J. mar. biol. Ass. India, **45** (2) : 232 - 234, July - Dec., 2003

Humic acids in mangrove sediments of Kerala

P. Kaladharan, J.P. George, A. Nandakumar and L.R.Khambadkar

Central Marine Fisheries Research Institute , Cochin-682 018, India

Abstract

Total humic acids (THA) content in the sediments of six mangroves located north of Cochin in Kerala along the southwest coast of India during the pre monsoon, monsoon and post monsoon period of 2002 is described in relation to the type of vegetation cover in the area. Annual mean values of THA in the sediments ranged from 1.97 to 5.81 $\mu g/g$. Monsoon and post monsoon seasons accounted for higher levels of THA in sediments. Litterfall from *Rhizophora* spp. contributed more THA (214%) to the sediment than that of *Avicennia* and other types of mangrove plants. Sediment from within the mangrove patches contained 17- 240% higher THA than the adjacent upstream and downstream areas.

Mangrove or tropical tidal wetland is one of the most productive coastal habitats and dynamic zones of fishery potential areas. The litterfall from the dense mangrove vegetation supports a host of detritivorous animals such as amphipods, mysids, harpacticoids, molluscs, crabs and larval stages of the icthyofauna. Production of surplus quantities of plant detritus, dissolved organic matter, recycling of nutrients and provision of adequate habitats for natural recruitment of coastal fisheries stock make the mangrove ecosystem a unique environment of great ecological value. Mangrove sediments are enriched with nutrients from secretion of carbon compounds and humus materials derived from decomposition of foliage of mangrove plants. Humic substances are the key index for the nutrient status of a particular zone. Humic acids of mangrove sediments of Pichavaram area have been studied by Perumal (1985) and the inshore water and sediment of Cochin by Kaladharan *et al.*, (1999). They are known to promote phytoplankton growth (Prakash and Rashid, 1968; Provasoli, 1963) and to inhibit the toxicity of tin (Barbera *et al.*, 1997), mercury (Kaladharan and Leela Bhai, 2002) and some pesticides (Ying *et al.*, 1996) as they are natural chelators. This paper portays the levels of total humic acids (THA) from the sediments collected from six mangroves located north of Cochin along the Kerala coast during the premonsoon, monsoon and post monsoon period of 2002.

The authors are grateful to the Director, CMFRI for encouragements and providing required facilities. Field support rendered by Shri. Ansy Mathew and

P.K.Jayasurya are gratefully acknowledged. This study is supported by financial grant received from Agro ecosystem Directorate Coastal, PSR mode of NATP., ICAR New Delhi.

Material and methods

The mangrove patches located along the Kerala coast especially north of Cochin (Lat. 10° 32'14.5" - 12° 35' 49.0"N and Long. 76° 03'01"E - 74° 56'28"E) from where sediment samples were collected monthly are listed in Table 1. Duplicate samples were taken from mangroves using a van Veen grab from within the mangrove (Stn. B) as well as from one km distance from both the upstream (Stn.C) and down stream (Stn. A) locations outside the mangrove area. THA from the sediment samples were extracted and estimated as per the method of Martin and Pierce (1971) and as described elsewhere (Kaladharan *et al.*, 1999).

Results and discussion

The THA content in the mangrove sediments of Kadalundi and Koduvally were higher in premonsoon season than in other areas studied, whereas in Chettuva, Valapattnam and Kunjimangalam, postmonsoon months registered higher values followed by monsoon season. Kumbala mangorves registered highest levels of THA in sediments during the post monsoon months (Table 2). The values of THA from the Kerala mangrove sediments were lower than the levels reported for Pichavaram mangroves, where higher levels are recorded during monsoon season (Perumal, 1985). The seasonal variation in the levels of THA in sediments in various mangroves may be due mainly to the phenology of mangrove plants, quantum of foliage and litter fall among the constituent species and the rate of fresh water run off from the upstreams.

