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THE WATER CHARACTERISTICS AND NUTRIENTS OF ADIRAMPATTINAM MANGROVE REGION, TAMILNADU, INDIA

[1]*Prabhahar, C., [2]Saleshrani, K., [1]Arsheed Hussain Dar and [1]Tharmaraj, K

[1]Department of zoology, Annamalai University, Annamalai Nagar.608 002, Chidambaram, Tamil Nadu, India
[2]Department of zoology,.Manonmaniam Sundaranar University, Thirunelveli, Tamil Nadu, India

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ABSTRACT

The quality of water may be assessed according to its physico-chemical and biological characteristics because of increasing industrialization, urbanization and anthropogenic activities from all fresh water bodies. At present industrial effluents sewage water, domestic wastes and agricultural wastes are being discharged into the river and oceans that causing degradation of water quality. An investigation was undertaken to assess the nutrient analysis, in Adirampattinam Mangrove region for four seasons (pre-monsoon, monsoon, post-monsoon and summer) during the year July 2010 - June 2011. For the present study two sampling stations were fixed *viz.* Mangrove water (Station I) and Adirampattinam coastal waters (Station II). Nutrients of water in the study area (Total Nitrogen, Total organic carbon, Total phosphate, nitrate, nitrite, free ammonia, calcium, magnesium, Iron and sulphate OC, PO_4, SiO_2, NO_2, NO_3, Calcium, Magnesium, Iron and Sulphate) also exhibited high values during the monsoon season and low values were recorded during the summer seasons. Except free NH_3 which also exhibited high values during pre-monsoon season and low values during post-monsoon seasons.

INTRODUCTION

Mangrove forest are one among the world's most productive ecosystem, they are often referred to as 'tidal forest', 'coastal forest' or 'oceanic rain forest. They are the woody plants that grow in tropical latitude along the land sea interface, bays, estuaries, lagoons, backwaters and in the rivers, where the water still remains saline. The mangrove ecosystems support genetically diverse groups of aquatic and terrestrial organisms. These forest ecosystems also support marine fisheries and protect the coastal zone, thus helping the coastal environment and economy. Water pollution may be defined as the "alternation of physical and biological properties of water or any addition of foreign material and the natural water which may have harmful effect on living beings, human agricultural system and other biological aspects, directly and indirectly, immediately after sometimes or after a very long period". (Kathiresan and Aasimi, 2005). Among the several characteristics of water quality the most important factors such as temperature, pH, dissolved oxygen, electrical conductivity, total dissolved solids, biological oxygen demand and chemical oxygen demand nutrients like phosphate, silicate, nitrate and nitrites, ammonia *etc.*, and heavy metals *viz* copper, chromium, cadmium, lead, zinc, manganese and iron will play an important role in the life of aquatic organisms (Karuppasamy *et al.*, 1999, Prabhahar *et al*., 2011)

Water quality monitoring is an important aspect of the overall water quality management and water resources development. A well planned and well managed water quality monitoring system is required to predict changes or trends of changes in the quality of a particular water body, so that creative and preventive measures can be taken to restore and maintain ecological balance in the water body (Singh *et al.*, 1999; Prabhahar *et al.*, 2011)

Environmental pollution monitoring is essential at strategic point in natural water bodies, as well as in commercial and industrial locations (Iyyapan, 2000). In general, there are two types of monitoring (a) Biological monitoring and (b) Physico-chemical monitoring. Biological monitoring is based on the assessment of population of critical species that are sensitive to pollution; while physico – chemical monitoring is based on the actual measurement of physical parameters *e.g* pH, temperature, rainfall, turbidity. Chemical parameters such as pesticides, insecticides and heavy metals, *viz.* copper, zinc, cadmium, chromium, lead, iron, cobalt mercury *etc* (Prabhahar *et al., 2011*). Biological monitoring directly provides qualitative information with regards to the health chemical monitoring provides quantative information about the presence of pollutants in the natural water

* Corresponding author: +91
E-mail address: prabhaharc@yahoo.com

bodies. Physico – chemical monitoring is also provides stable information with regards to incoming undesirable effluents, which eventually indicate the possible source of such effluents. Biological monitoring does not provide any such hints (Young *et al.*, 1996).

Dissolved oxygen was estimated by the modified Winkler's method, described by Strickland and Parsons, (1972). For the analysis of water nutrients, surface water samples were collected in clean 2 liter polythene bottles and kept in an ice box and transported immediately to the laboratory. The nutrient properties of water in phosphate nitrate nitrite free ammonia, calcium, Iron and sulphate by adopting the standard methods described by Strickland and Parsons, (1972).

