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RESEARCH ARTICLE

IMPACTS OF NUTRIENTS NITROGEN, PHOSPHORUS, POTASSIUM AND THEIR ROLE IN THE SEDIMENT OF MANAKUDY ESTUARY, TAMILNADU, S. INDIA

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ABSTRACT

Seasonal variation of nutrients like nitrogen, phosphorus, potassium of the sediment were studied in six stations. The study was conducted at monthly once during the morning time interval from May 2011 to April 2012. The pH (8.71) of the soil remains alkaline in nature throughout the study period. Nitrogen (82.67mg100g) in station 4, phosphorus 21.08 (mg/100g) in station 6 and potassium in station 4 21.08 (mg/100g). Sediment nutrients brings numerous pollutants and play an important role in the remobilization of contaminations in aquatic system between water and sediments. Nutrients becomes maximum ranges in the freshwater flow of riverine sides because of more plantations and agricultural wastages. The nutrients of sediments in the six stations were subjected to two way Anova found that they were not significant. The ecosystem of Manakudy estuary adversely effected by nutrient pollution.

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INTRODUCTION

Estuaries transport sediments through the action of freshwater flow and the nature and rate of sedimentation in an estuary depend on the nature of catchments (Postma, 1982). Sediments act as the storage house of nutrients in an aquatic ecosystem. Hydrodyanamical, chemical and biological factors with different time scales and these variations may influence sedimentary processes and also physical and chemical characteristics of sediments (Nair *et al*., 1983). Sediments are indicates of quality of overlying water and its study is a useful tool in theassessment of environmental pollution. The variation may also be due to the processes like adsorption and desorption of phosphate and buffering action of sediment under varying environmental conditions (Govindasamy, and Kannan, 2000). The Gironde Estuary was estimated to contribute 60% of the input of fine sediments to the continental shelf of the Bay of Biscay (Castaing and Allen, 1981). Although this system drains one of the less urbanized/industrialized water- sheds in Europe (Abril *et al*., 2002; Etcheber *et al*., 2007). Organic sediment and fertiliser runoff from pastures and intensive feed lots increases the amount of nutrients going into estuaries, causing excessive growth of phytoplankton and blue green algae. This leads to a loss of oxygen in the water, and results in the death of fish and other aquatic fauna. In estuarine ecosystems, the major source of nutrients are from rivers, ground water, atmosphere, and sediments (Conley, 2000). The nutrient load from river influx was extreme depending on the allchthonous and allchthonous precipitations in the basins. Rapid nutrient inputs are of considerable importance since they can modify the phytoplankton community structure (Sarma, 2009). The main objective of this paper is the impact of nutrient enrichment and their pollution status in the soil of estuarine environment.

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Description of the study area

The study was carried out at Manakudy estuary, Kanyakumari District is located on the southern extremity of the Indian Peninsula between latitude 802' and 804'N and between longitude 77026'and 77030'E. The Manakudy estuary is the confluence of river Pazhayar and has an area of about 150ha. It is a sand built estuary connected to the sea during the rainy season. For present investigation are based on the analyses of collection of sediments from the six stations.

Station I: This station is situated near the bar mouth of the estuary.

Station II: This station is 900 m distance from station 1. It receives household wastages.

Station III: This station is 2 km opposite side to the station 1, where the sewage from husk retting factory enters the estuary.

Station IV: This station is near the mangrove forest.

Station V: This station is 2 km away from the mangrove forest.

Station VI: This station is at the end of the estuary whereas the river pazhayar enters the estuary, which receives agricultural wastes.

MATERIALS AND METHODS

The soil samples were collected once a month from the sampling stations during the morning hours (7-9 a.m) throughout the year from May 2011 to April 2012.The soil samples were collected in polythene bags, shadow dried and neatly labeled. Then they were brought to the soil testing laboratory for further analysis

Soil quality parameters

Soil pH, and sediment nutrients such as nitrogen, phosphorus and potassium were detected. The sediment samples were subjected to various physical and chemical methods of investigations by standard methods. Nitrogen (Strickland and Parsons 1972), phosphate (stannous chloride method, standard methods APHA, 1978), Potassium (Flame photometric method, std method of APHA, 1928). The pH was measured by using digital pH metre.

Statistical analysis

All the values were computed, analysed and presented as mean ± standard deviation. Two-way Anova were calculated between station and season in the nutrient characteristics of soil by using MS office - Excel, to understand their relationship.

RESULTS AND DISCUSSION

Seasonal variation of the pH were recorded higher in station 2 (8.71±0.34) and it shows low value in the station 6 (7.57± 0.27) during the non-monsoon season of year 2011-2012 (Fig. 1). Two-way Anova test revealed that the variation in pH between station and season were not significant F=2.502, 1.677; P 0.05 in the year 2011-12 (Table 1).

