

Studies on the Pollution Status of Thengaithittu Fishing Harbour, Puducherry, India

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Abstract— Degradation of water quality has become a current environmental issue in view of its importance in maintaining the human health and ecosystem. The conventional source of drinking water is from rivers, wells and bore wells which are been used as untreated. Quality of water generally refers to the mineralogical component of water, which are necessary to be at the optimum level so as to maintain the proper growth of plants and animals. For the study Ariankuppam river an extension of Sankaraparani river situated at south of Puducherry region, south east coast of India was selected and the water samples were collected for different point and non-point sources and analyzed, for various physico-chemical water quality using appropriate certified and acceptable procedures. The study area experiences a seasonal climate and broadly divided into three seasons as winter (September & October), Rainy (November & December) and summer (January to March). Based on the demand for the potable water, the productivity has become a major concern which depends on the physico-chemical characteristic of the water body. The test were carried out for determining water quality parameters such as colour, Temperature, pH, Total Dissolved Solids (TDS), Suspended Solids (SS), Hardness, Chloride, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) for periodical water samples collected from the upstream, midstream and downstream based on the values recommended by WHO and BIS standards.

Key words: Water Pollution, Ariankuppam River, Physico-Chemical Characteristics, Field Investigation

I. INTRODUCTION

Estuarine ecosystems have been, and still are heavily influenced by the human species through pollution and habitat loss throughout the world and its impacts have resulted in a number of environmental issues including the enrichment of enclosed waters with organic matter leading to eutrophication, pollution by chemicals such as oil and sedimentation due to land-based activities or sea level rise due to the global change [31] India has 14 major, 55 minor and numerous small rivers. India is often referred as the "Land of Rivers" and few rivers reach the Bay of Bengal & Arabian Sea. The surface water sources such as rivers & streams are susceptible to pollution, due to untreated municipal waste, industrial effluent and lateral seepage from agricultural land which is used as chemical fertilizers.

Over 80% of all marine and river pollution originates from land-based effluents which are primarily industrial, agricultural and urban. Domestic sewage discharges in water bodies increase the concentrations of organic matter and nutrients that can affect the productivity of the system. In India it is reported that about 70% of the available water is polluted. It is observed that human

activities are the major factor in determining the quality of the surface and groundwater through atmospheric pollution, effluent discharges, use of agricultural chemicals, and land use. The chief source of pollution is identified as sewage constituting 84 to 92 percent of the waste water. Industrial waste water comprised 8 to 16 percent. Pollution of river and river side by garbage and wastewater is significant and is dated near settlements and mouth zones of the rivers [14].

Pondicherry is about 293 km² and has a population of around 12 Lakhs and generates wastewater of about 60 MLD, with the entire amount discharged untreated into the sea through backwaters and creeks. Due to tremendous increase of population in this area, the generation of wastewater has also increased. Pondicherry hosts major industries like paper, alcoholic beverages, chemicals and pharmaceuticals. The total treated wastewater discharged from industries is about 10 MLD. Wastewater from sewage contains mostly BOD compounds, nutrients and bacteria. Industrial wastewater mainly contains suspended matter, BOD compounds and trace amounts of oil and gas.

II. MATERIALS & METHODOLOGY

River Sankaraparani, drains into the Bay of Bengal on the southern side of Pondicherry region and it also known as river Gingee or Varahanadhi, it has its source at the hills of Malayanur in the South Arcot district of Tamil Nadu. The total length of Sankaraparani river is 78.5Km and of which it runs 34Km in Pondicherry. The river splits off into two branches namely Chunnambar in the south and Ariankuppam River in the north. Ariankuppam river and Estuary is situated in Pondicherry, between Latitude 11°46'03" to 11°53'40" N; and Longitude 79°49'45" to 79°48'00" E. Ariankuppam river, which originates from the river Sankaraparani, at Nallareddy Palayam (about 10 kms from the sea shore) usually gets cut off from river Sankaraparani. The waste generated from areas near to Ariankuppam is let out into the river directly, deteriorating the water quality of the river [31].

