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RECENT OBSERVATIONS ON PHYSICO–CHEMICAL CHARACTERISTICS OF THE COASTAL WATERS OF KANYAKUMARI DISTRICT, SOUTH INDIA

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ABSTRACT

Coastal water quality of the west coast of Kanyakumari district, Tamil Nadu, South India is presented here. As part of continuous monitoring of coastal water quality, the physico–chemical characteristics of seawater samples collected during July 2001 (South West Monsoon) are discussed. The distribution of nutrients in the sampling sites showed normalcy whereas salinity showed marked oscillation.

Key words : Physico–Chemical, Coastal water, Kanyakumari

INTRODUCTION

Kanyakumari is a coastal district of Tamil Nadu bordering three sides by oceans, Bay of Bengal on the east, Indian Ocean on the south and the Arabian Sea on the west. Geographically situated between 8°03' and 8°35' north latitude and 77°05' and 77°36' east longitude, the coastal ecosystem of this district comprises 68 km in length in which the main part of the coast faces Arabian Sea. As, increase in pollution threatens the global environmental health, this coastal district is also facing the similar type of problems due to lack of environmental protection. Some of the causes are small–scale industries, aquaculture, coir retting, sand mining, transport etc. The aim of the present investigation is to monitor the coastal water quality.

EXPERIMENTAL

Sampling and analysis

Seawater samples were collected at eighteen points (each three samples from six transects) about 400 to 500 meters except S4 and S16 (Fig. 1) from the shore and preserved separately as per the standard methods[1,2]. S4 and S16 are bar mouths. Parameters such as temperature, pH,

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Dissolved Oxygen (DO), conductivity and salinity were measured on site. For other parameters samples were brought to the laboratory and analysed using standard analytical procedures.[3,4,5]. Results are presented in Table 1. Estimation of alkalinity and hydrogen sulphide was done titrimetrically. Sodium and potassium were estimated using flame photometer while calcium and magnesium were estimated by EDTA method. Estimation of chloride and ammonia was carried out by using Orion ion analyzer; sulphate, phosphate and silicate by Spectrophotometry.

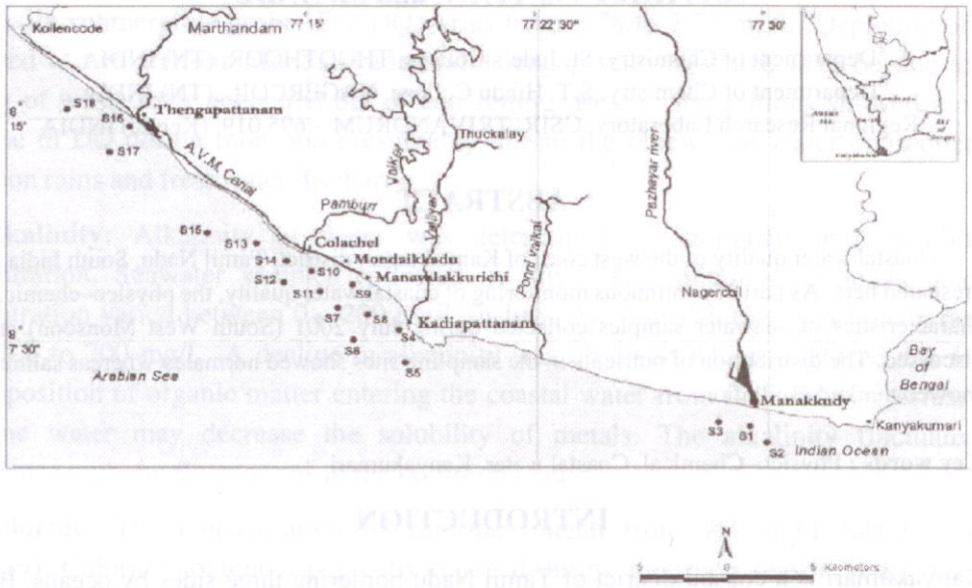

Fig. 1: Location of stations in Kanyakumari Coast

RESULTS AND DISCUSSION

Results of physico–chemical analysis of seawater samples are given in Table 1. As this is a continuous monitoring study and the water quality parameters are depending on the climatic conditions, most of the parameters showed fluctuations from the previous observations.

