Journal of the Indian Fisheries Association
18, 1988, 393-399

HUMIC ACIDS IN SEDIMENTS OF NORTH-CENTRAL ARABIAN SEA, WEST COAST OF INDIA

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ABSTRACT

Sediment samples (28) collected during the ORV SAGAR KANYA cruise-29, were analysed for humic acid (HA) concentration from the North-Central Arabian Sea. Generally oceanic samples had more HA concentration than the continental shelf (< 200 m depth) samples. The photo-acoustic infrared spectra of shelf sediment HA indicated the presence of more C - H saturated aliphatic chains, while oceanic HA had few peaks for the above groups. Both the IR spectra indicated the absence of aromatic C = C, carbonyl, ketonic groups. Clayey-silt sediment generally had higher concentration of HA compared to sandy - silt typeof sediment.

INTRODUCTION

The Study of humic substances (humic acid, fulvic acid and humin) till recently was largely confined to soil, peat, lakes and riverine systems. Of late, attention has been focussed on the coastal and marine environments, because, humic subtances do exist in these systems, and play an important role in aquatic productivity. Few works are available on HA concentration (Shanmukhappa et at., 1986; 1987; Perumal, 1985; Hair and Bassett, 1973) and characterisation (Stuener and Harvey, 1978; Preston, 1979; Kalle 1966) in coastal and aquatic biotopes. In the present study, HA was estimated in the Arabian Sea sediment samples collected during the 29th cruise of ORV SAGAR KANYA between latitudes - 15°N and 20°N and longitudes - 65°E and 74°E (Fig.1). An inventory on the humic acid characterisation of two samples, one from oceanic region (St.61) and another from continental shelf region (St.12) using a new method (photo-acoustic spectrometry) was also done.

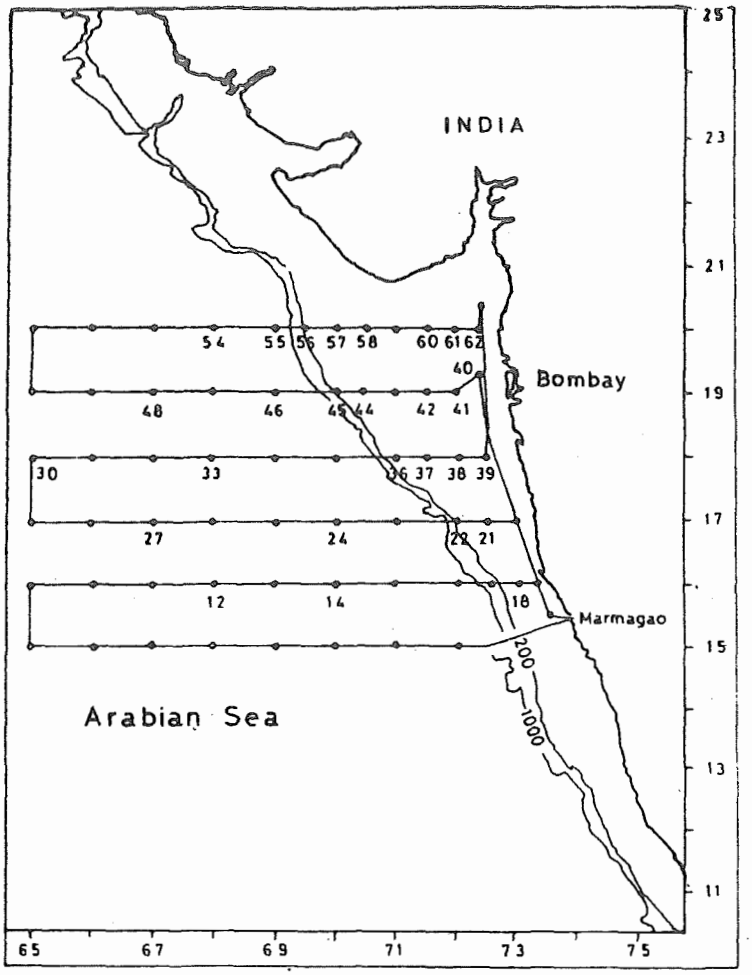

Fig. 1 : Map Showing the cruise route of ORV SAGAR KANYA and sampling Stations.

MATERIALS AND METHODS

Sediment samples were collected during ORV SAGAR KANYA cruise-29 duirng the period 24.1.1987 to 10.2.1987. The sediment samples were collected using Van Veen grab for depths < 60 m, Petersen grab up to 200 m depth and a Smith-McIntyre grab for greater depths (> 200 m). Top 10 mm of the grab sample was taken for the analysis of humic acids.

