

## CARBOHYDRATE CONTENT IN THE SURFACE WATERS OF THE BAY OF BENGAL

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### INTRODUCTION

Of the different organic constituents in sea-water, attention has been drawn only recently to the presence of substances in sea-water responding to analytical tests for carbohydrates. Even though Collier (1953) and Collier *et al.* (1950, 1953) detected these substances in the Gulf of Mexico in amounts up to 50 mg./l. and Wangersky (1952) isolated a dehydro-ascorbic acid in sea-water of the same area said to be present in inshore waters in concentrations reaching even 0.1 gm./l., it was the work of Lewis and Rakestraw (1955) who perfected the methods for quantitative estimation of the carbohydrates in sea-water which forms the basis of our knowledge regarding the distribution of carbohydrates in sea-water. The latter authors found that the mean dissolved carbohydrate content in the surface waters of the Pacific Ocean is 0.31 mg./l. while in the coastal lagoons it is found up to 7.9 mg./l. Recently Antia and Lee (1964) have determined "free" amino sugars in sea-water.

It is evident that more information is required not only regarding the quantities in which the dissolved carbohydrates are present in sea-water but also their distribution in the various seas. Further, very little is known about the distribution of carbohydrates in the Indian seas. The cruises of the oceanographic vessel I.N.S. Kistna, taking part in the Indian programme of the International Indian Ocean Expedition was, hence, availed of for collection of water samples in the Bay of Bengal. The results of carbohydrate determination on these water samples are presented here.

### METHOD

The surface sea-water was collected at eighteen stations during the VI and VII cruises of I.N.S. Kistna in the Bay of Bengal. Samples of water from the first twelve stations were collected in four-litre quantities and stored in large coloured bottles while water from the remaining stations were collected in 125 ml. reagent bottles. Mercuric chloride was added to the water soon after collection to give a concentration of 0.1 mg./l. to prevent bacterial

action (Jeffrey and Hood, 1958). The water was analysed at various times after collection.

One portion of each water sample was filtered through a bacterial filter (Jenkins and Co., U.S.A.) which removed all particulate matter of the size of bacteria. The method used by Dubois *et al.* (1956) for the estimation of total sugars was not sensitive enough to detect carbohydrates in sea-water. Instead, the method used by Lewis and Rakestraw (1955) was found to be suitable and anthrone was used in preference to N-ethyl carbazole. The optical density was measured at  $627\mu$  using a S.P. 600 Unicam Spectrophotometer. Sucrose was used as a standard in the range from 0 to 10 mg./l. and appropriate dilutions were prepared at the same time when estimations on sea-water were made. A correction factor was applied to all readings to account for the increase due to the presence of chloride ion against the distilled water blank (Lewis and Rakestraw, 1955).

### RESULTS

The results obtained are tabulated (Table I) along with the temperature, salinity and oxygen content of the surface waters at the time of collection. It may be observed that the carbohydrate content is higher in unfiltered water samples in contrast to sea-water filtered through a bacterial filter. The carbohydrate content in the unfiltered sea-water samples ranges from 1.1 mg./l. when taken away from the shore (Station 185— $16^{\circ} 30' N.$ ,  $86^{\circ} 00' E.$ ; about 700 kilometres from Madras and about 380 kilometres from the nearest shore) to 6.9 mg./l. when collected from the inshore region near the Andaman Islands (Station 161— $11^{\circ} 41' N.$ ,  $93^{\circ} 00' E.$ ; about 10 kilometres from Port Blair, Andamans). However, the same samples of water filtered through a bacterial filter show a carbohydrate content of 0.08 mg./l. and 0.53 mg./l. respectively. It is presumed that the values obtained for unfiltered water samples denote the carbohydrate content of the dissolved as well as the particulate matter in the sea. However, the results obtained for the filtrates through the bacterial filter possibly indicate the amount of dissolved carbohydrates in sea-water.

