Environment and Ecology 42 (3A) : 1224—1227, July—September 2024
Article DOI: https://doi.org/10.60151/envec/HKYR1908
ISSN 0970-0420

Studies on Mangrove Sediment Texture and Nutrients Along Bhayander Creek of Maharashtra Coast

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Received 29 January 2024, Accepted 22 May 2024, Published on 5 August 2024

ABSTRACT

The observation on mangrove sediment variables along Bhayander creek of district Thane within Maharashtra coast was carried to analyze the deterioration level of mangrove sediment due to water pollution. Research was conducted during October 2016 to September 2017. Different sediment variables like sand, silt, clay, organic carbon, organic matter, total nitrogen and available phosphate were determined. Texture of sand, silt and clay was widely oscillated during the said period. Organic matter, Organic carbon, available phosphate, and total nitrogen were found significantly different seasonally throughout the study period. Observations showed noteworthy uncertainties in all the sediment variables found distinct within their limits. Study proposes the measures to mitigate contamination of Bhayander creek and anthropogenic restrictions.

Keywords Organic carbon, Phosphate, Mangrove sediment, Texture.

INTRODUCTION

Due to occurrence of external contaminants like heavy metals, agricultural run-offs, flooding, urban developmental areas, disposal of industries effluents; domestic sewage, liquid wastes, which are close to mangrove zones found to be sink into creek waters (Zindge 1999, Fernandes *et al.* 2012). These create additional problems in different ways viz. binding of organic and inorganic solids with soil particles. This is important as nutrients availability is interfered. Reduces growth and affects burrowing benthic organisms. Release of toxic substances into coastal waters, potentially harmful to the aquatic organisms dwelling in it.

Along the Bhayander creek, Mumbai is possessed of vast brackish water resources and are found in the form of bay, mudflats, lagoons, back water, and mangrove swamps. These can be effectively brought under aquaculture through proper management that includes the sediment water interactions being manipulated to the benefit. The soil has a complex and

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intimate relationship with the overlying water and its play's significant role in biogeochemical recycling through the microbial activity (Sundby *et al.* 1992, Chakraborty *et al.* 2015).

Hence, in this study, an attempt has been made to investigate the variables of mangrove sediments in order to understand the health status and any gross impact of urbanization, redundant discharge of domestic waste and industrial effluents transported through the Bhayander creek water at one remove in the Arabian Sea.

MATERIALS AND METHODS

The sampling for the present study was carried out in mangrove forests along Bhayander creek around Mumbai coast. Study area is located towards North-Eastern of Mumbai around 19˚19'07.17" N latitude and 72˚51'33.82" E longitude and drains in west to the Arabian Sea. Bhayander creek receives domestic waste waters as well as industrial effluents from surrounding habitation and nearby industrial belt. Three sampling stations, S1, S2 and S3 representing Railway Bridge, Navghar Village and Jasal Park Site respectively were selected for the observations along the creek. Station S1 was nearby the mouth of the creek at Railway Bridge around 19˚19'07.17" N latitude and longitude 72˚51'00.02" E on Bhayander west between Naigoan, Vasai and Bhayander creek. This station experienced maximum tidal influence with minimal anthropogenic activities. The sampling station S2 further extends around latitude 19˚19'06.01" N and longitude 72˚51'17.31" E on Bhayander east around 500 m away. It receives minimum tidal influences compared to S1. At S2, there are no industrial units and their discharges; Joggers Park also was located without any garbage's and wastes. The sampling Station S3 lies between latitudes 19˚19'00.65" N and longitude 72˚51'33.82" E selected around 500 m away from S2. Sediment samples were collected fortnightly every month from S1, S2 and S3 along the Bhayander creek during October 2016 to September 2017 for the period of one year.

All sediment samples were collected in clean dry polyethylene bags during low tide in triplicate from each selected location using Ekman's grab (0.05m^2). Before the analysis of various variables, the sediment samples were grained and homogenized using mortar and pestle. While sediment texture was determined by following International pipette method (Muthuvel and Udayasoorian 1999); organic carbon and organic matter analyzed using (Walkley and Black 1934); total nitrogen analyzed by alkaline permanganate distillation method (Subaiah and Asija (1956) and available phosphorus by Olsen's method (Olsen *et al.* 1954). All the research values obtained were subjected to one-way analysis of variance (ANOVA) followed by Duncan's post hoc for multiple comparisons range test (DMRT) of Mean ± SEm (Standard error of mean). Data were analyzed using statistical software IBM-SPSS version 16.0 with a level of significance at $p < 0.05$.

RESULTS AND DISCUSSION

All the observations of various sediment parameters analyzed under this research study were presented in Table 1. The sand percentage, maximum was recorded in January and minimum in May, with the insignificant difference ($p > 0.05$) in months of October, November, and December, while there is significant difference in rest of the months. Silt was high in May and low in December, and a significance difference ($p < 0.05$) was recorded in February, March, April, June, July and August compared to other months. The highest percentage of clay was recorded in February and lowest in May, significance difference ($p < 0.05$) in January, March, April, June and September while it was insignificant difference ($p > 0.05$) in rest of the months.

In term of organic carbon, the highest percent was observed in October and lowest in May, there is a significance difference in February and August with rest of the months. Maximum percent of organic matter was observed in October and minimum in May, there is significance difference ($p < 0.05$) in December, February, and July with the rest of the months. Total nitrogen was recorded highest in January and lowest in May and a significance difference in February, July and June compared to other months. Similarly, the available phosphate was lowest in May and highest in October and a significance difference ($p < 0.05$) observed in January, February, June and

Table 1. Annual variations in mangrove sediment variables along Bhayander creek (Oct 2016 to Sep 2017).