Determination of humic acids : The HA in sediments was determined by the methods of Thurman and Maclom (1981) and Hair and Bassett (1973). The available HA is expressed as mg/g of dry sediments.

1:5 ratio of sediment and 0.5 N NaOH (in this case 10g of sediment and 50 ml of NaOH) was taken in a flask at room temperature (25° ± 22°C) and the contents were agitated mechanically using the magnetic stirrer for about 6 hours. It was allowed for 2 1/2 days for all the sediment to settle. Then the supernatent solution was filtered through Whatwan GF/C filter

paper (pore size 0.45). The filtrate was then acidified with 6 N HCl to pH 2.0, and refiltered through a Whatman 4 filter paper first, then through a preweighed Whatman GF/C filter paper to remove the precipitated humic acid. Later the paper was rinsed with distilled water followed by 95% ethanol three to four times. The filter paper alongwith HA extract was dried in an oven at 60°C for about 12 hours and then kept at room temperature for one day. The difference between the initial and the final weights of the paper gives the weight of humic acid.

RESULTS AND DISCUSSION

The HA concentration in the Arabian Sea sediments has been estimated for the first time. Table 1 gives the HA concentration at different stations together with the sediment type and colour.

The highest concentration of 7.200 mg/g of HA was found at St.55 (depth - 1900 m), while the lowest concentration of 0.200 mg/g at St.62 (depth-31 m). Scattered information is available on HA concentration in coastal ecosystems like estuaries, mangroves, etc (1, 2 & 4) and no work has been reported in the Arabian Sea Region.

Table 1 shows that generally oceanic samples have higher HA concentration than those from the continental shelf. The average HA concentration up to 200m depth samples was 2.227 mg/g of dry sediments, while for oceanic samples (200 m depth) it was 3.520 mg/g of dry sediments. Further, the white coloured sediments generally and maximum HA concentration than the black coloured ones. Also, quite agreeing to the previous reports about the type of sediments, clayey-silt sediments contained more of HA than sandy-silt type of sediments (1). In the present study, the clayey-silt type of sediment had an average HA concentration of 3.0481 mg/g of dry sediment and sandy-silt type of sediment had HA of 2.330 mg/g of dry sediments.

Previous reports (Shanmukhappa et al., 1986; 1987) indicate that in the coastal ecosystems, more HA was found in mangrove sediments than those from estuaries or the sea. One striking feature noticeable in the present study is that HA concentration is slighly lower in the continental shelf than in deeper depths, the reason being obscure. From Fig. 1 and Table 1, stations lying in the northern part of the Arabian Sea (Gulf of Kutch and Indus river discharge zone) had generally

TABLE 1 : Date of Sampling, Location, Station No., Depth Sediment type, Colour and Humic acid concentration of sediments from Arabian Sea.

Date	Stn. No.	Location (Lat. & Long.)	Depth (m)	Sediment		Humic acid (mg/g)
				Type	Colour	
24/1	12	15°59', 68°00'	3220	CS	Wh	2.475
25/1	14	15 59, 69 58	3700	SS	GW	2.000
26/1	18	16 00, 73 00	100	SS	Gn	2.930
28/1	21	17 00, 72 30	80	SS	Gn	1.600
28/1	22	17 00, 72 00	276	SS	Gn	1.000
29/1	24	17 00, 69 59	3500	CS	Wh	4.700
31/1	27	17 01, 67 00	3575	CS	Wh	2.020
31/1	30	18 00,65 01	3400	CS	Gy	2.260
01/2	33	18 02, 67 59	3400	CS	Wh	4.308
02/2	36	17 59, 70 59	85	SS	Gn	0.760
02/2	37	17 58,71 30	90	SS	Gn	1.920
02/2	38	17 59, 72 00	85	SS	Gn	2.460
03/2	39	18 00, 72 30	40	SS	Gy	1.100
04/2	40	19 29, 72 28	22	CS	Bl	3.000
04/2	41	19 00, 72 00	50	SS	Gn	2.000
05/2	42	19 00, 71 30	78	SS	Gn	1.680
05/2	44	19 00, 70 30	80	SS	GW	1.150
05/2	45	19 00, 70 01	195	SS	Wh	6.280
06/2	46	19 00, 69 00	2770	CS	Wh	1.200
06/2	48	19 00, 67 00	3200	CS	Wh	3.240
09/2	54	19 59, 67 59	3200	CS	Gy	5.800
09/2	55	19 59, 68 57	1900	CS	Wh	7.200
09/2	56	19 59, 69 30	150	SS	GW	4.840
10/2	57	19 59, 69 59	75	SS	Gn	2.900
10/2	58	20 00, 70 30	87	CS	Gy	4.020
10/2	60	19 59, 71 29	33	CS	Bl	1.500
10/2	61	20 00, 70 00	28	CS	Bl	0.750
10/2	62	20 00, 72 30	31	CS	Bl	0.200