Temperature: The temperature of seawater ranged between 25.9°C and 29.3°C during study period with a marginal difference between stations. Minimum (25.9°C) was recorded at S7 and maximum at S4 (29.3°C). During the monsoon season rainfall and cloudy sky brought down the atmospheric temperature, and subsequently the water temperature to a minimum.

pH: The pH of water body indicates the degree of pollution. pH values ranged from 7.5 to 8.3. The low value of pH may be due to the influence of rainwater. The lower the pH higher will be the level of corrosion[6]. Only slight variations were noticed in pH of the water samples collected. pH value increased with salinity. The pH of the water body indicates the degree of deterioration of water quality[7].

Table 1. Coastal water quality monitored in the month of July 2001

Location / Sample No.	Manakkudy			Kadiapattanam			Manavalakkurichi			Mondaikkadu			Colachel			Thengapattanam		
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18
pH	8.15	7.61	8.06	7.78	7.61	7.55	7.73	7.80	8.13	7.64	8.10	7.50	8.30	7.89	7.87	7.63	7.67	8.12
Conductivity (mS/cm)	50.1	51.7	51.0	2.3	49.7	51.2	51.0	50.3	50.1	51.4	51.8	49.7	50.0	51.1	49.5	12.4	37.6	49.7
Dissolved Oxygen	5.57	6.228	7.74	7.2	6.65	6.657	7.2	7.38	7.56	3.778	5.937	4.86	7.197	6.657	5.398	7.017	4.678	4.138
Temperature ^{o}C	27.9	28.5	27.3	29.3	26.2	26.5	25.9	27.1	27.3	26.5	26.2	26.1	26.0	26.5	26.0	27.3	27.3	26.2
Salinity	31700	32500	32600	1200	31490	32070	32300	31700	31500	32610	32520	31350	31330	32500	31400	6920	23000	31280
Chloride	19800	20700	22900	759	20800	22100	22100	22700	23800	23200	22000	23100	22500	23100	22800	5190	16900	23600
Carbonate	100	100	100	12	200	100	200	200	100	200	100	200	200	200	100	ND	100	200
Bicarbonate	500	700	500	250	200	600	200	400	400	400	350	300	200	200	300	400	300	250
Phosphate	0.500	0.250	0.333	ND	0.170	0.083	0.166	0.167	0.167	0.167	0.083	0.083	0.083	ND	0.083	ND	0.042	0.083
Reactive Silica	1.2	0.933	2.133	ND	1.67	0.8	0.467	0.467	0.933	0.8	0.733	0.733	0.62	0.466	6	0.43	0.73	0.85
Sulphate	1250	2125	2250	250	1875	2000	2250	2250	2375	2250	2125	2125	2000	2125	2250	1000	1750	1750
Hydrogen Sulphide	12.9	21.2	17.6	20.5	8.9	29.0	10.7	ND	17.9	23.3	5.0	18.6	12.5	13.0	18.7	23.0	19.4	8.6
Sodium	12790	13470	10640	460	10960	10960	10730	10080	11040	10350	10680	10970	10660	10720	10730	2900	7350	10600
Potassium	400	400	400	10	350	400	390	380	380	420	400	420	400	410	410	80	290	410
Calcium	340	400	360	15	300	400	420	400	400	400	420	460	400	380	380	80	280	340
Magnesium	1344	1356	1308	36	1332	1320	1332	1296	1320	1344	1368	1296	1356	1344	1320	336	1008	1356
Ammonia	0.320	0.345	0.444	0.068	0.347	0.275	0.301	0.298	0.528	0.500	0.411	0.324	0.371	0.358	0.382	0.331	0.450	0.212

All values are given in mg/L except pH, Temperature and Conductivity.
S4 and S16 are riverine samples.
ND– Not Detectable

Electrical conductivity: Electrical conductivity ranged from 2.3 mS/cm (S4–bar mouth) to 51.8 mS/cm (S11). The high conductivity values indicated that the seawater contained high concentration of dissolved ionisable solids[8]. Electrical conductivity values at bar mouths were 2.3 mS/cm (S4) and 12.46 mS/cm (S16). Variation in electrical conductivity values is due to mixing of river water.

Dissolved oxygen: Dissolved oxygen (DO) was measured using a YSI Model DO meter with submergible probe. The DO varies from 3.78 to 7.75 mg/L. Depletion of DO observed at two stations Mondaikkadu and Thengapattanam, which may be due to the mixing of wastewater generated out of coir retting. Rest of the stations showed marked increase in DO during monsoon presumably due to the renewal of water consequent to monsoon rains and freshwater discharge.