Months	Sand (%)	Silt (%)	Clay (%)	Organic carbon (%)	Organic matter (%)	Total nitrogen (mg/100g)	Available phosphate (mg/100g)
October	38.07 ±0.015^{h}	41.65 ±0.035^{b}	20.27 ±0.019^{g}	2.54 ±0.189^{e}	4.38 ±0.327^{e}	262 ±18.938^{e}	6.10 ±0.455^{e}
November	38.108 ±0.017^{i}	41.47 ±0.035^{b}	20.43 ±0.018^{h}	2.40 ±0.194^{e}	4.14 ±0.334^{e}	254 ±19.353^{e}	5.77 ±0.464^{e}
December	38.12 ±0.002^{j}	35.11 ±3.964^{a}	20.77 ±0.006^{i}	2.25 ±0.177^{de}	3.88 ±0.306^{de}	232 ±17.719^{de}	5.41 ±0.425^{de}
January	39.44 ±0.003^{k}	41.03 ±0.010^{b}	19.53 ±0.007^{d}	2.50 ±0.096^{e}	4.32 ±0.165^{e}	267 ±9.577^{e}	6.01 ±0.230^{e}
February	36.19 ±0.005^{e}	42.42 ±0.013^{bc}	21.38 ±0.009^{l}	1.31 ±0.039^{a}	2.26 ±0.067^{a}	145 ±3.880^{a}	3.15 ±0.093^{a}
March	34.57 ±0.003^{d}	45.39 ±0.009^{cde}	20.04 ±0.005^{e}	1.48 ±0.051^{ab}	2.56 ±0.087^{ab}	157 ±5.067^{ab}	3.55 ±0.122^{ab}
April	33.12 ±0.006^{b}	47.57 ±0.015^{de}	19.31 ±0.009^{c}	1.38 ±0.036^{ab}	2.37 ±0.062^{ab}	144 ±3.637^{ab}	3.30 ±0.087^{ab}
May	31.25 ±0.003^{a}	51.61 ±0.006^{f}	17.14 ±0.004^{a}	1.28 ±0.018^{a}	2.20 ±0.030^{a}	136 ±1.754^{a}	3.07 ±0.043^{a}
June	33.39 ±0.004^{c}	48.31 ±0.010^{e}	18.29 ±0.007^{b}	1.65 ±0.036^{b}	2.84 ±0.062^{b}	171 ±3.585^{b}	3.95 ±0.086^{b}
July	34.57 ±0.004^{d}	44.25 ±0.015^{bcd}	21.17 ±0.010^{k}	1.94 ±0.017^{c}	3.35 ±0.030^{c}	198 ±1.698^{c}	4.66 ±0.040^{c}
August	36.62 ±0.002^{f}	42.29 ±0.005^{bc}	21.09 ±0.003^{j}	2.00 ±0.010^{cd}	3.45 ±0.018^{cd}	212 ±1.027^{cd}	4.81 ±0.025^{cd}
September	37.82 ±0.004g	42.03 ±0.013^{bc}	20.14 ±0.009^{f}	2.05 ±0.009^{cd}	3.54 ±0.015^{cd}	216 ±0.898^{cd}	4.93 ±0.022^{cd}

Mean ± SE with various superscripts (^{a,b,c,d,e,f,g,h,i,j,k}) in a column differ significantly ($p<0.05$) followed DMRT.

July with rest of the months.

Maximum organic carbon was recorded might be due to nutrient enrichment by disposing enormous quantity of industrial waste into creek system (Kumary *et al.* 2001). Subaiah and Asija (1956) reported that Poonthura estuary severely adulterated due to unprocessed domestic effluents in south east coast of India. During study, observation of availability phosphate (3.07 mg/100g) recorded lowest, since it be subject to the uptake of cations and anions by plants in the mangrove sediments (Sharma and Banik 2014). Sandy seaside location susceptible by weak tidal action cause through hydraulic and hydrodynamics progressions (Sathasivam *et al.* 2015).

During this study, the relationship of organic matter with a fine grain size of sediment was recorded, which is in accordance with Reddy *et al.* (2008). Since the finer particles offer intensification of non retting areas per component weight for the preoccupation of organic matter. Different variables reported maximum levels of organic carbon, organic matter, total nitrogen and available phosphorus, due to the carriage of pollutants from the aquatic column to the bed, adapted the change in mangrove sediment variables.

From the observations on Bhayander mangrove sediment advocates that soil pollution may be because of throwing away of religious refuges; effluent wastes from industrial belt along the adjacent of creek and unprocessed inland waste disposals. Progressive happenings around creek such as reclamation structure dumping along the creek side should be stopped up and mangrove farmstead should be done to withstand mangrove ecology around the Bhayander creek.

CONCLUSION

Observations recorded during this study, can be used as a baseline information for thoughtful knowhow about the seasonal variations of mangrove sediment

variables such as texture, composition and classification that will be helpful for students, PhD scholars, political bodies, state authorities and researchers from the Bhayander region. Mitigation actions such as the setup of effluent treatment plants will be ultimately reinstated and reserve the biodiversity of creeks and the associated mangroves. This will restore the natural mineralization process in water and sediments and improve the productivity of mangroves along the Bhayander creek system.

ACKNOWLEDGMENT

Authors are grateful to ICAR-CIFE (Deemed University) Mumbai, for supporting and providing the necessary facilities for data collection and analysis to conduct the research. It is grateful to acknowledge thanks to the authorities of Dr B. S. Konkan Krishi Vidyapeeth, Dapoli for permission to conduct research at CIFE, Mumbai.

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