Environmental Assessment of Marine and Estuarine Waters along the Coast Of Thoothukudi City

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Abstract: *The coastal region plays a major role in producing the resources dynamically. The coastal pollution is due to the untreated industrial and domestic waste discharge, activities of harbor rummaging, spilling of shipping cargos, other fishing activities. The studies of marine pollution will effects on the chemical, biological and physical parameters in the surrounding areas. The effect or damage of certain parameters in the marine area is studied. This pollutions will affect the marine ecosystem and the creatures present there. This study is about the investigation of the marine and estuarine waters along the coast of Thoothukudi city. The Physico-chemical parameters are analyzed from the samples collected in 32 sites of the Thuthookoodi coastal area. All the physical parameters like pH, salinity, DO, Conductivity, Turbidity and TDS and chemical parameters like Arsenic (AS), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Lead (Pb), Molybdenum (Mo), Silicon (Si) are been analyzed. Most of the samples the silicates are been measured in the waters collected at the coastal site. Thoothukudi coastal water is exposed to seasonal variations in physico-chemical characteristics relied upon the seasonal tidal fullness and estuarine incursion influencing in continuous mixing of fresh and salt water at the Thutookoodi coastal areas. These changes in the parameters affected the climate shift, and altered in the temperature effects on regional and global scales. It has already challenging and complicated the situation. From the last few years it became clear that reactions can be more efficient achieved using a standard method of controlling pollutions like oil spillage, industrial sludge etc.*

Index Terms: *Marine water; Estuarine water; Thoothukudi; Fresh water; coastal region.*

I. INTRODUCTION

Coastal region plays a key role in the country's economy due to it availability of resources, productive habits, and wealthy biodiversity. India has about 7,500 kms of coastline. The Tamil Nadu coastline is about 10% of the length of the total coastal length of the Arabian Sea, Bengal Bay and the Indian Ocean [1]. The coastal ecosystems afford sustenance and other incomes, also used for waste disposal, recreation and inspiration. Water is very essential for all Living being. It is available in different forms in our environment. Coastal environment is vital for all human activities including industrial growth. Despite the coastal water is always treated as a simply accessible and eternal resource for the bio-ecology [2]. The interaction among oceans and land is impacted by the shore zone. Environmental circumstances like landscape, temperature, oxygen, salinity, water drive and nutrients exemplifying particularly water mass are also composed of its biota [3]. Thus the nature and distribution of flora and fauna in an aquatic system are mainly controlled by the fluctuations in the hydrographical parameters of the water body. Sea Coast Zone provides a significant buffer zone and as a filter structure for ecosystem. Coastal areas are very sensitive to climate variation and are predictable to be affected by the upsurge in sea level by over a million people, considerable land damage in South Asia [4]. These issues can be worsened by the enduring the continuous population rise in the region. Response tactics based on the physical parameters of these dangers are shown to improve the susceptibility of certain parts of the population in certain circumstances [5].

Estuaries are the weak ecosystem with the distinctive physical, biological and chemical properties dealing with the transition zone between waters and land. They are a movable water and complex climate, which can accumulate substantial nutrients as well as humane waste from the ground and transferred to the shore [6]. River water combines ocean water with a large number of physical and chemical processes that affect water quality [7]. But this area is a nursery and breeding ground for several species of economically significant crustaceans and fishes [8].

From the many researches over the pollution in natural ecosystem have several aspects, biological, physical and chemical. The physical characteristics comprise the distribution of possible pollutants inside the environment. The chemical characteristics comprise the level and pollutant in chemical form found inside both in abiotic and biotic mechanisms of ecology. But, it is identification of the biological influences of pollution that describes the true implication of the chemical and physical contamination.