TABLE I

*Carbohydrate content in eighteen stations of Bay of Bengal*

No.	Date and time of collection	Station	Location of the station		Temp. at the time of collection* (° C.)	Oxygen content* (ml. l.)	Salinity* (‰)	Carbohydrate content (mg./l.)		Remarks
			Latitude	Longitude				Un filtered sea-water	Sea-water filtered through a bacterial filter	
1	23-2-1963 (0510 hr.)	147	08° 30' N.	84° 20' E.	27.1	3.86	34.14	3.1	0.10	..
2	24-2-1963 (0635 hr.)	150	08° 30' N.	87° 02' E.	28.5	4.03	33.98	3.8	0.15	..
3	25-2-1963 (0250 hr.)	153	08° 20' N.	90° 00' E.	27.7	4.14	33.37	3.1	0.30	..
4	26-2-1963 (0610 hr.)	156	09° 33' N.	91° 53' E.	27.9	3.90	33.01	2.7	0.31	..
5	26-2-1963 (2330 hr.)	158	09° 31' N.	94° 00' E.	27.3	4.04	32.81	6.5	0.30	..
6	27-2-1963 (1835 hr.)	160	10° 40' N.	94° 48' E.	27.3	4.13	32.75	5.3	0.12	..
7	2-3-1963 (1650 hr.)	161	11° 41' N.	93° 00' E.	27.6	3.93	39.90	6.9	0.59	Inshore region near Port Blair, Andaman Islands
8	3-3-1963 (0645 hr.)	163	11° 30' N.	95° 00' E.	27.8	4.05	31.10	5.5	0.23	..
9	5-3-1963 (0510 hr.)	169	15° 02' N.	91° 58' E.	26.9	3.70	31.72	4.4	0.10	..
10	6-3-1963 (0630 hr.)	173	14° 12' N.	88° 41' E.	27.6	4.19	32.45	2.1	0.14	..
11	7-3-1963 (1650 hr.)	177	13° 15' N.	85° 01' E.	28.2	4.17	34.47	2.4	0.08	..
12	8-3-1963 (1512 hr.)	180	13° 20' N.	82° 00' E.	28.4	3.99	33.62	2.6	0.12	..
13	14-3-1963 (1630 hr.)	182	14° 01' N.	81° 00' E.				1.4	0.09	..
14	15-3-1963 (0630 hr.)	183	18° 50' N.	81° 56' E.				1.2	0.12	..
15	15-3-1963 (2100 hr.)	184	16° 30' N.	83° 30' E.				2.6	0.15	..
16	16-3-1963 (1345 hr.)	185	16° 30' N.	86° 00' E.		Data not available.		1.1	0.08	..
17	17-3-1963 (0230 hr.)	186	16° 30' N.	88° 15' E.				1.6	0.10	..
18	..	Madras	13° 40' N.	80° 17' E.				3.6	0.42	Inshore region near Madras
Mean								3.3	0.19	
Standard deviation for duplicate samples								±0.3	±0.07	

\* Data obtained from the estimations on board the ship.

For easy reference the place of collection and the dissolved carbohydrates (value for water filtered through the bacterial filter) at that station are given in Fig. 1. It is of interest to note that the dissolved carbohydrates increase with the proximity to the shore. Thus, the highest values obtained are from water samples collected from the inshore regions of Madras (0.42 mg./l.) and Port Blair (0.59 mg./l.). On

the other hand, in the off-shore regions it varies from 0.08 mg./l. to 0.31 mg./l.

#### REMARKS

The results reported by Lewis and Rakestraw (1955) seem to indicate that the amount of carbohydrates along the Pacific coast is also small. They found that while the dissolved carbohydrates varied from 0.16 to 0.45 mg./l.



(using anthrone) in the inshore regions, the unfiltered sea-water had a total carbohydrate content of less than 0.7 mg./l. in the open sea. As they obtained similar results from unfiltered

## SUMMARY

The total as well as the dissolved carbohydrates in surface water samples collected from eighteen stations in the Bay of Bengal

