

Distribution of particulate organic matter in Rajapur and Vagothan estuaries (west coast of India)

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The distribution of particulate organic carbon (POC), particulate carbohydrates (PCHO) and particulate proteins (PP) in the suspended particulate matter was studied. The POC, PCHO and PP concentrations ranged from 176 to 883 $\mu\text{g.l}^{-1}$, 115 to 647 $\mu\text{g.l}^{-1}$, 1.5 to 4.4 mg.l^{-1} at Rajapur estuary and 290 to 893 $\mu\text{g.l}^{-1}$, 108 to 653 $\mu\text{g.l}^{-1}$, 2.4 to 4.7 mg.l^{-1} at Vagothan estuary respectively. Correlation analysis showed that PCHO appeared to be associated with living phytoplankton at both the estuaries, however, POC formed a major source of PCHO at Vagothan estuary. Considerable quantity of organic matter was also associated with detritus originating from runoff.

The organic matter of natural waters consists of all major classes of naturally occurring compounds such as carbohydrates, proteins, lipids and other constituents of living organisms¹. Distribution of particulate carbohydrates and proteins for Indian waters has been reported earlier¹⁻⁶. However, very little information is available on the distribution of these compounds from the estuarine waters. In the present paper short term variations (4 months) in chlorophyll-*a* (chl-*a*), particulate organic carbon (POC), particulate carbohydrate (PCHO) and particulate protein (PP) are presented and discussed.

Surface water samples were collected at fortnightly intervals during January-April 1990 from Rajapur and Vagothan estuaries (Fig. 1) at Musakaji point (st. 1) and Vijaydurg point (st. 2) respectively (Fig. 1) using clean plastic containers. Immediately after collection the samples were filtered through 100 μm mesh plankton net for removal of any zooplankton. The zooplankton free water sample was then filtered through Whatman GF/C filters for chl-*a* and pre-combusted (450°C) Whatman GF/C filters for POC, PCHO and PP analysis. The filter papers for POC, PCHO and PP analysis were dried at constant temperature (60°C) before analysis. Chl-*a*, POC and dissolved nitrate were analysed following the methods of Parsons *et al.*⁷ PCHO and PP were determined by phenol-sulphuric acid method⁸ and folin-phenol method⁹ respectively.

The fortnightly distribution pattern of chl-*a*, POC, PCHO and PP at Rajapur and Vagothan es-

tuaries are shown in Fig. 2. The values reported here for PCHO concentrations were more or less similar to those reported from estuarine⁴ and coastal waters^{5,6}. The PCHO concentrations at Rajapur and Vagothan estuaries ranged from 115 to 647 $\mu\text{g.l}^{-1}$ and 108 to 653 $\mu\text{g.l}^{-1}$. There were wide variations in the concentrations during the study period. The PP concentrations at Rajapur and Vagothan estuaries ranged from 1.5 to 4.4 mg.l^{-1} and 2.4 to 4.7 mg.l^{-1} respectively. Three peaks were observed, one each at the end of January, March and mid April at Rajapur estuary (Fig. 2A). On the other hand two peaks were observed

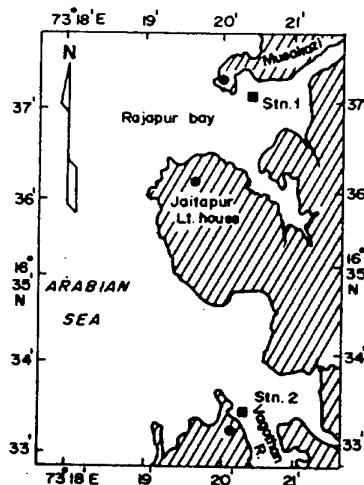


Fig. 1—Location of stations

at Vagothan estuary, the first during mid February and the second in mid April (Fig. 2B). This might be due to more phytoplankton production during the respective periods as evident from chl-*a* data during the study period.

The higher concentrations of PCHO observed during the mid April period at both Rajapur and Vagothan estuaries might be due to more phytoplankton production which was also evident from low nitrate concentration ($< 0.02 \mu\text{g-at.l}^{-1}$) observed at both the stations.