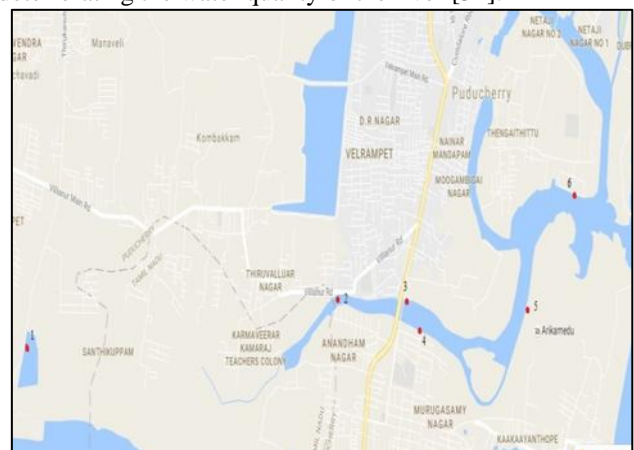


Fig. 1: Location of the water samples in Sankaraparani river

III. METHODS

The water quality analysis had been carried out by physico-chemical parameters such as Colour, Temperature, pH, Suspended solids (SS), Total Dissolved Solids (TDS), Hardness, Chloride, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) during pre-monsoon, monsoon & post monsoon.

A. Determination of Colour:

Colour of the sample is noted by general appearance of our eyes.

B. Determination of Temperature:

Both Atmospheric and Water Temperature were measured using Mercury thermometer and noted in °C

C. Determination of pH:

The digital pH meter (Model – Med DALAL) with a glass electrode was used to measure pH. The buffer solutions of pH 4 and pH 7 were used to calibrate the instrument. The basic principle is the measurement of hydrogen ions by potentiometric measurement using standard hydrogen electrode and a reference electrode.

D. Determination of Total dissolved solids (TDS):

Total dissolved solids (or TDS) are the measure of all organic and inorganic substances dissolved in a given liquid, revealing the proportion of different solids. In a laboratory setting, the total dissolved solids are determined by filtering a measured volume of sample through a standard glass fiber filter.

E. Determination of Suspended Solids (SS):

Suspended solids refer to small solid particles which remain in suspension in water as a colloid or due to the motion of the water.

F. Determination of Chloride:

It is measured by titration of a known volume of sample with standardized silver nitrate solution using potassium chromate solution in water as indicator and end point is the appearance of reddish tint from yellow colour. It is determined by Argentometric method.

G. Determination of Hardness:

For the estimation of total hardness, in 100 ml. of sample, 1 to 2 ml of buffer solution and a pinch of Eriochrome Black-T (used as an indicator) were added. After the appearance of wine red colour, the mixture was titrated against EDTA stirring continuously till end point change of wine red to blue is achieved. It is determined by (EDTA Method).

H. Determination of Dissolved Oxygen (DO):

For the estimation of Dissolved Oxygen the water samples were collected with care in BOD bottles without bubble formation. The DO was then fixed at the station itself by adding 1 ml each of Manganese Sulphate (MnSO₄) and Alkali-iodate azide (KI) reagents and brought to the laboratory. It is determined by Winkler's method.

I. Determination of Biochemical Oxygen Demand (BOD):

BOD is a measure of organic material contamination in water, specified in mg/L. BOD is the amount of dissolved oxygen required for the biochemical decomposition of organic

compounds and the oxidation of certain inorganic materials (e.g., iron, sulfites). Typically the test for BOD is conducted over a five-day period.

J. Determination of Chemical Oxygen Demand (COD):

COD is another measure of organic material contamination in water specified in mg/L. COD is the amount of dissolved oxygen required to cause chemical oxidation of the organic material in water.

IV. RESULTS AND DISCUSSION

The result obtain from the water samples collected for analyzing the various Physico – Chemical parameters for the study area for between pre and post monsoon as furnished below

Graphical Interpretation:

Comparison of concentration at six observation stations

1) pH

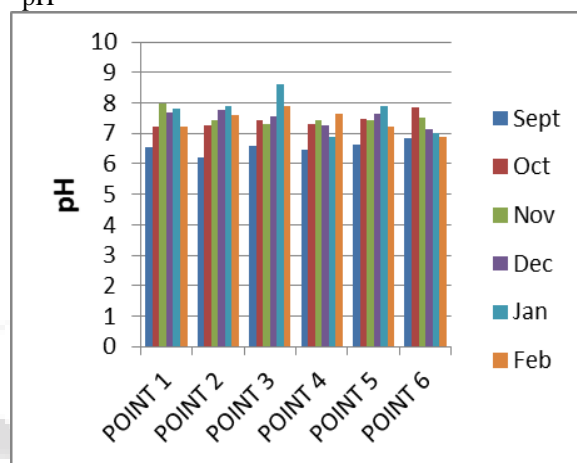


Fig. 2:

2) Total Dissolved Solids (TDS)

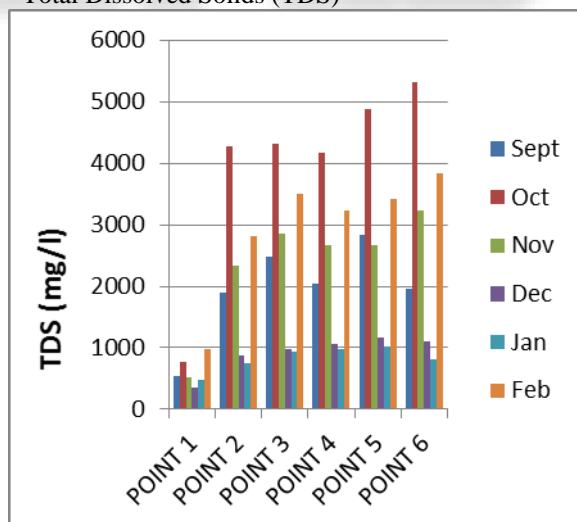


Fig. 3:

3) Chloride

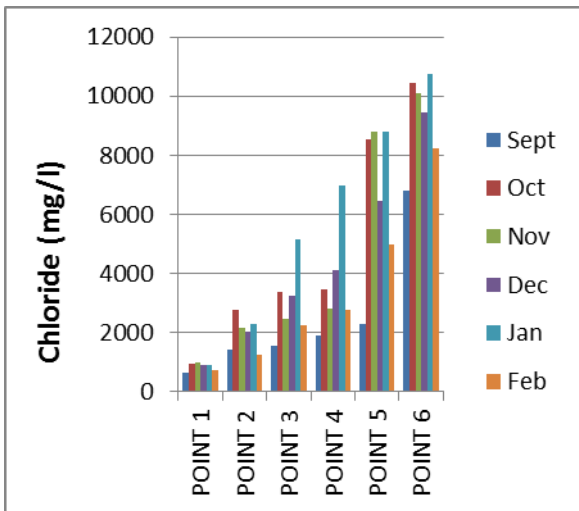


Fig. 4:

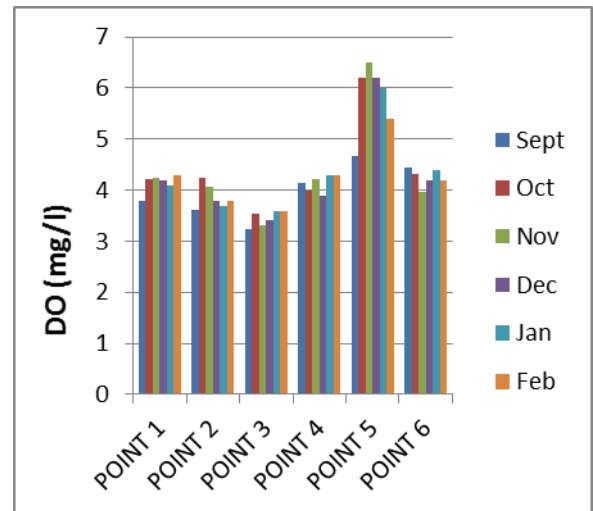


Fig. 7:

4) Hardness

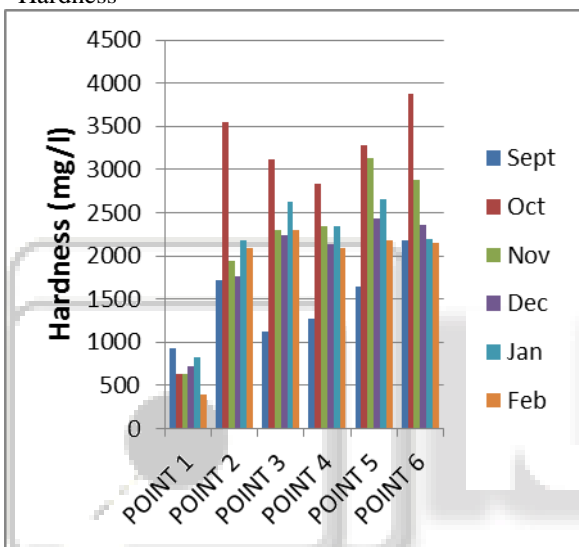


Fig. 5:

7) Chemical Oxygen Demand (COD)

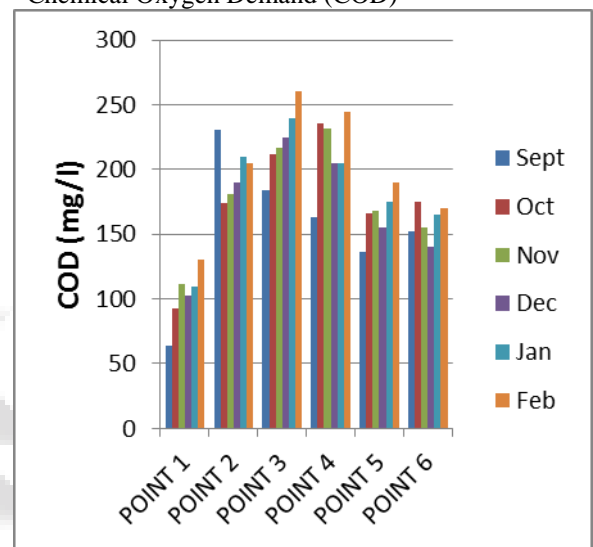


Fig. 8:

5) Suspended Solids (SS)

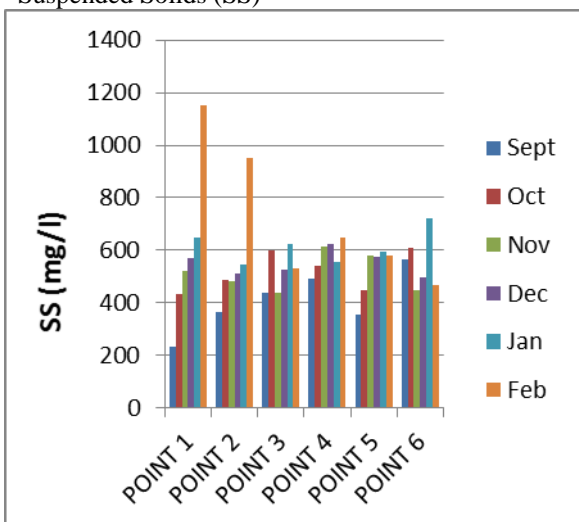


Fig. 6:

8) Biological Oxygen Demand (BOD)

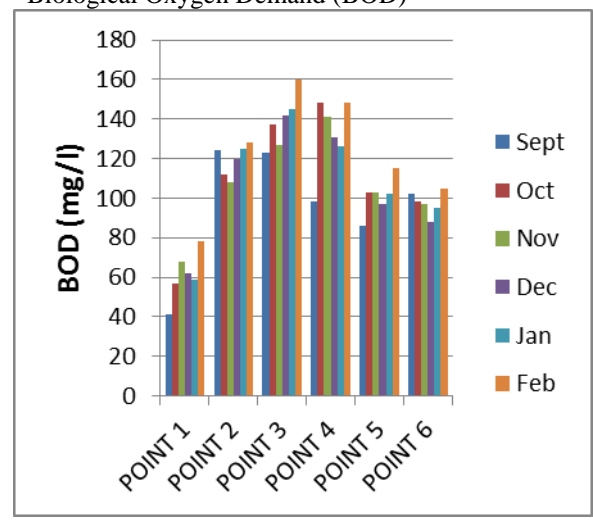


Fig. 9:

6) Dissolved Oxygen (DO)

V. RESULTS ON WATER QUALITY ANALYSIS

A. Colour:

The water sample collected appears to be pale yellow colour on the upstream side, grayish colour on the midstream side

and brown to colourless and on the downstream side by means of visual observation.

B. Temperature:

The mean monthly daily water temperature on the study area for the data acquisition period was found to be in the range of 23C to 33C when observed in the morning and mid-day.

C. pH:

The pH value was found to be in the range of 6.21 to 7.86 when observation made during pre-monsoon, 7.13 to 7.98 during Monsoon and 7.03 to 8.62 during post – monsoon period.

