days at 20^{o}C)

sample collected from IX station of river bank and in the sample from VII station of the canal bank. The salinity of the sample was more or less similar in the samples of all station the highest was being at station V and IX of the river bank. In few of the samples, the total acidity was negligible whereas in the samples of other stations, it was higher, the maximum was found in VII station of the canal sample. In all samples of river and canal banks, the total alkalinity ranged from 32 mg/L to 210 mg /L and these values for total hardness were 152m/L to 1650mg/L in samples of river bank.

The samples from few stations had lesser quantity of chlorides but the chloride content was higher in most samples in which the maximum was recorded at station IX of both river and canal banks. The concentrations of sulphide and chromium were found to be higher in the samples of canal bank when compared to the stations along the river banks. In all the samples, the sulphate content ranged from 7mg/L to 115mg/L, calcium content from 24mg/L to 276mg/L, magnesium content from 7.81mg/L to 280.60mg/L and phosphate content from 10mg/L to 170mg/L. The samples from the stations river bank had higher concentrations of nitrite (5.59mg/L to 126.15mg/L) whereas the ranges of values for nitrites in the samples from canal bank were between 1.58mg/L and 110.39 mg /L. But all the samples had silicate content ranging from 1.5mg/L to 87.50mg/L. The samples from river banks had higher quantity of oil and grease when compared to the samples of canal bank. The same trend was also noticed tannin and lignin content in the samples collected.

DISCUSSION

It is clear from the results that the samples from almost all stations along banks of the River Cauvery except stations II, V and VII, and the samples along the banks of canal except stations I, II and III have various parameters at maximum level. Along the river bank, the worst affected one was the station IX, and along the canal bank, station VI.

The indiscriminate discharge of domestic sewage along with industrial effluents would adversely affect the aquatic ecosystems and also its biota, thus posing a threat to human health. Kotaiah & Kumarasamy (1994) have reported that various physico-chemical parameters significantly influence plankton, benthos and other aquatic biota from Indian rivers. The rivers are polluted by both point and nonpoint sources in which nonpoint source pollution plays an important role in degrading the water quality.

In the present study, the fluctuation of temperature in the samples from different stations is due to low water level and velocity as well as atmospheric conditions such as solar radiation etc. The higher values of pH in the samples could be indicative of the presence of carbonate and bicarbonates. As recorded by Mohanty et al. (2003), the alkaline nature of industrial effluents could be the reason for higher pH value in the samples tested. The increased pH alters the taste of water, reduces the germicidal effect of chlorine and induces the formation of toxic trihalomethanes as also reported by Vijiyaram et al. (1989).

The higher concentration of total suspended solids in the samples could be due to insoluble organic matter in the sewage. According to Jain et al. (2003), the disposal of sewage and industrial effluents contribute suspended matter to the rivers. The highest BOD levels in the samples are mainly due to increased organic decomposition by the bacteria under aerobic conditions. In other words, the higher BOD values indicate the highest biological activity and enhanced pollution load. Moreover, high concentration of suspended and dissolved solids could be responsible for higher BOD levels in the samples. The higher COD values in the samples indicate the presence of increased concentration of industrial pollutants containing inorganic and organic substances, thus showing greater toxicity level. The absence of DO in the samples studied is indicative of organic pollution and might be due to utilization of oxygen for the decomposition of organic materials by aerobic bacteria. The bacterial decomposition of organic matter and diffusion of atmospheric CO_2 could be the possible factors for the maximum concentration of free CO_2 in the wastewaters.

The alkalinity provides an index for the nature of salts present in the samples. The mixing of large quantity of industrial effluents in low water content as well as high evaporation rate could be associated with the increased alkalinity in the samples collected from different stations of the study area. The high values of alkalinity show the presence of weak and strong bases such as carbonates, bicarbonates and hydroxides (Piper 1944). The higher hardness recorded in the samples could be indicative of presence of calcium and magnesium ions as bicarbonates, carbonates, chlorides and sulphates. The organic wastes of animal origin and domestic wastes could be responsible for high chloride content in the samples studied.

Prakash et al. (2001) has reported that the effluents from tanneries and pulp and paper industries as well as the usage of tannin in the internal treatment of boiler waters contribute tannin and lignin to the water courses. Oil and grease are shown to contain hydrocarbons, lipids, fatty acid, soaps, waxes and oils, the source of which are the lubricants applied to machineries.

Thus, analysis of physico-chemical characteristics of wastewaters collected from different sta-

tions clearly reveals the magnitude of pollutant load in the study area. As the industrial effluents and sewage are abundantly discharged, the river and canal could get highly polluted throughout the year. This would result in the deterioration of the water quality, accumulation of toxic chemicals and loss of aesthetic value. Narayan & Singh (1989) have opined that sewage and industrial effluents would cause mortality of fishes.

CONCLUSION

On the basis of Physico-chemical studies, it may be concluded that the quality of surface and ground waters in and around Erode would be affected adversely, if the wastewaters are discharged untreated. The governmental and non-governmental organizations have to plan for time to time monitoring of water quality. Thus, proper remedial measures such as periodical quality monitoring of water and appropriate water treatment would be beneficial to avoid water pollution in this area.

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