The POC, chl-*a*, PCHO and PP concentrations showed more or less similar interrelationship in distribution at both Rajapur and Vagothan estuaries but it was more prominent in the former case as compared to the latter. The correlation analysis carried out showed good relation of chl-*a* with PCHO ($r=0.82$, $n=7$, $p=0.01$) while there was poor correlation between other parameters at Rajapur estuary. However, at Vagothan estuary there was good correlation between chl-*a* and PCHO

($r=0.61$, $n=7$, $p=0.05$) and POC and PCHO ($r=0.91$, $n=7$, $p=0.001$). There was poor relationship between chl-*a* and POC. Poor relationship was observed between protein and other parameters.

A plot of POC/chl-*a* ratio against chl-*a* (Fig. 3) showed that there was fall in the ratio at a chl-*a* value of approximately $1.5 \mu\text{g.l}^{-1}$, which thereafter remained constant with further increase in chl-*a* concentration. High POC/chl-*a* ratios were related to detritus, while lower ratios were related to healthy phytoplankton¹⁰. Similar trends were also observed for POC/chl-*a* ratio against chl-*a* from the shelf waters between Vishakhapatnam and Bhimavaram coast⁶ and from the Vishakhapatnam harbour waters¹¹.

The data indicates that living phytoplankton were the major source of PCHO at Rajapur estuary while at Vagothan estuary besides living phytoplankton there was substantial contribution to the PCHO from the detrital material originating from the mangrove swamps all along the upper reaches of the estuary. The detrital material was of poor proteinaceous nature at both the estuaries with no significant relationship with any of the parameters.

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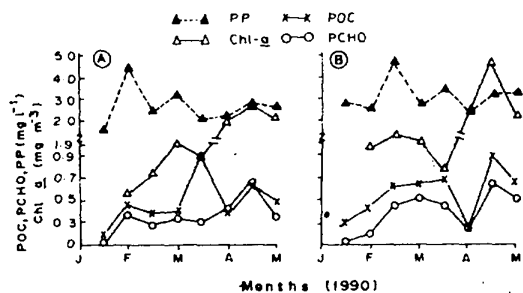


Fig. 2—Distribution of PP, PCHO, POC, chl-*a* in (A) Rajapur and (B) Vagothan estuaries

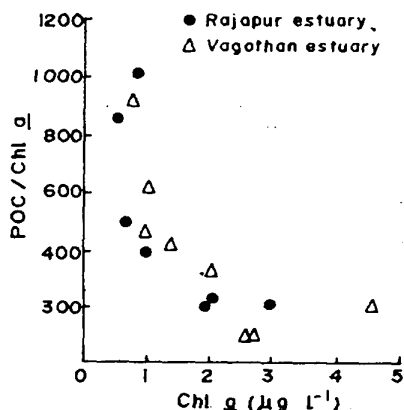


Fig. 3—Variation of POC/chl-*a* ratio with chl-*a*

References

- Qasim S Z & Sankarnarayanan V N, *Mar Biol*, 15 (1972) 193.
- Prémusic E E, Benkovitz C M, Gaffney J S & Walsh J K, *Org Geochem*, 4 (1982) 63.
- Sasamal S K, Sahu B K & Panigrahy R C, *Indian J Mar Sci*, 15 (1986) 129.
- Kamat S B, *Indian J Mar Sci*, 5 (1976) 232.
- Sankarnarayanan V N, *Indian J Mar Sci*, 11 (1982) 253.
- Sarma N S & Nageswara Rao I, *Indian J Mar Sci*, 18 (1989) 24.
- Parsons T R, Maita Y & Lalli C M, in *A manual of chemical and biological methods for seawater analysis*, (Pergamon Press, New York) 1984, 63.
- Dubois M, Gilles K A, Hamilton J K, Reebers P A & Smith F, *Anal Chem*, 28 (1956) 350.
- Lowry H, Rosebrough N J, Farr A L & Rendoll R J, *J Biol Chem*, 17 (1951) 247.
- Subramanian B R & Venugopalan V K, *Indian J Mar Sci*, 9 (1980) 246.
- Nageswara Rao I, Annapurna K & Sarma N S, *Indian J Mar Sci*, 20 (1991) 123.