Indian J. Microbiol, 30 (1) March, 1990, pp. 89-92

SHORT COMMUNICATION

Relationship between Heterotrophic Bacteria and Suspended Particulate Matter in the Arabian Sea.

Microbiological investigations of the oceans around Indian peninsula are to a large extent limited to the coastal areas (1-3), because of the paucity of vessels to undertake cruises for bacteriological work and also difficulties involved in conducting microbiological work at sea. In this communication, distribution of heterotrophic bacteria and suspended particulate matter (SPM) in the Arabian sea off Quilon, Kerala, the South West Coast of India are presented. This study was conducted during the cruise on board R. V. Skypjack, with an objective to record the aerobic heterotrophic bacteria found in the sea which play a very cruicial role in the decomposition of particulate matter and regeneration of nutrients (4) in the otherwise oligotrophic marine environment.

Location of the sampling stations is shown in Fig 1. Surface water samples were collected with Nansen bottles operated by hydraulic winch and a portion of it was transferred to 250 ml sterile glass bottles and stored in the refrigerator till processing. Water samples were collected from three depths at every station viz , secchi disc depth, mid secchi disc depth and surface (Secchi disc is a device to measure the depth of water upto which the visible light penetrates). Estimation of SPM was done by filtering 1 l of water sample through preweighed whatman GF/C glass fibre filter (0.45 μ pore size, 4.7 cm dia). The filter was then dried to constant weight at 70°C and the difference in the weight was recorded as SPM For bacteriological analysis, the water samples were plated on to Zobell's Marine agar 2216 in duplicate by serial dilution using the spread plate technique. After incubation for 5d, at 30°C, bacterial colonies were counted and recorded as total viable count (TVC). Morphologically distinct colonies were isolated and identified (5, 6). Some representative genera were tested for their capacity to hydrolyse starch, gelatin and tween-80 (7).

Bacterial number in the Arabian sea off Quilon ranged from 0.75 to 9×10^4 ml^{-1} with an average of 4.01×10^5 ml^{-1}. Bacterial population in these waters are found to be lower than that in the coastal areas (1) and higher than that in the surface waters of the wadge bank region of the Indian Ocean (8). This could be due to the area of study, which is away from the shore but within the continental shelf margin. These waters may not be oligotrophic as in the open ocean and at the same time may not be organically rich like the coastal waters. The average bacterial count showed a decreasing trend away from shore in the 8° 40'N transect, while this phenomenon was not observed for 9° 40'N transect. The bacteria encounted in this region of Arabian Sea were mostly gram negative and belonged to the genera of *Pseudomonas Aeromonas, Moraxella, Vibro, Acinetobacter, Micrococcus* and the pigmented forms *Flavobacterium* and *Cytophaga* (Table 1). Members of genus *Pseudomonas* were found to be most

predominant at all the sampling stations, while other genera were less frequent. This observation is in conformity with the earlier findings (9).

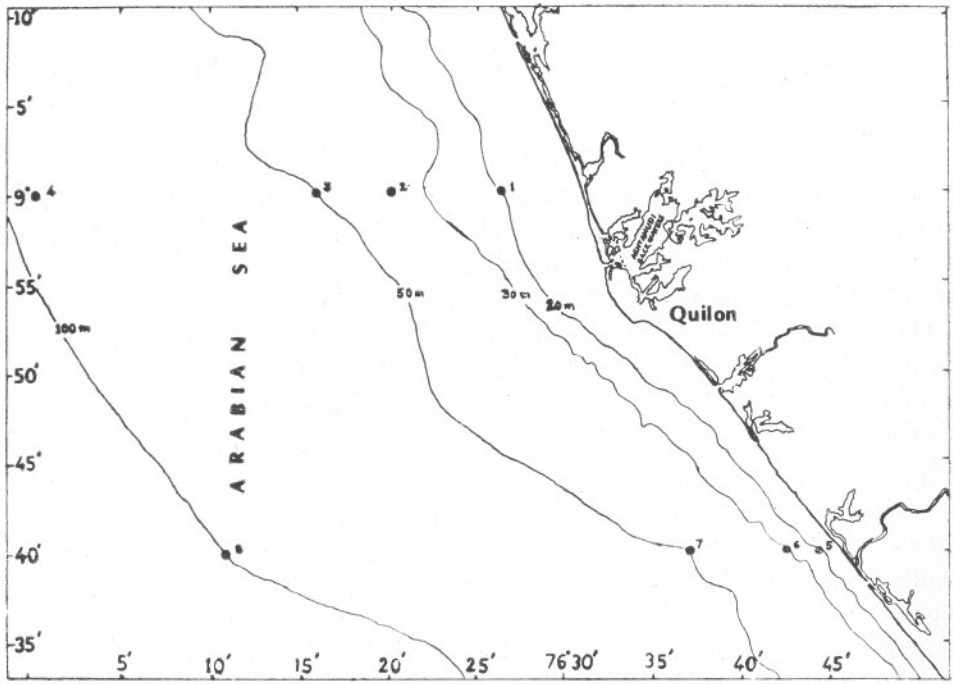

Fig. 1. Location of sampling stations.

