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# Textural Features - Indicators of Pollution

# Leena Grace Beslin\*

Department of Biotechnology, Gogate Jogalker College, Ratnagiri, Maharashtra, India

#### Abstract

The dynamic estuarine environment influences the sedimentary processes like physical and chemical characteristics of sediments. The dominant factor in sediment transport is the motion of water. The particles are moved by the current of water in the way of sliding, rolling, siltation and suspension. Texture a peculiar feature of the sediment which describes the nature of soil. In the water bodies, the textural characteristics reflect how long the sedimentary particles are affected by organic and inorganic contaminants. For the present study three different estuaries namely Kadinamkulam backwater, Veli Lake and Poonthura backwater around the Trivandrum city of Kerala were chosen as study sites. From each estuary three stations such as riverine zone, middle zone and bar mouth zone were fixed for collection of samples. Monthly collection of sediment for a period of one year from April-2014 to March 2015 was carried out. Regular analysis of texture was done and calculated the results. The observations from the present study showed that most of the months and in all the selected stations such as solutions in specific seasons.

Keywords: Texture; Sediment; Sand; Silt; Clay; Estuary

## Introduction

The sub-surface environment of the estuaries is highly heterogeneous in its composition. Very often, a subsurface is composed of layers of materials with vastly different properties such as sand, silt and clay. The composition may vary over distances of few centimetres, because fluids can move only through the pore spaces between the grains of sand. The sand openings are distributed scattered and their contaminant migration pathways are extremely difficult to predict. Fine grained bottom sediments are formed out of suspended material and have a composition that reflects the original suspended material with geochemical, biological and geological processes operating in the aquatic environment [1]. The nature of the backwater sediments changed with spatial and temporal variations in the percentage composition of sand, silt and clay fractions. Gravels and coarse sediments that show less organic matter are less contaminated unless they are in the vicinity of a source of effluent. The fine fractions of the organic content are due to the large surface area provided by clay fractions for the adsorption [2]. According to Geetha Bhadran high percentage of sand in the sediment shows that the site is well drained by water. Concentration of sand in relation to clay and silt serves to emphasize the range of soils, more specifically with respect to drainage.

#### Materials and Methods

Three different estuaries around Trivandrum city of Kerala state was selected for the collection of sediments. The estuaries were Kadinamkulam estuary, Veli lake and Poonthura backwater. From each estuary three different stations were located to get a accurate data of texture. The textural analysis of the sediment was carried out by adopting pipette method as described by Carver [3]. The various size fractions of the sediment were computed from their respective settling velocities of the sediment. The sediment textural characteristics were classified into three groups based on the size of the particles.

Viz. Clay  $\rightarrow$  <4 µm, Silt  $\rightarrow$  between 4 µm and 63 µm and Sand  $\rightarrow$  >63 µm.

#### Results

The textural characteristics of the three selected estuaries were

presented. The monthly distribution of the size of the particles in different stations on a percentage basis was illustrated in Tables 1-3. The textural study of the sediment revealed that in Kadinamkulam backwater the mean percentage composition of sand was 63.55 which ranged from 60.99 in station III to 67.73 in station II. The mean sand content of Veli Lake was 61.59% which ranged from 52.4% in station II to 74.63% in station I. In Poonthura the mean sand content was 53.85% which varied from 45.62% in station I to 59.55% in station III. The mean silt content of Kadinamkulam was 22.41% which ranged from 19.98% in station II to 24.73% in station I. The mean silt content of Veli was 23.02% which varied from 12.96% in station II to 29.46% in station I. In Poonthura, the mean silt content was 26.8% which ranged from 24.67% in station II to 29.54% in station III. The mean distribution of clay content was 14.43% in Kadinamkulam estuary which ranged from 16.49% in station III to 13.12% in station II. In Veli, the mean clay content was 15.17% which varied from 11.84% in station III to 21.23% in station I. The mean clay content of Poonthura backwater was 19.91% which ranged between 12.05% in station III and 28.13% in station I (Figures 1-3).

## Discussion

The major textural class of the entire sediment contained coarse sand to very fine sand with negligible quantities of silt and clay. The marked difference seen between samples of different stations could be attributed to the difference in environmental conditions like waves, tides and river flow in the estuaries. The deposition of sandy sediments in the main channel area of estuaries was influenced by the sea and they get transported into the estuaries through the inlets by tidal waves [4]. The present study agrees the above findings that the marked difference seen between samples of different stations could be attributed to the

\*Corresponding author: Leena Grace Beslin, Department of Biotechnology, Gogate Jogalker College, Ratnagiri-415 612, Maharashtra, India, Tel: 02227453820; E-mail: drblgrace@rediffmail.com

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Page 2 of 4

MONTHS		5	TATION	·l			STATION-III					
	sand	silt	clay	soil nature	sand	silt	clay	soil nature	sand	silt	clay	soil nature
April (2014)	56.22	29.98	13.80	sandy	63.88	17.32	18.80	sandy	60.35	11.45	28.20	Sandy
Мау	59.65	24.83	15.82	sandysilt	67.33	18.23	14.44	sandy	62.74	21.74	15.52	Sandysilt
June	70.32	14.10	15.58	sandy	71.02	20.10	8.88	sandy	76.22	4.90	18.88	Sandy
July	88.14	1.42	10.44	sandy	80.83	6.93	12.24	sandy	83.85	2.83	13.32	Sandy
August	71.65	19.51	8.84	sandy	76.25	12.53	11.22	sandy	40.52	40.66	18.82	Siltysand
September	62.55	30.11	11.32	sandy	70.35	28.11	11.54	sandy	38.12	49.56	12.32	Siltysand
October	62.32	26.80	10.88	sandy	68.56	20.50	10.94	sandy	43.22	45.46	11.32	Siltysand
November	51.89	29.27	18.84	sandysilt	70.88	11.40	17.72	sandy	69.34	12.78	17.88	Sandy
December	52.33	31.03	16.64	sandy	65.55	25.57	8.88	sandy	62.55	17.37	20.08	Sandy
January (2015)	56.32	34.84	8.84	sandy	53.56	35.12	11.32	sandysilt	56.38	32.07	11.55	Sandysilt
February	56.22	24.96	18.82	sandy	64.28	19.06	16.66	sandy	65.74	18.68	15.58	Sandy
March	55.68	29.92	14.40	sandy	60.31	24.89	14.80	sandy	72.87	12.73	14.40	Sandy

 Table 1: Monthly distribution of particle size (%) in sediments of Kadinamkulam backwater.