Table 1. Two-way ANOVA for seasonal variation of pH in the soil sample

Study year	pH						
	Source of Variation	SS	df	MS	F	P-value	F crit
2011-2012	Between station	0.893594	5	0.178719	2.502462	0.101772	3.325835
	Between season	0.239536	2	0.119768	1.677019	0.235471	4.102821
	Error	0.714172	10	0.071417			
	Total	1.847303	17				

P 0.05 is statistically significant

Table 2. Two-way ANOVA for seasonal variation of nitrogen (mg/100g) in the soil sample

Study year	Nitrogen						
	Source of Variation	SS	df	MS	F	P-value	F crit
2011-2012	Between station	1664.324	5	332.8648	4.678648	0.018387	3.325835
	Between season	0.269175	2	0.134588	0.001892	0.99811	4.102821
	Error	711.4552	10	71.14552			
	Total	2376.048	17				

P 0.05 is statistically significant

Table 3. Two-way ANOVA for seasonal variation of phosohorus (mg/100g) in the soil sample

Study year	Phosphorus						
	Source of Variation	SS	df	MS	F	P-value	F crit
2011-2012	Between station	22.22519	5	4.445038	0.534029	0.746647	3.325835
	Between season	28.84838	2	14.42419	1.732927	0.225855	4.102821
	Error	83.23596	10	8.323596			
	Total	134.3095	17				

P 0.05 is statistically significant

Table 4. Two-way ANOVA for seasonal variation of potassium (mg/100g) in the soil sample

Study year	Potassium						
	Source of Variation	SS	df	MS	F	P-value	F crit
2011-2012	Between station	18932.76	5	3786.552	1.496167	0.274387	3.325835
	Between season	13814.5	2	6907.249	2.729236	0.113284	4.102821
	Error	25308.35	10	2530.835			
	Total	58055.61	17				

P 0.05 is statistically significant

During the study period of Manakudy estuary, the seasonal variation of pH ranges between 7.57 to 8.71. Higher level and lower level was observed in the non- monsoon season.

