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Appraising Water Quality Aspects for an Expanse of River Cauvery alongside Srirangapatna

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Abstract: River Cauvery which converts Srirangapatna into an island is one among the most significant holy places in Southern India. In the present study, an expanse of river Cauvery was selected based on prevailing human activities and its water quality was monitored across 12 strategic points over two seasons. The river is also presently serving as a principle means of municipal wastewater carrier. The water samples were analyzed based on various analytical techniques during wet and dry flow conditions, to ascertain the probable water quality for the average flow conditions. The analysis highlighted that the Dissolved Oxygen of river was significantly less along with the increase in Biochemical Oxygen Demand and Total Coliform population, therewith clearly indicating impairment of the natural water-course beyond its self-purification capacity.

Keywords: Cauvery; water; municipal; quality.

I. Introduction

Today, with ever increasing demands being made on streams and rivers, the need to understand streams and rivers as ecological systems and to manage them effectively has become increasingly important [1]. Consequently water quality management is (or should be) one of the most important activities of mankind, so as to protect and save human life and the life of other living organisms. Water pollution originates from point and non-point (diffuse) sources and most of which is always due to human action [2]. To restrict pollution below a given threshold, the assimilative capacity of the river should remain sufficient to comply with the current pollution load all along the river [3]. The study area *Srirangapatna* lies in *Mandya* district at latitude of 12°23'22" and longitude of 76°39'13". The town is famous for ancient temples and its population ranges from 20,000 to 60,000. As River *Cauvery* is considered a sacred river, consequently numerous religious rituals are being performed involving several human activities inciting its selection as study area.

II. Materials and Methodology

The present study endeavors the assessment of impact of Municipal wastewater discharge on an expanse of River *Cauvery* by performing periodic water quality monitoring and its analyses. In this study, the river course selected extends from the upstream of the municipal sewer discharge point near the Fort of *Srirangapatna* up to Sangama. The entire expanse accounts for about 2.5 km and is divided into two "REACHES". REACH-1: From the upstream of the municipal sewer discharge point near the Fort of *Srirangapatna* to the downstream river course at *Karighatta* bridge and REACH-2: From the downstream of *Karighatta* bridge up to *Sangama*. The sampling was carried out for two seasons under high and low flow conditions at 12 strategic points, selected based on human activities which can impair the water quality. The samples collected were subjected for water quality analysis for diverse parameters such as pH, temperature, Total Dissolved Solids (TDS), turbidity, conductivity, phosphate, sulphate, chloride, Nitrate, Bio-chemical oxygen demand (BOD), Chemical oxygen demand (COD), Dissolved oxygen (DO), total coliform organisms, calcium hardness and total hardness. An attempt has hence been undertaken to estimate the probable water quality during the normal/average flow conditions.

III. Results and Discussion

The water quality of River *Cauvery* has been analyzed during the months of April and May, 2011. The Month of April is considered as summer season as there was no rainfall, whereas the month of May is considered as pre-monsoon as two showers had fallen before sampling was done. The results obtained by their comparative study are discussed under two different conditions of river flow.

1. Water Quality at Low Stream Flow (Summer)
2. Water Quality at High Stream Flow (Pre-Monsoon)

During the month of April the stream flow at the point just below the municipal wastewater discharge was found to be 15.8 cubic meter per second whereas for the month of May it was found to be 34.2 cubic meter per second. The width of river was found to be varying between 110m to 150m during low flow conditions and 110 to 160 metre during high flow conditions. Hence it was estimated that during average flow conditions the width of the river may vary between 110 to 160 metre. Results of the pH of the river water measured about each strategic point of sampling are graphically represented in Chart 1. From this chart it is clear that the pH of the water course was varying between 6.8 to 7.25 during summer, and 6.97 to 7.55 during pre-monsoon. The water temperature was found not to vary much during sampling. It was about 24.5 to 26.56 °C during summer and 24 to 25.4 °C during pre-monsoon, as shown in Chart 2.