MONTHS		S	TATION-I			ST	ATION-II		STATION-III				
	sand	silt	clay	soil nature	sand	silt	clay	soil nature	sand	silt	Clay	soil nature	
April (2014)	65.70	18.50	15.80	sandy	62.20	24.40	13.40	sandy	55.62	35.58	8.80	siltysand	
May	72.30	11.02	16.68	sandy	64.40	25.68	9.92	sandysilt	56.98	41.46	1.56	siltysand	
June	62.55	33.01	4.44	sandysilt	50.58	40.54	8.88	siltysand	37.58	44.22	6.64	siltysand	
July	71.94	13.62	14.44	sandy	56.20	29.32	14.48	sandysilt	48.97	42.15	8.88	siltysand	
August	63.55	17.63	18.38	sandy	50.28	9.14	40.58	sandy	50.62	22.70	26.68	sandy	
September	72.58	14.87	12.55	sandy	65.58	17.77	16.65	sandy	68.32	13.90	17.78	sandy	
October	72.55	15.57	11.88	sandy	66.32	21.36	12.32	sandy	69.65	16.63	14.32	sandy	
November	83.36	4.32	12.32	sandy	53.05	39.15	12.80	sandy	49.56	36.00	14.44	sandy	
December	72.55	7.47	19.98	sandy	50.65	36.11	13.24	sandysilt	60.55	27.61	11.84	sandysilt	
January (2015)	78.55	9.57	11.88	sandy	43.22	44.23	12.55	siltysand	53.22	37.90	8.88	sandysilt	
February	88.42	2.98	8.88	sandy	55.22	25.96	18.82	sandy	67.55	25.81	6.64	sandy	
March	91.46	6.98	1.56	sandy	11.04	7.90	81.06	sandy	74.25	10.15	15.60	sandy	

 Table 2: Monthly distribution of particle size (%) in sediments of Veli Lake.

MONTHS	STATION-I					STATION-II				STATION-III			
	sand	silt	clay	soil nature	sand	silt	clay	soil nature	sand	silt	clay	soil nature	
April (2014)	10.58	6.79	82.63	clayey	50.32	39.76	9.92	sandysilt	51.62	35.00	13.38	sandysilt	
Мау	65.32	18.68	16.00	sandy	56.98	1.46	41.56	clayeysand	56.80	42.32	14.48	siltysandy	
June	51.08	36.70	12.22	sandysilt	53.94	27.18	18.88	sandysilt	50.82	39.20	9.98	sandysilt	
July	61.03	20.09	18.88	sandy	71.12	18.84	10.04	sandy	60.36	30.76	8.88	sandysilt	
August	38.32	50.36	11.32	siltysand	56.22	30.46	13.32	sandysilt	60.22	20.90	18.88	sandy	
September	68.55	12.58	18.87	sandy	56.22	20.90	22.88	sandy	48.22	26.90	24.88	sandy	
October	9.65	8.03	82.32	clayey	56.32	33.12	10.56	sandysilt	52.33	36.79	10.88	sandysilt	
November	35.41	50.95	13.64	siltysand	59.87	28.65	11.48	sandysilt	73.50	16.18	10.32	sandy	
December	35.32	36.34	28.34	siltysand	50.32	21.36	28.32	clayeysand	56.22	40.90	2.88	sandysilt	
January (2015)	19.88	56.90	23.22	silty	56.32	9.46	34.22	sandyclay	50.32	40.80	8.88	sandysilt	
February	67.22	13.84	18.94	sandy	56.28	32.38	11.34	sandysilt	76.22	13.94	9.84	sandy	
March	85.05	3.83	11.12	sandy	52.65	25.23	22.12	sandysilt	77.94	10.78	11.28	sandy	

 $\label{eq:constraint} \textbf{Table 3:} \ \textbf{Monthly distribution of particle size (\%) in sediments of poonthura backwater.}$ 



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difference in environmental conditions like oscillation of waves, tidal influx and river flow in the three estuaries. The textural properties of the present study revealed that even though the sandy material dominated throughout the year, the clay and silt content were represented more in certain months especially in Poonthura backwaters. Kumary et al. [5] reported that of Poonthura estuary with higher percentage of finer particles at the sheltered upstream stations. Generally there exists a gradation towards finer materials form the mouth of the estuary due to reduced flow, deposition of fine mud and tidal flow during different seasons. See tharamaiah and Swamy [6] stated that due to low velocity of the wave motion, the sand particles settled within a short distance from the point of their entry into the estuarine system. The area with a high percentage of clay is capable of having a high proportion of organic matter [7]. Organic matter content is greater in the samples where fine fractions predominate. This is due to the large surface area provided by clay fractions for adsorption [8]. From the present study, the textural properties of three estuaries with different stations revealed that the sandy soils having less pollutants like organic matter and heavy metals. The clayey and silty soils reflect more metals and other pollutants.

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