Alkalinity: Alkalinity of water was determined by carbonate and bicarbonate concentration. Seawater samples collected in July 2001 contained carbonate and its concentration varied between 0 – 200 mg/L in July. Alkalinity due to bicarbonate ranged from 200 to 700 mg/L. A decline in alkalinity was observed which might be due to the decomposition of organic matter entering the coastal water from the adjoining estuaries[9]. Alkaline water may decrease the solubility of metals. The alkalinity fluctuated in accordance with the fluctuations in the pollution load[10].

Chloride: The concentration of chloride ranged from 759 mg/L(S4) to 23800 mg/L(S9). Chloride content was greatly reduced during monsoon season at all stations. Land run off was an important factor affecting the salinity of coastal water. The level of chloride was considerably low at S4 and S16, in the present study due to the opening of river mouth to the adjoining region of coastal study area.

Salinity: Salinity varied from a minimum of 1200 mg/L (S4) to a maximum of 32610 mg/L (S10). Opening of the river mouth to the adjoining region of coastal area was the reason for the lower salinity. During monsoon the seawater was less saline. Among the eighteen samples, samples from Manakkudy and Mondaikkadu had high salinity. The least salinity values were recorded at S4 and S16 due to the water mixing in the bar mouth. During the study period pH was directly related to salinity. Salinity was greatly reduced during the monsoon season at all sites. Recording of low salinity may be due to high amount of rainfall and lower rate of evaporation.

Sulphate: The amount of sulphate ion was estimated to be very high at all the sites. Its value varied between 250 – 2375 mg/L. It may cause scaling problems in boilers[11]. Among

all the places throughout the course of the study the amount of sulphate was found to be maximum at Manavalakkurichi.

Silicate: Silicate concentration increased from the summer season to monsoon season and decreased afterwards which could be attributed to higher fresh water input during the monsoon seasons. Occurrence of low silicate concentration was found to be associated with an increase in salinity during the summer season. Silicate values ranged from 0 to 6.0 mg/L in July.

Phosphate: In the present study phosphate value ranged from 0 to 0.5 mg/L. The concentration of phosphate was low near the river mouths (S4, S16) [12]. The higher values of phosphate are mainly due to the use of fertilizers, detergents and pesticides by the people residing in this area[6]. The enhanced phosphorous level may be due to phosphorous arising from the sewage input[13].

Hydrogen sulphide: The concentration of hydrogen sulphide ranged between 0–29 mg/L. Hydrogen sulphide level was found to be comparatively high in many of the study locations mainly from run–off. This may be due to the mixing of leachate from coir retting zones[14].

Sodium: During the present investigation the concentration of sodium in all the water samples was found to be in the range of 460 to 13470 mg/L. The low level of sodium was recorded at all stations in July during the monsoon. Seawater contained higher concentration of sodium than potassium. Sodium content of seawater under study was very high at S1and S2 of Manakkudy. The level of sodium fluctuated in rainy season at bar mouth sites S4 and S16 in Kadiapattanam and Thengapattanam, respectively.

Potassium: The concentration of potassium in water samples was found be in the range of 10 – 420 mg/L during the study period. In the present investigation the concentration of potassium was found to be low in July. It was found to be very low at sites S4 and S16 due to the opening of bar mouth (river water mixing). Potassium content was very high in stations S10 and S12, i.e. 420 mg/L each, respectively during July.

Calcium: According to the present study the calcium content varied from 15 – 460 mg/L. Minimum values were recorded at bar mouth sites S4 and S16 due to the mixing of river water i.e. 15 mg/L at S4 and 80 mg/L at S16 in July 2001. Maximum values were recorded during summer at S17 in Thengapattanam and S14 and S15 sites of Colachel. The low calcium concentration recorded during monsoon season may be due to the low concentration of salts in water owing to reduction in evaporation during July when the rate of flow of water is high.

