Studies on the monthly variation of sediment parameters of Manakudy estuary with adjoining rivers, South West coast of India.

V.LOLA CATHERINE[1], H.MARY HELEN[2]
1. Research Scholar, Department of chemistry, S.T. Hindu College, Nagercoil, T.N, India.
2. Assistant Professor, Department of chemistry, S.T HinduCollege, Nagercoil, T.N, India.

Abstract

The Manakudy estuary is the second largest estuary in Kanyakumari District. Sediment samples were collected for a period of one year from October 2016 - September 2017. Five different sampling stations were selected. The parameters such as pH, EC, Total Nitrogen, Total Phosphorous, Organic Carbon, Sodium and Potassium were analysed using standard procedures. pH value varied from 6.7 – 8.5, Value of EC ranged from 1.72 – 6.08dS/m, Nitrogen value ranged from 0.03 – 0.39%, Phosphorous value varied from 0.16 – 0.59%, Organic Carbon content ranged from 1.15 – 5.15% respectively. pH was high in the month September 2017, EC was found to be high in the month January 2017, Nitrogen was found to be high in the month of March 2017, Phosphorous was high in the month February 2017 and OC was high in April 2017. Total Nitrogen content present in the sediment samples may be due to anthropogenic influence, retting of coconut husk and river discharge. Total Phosphorous was high due to the agricultural waste discharge from the paddy fields of the nearby region. Nutrients become maximum ranges in the fresh water flow of riverine sides because of more agricultural wastes and various anthropogenic activities. The ecosystem of Manakudy estuary with adjoining rivers adversely affected by nutrient pollution. Extensive addition of nutrients would neither be economical nor safe from environmental point of view. Hence remedial measures need to be taken for sustainability of the ecosystem.

Keywords: Estuary, Sediment samples, Seasonal variation, nutrients, Organic carbon.

Introduction

Estuary is a transition zone between land and sea as well as fresh water and salt water. Sediments are defined as the organic and inorganic materials or solid fragments derived from the weathering process of sand, pebbles, silt, mud and fine – grained soil. Sediment materials carried into the estuary from the sea and rivers form the mud flats. The nature and rate of sedimentation in an estuary mainly depends on the nature, water transport and ecological stress (Postma, 1967). The nutrient economy of an aquatic system is mostly governed by the sediments and the knowledge on the role of sediment – nutrient is useful in determining the sediment – water interaction which eventually affects the productivity (Balakrishnan et al, 1983). Thus the sediment acts as a source and sink of nutrients and plays a vital role in changing the quality of the overlying water column. Further, sediment testing reflects the long term quality situation independent of current inputs (Hodson, 1986). Thus sediment quality indicates the extent of biological activity and indirectly the fertility of the overlying water and also the actual state of pollution of a water body (Alagarsamy, 1991).

Description of Study Area

The Manakudy estuary is the second largest estuary in Kanyakumari District. It has a total area of 145 hectares. Manakudy estuary is situated about 8 kilometers north west of cape Comorin falling within the latitude 8º4’ and 8º21’ N and longitude 77º26’ and 77º30’ E. The climate of the region is greatly influenced by both South West and North East monsoons. The tail end of Pazhayar River merges with the Arabian Sea at Manakudy. The river originates at the Western Ghats, flowing through Surlodu, Azhagiapandipurum, Ozhiginasery, Suchindrum, Thamaraikulam finally destinating at Manakudy covering a distance of 67kms. It is a sand built estuary connected to the sea during the rainy season. During the period of total occlusion of the river mouth, the estuarine water swells due to heavy inflow of water from the head of the estuary and also by the land drainage. During heavy inflow into the estuary the sand bar opens up under the force of gravity. Compared to the expanse of the estuarine area, the bar mouth is relatively small and even during summer months the local people cut open the bar mouth and the estuary has open access to the sea. The location map of Manakudy estuary is shown in fig 1. Station 1 is located at the mouth of the estuary, Station 2 is Puthalam which is 6

km away from station 1, Station 3 is Thamaraikulam which is 10 km away from station 1, Station 4 is Suchindrum, which is 14 km away from station 1 and Station 5 is Ozhiginasary which is 18 km away from station 1.