For the estimation of particulate organic carbon (TOC) the surface water samples were collected in two clean polythene bottles and filtered using 4.7 cm Whatmann Glass filter paper (GFP) coated with Sodium Sulphate (Na_2SO_4) with a filtration unit, then the TOC was determined by wet ashing the filter paper with a mixture of Potassium dichromate and concentrated Sulphuric acid by measuring the decrease in extinction of the Yellow dichromate. Soil concentration of the POC was measured in UV double beam 220 Spectrophotometer (Hitachi). The TOC observed in high monsoonal season, phosphate value might be due to the regeneration and release of total phosphorus from bottom mud into the water column by turbulence and mixing (Saravanakumar *et al.*, 2008). The post monsoonal low value could be attributed to the limited flow of freshwater, high salinity and utilization of phosphate by phytoplankton (Rajasekar, 2003).

RESULTS

The Total Nitrogen value at station I varied from 38.98 to 28.07mg/l. The minimum was recorded as 28.07mg/l (June). The maximum was recorded as 38.98mg/l (Nov.). At station II the Total Nitrogen value varied from 36.8 to 26.83mg/l. The minimum was recorded as 26.83mg/l (May). The maximum was recorded as 36.8mg/l (Dec.).

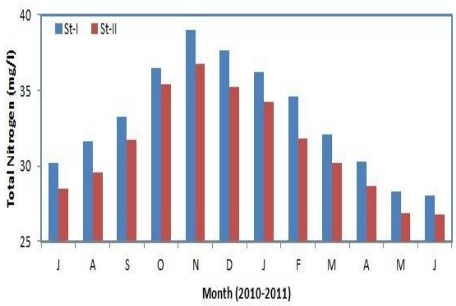

Fig.1 Monthly variation in Total Nitrogen recorded at stations I and II from July 2010 to June 2011.

The total organic carbon value at station I varied from 1.25 to 0.32mg/l. The minimum was recorded as 0.32mg/l (June). The maximum was recorded as 1.25mg/l (Nov.). At station II the total organic carbon value varied from 1.53 to 0.59mg/l. The minimum was recorded as 0.59mg/l (May). The maximum was recorded as 1.53mg/l (Dec.).

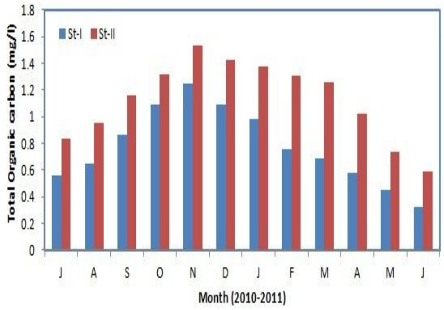

Fig.2 Monthly variation in Total Organic Carbon recorded at stations I and II from July 2010 to June 2011

The total phosphate value at station I varied from 2.09 to 0.98mg/l. The minimum was recorded as 0.98mg/l (June). The maximum was recorded as 2.09mg/l(Dec). At station II the total phosphate value varied from 2.36 to 1.32mg/l. The minimum was recorded as 1.32 mg/l(May). The maximum was recorded as 2.36mg/l (Dec.).

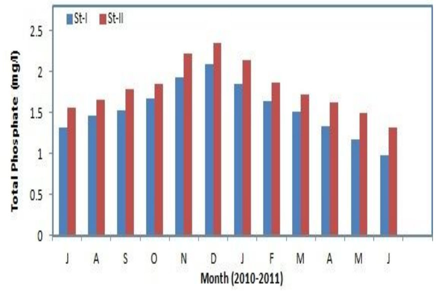

Fig.3 Monthly variation in Total Phosphate recorded at stations I and II from July 2010 to June 2011.

The reactive Silicate value at station I varied from 37.4 to 14.6mg/l. The minimum was recorded as 14.6mg/l (June). The maximum was recorded as 37.4mg/l (Nov.). At station II the reactive silicate value varied from 41.2 to 13.02mg/l. The minimum was recorded as 13.02mg/l (May). The maximum was recorded as 41.2mg/l (Nov.)

