

**CHLOROPHYLL, CARBOHYDRATE AND POLYPHENOL CONTENTS FROM
THE LEAVES OF *AVICENNIA OFFICINALIS* IN RESPONSE TO WATER
AND SOIL QUALITY**

ABSTRACT

The present study is undertaken to evaluate pollution status of estuaries in Ratnagiri District. For this piece of work five stations from four different estuaries have been selected depending upon a visible inflow of domestic sewage. The water and soil samples were collected simultaneously from their locations. It is observed that the highest salinity is at Bandhkind. At this place DO is lowest and BOD is highest, amongst the five stations. The effect of water quality is studied by analysing the leaves of *Avicennia officinalis* for chlorophylls, carbohydrates and polyphenols. It is seen that highest chlorophyll content in the leaves exists with lowest BOD and salinity. Carbohydrate levels go hand in hand with chlorophylls. However, polyphenols do not show this trend. The lowest chlorophyll value is 41.9 mg/100 g fr. wt., while the highest value is 100.47 mg/100 g fr. wt. This gives the variation of 58%.

EARLIER work from our laboratory has indicated that there is some extent of pollution in the estuaries mainly due to domestic sewage at Ratnagiri and nearshore areas. Five stations along the estuaries of Ratnagiri District have been considered in the present

study to know the effect of sewage pollution on mangroves. It was proposed in the present study, to analyse water and soil quality as well as plants.

Material and methods

For the determination of physical and chemical characteristics, water and soil samples were collected from Sakhartar, Bandhkhind, Bhatye and two stations from Ganpatipule Estuaries in the Ratnagir District.

Electric conductivity and pH of soil and water was determined with the help of conductivity meter and pH meter (Elico make). Salinity was calculated from the chlorinity. Chlorides in water and soil were found out by a common titrametric method involving direct titration of the water and soil (1 : 5) solutions, with silver nitrate (0.1 N), using potassium chromate as an indicator.

DO and BOD were determined by Winklers (1888) idometric method. From the plant material, carbohydrates were determined by the method of Nelson (1944). Chlorophyll estimation was according to the method of Arnon (1949), whereas polyphenols were determined according to Horwitz (1965).

Result and discussion

The physico-chemical properties of water and soil are given in Table 1. In water samples the pH range from 6.57 to 7.12. It shows the pH of water is lightly acidic in Bandhkhind Estuary. Choudhury *et al.* (1984) have reported the basic pH of water from Sunderbans. Richard Harrel (1985) has recorded the pH of water from Southeast Texas as 4.5 to 6.5. The earlier work by Kotmire and Bhosale (1979) reported slightly basic pH of water. In soil samples the pH values range from 6.5 to 7.5. The Sakhartar and Bandhkhind Estuary shows the lowest

level of pH and Ganpatipule station I and II shows the highest level of pH. Lionel Eleuterius and Caldwell (1985) reported physical and chemical characteristics of soil from four widely separated tidal marshes in Mississippi. They have reported range of pH is 6.3 to 7.5. Similarly Priscilla (1986) showed the pH values of the sediments from the estuaries ranging from 6.2 to 6.5. Present values are within the range observed by different workers.

The pH of water and soil is more acidic in Bandhkhind Estuary as compared to other estuaries and it indicates that the discharge of domestic sewage possibly affects the pH of soil and water.

Electrical conductivity of water ranges from 0.64 to 30.5 m mhos/cm, highest value is seen for Bandhkhind Estuary and lowest for Ganpatipule station II. It shows more salinity in the Bandhkhind Estuary. In soil samples the EC ranges from 0.24 to 2.67 m mhos/cm. The highest EC is at Bandhkhind and lowest at Ganpatipule station I. Salinity range is from 1.24 to 21.19 which parallels the EC. In case of DO values range from 4.75 to 6.29 ml/l and BOD ranges from 70 to 106 mg/l. The lowest DO and highest BOD are found in Bandhkhind estuary as compared to other estuaries. Prasad and Mansuri (1982) have shown decrease in dissolved oxygen in the sea water due to release of effluent from chemical industry. Choudhury *et al.* (1984) reported DO values for estuaries ranging from 1.5 to 5.3 ml/l. The present values are in comparison high indicating more oxygen available to estuarine organisms. Zingde and Desai (1983) have reported that BOD is very high and exceeds 100 mg/l in Mahim Creek. This shows that the present value of 106 mg/l of BOD is very high indicating the organic pollution in the estuary. Table 2 and 3 record the organic constituents of leaves of

TABLE 1. *Physico-chemical characteristics of water and soil from five different stations in Ratnagiri District*

Sample stations	pH		EC		Salinity		DO ml/l	BOD mg/l
	S	W	S	W	S	W		
Sakhartar ..	6.5	7.10	2.67	27.9	0.94	19.98	6.01	78.0
Bandhkhind ..	6.5	6.57	2.67	30.5	0.94	21.19	4.75	106.0
Bhatye ..	7.0	6.64	2.12	8.7	0.33	6.07	5.45	96.0
Ganpatipule								
Station I ..	7.0	6.67	0.24	3.12	0.18	1.84	6.29	70.0
Station II ..	7.5	7.12	1.38	0.64	0.26	1.24	6.15	78.0

TABLE 2. *Carbohydrates from the leaves of A. officinalis from five different stations in Ratnagiri District*

Sample stations	Reducing sugars (A)	Total sugars (B)	Starch (C)	Total carbohydrates (B + C)
Sakhartar ..	0.529	1.923	2.714	4.637
Bandhkhind ..	1.385	1.885	2.22	4.105
Bhatye ..	0.276	0.662	4.811	5.473
Ganpatipule				
Station I ..	0.495	1.254	5.369	6.623
Station II ..	0.652	2.100	3.551	5.651

Values expressed in g/100 g fresh plant material.

TABLE 3. *Chlorophyll and polyphenol contents in the leaves of A. officinalis from different stations in Ratnagiri District*

Sample stations	chl. a mg/100 g	Chl. b mg/100 g	Total Chl. (a + b)	Chl. a/Chl. b	Polyphenols g/100 g. f.wt.
Sakhartar ..	38.80	19.10	57.89	2.03	1.074
Bandhkhind ..	27.22	14.68	41.90	1.85	1.026
Bhatye ..	38.32	20.05	58.38	1.91	0.781
Ganpatipule					
Station I ..	70.64	29.84	100.47	2.37	0.932
Station II ..	66.35	29.05	95.40	2.28	1.05

Avicennia officinalis Linnaeus. The carbohydrate level ranged from 4.105 to 6.623 g/100 g fresh weight. The highest level of carbohydrate is recorded in the leaves of plants from Ganapatipule station I and lowest in plants at Bandhkhind. It clearly shows that the carbohydrate level in *A. officinalis* is affected due to pollution of water and soil.

The same trend was seen in chlorophylls.

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Total chlorophyll values range from 41.90 to 100.47 mg/100 g fresh weight the lowest being at Bandhkhind and highest at Ganapatipule Station I. Polyphenols seem to have a protective role to play under polluted conditions. The highest level of polyphenols was observed in plants at Sakhartar and lowest at Bhatye Estuary. It indicates that the polyphenols are related to pollution stress, the nature of action is obscure.

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