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Chemical studies of water affords a good suggestion of the chemical quality of the water systems, but do not consider the environmental factors such as altered flow regime or altered riparian vegetation, and thus, do not certainly reproduce the environmental state of the system [9]. The aquatic systems are influenced by certain health aggravation that extensively reduces biodiversity, the danger of biodiversity and its influences are predicted to be better for aquatic ecosystems than for physical environments [10]. To analyze the characteristics of any aquatic system, the hydrobiological investigations are very important. Physico-chemical characteristics are accountable for altitudinal progressive differences of all marine entities. Several investigators have investigated the chemical and physical features of certain Indian estuaries. However, significant consideration has been investigated in the current scenario to analyze the physico-chemical characteristics of the waters in coastal region everywhere in India with the intention of define the water effectiveness and quality, very small info is accessible on these aspects. The present study was made to acquire the present position of hydrographical parameters of estuarine and marine coastal waters within 1 km of Thoothukudi, Tamil Nadu, India. This study would be supportive in the ecological monitoring of this ecosystem.

II. MATERIALS AND METHODS

In this study the Thoothukudi coast is situated in the southeast coast of Bay of Bengal, Tamil Nadu is considered. The overall coast area of 32 kms is considered for the collection of data samples. These area of 32 Kms were selected as they represent the south part of palayakkayal to through the costal line to the north of the Saltpan of Thoothukudi.

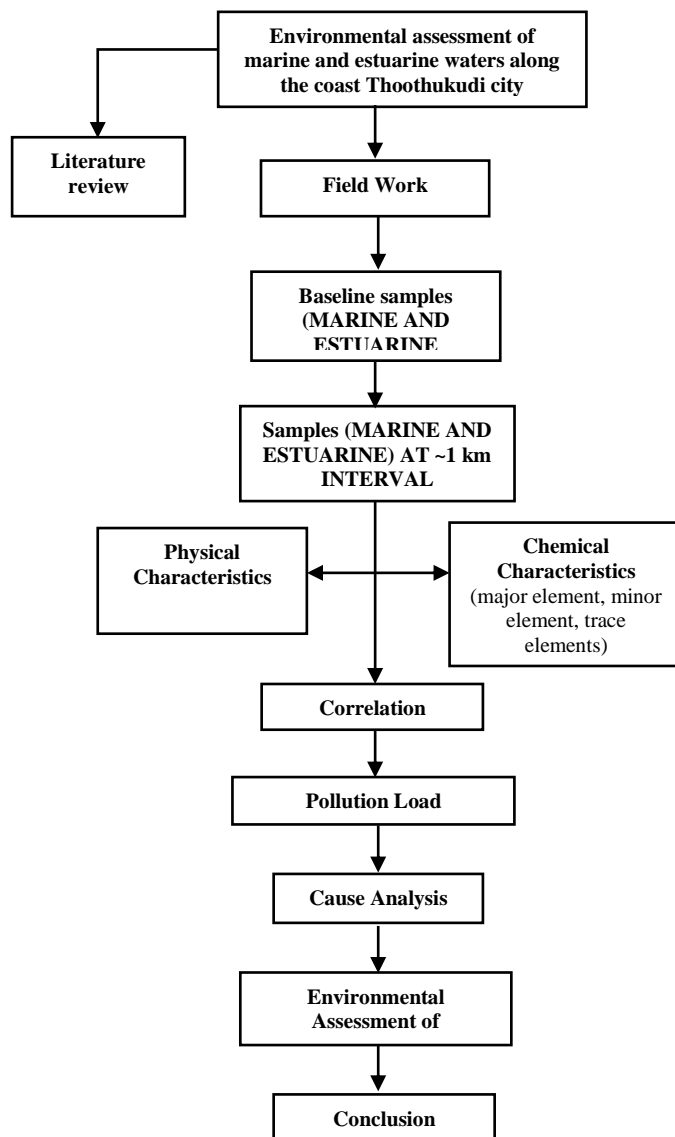**Fig 1 Considered area of the Thutookoodi costal area**

Fig 2 Flow chart of the research

The process of the research is shown in the figure 2. The initial literature is drawn from several studies and then the area study is selected. Then the baseline samples are collected in desired area shown in fig 3 at 36 sites.