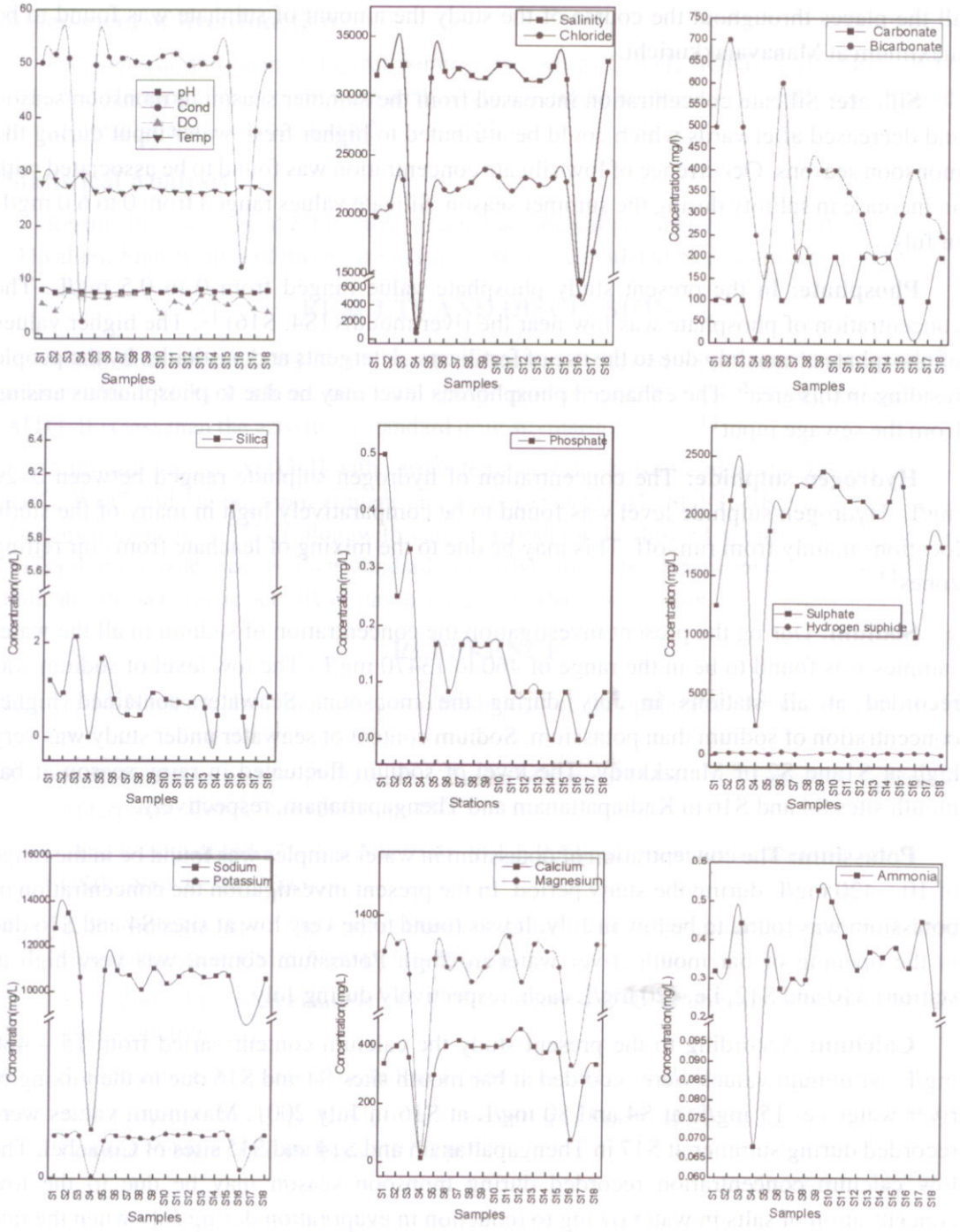

Fig. 2: Status in July (2001)

Magnesium: Observation of different samples revealed that S11 recorded a higher amount of magnesium than the other samples in July 2001, (1620 mg/L). S4 and S16 samples exhibited minimum magnesium content in July 2001 due to the opening of bar mouth, ie., 36 and 384 mg/L, respectively. The present study revealed that magnesium level was high (above 1620 mg/L) in especially at the three sites of Mondaikkadu.

Ammonia: During the present investigation the ammonia content in all the water samples was found to be in the range of 0.068 – 0.528 mg/L. The low level of ammonia was recorded at S4.

The slightly higher values of few physico–chemical parameters in coastal water samples collected from these stations can be attributed to (a) temporary seasonal variation, (b) anthropogenic activities, (c) previous agriculture runoff and (d) disposal of wastes. In monsoon the municipal sewage outlets were overflowed, and leached nutrients entered into the rivers finally reached the sea. The overall observation during July 2001 shows minor pollution load throughout the Arabian coastal region of Kanyakumari district.

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