Figure 1: Location Map of the study area

Materials and Methods

Sediment sampling was made for a period of one year. Five sampling stations representing different ecological conditions were chosen for collection of sediments samples in the Manakudy estuary from estuarine mouth bed to Ozhuginasery river basin. Sediment sampling was done usually during the morning hours between 9.00am to 11.00am. Samples were collected during post monsoon (October 2016 – January 2017) Pre monsoon (February 2017 – May 2017) monsoon (June 2017 – September 2017). Sediment samples were transferred separately to clean, dry polythene containers, homogenized well and were brought to the laboratory for analysis. pH was measured using a Elico pH meter. EC was determined by conductivity meter. Percentage of OC was determined by titration method (El waked and Riley, 1957). Phosphorous was determined by Olesen's method using spectrophotometer. Total nitrogen was estimated by modified Kjeldahl method. Sodium and Potassium were determined by flame photometer. All the reagents and chemicals used were of analytical grade.

Results and Discussion

pH

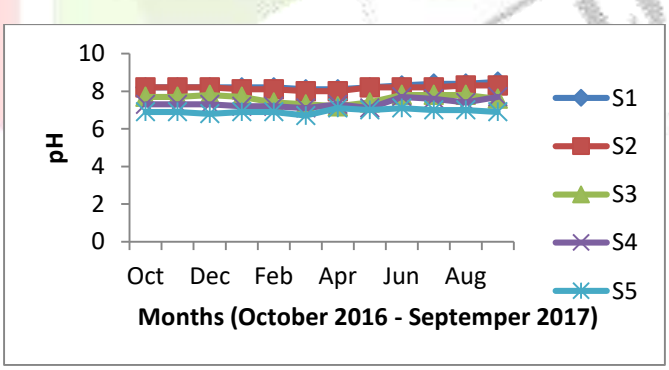

Figure 2: Monthly variation of pH in sediment at five stations

pH value varied from 6.7 – 8.5. The maximum value of pH (8.5) was observed in the month of September 2016 at station 1 and minimum (6.7) was observed during the month of March 2017 at station 1. The results on the monthly changes in sediment pH of the experimental stations revealed that it was maximum during the monsoon season and minimum during the pre monsoon season. The higher pH is indicated that highly alkaline effluents were discharged during the rainfall time. The lower pH value recorded at station 1 may be due to the increased rate of decomposition of organic matter and conversion of released Co_2 into carbonic acid. This result in accordance with earlier report (Saha, 1985).

EC

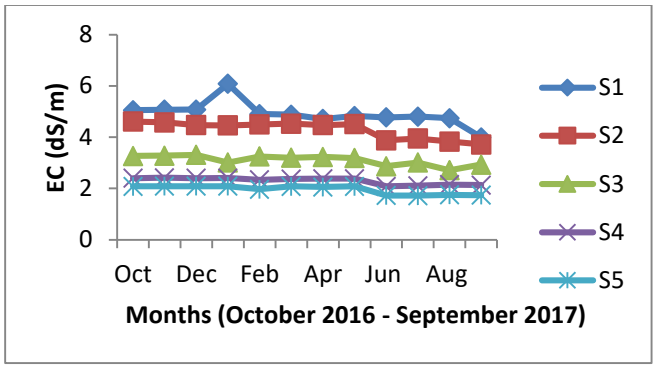

Figure 3: Monthly variation of EC in sediment at five stations

Value of EC ranged from 1.72 – 6.08dS/m. The maximum value of EC (6.08dS/m) was observed in the month of January 2017 at station 1 and minimum (1.72dS/m) was observed during the month of July 2017 at station 5. EC is directly related to the soluble salt concentration of sediment. Higher EC value could be accumulation of soluble salts in sediments may be probably due to sufficient leaching of salts due to higher rainfall from the nearby salt pan. This lowering in EC value may be due to freshwater influx from rivers to the estuary during monsoon season.

Total Nitrogen

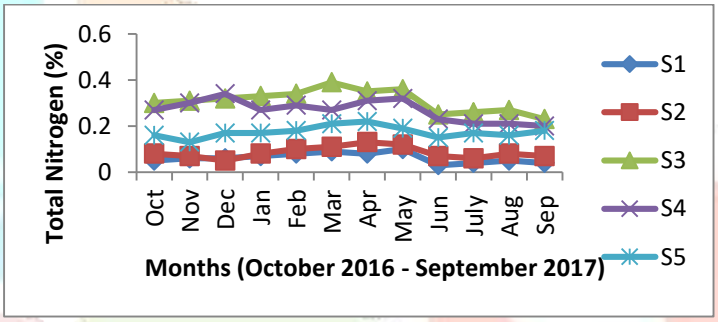

Figure 4: Monthly variation of nitrogen in sediment at five stations

Nitrogen value ranged from 0.03 – 0.39%. The maximum value of Total Nitrogen (0.39%) was observed in the month of March 2017 at station 3 and minimum (0.03%) was observed during the month of June 2017 at station 1. Total nitrogen content present in the sediment samples may be due to anthropogenic influence, retting of coconut husk and river discharge. The infiltration of fertilizer used in the nearby agricultural fields, retting of coconut husk and other anthropogenic activities facilitate an increase in the concentration of nitrogenous material in the sediment (Geroge Sebastian et al, 2012).