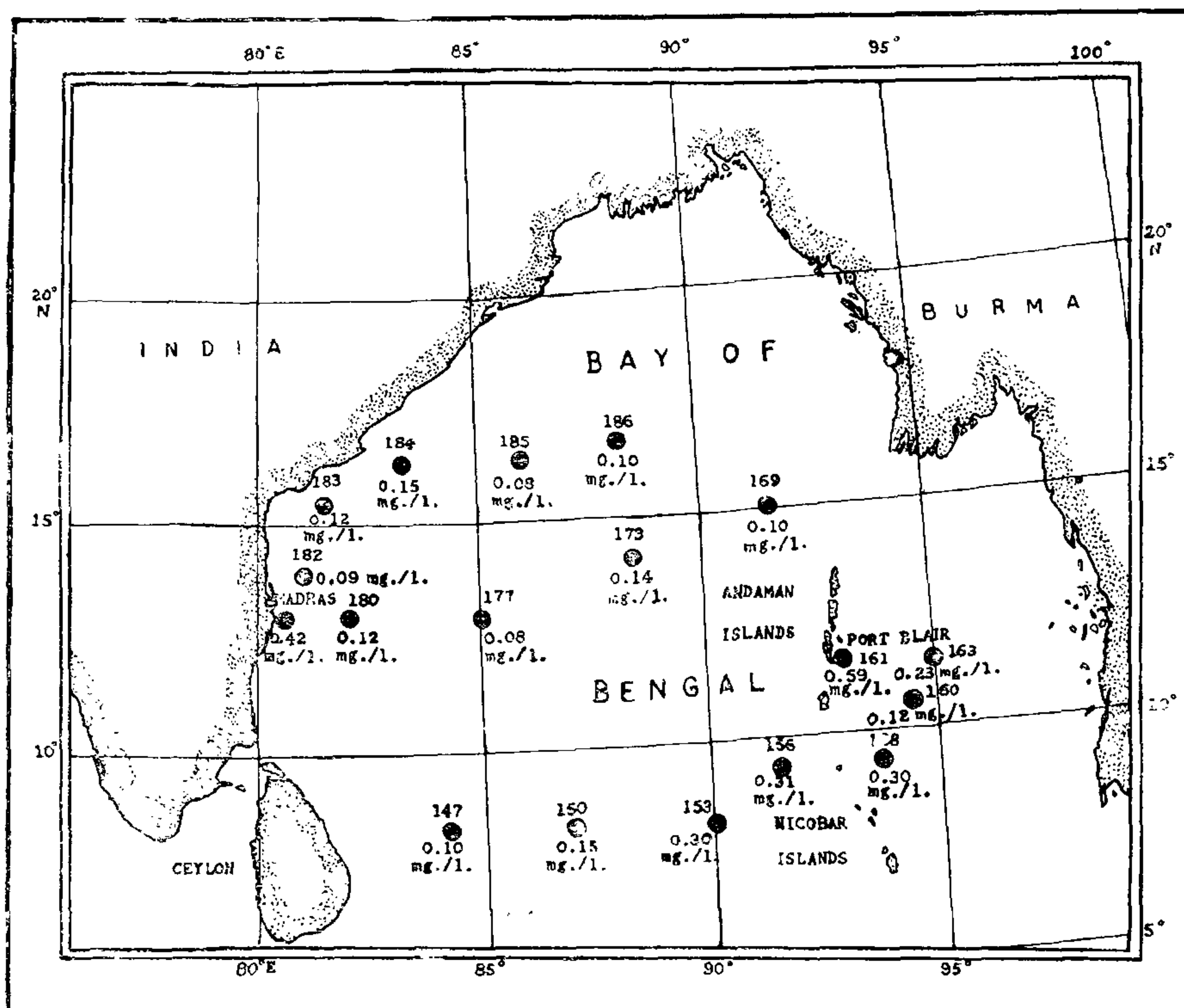


FIG. 1. Location of the stations with the amount of dissolved carbohydrates.

and filtered samples, they came to the conclusion that "the relative amount of such particulate material is small" at least along the Pacific Coast. It may be deduced from the results of the present investigation that the quantity of particulate material in the surface waters of the Bay of Bengal is considerable. However, there does not appear to be any concentration of carbohydrates in these waters as has been reported in the Gulf of Mexico by Collier (1953) and Collier *et al.* (1950, 1953) who detected them in amounts up to 50 mg./l.

It is proposed to continue the work when more samples are available.

were estimated. While the quantity of total carbohydrates ranges from 2.04 mg./l. to 6.9 mg./l. (mean: 3.3 mg./l.), the dissolved carbohydrates vary between 0.08 mg./l. and 0.59 mg./l. (mean: 0.19 mg./l.). Further, the carbohydrates dissolved in sea-water show an increasing concentration with the proximity to the shore.

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## ISOLATION OF CHIKUNGUNYA VIRUS FROM *Aedes aegypti* FED ON NATURALLY INFECTED HUMANS IN CALCUTTA

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**E**PIDEMIOLOGICAL evidence and laboratory transmission studies have implicated *Aedes aegypti* as the principal vector of chikungunya virus in the recent epidemics in Calcutta.<sup>1-4</sup> It has been of interest therefore to determine whether humans circulating the virus could infect this species. For this purpose a colony of *Aedes aegypti* was established at the Calcutta School of Tropical Medicine from larvæ and pupæ collected from Calcutta City and nearby Howrah.

Unfortunately it was difficult to persuade people to allow themselves to be fed on by the mosquitoes. However, five individuals with fever and clinical symptoms similar to those associated with chikungunya virus infection gave permission. Since most arboviruses circulate during the earliest phase of the illness, and generally only for a relatively short period, it was necessary to feed the mosquitoes before the diagnosis was definitely established. In the present trials, virus was isolated from the blood of only three of the patients.

The first patient was an entomological technician who was presumably infected while collecting mosquitoes in localities where cases of chikungunya virus infection were occurring. He became ill on July 27, 1964. On July 29th, he was exposed to 40 *Aedes aegypti* and thirty-eight of them engorged. Chikungunya virus was isolated from a blood sample obtained at the time the mosquitoes were feeding, the titer of which was approximately  $10^4$  LD<sub>50</sub>/0.02 ml. The mosquitoes were kept at room temperature until August 5th when they were allowed to feed on normal infant mice from the laboratory colony before shipment to the Poona headquarters of the Virus Research Centre.

During this interval 16 of the mosquitoes died but all of the remaining mosquitoes were successfully transported by air in closed wooden containers. After arriving in Poona, the mosquitoes were maintained in an environmental room at about 30° C. and 80% relative humidity. On August 11th, 13 days after feeding, each of a group of eight of the mosquitoes was allowed to feed on a separate two-day-old mouse but none of the mice became sick. Individual two-day-old mice were again exposed to the bite of several mosquitoes on August 17th and one of these became ill on the 4th day after the feeding. An agent was isolated from its brain which was identified as chikungunya virus by complement fixation test with known normal and hyperimmune sera. A third feeding was

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