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Assessment of Physico-chemical Characteristics of Vairtarna Estuary of Palghar, (M.S.) India

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ABSTRACT

The study of estuarine water quality plays an important role in evaluating and determining the pollution status and health of the water. Vaitarna River estuary is one of the important water bodies in the Palghar district. Entire stretch of the estuary was arbitrarily divided into three zones. Physical and chemical variables of water were monitored season-wise in the year 2016. In the present study, the entire stretch of estuary showed high values of Temperature, pH, BOD, C.O.D. Acidity, Salinity, Hardness and Sulphate different physicochemical parameters were studied in 3 stations of the estuary. There was no previous data from the Vaitarna estuary. The study revealed that one-year data (January 2016 to December 2016) shows good environmental conditions to differences in physicochemical characteristics within the permissible limit. It concluded that the water quality is good, and it is the responsibility of our society the importance of such water bodies to keep free from pollution. Because of the fishery point of view the local fishermen depend on this area of water resources.

Key words: *Vaitarna Estuary; Palghar, Physicochemical, Characteristics, Water.*

Introduction

Chemical analyses of water provide a good indication of the chemical quality of the aquatic systems. Further, the environmental conditions such as topography, water movement, salinity, Oxygen, temperature and nutrients characterizing particular water mass also determine the composition of its biota. Thus the nature of distribution of flora and fauna in the aquatic system are mainly controlled by the fluctuations in the physical and chemical characteristics of water body. Several workers all over the world have assessed physicochemical parameters of estuarine water all over the world to evaluate the level of pollution and the health of the ecosystem (Millero, 1986; Madson *et al.,* 2012; Uddin *et al.,* 2020).

A number of researchers have studied the physical and chemical characteristics of some Indian estuaries; (Anilkumar and Dineshkumar, 2002; Rathod and Patil, 2009; Soundarapandian *et al*., 2009; Prasanna and Panda, 2010; Lagade *et al.,* 2011; Behera. and Padhy, 2012; Dixit *et al.,* 2013; Dhumal and Sabale, 2014; Thommai *et al.,* 2014; Vijaykumar *et al*., 2014; Ayyanna *et al*., 2015; Dhanya *et al.,* 2017; Krishna, *et al.,*. 2017; Eucharista, 2019; Junita *et al*., 2020; Mishra and Kumar, 2021) in Indian estuarine water. The study revealed that the water parameters are fluctuates throughout the season (Gadhia *et al.,* (2012). It was observed that uncontrolled discharges of domestic wastes and industrial effluents have affected the estuary. High Biochemical oxygen demand (B.O.D.) and Chemical Oxygen Demand (C.O.D) showed that the water quality of the estuary

has been affected by industrial and domestic effluents.

Isaiah *et al.,* (2012) and Nirmal *et al*., (2012) studied physicochemical characters of the coastal water of Narmada estuary. This study summarizes seasonal fluctuations in the various physicochemical parameters in the coastal waters of Narmada estuary as exploratory statistical data output.

Anitha and Sugritha, (2013**)** studied seasonal variations in physicochemical constituents in the shows wide seasonal fluctuations. Study also revealed that with such an overloaded situation cannot sustain any further sewage discharge and proper alternative arrangement like sewage treatment before discharge are to be made to prevent further damage to the estuarine ecosystem (Dixit *et al*., 2013).

Dhumal and Sabale (2014); Ayanna *et al.,* (2015); Dhanya *et al.,* (2017) analyzed physicochemical parameters of estuaries and shows that temperature, hardness, dissolved oxygen, alkalinity, salinity, carbon dioxide values were within permissible limit.

Though, considerable attention has been paid in the recent years to study the physico-chemical parameters of the coastal waters around India. In order to ascertain the water quality and productivity, no information is available on Vaitarna estuary, hence we undertaken to study on Vaitarna estuary.

Materials and Methods

Study Area

Vaitarana is a river north of the city of Mumbai, India. It is near the border with Gujarat state. Vaitarna supplies Mumbai's drinking water. It is largest river in Northern-Konkan region and drains whole Palghar district, Maharashtra Vaitarna is the principal river of Palghar district. It rises at Tyambak from Bramahagiri hills, in Nashik district, opposite to the origin of Godavari. Geographical position of Vaitarna estuary lies within 19°30'49.8''N Longitude, 72°51'55.6" E Lattitude. The River flows across Shahapur, Wada and Palghar talukas and enter the Arabian Sea through a wide estuary off Arnala (Fig. 1).

Physico-chemical parameters

All parameters performed according to standard methods from, Trivedy and Goel, 1984 and APHA, 2005.

