

Short Communication

Particulate carbohydrates in the Bay of Bengal

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Particulate matter collected from 77 water samples over a 3000 m water column was analyzed for particulate carbohydrates (PCHO). PCHO in the surface waters ranged from 43 to 143 $\mu\text{g.l}^{-1}$, and below 250 m it was < 16 . PCHO showed large variations at all the depths and decreased with depth. PCHO values were higher than those reported from the other oceanic regions. Despite this, PCHO demonstrated similar depth gradient as observed in other oceanic waters.

There are many reports on the distribution of particulate carbohydrates (PCHO) in the temperate and sub-tropical marine environments^{1,2}, while, very little information is available from the Bay of Bengal³. In this paper, distribution of PCHO in the oceanic waters of the Bay of Bengal is discussed.

Seawater samples were collected using Niskin water samplers from surface to 3000 m depths at 9 stations (Fig. 1) during 19th cruise of *ORV Sagar Kanya* in the central Bay of Bengal from 10 October to 15 November 1985. The PCHO was analyzed as described earlier⁴. After extracting the filters with 90% acetone, chlorophyll *a* concentrations were estimated spectrophotometrically.

PCHO varied from 43 to 143 $\mu\text{g.l}^{-1}$ ($\bar{X} = 79.84 \mu\text{g.l}^{-1}$ at the surface water only) (Fig. 2). At st 250 (Fig. 1), the ship was anchored for 6 d during which daily variations in the surface PCHO concentrations were monitored. PCHO varied from 40.76 to 61.15 $\mu\text{g.l}^{-1}$ during a week's time, suggesting short term temporal variations in the concentrations which probably may be caused due to variable phytoplankton species composition. The present values for PCHO are more or less similar to those observed earlier in the surface waters of the Bay of Bengal³, and are somewhat higher than those reported from the other oceanic waters^{1,6,7}. Relatively higher values observed here are probably due to higher primary production⁸ as well as large inputs of organic matter from 6 major rivers of the Indian sub-continent⁹. These higher surface concentrations are in turn reflected in the increased subsurface concentrations all the way to 1000 m. But at greater depths, PCHO values are similar to those reported from other marine environments^{1,10}.

Despite the widely scattered values of PCHO, its concentration decreased exponentially following the equation

$$\text{PCHO} = \text{PCHO}_0 e^{KZ}$$

where PCHO_0 is the PCHO at the surface, K is the decay coefficient and Z is the depth (m). This equation was fitted to the data from individual station as well as to the mean values at each depth for all stations (Fig. 2). The decay coefficient was constant, ranging from -0.0023 to -0.0031 . This is higher than decay coefficients calculated from the data of Romankevich¹, and Handa¹⁰ (Table 1). A graphic comparison of data from these areas shows that regardless of the depth the rate of decrease is always greater in the Bay of Bengal. However, below 1000 m, there is no appreciable difference in the decrease of PCHO in these areas.

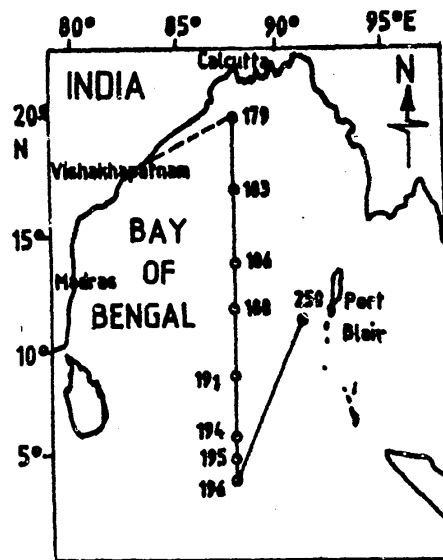


Fig. 1—Location of sampling sites

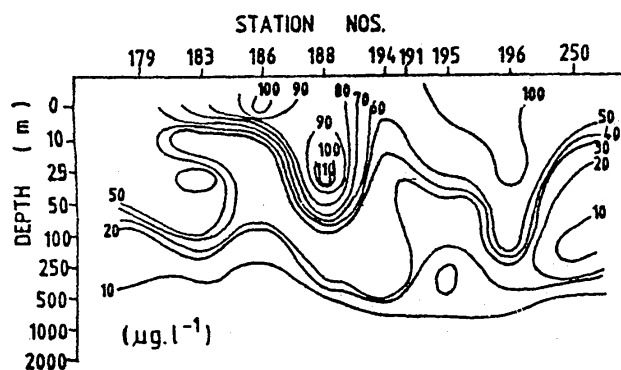


Fig. 2—Contours showing distribution of PCHO ($\mu\text{g.l}^{-1}$) with depths at various stations

Table 1—Decay coefficient for PCHO from Pacific Ocean, Japan Sea and Bay of Bengal

Location	K_0 -1000 m	K_0 -500 m	PCHO ₀ ($\mu\text{g.l}^{-1}$)
Pacific Ocean	-0.0017	-0.0027	35.50
Japan Sea	-0.0014	-0.0028	48.28
Bay of Bengal*	-0.0028	-0.0042	79.84

*Present study

The observed decrease in PCHO was probably due to preferential utilization of labile carbohydrate of reserved polysaccharides. Handa and Yanagi⁷ observed that 19 to 36% of PCHO is labile. If we assume the upper limit (36%) of labile PCHO for the Bay of Bengal samples then we get $28.74 \mu\text{g.l}^{-1}$ of this fraction. The PCHO decreased from surface ($79.84 \mu\text{g.l}^{-1}$) to 500 m ($9.91 \mu\text{g.l}^{-1}$). If all the water extractable carbohydrate ($28.74 \mu\text{g.l}^{-1}$) is degraded as the particulate matter sinks to 500 m then $41.19 \mu\text{g.l}^{-1}$ (59%) of water insoluble carbohydrate might have been removed during the descent. This observation suggests that in addition to the removal of water extractable storage carbohydrates some degradation of structural or residual carbohydrate

takes place as the particulate matter sinks to deeper water.

Irrespective of the water masses, the mean of PCHO ($\mu\text{g.l}^{-1}$) decreased from surface to bottom waters (surface 51.12, intermediate 15.17 and bottom 5.65). This strongly suggests active transport of PCHO from surface to deep water rather than advection of water masses containing higher and lower levels of PCHO.

Regression analysis of PCHO and chlorophyll *a* did not show a significant correlation coefficient indicating very little actively growing phytoplankton was associated with the PCHO of particulate matter in the upper 100 m water column. This implies that the particulate matter may be of detrital in nature and perhaps results from the decomposition of living phytoplankton in the overlying waters or might have been derived from the terrigenous organic matter brought into the Bay by the rivers.

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