Ecology of Indian Estuaries: Distribution of Organic Carbon in the Sediments of the Ashtamudi Estuary*

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Organic carbon (OC) content varies from 0.06 to 4.95%. On the basis of mean values of 8 zones, distribution of OC is lowest at zone H (marine) and highest at zone A (river), other zones presenting intermediate values. Higher levels of OC have been noticed in 2 sheltered areas out of the 8 zones examined.

Study of organic carbon (OC) in the sediments is of potential significance for a proper understanding of its flow in an aquatic ecosystem. Distribution and seasonal variation of OC in the sediments of Cochin backwaters have been reported1-4. But in Ashtamudi estuarine system in Kerala not much work has been done on the distribution of OC in the sediments5. In the present study OC in sediments from riverine to marine area of this estuarine system has been estimated.

For the present study 52 stations were selected from riverine to marine area and they were divided into 8 zones representing nearly 5-6 stations on the basis of noticeable ecological and other characteristic features (Table 1).

Sediment samples were collected from 52 stations during 3-17 March 1981 using a metal corer6. A portion of sediment for chemical analysis was oven dried at 100-105°C overnight, ground and sieved (0.5 mm sieve). Dried material was taken for OC7 and grain size analyses. Samples of overlying water were also taken and estimations were done using standard procedures9.

Among the hydrographical features of the overlying water, salinity was by far the only factor showing increasing trend from river (A) to marine (H) zone (Table 2). Temperature and dissolved oxygen content showed minor fluctuations and light penetration showed some variability.

Distribution of OC at different stations in the estuarine system is shown in Fig.1. Zone A sediments showed higher concentrations of OC in almost all stations and the content ranged from 0.9 (A6) to 3.24% (A1). Zone B showed erratic fluctuation in the OC level as well as in sediment texture. Zones C and D have similar characteristics with higher percentage of coarse sand and lower concentration of organic carbon. Many of the stations in zones E and G had coir

Table 1—Different Zones and Their Characteristics in Ashtamudi Estuary

<table>
<thead>
<tr>
<th>Zone</th>
<th>Characteristics</th>
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<tr>
<td>A - River (sts A1-A8)</td>
<td>Paper mill effluents, manual dredging, coir processing and heavy siltation</td>
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<tr>
<td>B-Confluence (sts B1-B7)</td>
<td>River mouth, siltation, isolated retting and paper mill effluents</td>
</tr>
<tr>
<td>C-Kanjirakode (sts C1-C7)</td>
<td>Interior most segment, algal and seagrass beds, intense fishing, coir processing, clam beds and industrial pollution</td>
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<tr>
<td>D-Ashtamudi (sts D1-D7)</td>
<td>Central portion of the estuary, intensive fishing, isolated retting and patches of algal beds</td>
</tr>
<tr>
<td>E-Chavara (sts E1-E6)</td>
<td>Interior area of the estuary and pollution from coconut husk retting</td>
</tr>
<tr>
<td>F-Thopilkadavu (sts F1-F6)</td>
<td>Isolated retting, coir processing and sheltered area</td>
</tr>
<tr>
<td>G-Kandachira (sts G1-G6)</td>
<td>Interior arm of the estuary, intensive retting and sewage pollution</td>
</tr>
<tr>
<td>H-Marine (sts H1-H6)</td>
<td>Zone closest to Arabian Sea, Neendakara harbour area, major fish landing centre on the south west coast of India, studded with several small islands, rich beds of algae and clams</td>
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processing units and the retting of coconut husks was more intensive all along the area and relatively maximum concentrations of OC were found. These 2 zones are topographically identical in their sheltered nature where the tidal influx is not pronounced.

Based on the average values of OC in the 8 zones of the Ashtamudi estuary (Table 2) 2 distinct distribution patterns are seen: (i) a minimum in the zone H and an increase towards the zone B and highest in zone A and (ii) relatively higher values in the 2 sheltered zones (E and G) which are characterised by the dense retting of coconut husks.

High OC in zone A is mainly derived from allochthonous sources by transport of leached and...
eroded material by the river and this input is further enhanced by the discharge of effluents from the Punalur Paper Mills. Report of high OC in the sediments of riverine area receiving the pulp mill effluent in Miramichi estuary\textsuperscript{10} is in agreement with the present investigation. Penetration of saline water into the upper reaches of zone A is noticed. Increased salinity in the zone B is correlated with the higher value of OC and this may be due to flocculation and settling of suspended organic matter during the ebb tide. In zones C and D which represent true brackishwater areas the flocculation is slower than in zone B because in this zone the seaward flow is more with the river discharge. The suspended load of particulates in the estuarine area is less when compared to the zone B. The low levels of OC in zones F and H can be explained by the fact that these 2 zones are near to the barmouth, and the tidal influx and efflux along with heavy siltation are more acute so as to change the whole physical structure of the sediments. Moreover in zone H there is dredging for navigational purposes. The relative abundance of burrowing organisms in this sector can cause bioturbation, a process of stirring of sediments by the activity of infaunal benthic organisms, and the activity results in virtually pumping interstitial water out of sediment and bringing in water mostly richer in oxygen and active transport of particulate material to the surface from the deeper layers\textsuperscript{11}.

In the absence of allochthonous organic matter in the zone H, autochthonous organic matter is mainly derived from primary production within the ecosystem and this source is also less in zone H than in the brackish zone and this is supported by the results of Murty and Veerayya\textsuperscript{1}.

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References