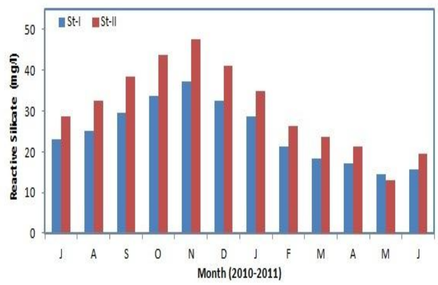

Fig.4 Monthly variation in Reactive Silicate recorded at stations I and II from July 2010 to June 2011

The Nitrate value at station I varied from 22.3 to 13.01mg/l. The minimum was recorded as 13.01mg/l (May). The maximum was recorded as 22.3mg/l (Dec.). At station II the Nitrate value varied from 24.8 to 13.56mg/l. The minimum was recorded as 13.56g/l (May). The maximum was recorded as 24.8mg/l (Dec.). The Nitrite value at station I varied from 10.21 to 5.23mg/l. The minimum was recorded as 5.23mg/l (June). The maximum was recorded as 10.21mg/l(Dec.). At station II the Nitrite value varied from 12.32 to 6.21mg/l. The minimum was recorded as 6.21mg/l (May). The maximum was recorded as 12.32mg/l (Dec.).

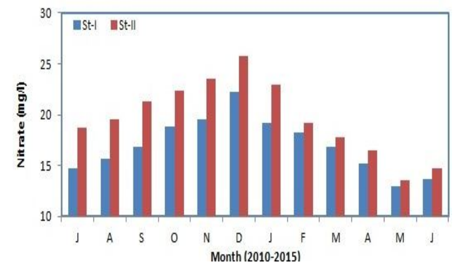

Fig.5 Monthly variation in Nitrate recorded at stations I and II from July 2010 to June 2011.

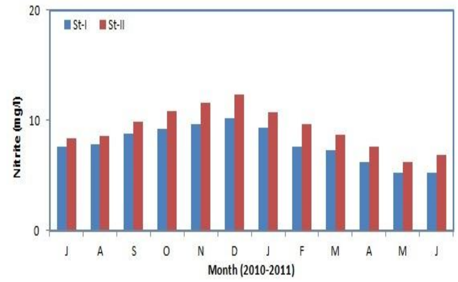

Fig.6 Monthly variation in Nitrite recorded at stations I and II from July 2010 to June 2011.

The Free Ammonia value at station I varied from 0.99 to 0.19mg/l. The minimum was recorded as 0.19mg/l (June). The maximum was recorded as 0.99mg/l (Aug.). At station II the Free Ammonia value varied from 0.89 to 0.12mg/l. The minimum was recorded as 0.12mg/l (June). The maximum was recorded as 0.89 mg/l (Aug.).

Fig.7 Monthly variation in Free Ammonia recorded at stations I and II from July 2010 to June 2011.

The Calcium value at station I varied from 1052 to 853mg/l. The minimum was recorded as 853mg/l (June). The maximum was recorded as 1052mg/l (Dec.). At station II the Calcium value varied from 1006 to 836mg/l. The minimum was recorded as 836mg/l (June). The maximum was recorded as 1006mg/l (Dec.).

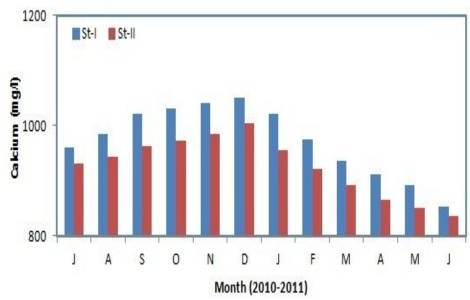

Fig.8 Monthly variation in Calcium recorded at stations I and II from July 2010 to June 2011.

The Magnesium value at station I varied from 279 to 167 mg/l. The minimum was recorded as 167 mg/l (May). The maximum was recorded as 2791mg/l (Dec.). At station II the Magnesium value varied from 256 to 148 mg/l. The minimum was recorded as 148mg/l (May). The maximum was recorded as 256mg/l (Dec.).

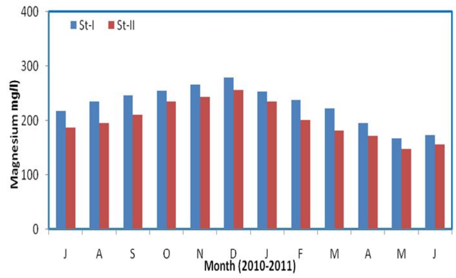

Fig.9 Monthly variation in Magnesium recorded at stations I and II from July 2010 to June 2011.

The Iron value at station I varied from 1.96 to 0.76mg/l. The minimum was recorded as 0.76mg/l (June). The maximum was recorded as 1.96mg/l (Dec.). At station II the Iron value varied from 2.42 to 1.06mg/l. The minimum was recorded as 1.06mg/l (June). The maximum was recorded as 2.42mg/l (Dec.).