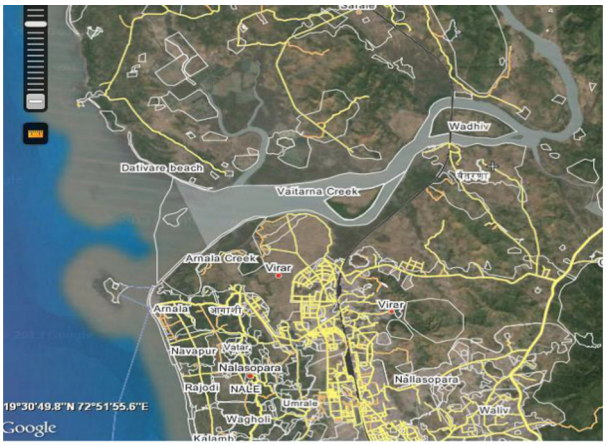

Fig.1. Google Map of the three sites of the study namely Dativare beach,Vaitran creek and Wadhiv.

Collection of water sample

For duration of one year i.e. from January 2016 to December 2016, three sites of Vaitarna estuary i.e Dativare Coast, Vaitarna Railway Bridge and Wadhiv visited fortnightly (Figure 1). Water from these sites was collected in the morning between 8.00 am to 9.00 am. in a pre- rinsed 5 liters polythene cans. Collected sample was brought to laboratory and preserved by appropriate method.

Temperature of the surface water was measured at the site of collection between 8am to 9am with calibrated mercury thermometer. pH of the surface water was determined on situ at the time of collection. Calibrated pH Pen meter manufactured by HANNA Instruments (Range 0-14) was used to measure pH of the surface water at the site of collection.

Biochemical oxygen Demand (B.O.D.) was determined by Wrinkler's Iodometric Method. Biochemical Oxygen Demand was calculated using suitable formula. Chemical oxygen demand (C.O.D.) was determined by Potassium Permanganate oxidation method (Alkaline Potassium Permanganate method). Demand (C.O.D.) was calculated using suitable formula by using blank (Flask prepared with digestion of distilled water with acidic KMnO4 as a reference.

Acidity of the water sample was determined by Titration method. Burette reading was noted. Phenolphthalein Acidity (Total Acidity) was calculated using suitable formula.

Salinity of the collected water sample was determined by Mohr's Method or Argentometric titration

Table 1. Standard Deviation in physicochemical parameters at three stations Dativare beach, Vaitarna Bridge and Wadhiv from January 2016 to December 2016

Parameters Season	Temp. ^{0}C	pH	B.O.D. mg/l	C.O.D. mg/l	Acidity mg/l	Salinity g/l	Hardnessm g/l	SO_4 mg/l
Summer	28.4 ±0.79	7.35 ±0.42	1.74 ±0.48	772.5 ± 409	2625 ±904.8	38 ±1.34	1389 ±123	28.84 ±0.36
Monsoon	26.7 ±1.95	7.12 ± 0.39	2.17 ±0.63	592.5 ±274	4925±1247	28.95 ±2.10	1238 ±58	23.76 ±3.95
Winter	25.6 ±1.50	7.2 ±0.17	2.63 ±1.05	368.7 ±220	2983 ±1214	29.38 ±3.23	1267±111	29.33 ±6.64

Table 2. Correlation physicochemical parameters at Dativare beach, Vaitarna Bridge and Wadhiv of Vaitarna Estuary from January 2016 to December 2016.

	Temp.	pH	B.O.D.	C.O.D.	Acidity	Salinity	Hardness	SO_4
Temp.	1.00	-0.24	-0.04.	-0.05.	0.49	-0.28	-0.50	-0.48
pH		1.00	-0.07	0.55	-0.81	0.28	0.06	0.44
B.O.D.			1.00	-0.12	-0.12	0.27	0.15	-0.25
C.O.D.				1.00	-0.59	0.20	0.13	0.36
Acidity					1.00	-0.60	-0.43	-0.49
Salinity						1.00	0.62	0.03
Hardness							1.00	0.53
SO_4								1.00

method. Burette reading was observed and used to calculate Chloride content of the water sample. The amount of chloride content obtained is used to calculate the salinity of water sample using

Hardness of the sample water was determined by EDTA titration method. The burette reading was noted and used to calculate total hardness of the given water sample.

Amount of sulphates from the water sample was determined by (Turbidity) colorimetric method. Absorbance was measured at 420 nm on calibrated colourimeter (Equiptronics EQ -650) using set of standard tubes as a reference.

Results and Discussion

Physicochemical parameters of Vaitarna estuary had been studied for one year, i.e. from January 2016 to December 2016. Samples were collected from three sites namely Dativare, Vaitarna Bridge and Wadhiv. Following observations were made.

The mean temperature recorded in summer was 28.4±0.79 ^{0}C. For monsoon it was 26.7±1.95 ^{o}C, and the mean for winter of 2016 was observed to be 25.6±1.50 ^{o}C (Table 1). Temperature also influences the concentration of dissolved oxygen and many other physical and biological factors in the water bodies (Jayakumar *et al*., 2009). It also controls the reproduction, diversity, migration and behavioral characteristics of animals and plants. Similar findings were also recorded by Ravichelvan *et al.* (2015) in the Uppanar Estuary of Cuddalore, South East Coast of India and Raju *et al.* (2017) of Arasalar estuary in southeast coast of India.

