

Short Communications

Distribution of organic carbon in the sediments of Cochin mangroves, south west coast of India

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Vertical and horizontal distribution pattern of organic carbon in the mangrove sediments have been studied. Concentration of organic carbon varied from 0.17 to 4.05% in the study area. Correlation and predilection between organic carbon and the texture of sediment are elucidated. Organic carbon has a proportional and patent relationship with the finer fractions (silt + clay) of the sediment. Inconsistent pattern concomitant with the inconsistent concentration in accumulation of organic carbon in the sediment with regard to vertical as well as horizontal distribution was discernible in the tidal area of mangrove swamp.

Total organic carbon of the sediment has a major role in keeping the fertility of soil and thereby flourishing the biological productivity. Since the mangrove ecosystem is one of the most productive aquatic ecosystem like coral reef and seagrass, an understanding of its organic carbon is prerequisite for assessing and also determining the extent of nutrient input into the surrounding mangrove water. In the present investigation an attempt has been made to study the horizontal as well as the vertical distribution pattern of sediment organic carbon in the intertidal areas of Cochin mangroves.

Sediments were collected from three mangrove areas located in the lower part of Cochin estuary (Fig. 1). Sampling was done once in three months for one year (March 1990 to March 1991). At each station samples were taken from three tidal levels [Low Tide Level (LTL), Mid Tide Level (MTL) and High Tide Level (HTL)] using a box corer (120 cm² area) up to 20 cm depth. Top 15 cm sample was taken and cut into three equal portions (0-5, 5-10 and 10-15 cm). A portion of sediment was taken from these three depth strata and analysed by the method described by Walkley & Black¹ and Wakeel & Riley². Before analysis, in the laboratory, the samples from each strata were dried in a hot air oven around 65°C. All debris and roots of mangrove flora were removed from samples and then finely pulverized.

Distribution pattern of organic carbon content with respect to tidal level and sediment depth is given in Table 1. Relatively higher values were recorded for

sediments in all the tidal levels of st. 2 and high tide level of st. 3. Spatial variations of organic carbon range from 0.17 to 1.17%, 1.23 to 2.97% and 0.35 to 4.05% at st. 1, st. 2 and st. 3 respectively. No distinct seasonal distribution pattern was perceived in organic carbon, during the present study, indicating the constant and eternal supply of mangrove detritus, irrespective of seasons, which give substantial flux of organic residues to the sediments by the decomposition process.

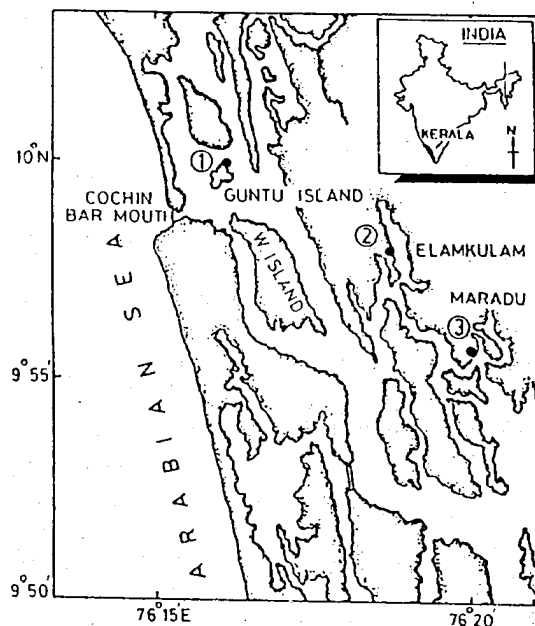


Fig. 1—Location of stations

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Table 1—Organic carbon (%) of sediments

Month	Depth	Station 1			Station 2			Station 3		
		LTL	MTL	HTL	LTL	MTL	HTL	LTL	MTL	HTL
March 1990	0-5	0.29	0.17	0.54	2.55	2.42	1.43	0.79	0.81	2.56
	5-10	0.41	0.69	0.99	1.92	1.97	1.59	0.75	0.92	1.32
	10-15	0.56	0.45	0.78	2.57	2.09	1.56	0.83	1.23	1.28
June	0-5	0.26	0.24	0.57	2.93	2.97	1.79	0.35	3.50	2.79
	5-10	0.42	0.66	0.83	2.01	2.54	1.62	0.68	3.15	2.15
	10-15	0.63	0.38	0.56	1.23	2.84	1.34	0.44	1.65	3.12
Sept.	0-5	0.21	0.41	0.36	1.95	1.44	1.44	0.74	3.00	3.30
	5-10	0.32	0.48	0.42	2.51	1.94	1.38	0.90	1.80	2.25
	10-15	0.51	0.77	0.56	2.64	1.74	1.50	0.78	1.20	2.85
Jan. 1991	0-5	0.42	0.48	0.56	2.03	1.85	1.67	0.69	0.96	4.05
	5-10	0.83	0.95	0.93	2.25	1.74	1.62	0.78	0.92	3.15
	10-15	0.66	1.01	1.17	2.81	1.86	1.65	0.89	0.93	1.80
March	0-5	0.72	0.45	0.61	2.24	1.80	1.39	0.56	0.96	2.10
	5-10	0.51	0.38	0.90	2.48	1.89	1.52	0.62	0.81	1.38
	10-15	0.64	0.22	0.87	1.92	1.63	1.68	0.83	0.75	1.12