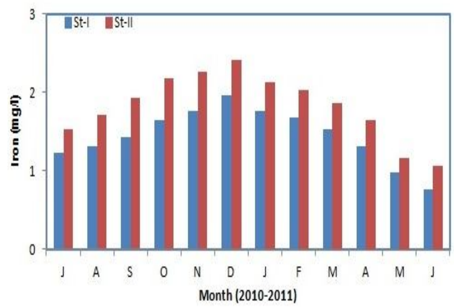

Fig.10 Monthly variation in Iron recorded at stations I and II from July 2010 to June 2011.

The Sulphate value at station I varied from 746 to 563 mg/l. The minimum was recorded as 563mg/l (June). The maximum was recorded as 7465mg/l (Dec.). At station II the Sulphate value varied from 854 to 615 mg/l. The minimum was recorded as 615mg/l (June). The maximum was recorded as 854mg/l (Dec.).

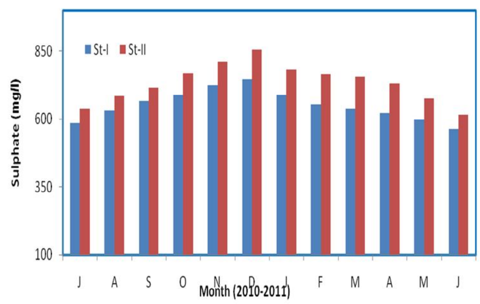

Fig.11 Monthly variation in Sulphate recorded at stations I and II from July 2010 to June 2011.

DISCUSSION

The present study, it was been observed that the Nitrate value was within the WHO and BIS standards the desirable and permissible value is 45 – 100 mg/l. Algal growth and Blue Baby diseases in infants is the general and health effects of Nitrate. No chance for the occurrence of Blue Baby (Methaemoglobineamia) disease is found at the study area. High concentration of nitrate in the water may be due to local run off from the adjacent crop fields where the farmers have used nitrogen fertilizers. The high concentration may be due to the influenced oxidation of the nitrogenous ammonia of nitrite to nitrate. The recorded highest monsoonal nitrate value could be mainly due to the organic materials received from the catchment area during the tidal flow (Ashok Prabu *et al.,* 2008).

In the present study, it was been observed that the Nitrite value was within the BIS and WHO standard. The desirable and permissible value is 0.2 - 15 mg/l the general and health effects of Nitrite is to form nitrosamines which are carcinogenic. This was due to the addition nitrogenous nutrients mainly terrestrial runoff like break down of vegetation, use of chemical fertilizers in agriculture and oxidation of ammonia from of nitrogen to nitrite (Jayaraman, 1959).

Ammonia value was within the desirable limit of BIS and WHO standards the desirable limit is 0.2 – 15mg/l. Because the surface runs off wastes, agricultural wastes washed and show maximum value in pre-monsoon. Excess ammonia indicates polluted water and maximum algal growth. (Luoma, 1983). Calcium value was not with the desirable limit of BIS and WHO standard. The desirable and permissible value of calcium 75-.200 mg/L. The calcium and magnesium contributes to the hardness of water as their carbonate magnesium is always considerably lower than of calcium component excessive concentration of magnesium is undesirable in domestic water because of the problems of scale formation of pitting (APHA, 2000).

Magnesium value was not within the desirable limit of BIS and WHO standards 1981). The desirable and permissible value of Magnesium is 30-100 mg/l the general effect of magnesium poor lathering and deterioration of cloths.

Iron value was not within the desirable value of BIS and WHO standards , the desirable and permissible limit of Iron in drinking water is 0.3 - 1.0 mg./l. The source of Iron is leaching of cost iron pipes in water distribution system and natural effects of iron are brackish colour, iron bacteria and discoloured beverages.

Sulphate value was not within the desirable limit of BIS and WHO standard the desirable and permissible limit is 200-400 mg/l. Waste water for Tanneries, paper mill and textile mills contribute the sulphate in natural water along with some agricultural run-of containing residue of fertilizers. It can cause gastrointestinal irritation. The TOC observed in high monsoonal season, phosphate value might be due to the regeneration and release of total phosphorus from bottom mud into the water column by turbulence and mixing (Saravanakumar *et al.,* 2008). The post monsoonal low value could be attributed to the limited flow of freshwater, high salinity and utilization of phosphate by phytoplankton (Rajasekar, 2003).

The TOC observed in high monsoonal season, phosphate value might be due to the regeneration and release of total phosphorus from bottom mud into the water column by turbulence and mixing (Saravanakumar *et al.,* 2008). The post monsoonal low value could be attributed to the limited flow of freshwater, high salinity and utilization of phosphate by phytoplankton (Rajasekar, 2003).

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