Numerous environmental features were observed and collected samples of water were inspected that are collected during Dec 2018. Sea surface temperature (SST) was analyzed with a digital multi-stem thermometer of 0.1°C accurateness. Salinity was analyzed with a hand-held refractometer and the pH was assessed with a pH probe with the accurateness of ±0.1. Dissolved oxygen (DO) was analyzed with the improved Winkler's Method. The Metals present in the water like, As, Co, Cd, Cu, Cr, Mn, Hg, Ni, Pb, Zn, Mo, and Si using PERKIN ELMER OPTIMA 5300 DV ICP-OES with a dilution factor 10.

The main intention of study is to estimate the baseline characteristics for the marine water and to analyze the chemical and physical characteristics of marine water of the environment in coast of Thoothukudi City. The samples of water collected from the Estuarine and Marine areas that are presented in fig 2. Totally 38 samples are gathered from the site presented in the figure.

Fig 3: Sample located map

III. RESULTS

Physical-chemical parameters are measured one of the most significant characteristics that have the ability to impact marine ecosystem and show wider progressive and spatial variations. All physical-chemical parameters have presented with certain periodic patterns that are typical to the tropical marine ecosystem.

Table 1: Physical Characteristics of sample at site

S.NO	pH at site	pH using probe	Conductivity (mS)	Turbidity (NTU)	DO (ppm)	TDS (ppt)	Salinity (ppt)
1	8	7.56	53.1	4.2	4.8	27.9	26.9
2	7	7.56	52.8	6.4	3.4	27.8	26.9
3	7	7.51	52.8	9.4	3.7	27.9	26.9
4	6	7.5	52.7	9.4	4.1	27.8	26.9
5	7	7.45	52.7	2.9	2.9	27.8	26.9
6	6	7.4	52.7	0.9	3.5	27.8	26.9
7	6	7.33	52.6	2.3	3.1	27.7	26.7
8	6	7.41	52.4	2.3	4.3	27.6	26.7
9	7	7.45	52.1	5.4	3.5	27.4	26.6
10	6	7.48	52.1	4.1	4.6	27.5	26.6
11	7	7.56	52.2	1	3.7	27.6	26.7
12	6	7.32	52.2	1.6	3.7	27.5	26.6
13	7	7.52	51.9	1.7	3.2	27.4	26.5
14	6	7.57	52.4	1.6	4	27.6	26.7
15	6	7.63	52.1	5.8	4.2	27.3	26.4
16	6	7.49	52.7	1.7	2.7	27.7	26.8
17	7	7.48	52.9	14.8	3.4	27.9	26.9
18	7	7.5	53	18.1	2.8	27.9	27
19	6	7.33	53.3	22.5	2.9	28.5	27.1
20	6	6.76	46.8	44.1	0.1	24.6	23.8
21	6	6.78	51.3	112.5	0.4	26.9	26.1
22	6	7	52.8	4.8	2.6	27.7	26.8
23	7	7	53.1	1.6	2.2	27.8	26
24	6	6.64	46.9	33	4.3	26.2	25.3
25	7	6.95	52.6	8	2.2	27.7	26.8
26	6	7.24	53	13	4.3	27.8	26.8
27	6	7.52	52.7	10.9	4.2	27.7	26.8
28	6	7.53	52.7	6.1	3.4	27.7	26.8
29	7	7.54	52.4	15.8	3.8	27.6	26.7
30	6	7.48	53.1	12	3.4	27.9	27.1
31	7	7.43	53.1	11	3.8	27.9	27.1
32	6	7.36	52.9	1.3	3.4	27.9	26.9
33	7	7.34	52.9	2.6	3.7	27.9	26.9
34	6	7.41	52.9	4.1	5.2	27.9	26.9
35	6	7.16	52.8	11.5	3.3	27.8	26.9
36	7	7.33	52.9	6.1	3.6	27.8	26.9