The total SPM in the surface waters off Quilon ranged from 8–30 mg l^{-1} with an average of 15 mg l^{-1}. The SPM values decreased away from the shore upto 50 M depth stations and then again increased at 100 M depth stations (Stns 4 and 8, Fig. 1). Although the sampling stations are located within the continental shelf in the present study, the SPM values are not as high as those at the eastern continental shelf. (10). A positive correlation coefficient (+0.65) has been observed between the TVC and SPM levels (Fig. 2). Similar results have been reported with the distribution of particulate organic carbon in the Sagami and Tokyo Bay (11). The particles are reported to contain carbohydrates and proteins in similar concentrations as that found in the living phytoplanktons (12). The representative genera tested for their extracellular enzyme activity in the present study were found to be quite active in degrading starch, gelatin and tween-80 (Table 2). These results indicate that the heterotrophic bacteria play a very important role in the decomposition of the macromolecules found in the particles into smaller fragments or monomers for the assimilation by other flora and fauna.

Table 1. Distribution of bacterial genera in the surface waters of Quilon

Stn. No. (Secchi disc depth)	Genus	Surface	Mid Secchi depth disc ($\times 10^5$ ml^{-1})	Secchi disc depth
1	*Pseudomonas*	4.6	3.8	8.1
(4m)	*Vibrio*	1.1	—	—
	Moraxella	3.3	—	—
	Acinetobacter	—	2.6	—
2	*Pseudomonas*	3 2	1.4	1.7
(5m)	*Cytophaga*	—	—	0.3
	Acinetobacter	—	—	0.2
	Micrococcus	—	—	0.5
3	*Pseudomonas*	0.9	2.3	3.9
(6m)	*Acinetobacter*	0.45	—	—
	Flavobacterium	—	0.4	—
	Moraxella	—	2.0	1.8
4	*Pseudomonas*	1.1	2.3	4.9
(6.5m)	*Aeromonas*	0.3	—	0.4
	Acinetobacter	—	0.6	—
	Flavobacterium	0.1	—	—
	Cytophaga	0.1	—	—
5 (9m)	*Pseudomonas*	6.8	2.9	9.9
6 (10m)	*Pseudomonas*	3.5	0.76	0.75
7 (8m)	*Pseudomonas*	1.6	4.9	8.5
8	*Pseudomonas*	1.2	2.1	4.6
(4m)	*Ameromonas*	0.4	1.3	0.6
	Vibrio	—	0.3	0.1
	Flavobacterium	0.3	0.6	—

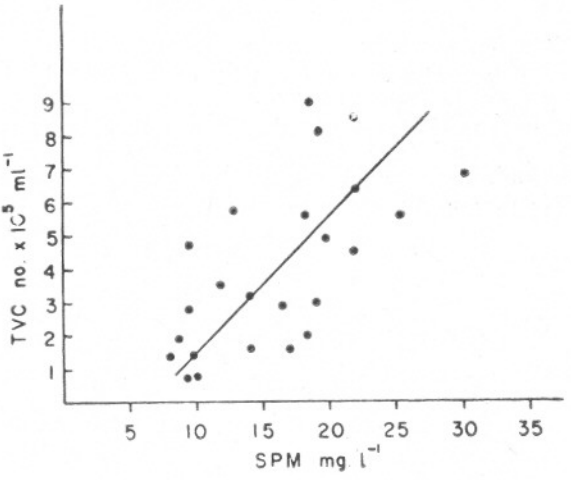

Fig. 2. Relationship between total viable counts (TVS) of aerobic heterotrophic bacteria and suspended particulate matter (SPM).

Table 2. Hydrolysis of starch, gelatin and tween-80 by aerobic heterotrophic bacteria

Genus	No. of Isolates tested	Starch	Gelatin	Tween-80
Pseudomonas	3	+−|−	+−−−	+−|−
Aeromonas	3	+++	+++	++−
Vibrio	2	+−	++	−+
Moraxella	1	−	−	−
Acinetobacter	1	−	−	−
Micrococcus	1	+	+	+
Flavobacterium	1	+	+	−
Cytophaga	1	+	−	−

Acknowledgements : The author is thankful to Dr. P.S.B.R. James, Director and Dr. P.V.R. Nair retired Jt. Director and Shri M.S. Rajagoplan, Head, Fisheries Environmental Management Division for the encouragement.

Central Marine Fisheries Research Institute,
P. O. Box 2704,
Cochin-682 031, INDIA.

S. V. ALAVANDI

References

1. Alavandi SV 1989 Indian J Mar Sci 18 : 174.
2. Kannan L and Vasanta K 1986 Indian J Mar Sci 15 : 267.
3. Vasanta K and Kannal L 1987 Mahasagar 20 : 35.
4. Hobbie JE and Leb WPJ (eds) 1984 Heterotrophic Activity in the Sea, Plenum Press, New York 569.
5. Buchanan E and Gibbons NE 1974 Bergey's Mannual of Determinative Bacteriology, 8th ed, The Williams and Wilkins Co. Baltimore, 1268.
6. Oliver JD 1982 Deep Sea Res 29 : 785.
7. Colwell RR and Wiebe WJ 1970 Bull Georgia Acad Sci 28 : 165.
8. Alavandi SV 1989 Proc first workshop on the scientific results of FORV/Sagar Sampada, Cochin 5-7 June 1989, sponsored by DOD & ICAR, organised by CMFRI, Cochin (In press).
9. Zobell CE 1946 Marine Microbiology, Cronica Britanica Co., Waltham, USA, 240.
10. Rao M 1985 Indian J Mar Sci 14 : 15.
11. Fukami K, Simidu U and Taga T 1983 Canadian J Microbiol 29 : 573.
12. Wangersky PJ 1984 In : Hobbie JE and Leb WPJ (eds) Heterotrophic Activity in the Sea. Plenum Press, New York 569.