The mean of pH in summer was observed to be 7.35 ±0.42. The average pH observed in the monsoon of 2016 was 7.12 ± 0.39 in winters it was observed to be 7.2±0.17 (Table 1). Master variable in water is known as pH since many properties, processes and reactions are pH dependent. Because of buffering capacity in the sea water, generally the pH ranges from 7.8 to 8.3 in estuaries Millero, (1986). Similar observations were made by Prasanthan and Nair (2000) on Parvathy puthen estuary and Assessment of physicochemical characteristics of the estuary water at punnaikayal Eucharista, (2019).

The average B.O.D. measured in the summer was 1.74 ±0.48 mg/l in monsoon the average B.O.D. recorded was 2.17±0.63 mg/l Mean B.O.D. reported in winter was 2.63±1.05 mg/l (Table 1). Similar observation made by Vijayakumar *et al.,* (2014) of Thengaithittu estuary, Puducherry.

The mean C.O.D. observed in summer was 772.5 ± 409 mg/l. The mean C.O.D. observed in monsoon was 592.5 ± 274 mg/l whereas in winter it was 368.7 ±220 mg/l (Table 1). C.O.D. of Tapi estuary at Dumas Jetty, Surat, was reported similar range by Ranajana *et al*. (2013).

The average alkalinity in summer was 110 ± 16.7 3 mg/l in monsoon 77 ± 31.9 8 mg/l and in winter 121.25 ±30.9 mg/l (Table 1). Similar observation was made by Dhumal and Sabale (2014) of estuarine wa-

ter bodies from Sindhudurg district of Maharashtra.

The average salinity measured in the summer of 2016was 38 ±1.34 gm/l in monsoon the average salinity recorded was 28.95 ± 2.10 gm/l. Mean salinity reported in winter was 29.38 ±3.23 gm/l (Table 1). This is in close conformity with Govindasamy *et al.,* (2000) in the coastal water biotopes of Coromandel Coast, India. Prabu *et al.,* (2008) of Pichavaram mangroves, southeast coast of India; Balakrishnan *et al.,* (2017) of Tuticorin coastal waters, southeast coast of India and Eucharista, (2019) of the estuary water at punnaikayal.

The average hardness measured in the summer of 2016 was 1389 ± 123 mg/l in monsoon the average hardness recorded was 1238±58 mg/l Mean hardness reported in winter was 1267±111 mg/l (Table 1). Similar range of total hardness was reported by Mohan Raj *et al.* (2013); Lad and Patil (2014) of Ulhas river estuary, Thane; Thommai *et al.,* 2014; Dhumal and Sabale (2014) of estuarine water bodies from Sindhudurg district of Maharashtra and Vasanthi, and Sukumaran (2017) coastal water of east coast of Tamil Nadu (Muthupet estuary).

The mean sulphate observed in the summer of 2016 was found 28.84 ±0.36 mg/l, in monsoon it was observed as 23.76 ±3.95 mg/l whereas in winter the mean of sulphate was 29.33 ± 6.64 mg/l (Table 1). Similar observations made by Sen Gupta and Naik 1981 from Mandovi and Zuari river systems of Goa and Anitha and Sugritha, (2013) of water and sediment in Thengapattanam estuary, southwest coastal zone, Tamilnadu, India.

Bicarbonates, carbonates, chlorides, nitrates, phosphates, and sulphates are present in the form of Na+, K+, Mg^{2+} and Ca^{2+} and are mainly responsible for the alkalinity and hardness of water (Ravaniah *et al.*, 2010).

Sulphate, Phosphate and Nitrate are considered as one of the most important Nutrients parameter in the estuarine environment. It influences the growth, reproduction and metabolic activities of the living beings. Distribution of nutrients is mainly based on the seasons, tidal condition and fresh water inflow from land sources. This study has demonstrated that there is a strong relationship between estuarine physicochemical characteristics and seasons. Estuaries are the integral part of the coastal environment. Estuaries have variable physicochemical properties. The fluctuation creates a stressful environment for aquatic organisms. The statistical analysis of this study showed that the physicochemical parameters observed in all the three stations were varied significantly between the stations with some exceptions. Atmospheric temperature, water temperature, pH, B.O.D., C.O.D., Acidity, hardness, salinity, and sulphate were not that much varied significantly between the locations. From all observations it could be stated that the Vaitarna estuary is fairly clean.

Conclusion

The present study indicated the physicochemical status of the Vaitarna estuary waters water was good and maintains stable and healthy aquatic ecosystem. However, estuary water the physicochemical parameters were not very much variable there was no harmful chemical contamination. The fluctuations in physicochemical parameters influence the natural activity and efficiency of marine organism.

Conflict of Intersest

There is no any conflict of interest among authors.

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