The observed pH values ranged between 6.64 and 7.57. The least Conductivity (mS) is 46.8 at E20, the extreme value is measured at E19 of 53.3. The DO (ppt) concentration fluctuated between 5.2 and 2.9 ppm. Turbidity (NTU) is varied from 1 to 112.5. TDS (ppt) is fluctuated from 24.6 to 27.9. Salinity (ppt) is ranging from 23.8 to 27.1. The discrepancy of the characteristics is visually is presented in the fig 4.
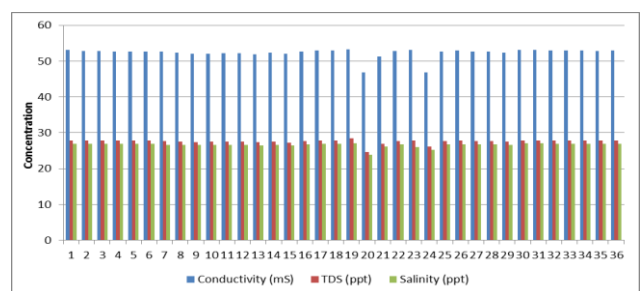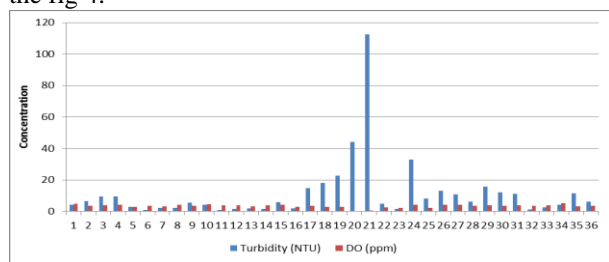

Fig 4: Physical characteristics of 36 samples
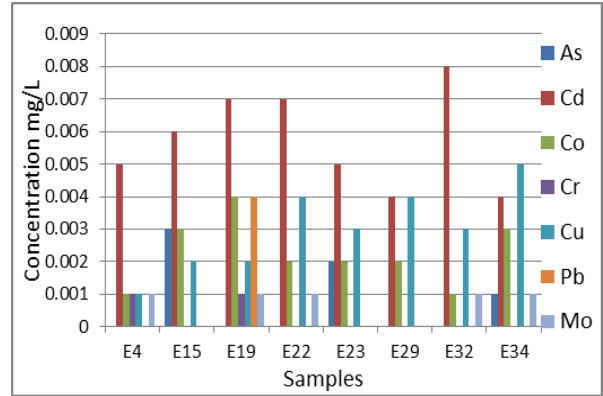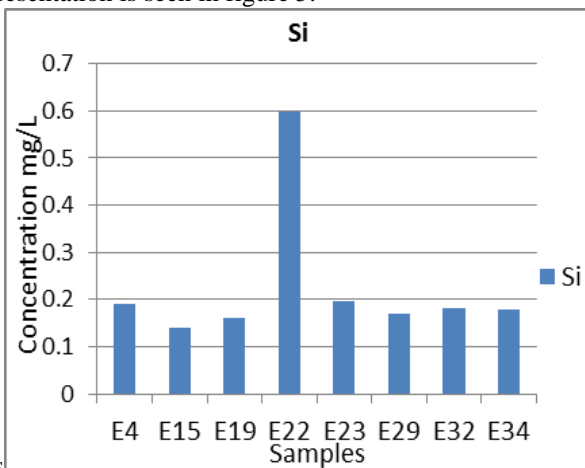
Chemical characteristics:

The various chemical characteristics of the collected water samples at the coastal area of the Thuthookoodi are been analyzed and shown in below table.

Table 2: Chemical characteristics of the selected samples

Samples	As mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Pb mg/L	Mo mg/L	Si mg/L
E4	BDL	0.005	0.001	0.001	0.001	BDL	0.001	0.191
E15	0.003	0.006	0.003	BDL	0.002	BDL	BDL	0.14
E19	BDL	0.007	0.004	0.001	0.002	0.004	0.001	0.162
E22	BDL	0.007	0.002	BDL	0.004	BDL	0.001	0.599
E23	0.002	0.005	0.002	BDL	0.003	BDL	BDL	0.196
E29	BDL	0.004	0.002	BDL	0.004	BDL	BDL	0.17
E32	BDL	0.008	0.001	BDL	0.003	BDL	0.001	0.183
E34	0.001	0.004	0.003	BDL	0.005	BDL	0.001	0.18