Table 1. *Location of the mangrove vegetation along the Kerala coast (North of Cochin; Districts shown in parenthesis)*

Name	Position
1. Chettuva (Thrissur)	10° 32' 14.5" N; 76° 03' 01"E
2. Kadalundi	11° 07' 46.0" N; 75° 50' 17"E
3. Koduvally	11° 45' 58.0" N; 75° 28' 43"E
4. Valapattnam	11° 56'04.0" N; 75° 21' 18"E
5. Kunjimangalam	12° 04' 25.0" N; 75° 13' 29"E
6. Kumbala	12° 35' 49.0" N; 74° 56' 28"E

Table 2. *Seasonal mean levels of THA (µg/g) from mangrove sediments of Kerala*

No	Pre monsoon	Monsoon	Post monsoon
1	1.75	2.84	2.59
2	3.49	1.76	2.57
3	2.26	1.82	1.89
4	3.83	4.17	3.56
5	6.00	6.75	4.72
6	3.72	4.99	8.51
Mean	3.51	3.72	3.97

Mangrove sediments from all the six areas showed higher levels of THA within the mangrove patches (170 - 240% higher) compared to the adjacent upstream (C) and downstream (A) stations (Table 3).

Table 3 *Annual mean levels of THA (µg/g) in the sediment samples from within the mangrove patches as well as from upstream and downstream locations.*

No	A (Downstream)	B (Mangrove)	C (Upstream)	Mean
1	1.99	3.24	1.96	2.40
2	2.16	3.47	2.20	2.61
3	1.29	3.80	0.83	1.97
4	3.29	6.59	1.68	3.85
5	3.38	11.82	2.23	5.81
6	3.99	10.91	2.32	5.74

Kunjimangalam and Kumbala mangroves exhibited maximum levels of THA in their sediments where the dominant floral components consisted of *Rhizophora mucronata* in addition to *Avicennia officinalis* and *A.marina* plants. Other mangroves are dominated by *Avicennia* spp. Higher levels of THA in the mangrove sediments of Kunjimangalam and Kumbala compared to other areas as shown in Table 3 is attributed to the extend of vegetation cover recorded by George *et al.* (2002) that the former two ecosystems cover 18 to 20 hectare area while the remaining mangrove areas are spread to 0.2 to 10 hectare only and not entirely dominated by *Rhizophora* sp.

In Valapattnam, Kunjimangalam and Kumbala mangroves, the levels of sediment THA in downstream stations after the mangroves are considerably higher than the upstream stations, possibly due to excess THA formed by the leaf litter fall from *Rhizophora* poulations that too from larger extend of vegetation cover. It can be surmised from our study that mangrove plants do contribute to the build up of organic humic materials in the sediment and *Rhizophora* are more productive than *Avicennia* and other mangrove plants. The THA from mangrove sediments also contribute to the productivity of coastal waters through downstream runoff

References

Barbara, P.S., R.Daczorowska and T. Skowronski. 1997. *Environ. Pollution,* **97**(1-2): 65-69.

George, J.P., G.S.D. Selvaraj, P.Kaladharan, T.S.Naomi, D.Prema, A.Nandakumar, Geetha Antony, P.K.Jayasurya , N.P.Ansy Mathew and M.S.Rajagopalan. 2002. *Mar. Fish. Infor. Serv., T & E Ser.,* **172**: 1-3.

Kaladharan, P., A.Nandakumar and V.K.Pillai. 1999. *Proc. Natn. Sem. Ocean, Fish and Fisheries 1999. Irinjalakuda* , 76- 81.

----------, P. and K.S.Leela Bhai. 2002. Effect of humic acids on the mercury toxicity to marine algae. Presented to Sixth conference of Indian Fisheries Forum, December 21-24, 2002 Bombay.

Martin, D.F. and R.A. Jr., Pierce. 1971. *Environmental Letters.* **1** (1): 49- 52.

Perumal, P. 1985. *Proc. Natn Symp Biol. Util. Cons. Mangroves, Aurangabad* . 369 - 371.

Prakash, A. and M.A. Rashid,.1968. *Limnol. Oceanogr.,* **13** (4): 598-606.

Provasoli, L.1963. Organic regulation of phytoplankton fertility. *In*: M.N.Hill (Ed.) *The Sea.* Vol. 2 , Inter Science London. 165- 219.

Ying, X., W. Wenzhong and Z. Yonyuan. 1996. *Acta Hydrobiol. Sinica.,* **20**(2): 160- 163.