Total Phosphorus

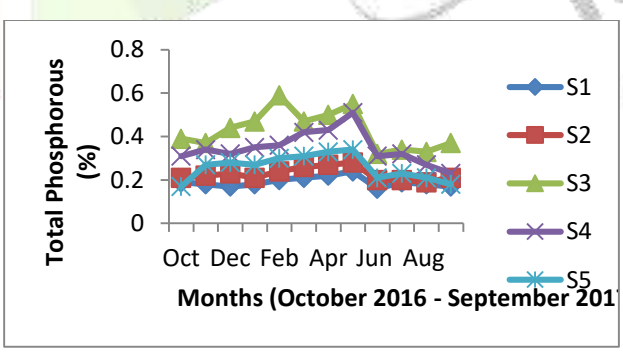

Figure 5: Monthly variation of phosphorus in sediment at five stations

Phosphorous value varied from 0.16 – 0.59%. The maximum value of Total Phosphorus (0.59%) was observed in the month of February 2017 at station 3 and minimum (0.16%) was observed during the month of June 2017 at station 1. Phosphorus at station is due to the agricultural waste discharge from the paddy fields of the nearby region and coconut husk rest activities. The higher values were due to the dead organic matter settling from top and are related to the permeability of the sediment. Similar conditions was reported by (Bragadeeswaran et al, 2007) . Further maximum concentration of phosphorus was due to phosphate containing fertilizers washed off from agricultural fields. Increased application of fertilizers, use of detergents and domestic sewage play a great role in contributing to the heavy loading of phosphorus in the sediment (Vasantha, 2010).

Organic Carbon

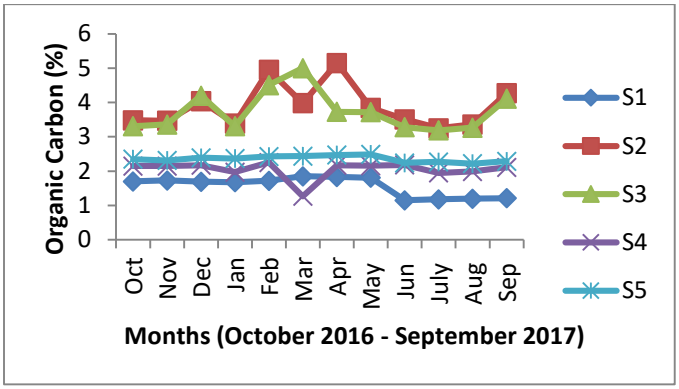

Figure 6: Monthly variation of Organic Carbon in sediment at five stations

Organic Carbon content ranged from 1.15 – 5.15%. The maximum value of organic carbon (5.15%) was observed in the month of April 2017 at station 2 and minimum (1.15%) was observed during the month of June 2017 at station 1. Enrichment of OC indicates incorporation of organic materials from the river water. OC content estimation indicates variations in all the sites. Further OC is a reliable index of nutrient degradation and productivity of the water body (Deleep Packia Raj, 2010). The higher OC% may be due to heavy sewage discharges, anthropogenic activities, adsorption of organic matter by the increased finer fractions of the sediment and hectic coconut husk retting activity. Similar reason was reported by (Anitha and Sugirtha, 2013).

Conclusions

Based on the above results and discussions, the present study clearly shows that the estuarine sediments are contaminated. The nutrient pollution is mainly due to agricultural and anthropogenic activities. Nitrogen and Phosphorus were high in Station 3. Higher nutrient concentration is associated with low oxygen content and high salinities. This would affect fish production. Extensive addition of nutrients would neither be economical nor safe from environmental point of view. Hence remedial measures need to be taken for sustainability of the ecosystem.

Acknowledgement

The authors are thankful to the management and staff of S.T. Hindu college, Nagercoil, Kanyakumari District, Tamil Nadu.

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