BDL- Below Detectable Limit

From the table 2 it is observed that Arsenic (AS), Cobalt (Co), Cadmium (Cd), Chromiun (Cr), Molybdenum (Mo), Lead (Pb), Silicon (Si) are the elements are measured at the sample site. Arsenic (AS) is estimated from 0.001 mg/L to 0.003 mg/L, Cadmium (Cd) is estimated from 0.004 mg/L to 0.008 mg/L, Cobalt (Co) is estimated from 0.001 mg/L to 0.004 mg/L, Chromiun (Cr) is estimated very least values and maximum upto 0.001 mg/L, Lead (Pb) very least values and maximum upto 0.004 mg/L, Molybdenum (Mo) very least values and maximum upto 0.001 mg/L, Silicon (Si) is the most maximum measured metal that is ranged from 0.14 mg/L to 0.599 mg/L. The silicon is the most measured metal in the water that are collected from the sites. The pictorial representation is seen in figure 5.

Fig 5: Chemical characteristics of the Samples collected

IV. DISCUSSION

These short bar charts the data may allow us to understand the effects of biological variations in the physico-chemical and organic situations in the coastal seawaters, Thoothukudi region of Tamil Nadu. The discrepancies of the climate and neighboring areas like Thermal power plant and other activities that produce the contaminants. Hence, the current study has analyzed quality of water changes through deliberate regularly new data collections related to the seasonal hydrographical environment of Thoothukudi region of Tamil Nadu.

The samples at the area site the pH value estimated from the probe and standards does not change for both. The pH value of the region varies in different seasons over the year, eliminating CO_2 through photosynthesis by bicarbonate reducing, reducing marine water through freshwater flow, salinity and temperature reduction and organic decomposition. High pH values observed may cause sea water deprivation and high density phytoplankton effect (Prabu, et al, 2008).

The variation of the DO is estimated by the oxygen consumption by bacteria when disintegrating organic matter in aerobic conditions. This is due to the large amount of drainage and waste water coming out of the Buckal canal [11].

The variability of salinity estimated in the 27.1 ppt stimulates the upright mixing of the water column due to the nature of the sea tide this season. The salinity demonstrations the negative liaison with phytoplankton biota, whereas DO indicate the symmetry between respiration and photosynthesis and exposed a positive liaison [12].

Silicate content from chemical composition is more than all other components. This is due to heavy monsoon investments. In the coastal waters, silicate from the sedimentary cells, co-respiration with soil minerals, co-sedation with moisturizers and biological removal by phytoplankton (diatoms and silico-flagellates) significantly affect the spill-temporal variation of silicate in coastal waters [13].

V. CONCLUSION

The present study attempted to investigate the marine and estuarine waters along the coast of Thoothukudi city of Tamilnadu, India. Analyses of our data sets exposed that coastal region of Thoothukudi area. All the chemical and physical parameters showed clear pollutant patterns of surroundings, and are typical to the tropical marine environment without any marked variation between the samples areas. Increased thermal stratification especially on surface waters increases the availability of silicate chemical at the nearby region of Thoothukudi. Thoothukudi coastal water is consistent with recurrent fluctuations in chemical and physical characteristics. The spread of recurrent fluctuations and the flow of estuarine result in constant fresh and salt water in the sample areas. Marine rubbishes like Nets, Food reapers, and Plastics, now contaminated by the oceans, affect wildlife, survival and human security. In fact, early procedures for prevention of marine pollution reflect the contrast between these terms, but recent approaches influence both the more or less identical descriptions of these expressions. The treatment of the waste from factories can help in reduction of pollutions and the maintained loading and unloading of the oil shipping can reduce the probability of the oil spillage. Prior to the transportation and influenced of the recommended materials for dumping in the ocean, the marine ecosystem was achieved through scientific estimates and defined the amount of permissible considerations that were not considered as the result of substantial or tolerable influences. This redirects mainly controlling and regulating theories of pollution.

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