LTL = Low Tide Level, MTL = Mid Tide Level, HTL = High Tide Level

A more or less horizontal pattern of organic carbon was discernible during the present study at each station and the concentration of organic carbon in each tidal level of the respective station depend upon the sediment textural characteristics. Organic carbon content increases with increasing finer fraction and decreases with the increasing coarser fraction in the sediments. One of the features of organic carbon in the sediments is that its concentration increases, as the particle size of the sediments decrease³. Statistical analysis between sediment particle size and organic carbon revealed a significant positive correlation of organic carbon with silt fractions in the HTL of st. 1 and all the tidal levels of st. 3. Similarly, clay fractions showed significant positive correlation with organic carbon in the LTL and MTL of st. 1 and MTL and HTL of st. 2 (Table 2). The finer fractions (silt + clay) showed an efficacious relationship with organic carbon while the coarser fractions have no patent kinship. Comparatively higher concentration of organic carbon at st. 2 and the mid and high tide levels of st. 3 plus the inadequacy of organic carbon at other areas may be owing to the variability of sediment.

A relatively lower percentage of organic carbon in the top soil (0-5 cm) than the subsurface at st. 1 could be attributed to the constant flushing activity by tides along with the impact of waves which removes the finer fractions of the sediments from the fringing area. The tidal influence and wave action are maximum at st. 1, since it is nearer to the barmouth area. Also the organic residues from the decomposed mangrove litter appear to be subsided more in the subsurface by

Table 2—Correlation coefficient (*r* values) between sediment particles and organic carbon

	Sand	Silt	Clay
Station 1			
LTL	-0.8363	-0.3390	0.9985**
MTL	-0.9988	-0.1064	0.9024**
HTL	0.6560*	0.9197**	-0.8189
Station 2			
LTL	-0.8542	0.3773	-0.3829
MTL	-0.1803	-0.3916	0.9655**
HTL	-0.9111	-0.3310	0.8390**
Station 3			
LTL	-0.2935	0.9410**	-0.8644
MTL	-0.9983	0.9931**	-0.9973
HTL	-0.8016	0.6088*	-0.2509

* - Significant at 5% level ($P < 0.05$)

** - Significant at 1% level ($P < 0.01$)

Degrees of freedom = 8

percolation process. Sahoo *et al.*⁴ stated that the percentage of organic carbon in the surface soil is higher than in subsurface in the Sunderbans mangroves and relatively higher values in the surface is due to the confinement of the organic residues in these layers. This type of seclusion of organic residues in the top soil of Sunderbans is incongruous with Cochin mangroves pertaining to st. 1 where the perceptible less concentration of organic carbon was found in the top soil than subsurface. Though the environmental conditions, particularly the distinct feature of tidal rhythms concomitant with the wave

action, are not congenial for the transudation and aggregation of organic carbon in the sediments at st. 1, these conditions are not seen to be detrimental to the ample supply and accumulation of organic carbon in other stations where the effect of waves are negligible. Therefore, the less concentration of organic carbon at st. 1 could be associated with possible disturbances pertaining to the sediment and its composition.

In the present study area, mixing and percolation of putrified vegetative matter at deeper layers might be less than that of surface and there was no compatible pattern of organic matter distribution between surface and bottom layer. Hence organic matter did not show a substantial increasing or decreasing trend towards the deeper layer. The supply of organic residues from the putrified vegetation deemed to be poured more into the unconsolidated soil and accumulate in the deeper layer. The leaching process, on the other hand, may be

excluded in the consolidated sediment where the intricate root system of mangrove flora restrain the nature of substratum particularly above the mid tide level as in the present study. All these factors, specific to mangrove ecosystem, could be attributed for the inconsistent concentration of organic carbon both horizontally and vertically.

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