CS - Clayey silt; SS - Sandy silt; Wh - White; Gy - Greyish; Gn - Greenish; Bl - Black; GW - Greyish White.

higher HA concentration than the central Arabian Sea sediments. The reason for this can be attributed to the discharges from major and minor rivers which contain plenty of humus and subsequent deposition over a period of time, which would have accumulated more of HA in this zone. Along the central Arabian Sea (about 15° - 17° N lat), no major riverine discharge is noticed. Hence, these stations (Stns. 12-27) generally had lower HA concen-

tration. Further, the continental shelf of Arabian Sea on the west coast of India is known for upwelling. Due to this phenomenon, HA absorbed onto the sediment may go into suspension resulting in lower HA concentratin in the sediments.

The west coat of India is more productive (in terms of primary production and phytoplankton biomass) than the east coast (Bay of Bengal), because of upwelling. This has a bearing on the abundance of HA concentration, since the humic and acid is formed by the death and decay of plant and animal matter. Further, the riverine discharges also contribute to the HA budget of the Arabian Sea sediments.

A preliminary study on the spectral characteristics has been done for one representative sample each of continental shelf and oceanic sediment HA. The scanning of HA extract was done on Photo-acoustic Spectrophotometer (OAS-Optoacoustic

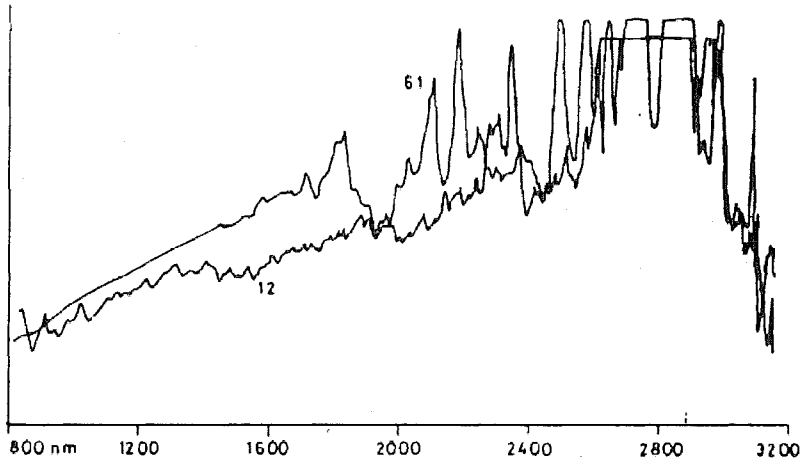

Fig.2 : Photo-accoustic IR spectra of sediment HA from one ecah of oceanic (61) and continental shelf (12) Stations.

Spectrophotometer, Model - 400, edt RESEARCH, London) between 800 and 3200 nm. Fig.2 gives the comparative spectral characteristics of both HAs in the IR region. There was a clear difference observed in the peaks in the region of 2000 - 3200 nm which is an indication of C-H aliphatic chains. The peaks are more in number for the continental shelf HA. There are several sharp absorption peaks between 2400 and 3200 nm for continental shelf HA, while prominent absorption peaks were observed around 2900 nm, 3150 nm and 3180 nm (aliphatic C-H chains). Further, the intensity of absorption peaks varied considerably, where continental shelf HA had stronger intensity than the oceanic HA. Thus, the possible dominance of many types of aliphatic chains are more in continental shelf HA in contrast to oceanic HA, where such peaks were absent in the latter. Prominent peaks

which are indicative of aromatic C-H, Hydrogen bonds in C=O of Carbonyl, proteins and carbohydrates which normally give peaks at around 1640 nm and 1540 nm are absent in both of these HAs. On the contrary, they are reported to be present in other HAs (Hayes and Swift, 1978). Certain peaks were also observed in the region of 2480, 2580, 2640 and 2680nm is coastal samples which are again aliphatic C-H stretches and such peaks were absent in oceaninc samples.

The present study was aimed at establishing the concentration of HA in the marine sediments which are less studied, though the characterisation and chemical studies of recent and old sediments have been done (Vendenbrouchke et at., 1985). However, such types of study need special attention and a more detailed account on spectral characteristics of HA. Hence, it is recommended that the present study can be taken as a base to go into more details about concentration and characterisation of HA in the other parts of Arabian Sea in particular and Indian Ocean in general.

ACKNOWLEDGEMENTS

We acknowledge the Department of Ocean Development, Govt. of India for giving an opportunity (DCS) to participate in the 29th cruise of ORV SAGAR KANYA and Dr. Ulhas G. Naik for the neat sketch.

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