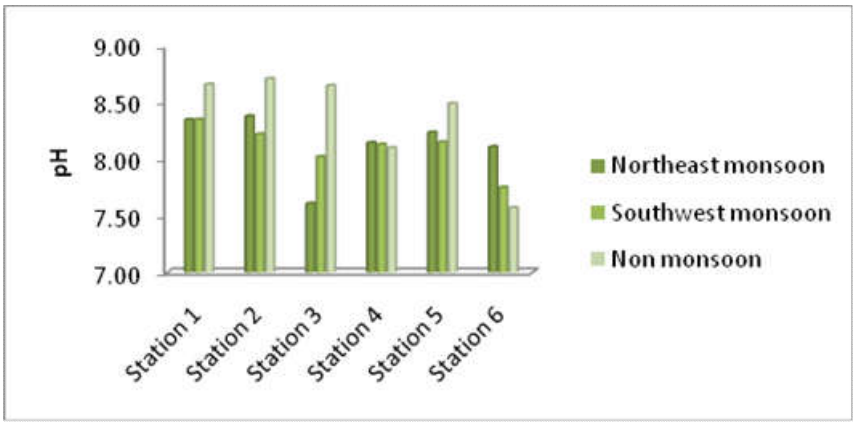

Fig. 1. Seasonal variation of pH in the soil sample

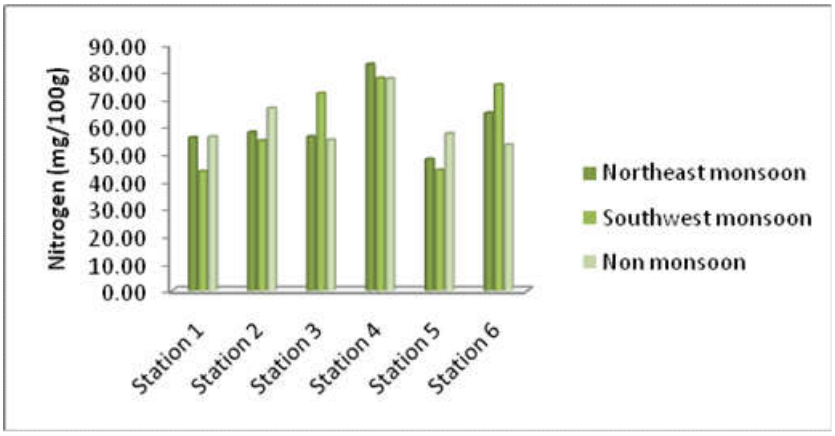

Fig 2. Seasonal variation of Nitrogen (mg/100g) in the soil sample

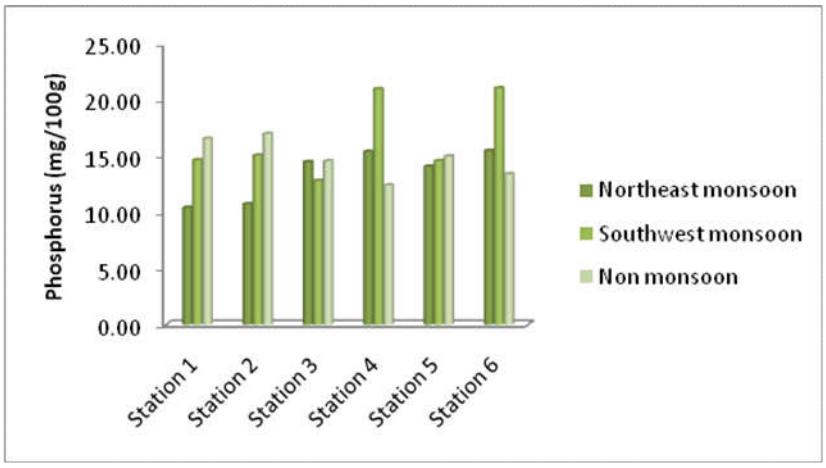

Fig 3. Seasonal variation of Phosphorus (mg/100g) in the soil sample

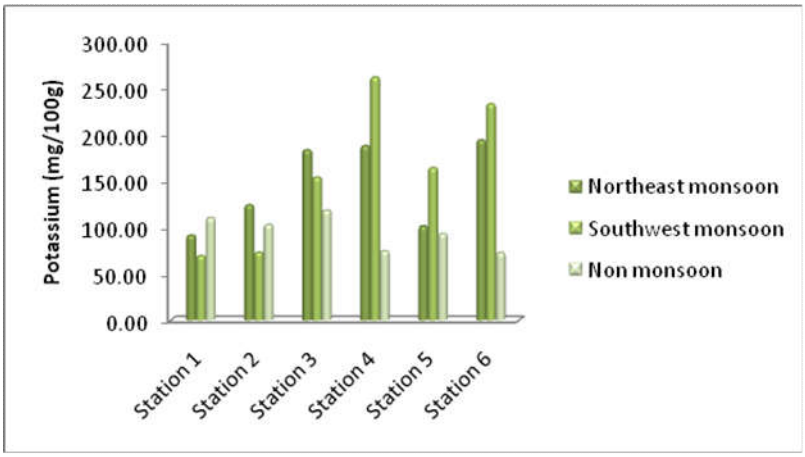

Fig 4. Seasonal variation of Potassium (mg/100g) in soil sample

Depend upon rainfall the pH value increase in rainy season and decreases during summer in estuary. The major factors governing the pH of soil include the concentration of reduced metals like iron, manganese as well as carbonates, carbonic acid and humic acid (Patrick and Mikkelsen, 1974). Seasonal variation of nitrogen concentration was higher in 82.67±7.92 in station 4 of northeast monsoon season and become lower (43.58±21.24) in station 1 of southwest monsoon season (Fig 2).Two-way analysis of variance for the data of nitrogen as a function of sampling stations showed that they are significant F=4.678; P 0.05 the variation between season were not significant F=0.001, P 0.05 (Table 2). The data on the seasonal variations in the present sampling areas of the sediment nitrogen showed maximum in station 4 during northeast monsoon and it was minimum in station 1 during southwest monsoon .Low values of sediment nitrogen during premonsoon was attributed to the combined effects of biological utilisation and desorption from suspended particulates (Nasnolkar *et al*., 1996). High nitrate levels (>1 mg l-1) are not good for aquatic life. The seasonal variation of phosphorus, maximum in the south west monsoon season of station 6 (21.08±10.57) and minimum in northeast monsoon season of station 1 (10.42±7.03) (Fig 3). Two-way Anova test revealed that the variation in phosphorus between station and season were statistically not significant F= 0.534,1.732 ;P 0.05 in the study year (Table 3). High Levels of both phosphate and nitrate can lead to eutrophication, which increases algae growth and ultimately reduces dissolved oxygen levels in the water (Murdoch *et al.,* 2001). Detritus is the main source of organic phosphorous in the sediment, it gets bound with the shells and bones of invertebrate animals and when the shells break the phosphorous is released into the sediment and low values during monsoon is also attributed to the leaching of phosphate from sediments to the overlying water. During the present investigation of Manakudy estuary, the low value were observed in station 1 of northeast monsoon and in station 6 high value of southwest monsoon due to freshwater inflow in riverine side. Seasonal variation of potassium was high (261.67±78.53) during the southwest monsoon season of station 4 and low level (72.42±5.32) was recorded in the non -monsoon season of station 6 in the study period (Fig. 4). Two-way Anova test revealed that the variation in potassium between station and season were not significant F=1.496,2.729; P 0.05 (Table 4). Leaching of potassium from the nearby coconut plantation, by way of potash fertilizers may be the reason for the higher concentrations of potassium in station 4 of study area. The seasonal variation of potassium showed maximum and minimum range during southwest monsoon. Higher concentration was also reported by Evgueni *et al*. (2002) in Colorado river delta.

Conclusion

In the present work of Manakudy estuary, it is affected by the nutrient enrichments like nitrogen, phosphorus, potassium through the inflow of freshwater. The station 4 and 6 mainly interrupted throughout the study period due to the accumulation of nutrients from nearby coconut plantations. The pH become 7-8 in sediment. Two-way anova revealed that the nutrients were statistically not significant between station and season (P 0.05).

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