

CONSISTENT EVALUATION OF LARGEST RIVER OF KERALA TO RESTRICT WATER LIMITATIONS AT TEN LOCATIONS

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ABSTRACT

Water resource, being the most precious natural resource is getting depleted in the recent times in a drastic manner as ever before. The river water bodies, due to the discharge of industrial effluents and other wastes, is becoming more and more polluted, severely degrading its quality of usage. Recent studies have shown the serious need of Water quality assessment to know how far the resource is being polluted. The paper is on a survey work carried across the river Periyar at different sampling points to determine and analyze the water pollution trends.

KEYWORDS: Water-Pollution, Alkalinity, Turbidity, Acidity.

The work focuses on river Periyar, the longest river of Kerala. Originating from the Sivagiri peaks of Sundaramala, in Tamil Nadu; it extends over a stretch of 300 kilometers with a catchment area of 5396 square kilometers. With an estimated annual flow of 11607 cubic meters, the river along with its minor tributaries Muthayar, Perunthuraiar, Chinnar, Cheruthony, Kattappanayar and Edamalayar flows to reach Arabian Sea at Cochin. The river is much significant to the state from its economic point of view as it supports industries like tourism, fisheries, irrigation and its vital role in electricity generation as well. But the present scenario

of the river to continue its qualitative usage is doubtful from the prevailing and continuing health standard of the river, which is highly affected by the various anthropogenic sources.

METHODOLOGY

The method used for the work involves the splitting of the entire stretch of river Periyar (244 kilometers) into 10 sampling points. Suitable locations were identified and the water samples were collected from the 10 sampling points. Each of the sampling location is around 25km long. This was performed during December 2015. The names of the 10 sampling stations are listed as table 1:

Table 1: Location of water sample

| Sl. No | Sampling Points |
|--------|-------------------|
| 1 | Near Periyar Park |
| 2 | Cheruthoni |
| 3 | Upputhara |
| 4 | Vandiperiyar |

| | |
|----|------------------------|
| 5 | Panamkutti |
| 6 | Neriyamangalam |
| 7 | Bhoothathankettu |
| 8 | Kurichilakodu |
| 9 | Thekkumbhagom |
| 10 | Valiyapanickenthuruthu |

The geographical locations of the 10 sampling stations are located as figures:



Figure 1: Periyar Park



Figure 2: Vandiperiyar

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Figure 3: Upputhura



Figure 7: Bhoothathankettu



Figure 4: Cheruthoni



Figure 8: Kurichilakodu



Figure 5: Panamkutti



Figure 9: Thekkumbhagom



Figure 6: Neriya Mangalam



Figure 10: Valiyapanickentheruthu

RESULTS AND DISCUSSION

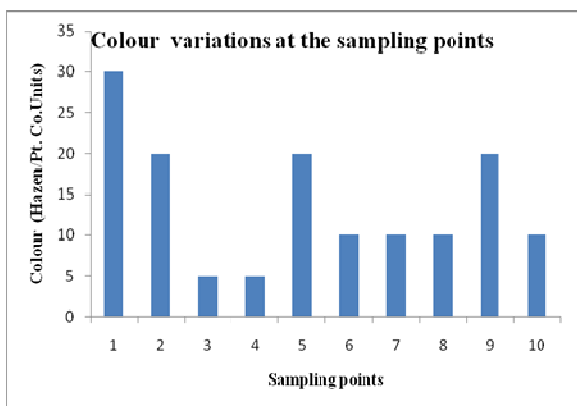
Over the entire stretch of River Periyar divided into 10 sampling locations, water samples were collected

and various physico-chemical parameters including Color, Turbidity, pH, Acidity, Alkalinity, Total Dissolved Solids, Calcium, Nitrate, were analyzed and the results obtained are discussed as below Table 2:

Table 2: Physico-Chemical Parameters

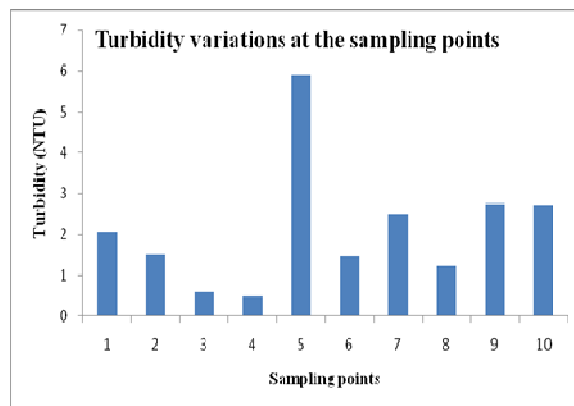
| SI No | Parameters | Unit | Desired Limit | Sampling Points | | | | | | | | | |
|-------|-----------------------------|----------------------|---------------|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | Color | Hazen /Pt. Co. Units | 5 | 30 | 20 | 5 | 5 | 20 | 10 | 10 | 10 | 20 | 10 |
| 2 | Turbidity (NTU) | NTU | 1 | 2.07 | 1.52 | 0.60 | 0.49 | 5.90 | 1.49 | 2.49 | 1.22 | 2.74 | 2.73 |
| 3 | pH | | 6.5-8.5 | 6.67 | 6.63 | 6.66 | 6.60 | 6.85 | 7.01 | 6.87 | 7.29 | 6.69 | 7.74 |
| 4 | Acidity | µs/cm | | 8 | 6 | 4 | 6 | 6 | 6 | 8 | 6 | 8 | Nil |
| 5 | Alkalinity | mg/ litre | 200 | 20 | 20 | 24 | 24 | 20 | 20 | 24 | 18 | 20 | 100 |
| 6 | Total Dissolved Solids(TDS) | mg/litre | 500 | 19.4 | 28.3 | 32.4 | 30.5 | 31.5 | 25.3 | 31.5 | 22.4 | 23.2 | 12300 |
| 7 | Calcium(Ca) | mg/litre | 75 | 4 | 6.4 | 6.4 | 8 | 6.4 | 4.8 | 8 | 5.6 | 8 | 320 |
| 8 | Nitrate(NO ₃) | mg/litre | 45 | 0.416 | 0.618 | 0.800 | 0.396 | 0.946 | 0.661 | 0.824 | 0.467 | 0.447 | 0.713 |

Color, being one of the most important physical parameter that bears a desirable limit of 5Hazen units ,was analyzed across the stretch and apart from two sampling stations, all the rest showed deviations from the desirable limit. This is mainly because of the turbulence subjected to the river by run-off from the high lying terrains. The larger deviations from the permissible limit is observed to be the result of various kinds of developmental activities. The graphical plot of color variations across the sampling stations is obtained as:

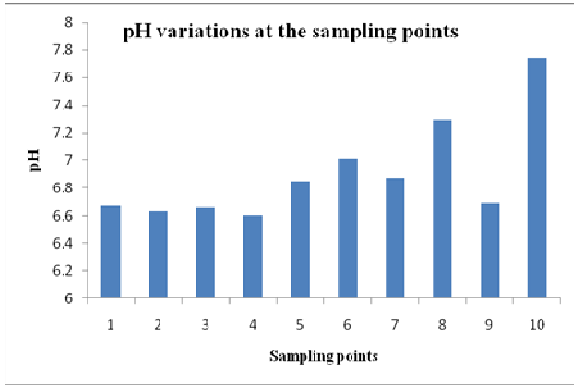


Turbidity is also one of the physical parameter that was analyzed across the stretch of river Periyar. It bears a permissible limit of 1NTU. The results showed that apart from two sampling stations, the rest showed a deviation from the permissible limit, which was again due

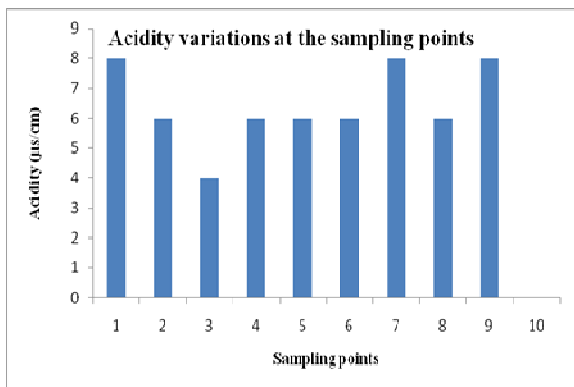
to the turbulence of the river due to considerable runoff from the high lying terrains during the rain. The graphical plot of the turbidity variations across the sampling stations is obtained as:



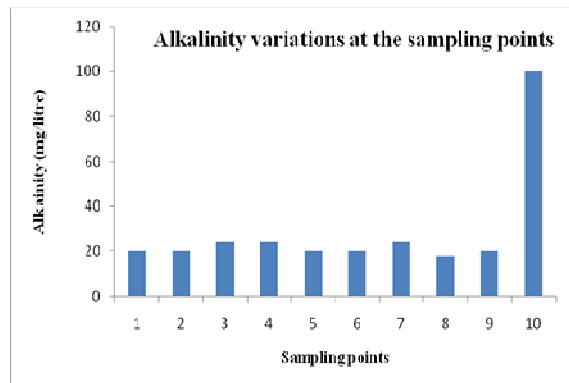
pH, being the most important chemical characteristics of the river was also analyzed. The desired limit of pH varies in the range 6.5-8.5. The results showed that almost all values taken across the sampling stations lied within the range and showed least deviations. The study on this ecological factor is so important to look for deviations for the growth of aquatic life. The graphical plot of pH variations across the stretch is obtained as:



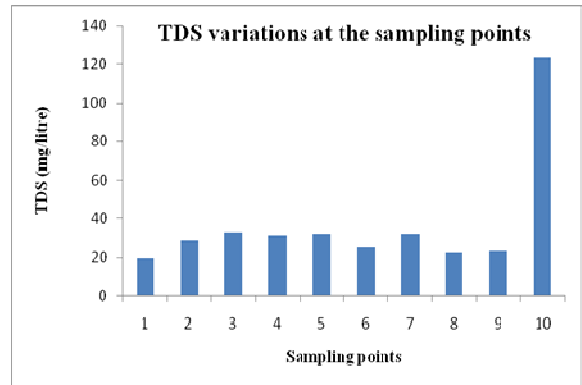
Acidity, is one another property of the river water body being analyzed and the results showed that in six of the sampling stations the result for acidity was obtained positive. This shows a serious trend of the river water body getting polluted in an alarming rate. The graphical plot for acidity variations across the stretch is obtained as:



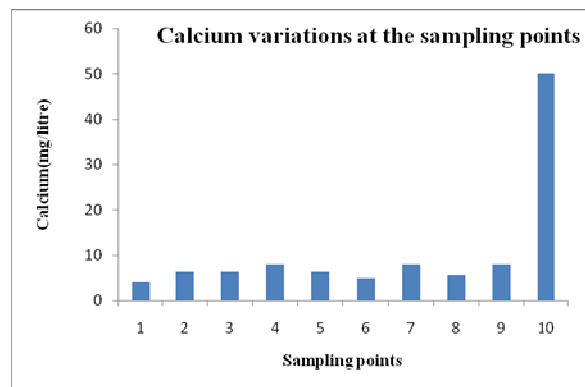
Alkalinity, being the ability of water to neutralize acids was also measured and analyzed to know the buffering capacity of water bodies. The permissible limit of alkalinity is 200mg/litre. The results showed that across the 10 sampling stations, no single station raised a value that exceeded the permissible limit. The graphical plot of the alkalinity variations across the stretch is obtained as:



Total Dissolved Solids(TDS) is one another parameter taken into study. This refers to the inorganic constituents along with certain organic constituents that are dissolved in the water bodies. The permissible limit of TDS in water bodies is 500mg/litre. The results showed that none of the values in any of the sampling station exceeded the permissible limit. The graphical plot for the TDS variations across the stretch is obtained as:

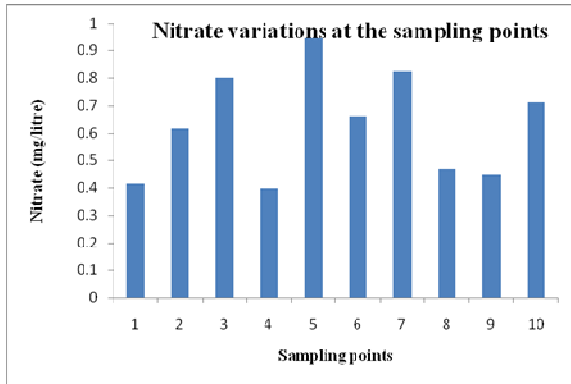


Calcium in water bodies is an indicator of water hardness as the same may be present in the form of Ca^{2+} ions. This property in water is not an effect of a single constituent but the combined effect of dissolved polyvalent metallic ions. The permissible limit of Calcium in river water body is 75mg/litre. The results showed that apart from one of the stations that showed a tremendous deviation from the permissible limit, which lies near the river mouth, all other station points raised values that fall below the permissible limit. The graphical plot for variations in calcium concentrations is obtained as:



Nitrates are one of the important forms of ammonia that serve as a nutrient for the growth of flora and fauna. This was one another parameter taken into observation and analysis. The permissible limit of nitrates in river is 45 mg/litre. The results showed that none of the sampling stations raised a value that exceeded the

permissible limit. That is, the river water body showed a much lesser concentration of nitrates. The graphical plot of variations in the concentration of nitrates across the stretch is obtained as:



CONCLUSION

The water samples were collected from 10 sampling stations across the 244km stretch of the river Periyar and the survey work carried out found the results discussed above. The various physico-chemical parameters were studied and the following conclusions can be made:-

- Most of the results showed large deviations from the permissible range of the various parameters and this indicates the extent of pollution of the river. The obtained values were either much lower than the limit or they didn't fall within the range and values that lied within the permissible limit were very few.
- The pH values obtained showed the pertaining acidic behavior of the river at various locations mainly with the discharge of industrial effluents. Comparing with the BIS norms, 70% of the samples are not fit for drinking. The major conclusion to be made is the policies of government agencies must be made stringent against the disposal of untreated industrial wastes into the river.

- The contamination of river is also accompanied by the change in its temperature. The thermal variations in the river affects the life of aquatic flora and fauna.
- The river being the lifeline of the state is deteriorating in its quality at an alarming rate. This needs the decisions at the authoritative level to work against further deterioration of the river.
- Also prior to any developmental activities in future near the banks of the river, Environment Management policies like EIA assessment and related studies must be made to ensure the health of the river and such natural resources.
- The study can be made as a reference tool for further research works in the related areas that aims in preventing the qualitative degradation of our natural resources.

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