D. Total dissolved Solids (TDS):

The TDS value for the water sample collected from the study area was found to be in the range of 550 to 5323 mg/l during pre-monsoon, 510 to 3230 mg/l during monsoon and 473 to 3830 mg/l during post – monsoon

E. Suspended solids (SS):

The suspended solids for the water sample collected from the study area varies from 235 to 609 mg/l during pre-monsoon, 438 to 625mg/l during monsoon and 547 to 950 mg/l during post – monsoon.

F. Hardness:

The hardness value for the water sample collected from the study area varies from 632 to 3876 mg/l during pre-Monsoon, 625 to 3138 mg/l during Monsoon and 396 to 2657 mg/l during post monsoon

G. Chloride:

The Chloride content for the water sample collected from the study area varies from 640 to 10432 mg/l during pre-monsoon, 920 to 10116 mg/l during Monsoon and 748 to 10744 mg/l during post – Monsoon.

H. Dissolved Oxygen:

The dissolved Oxygen level present in the water sample collected from the study area varies from 3.23 to 6.21 mg/l during Pre-Monsoon, 3.31 to 6.20 mg/l during Monsoon and 3.6 to 6.0 mg/l during post – Monsoon.

I. Chemical Oxygen Demand:

The COD level for the study area varies from 64 to 236 mg/l during pre-Monsoon, 103 to 232 mg/l during Monsoon and 110 to 260 mg/l during Post – Monsoon.

J. Biological Oxygen Demand:

The BOD level for the study area varies from 41 to 148 mg/l during pre- Monsoon, 62 to 142 mg/l during Monsoon and 59 to 160 mg/l during Post Monsoon.

VI. CONCLUSION

From the test results obtained for the various physico-chemical characteristic of the water sample collected from the Upstream mid-stream and Downstream on the Ariyankuppam river and the Thengaihitu Estuary for a period of six month from September 2016 to February are as follows:

A. Colour:

From visual observation the water sample obtained from the upstream side appears to be pale yellowish colour may be due

contamination by Eutrophication and other chemical Industries .In the midstream side the water sample appears to be in grayish colour which denotes the contamination by urban runoff. On the downstream side it appears to be colourless and less affected may be due to the flushing of sea water through the tidal inlet.

B. Temperature:

The observed mean monthly surface water temperature was found to be in the range of 23.4°C to 33°C .The temperature was found to be elevated when compared with the standard temperature for the study area during the observation period due to monsoon failure.

C. pH:

The pH value was found to be in the range of 6.2 to 7.8. The value of pH was towards acidic during the month of September in the mid-stream location due to the leachate of acid forming substance due to precipitation.

D. Total dissolved Solids (TDS):

The total dissolved solids were found to be in the range of 600 to 5400 Mg/l. The maximum TDS level was found in the midstream and downstream location. The higher level of TDS may be due to the influence of industries present near the observation location

E. Suspended Solids (SS):

The suspended samples were found to be in the range of 220 to 950 mg/l. The suspended sediment has reached a high value during the month of September in the upstream and mid-stream location due to surface runoff, soil erosion. An average of 500mg/l was prevailing in all other location for the entire observation period.

F. Chloride:

The chloride level was found to be in the range of 1000 to 110000 mg/l. minimum level was found in location 1 for all observatory period and the value increment along the other location on the downstream side and reaches a maximum value at the Estuary.

G. Dissolved Oxygen:

The dissolved oxygen level was found to be in the range of 3.3 to 6.2 mg/l. the dissolved oxygen level was found to be minimum at the location 3 during the month of September 2016 and a maximum level was found at the location 5 during the month of November 2016.

H. Hardness:

The hardness level in the water sample tested for all the identified location was found to be in range of 300 to 3700 mg/l. the minimum value of hardness was found in location 1 during the month of February and the maximum value was observed in the location 6 during the month of February.

I. Chemical Oxygen Demand:

The COD level was found to be in the range of 60 to 220 mg/l. The lowest COD level was observed in the location 1 during the month of September 2016. The highest value was observed in location 3 during the month of February 2017.

J. Biological Oxygen Demand:

The biological oxygen demand was found to be in the range of 40 to 160 mg/.The minimum value was observed in location 1 during the month of September 2016 and the maximum value was found to be observed in location 3 during the month of February 2017.

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