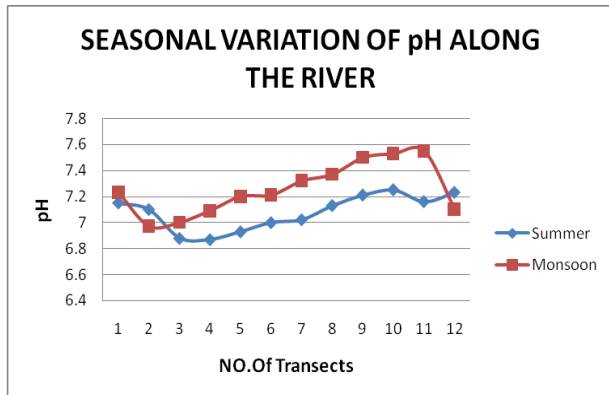


Chart 1: Seasonal variation of pH along the river.

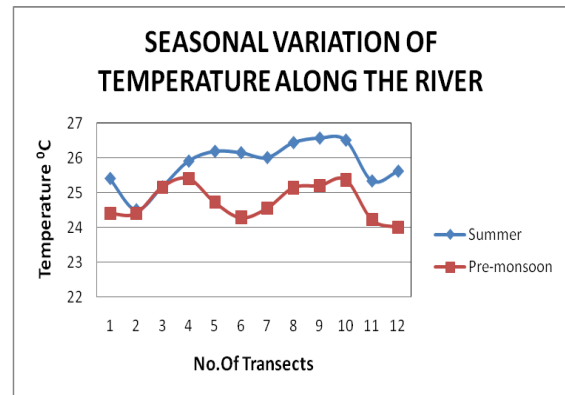


Chart 2: Seasonal variation of Water Temperature along the river.

The depth profile and the flow velocity of the river are as shown in Chart 3 and Chart 4 respectively. During Low flow conditions, the depth and velocity of the river was found to be varying between 0.6 to 1.6 metre and 0.1 to 0.22 m/s respectively. On the other hand during high flow conditions depth and velocity of river was found to be varying between 1.16 to 2.2 metre and 0.14 to 0.247 m/s respectively, whereas during average flow conditions depth and velocity of river was estimated to vary between 0.8 to 1.6 metre and 0.12 to 0.22 m/s respectively.

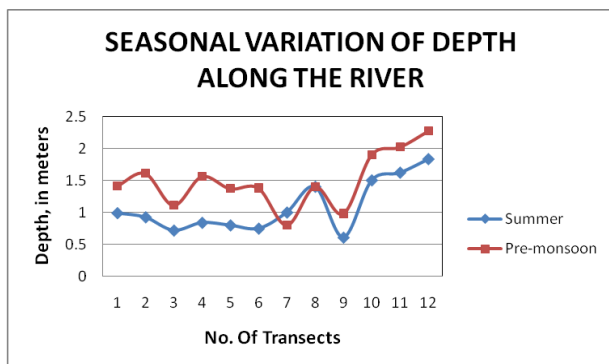


Chart 3: Seasonal variation of depth along the river.

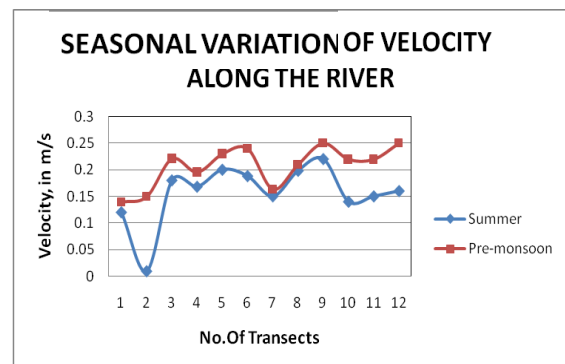


Chart 4: Seasonal variation of velocity along the river.

The amount of solids dissolved in water was found out by measuring the TDS content of the water samples. The analysis showed that TDS in water varied from 82.62 to 233.83 mg/l during low flow and 84.81 to 282 mg/l during high flow conditions. The concentration of TDS at each point of sampling is represented in Chart 5. The conductivity of water was measured and is shown in Chart 6. The conductivity of the water course was about 135.78 to 369.83 μ S in the first month of sampling, and 151.42 to 416 μ S during the second month of sampling.

The turbidity of the river at each sampling port is represented in Chart 7. It was found that turbidity of the water was more during pre-monsoon. The turbidity was ranging from 0 to 14 NTU during April and 0 to 18 NTU during May. A detailed representation of the concentration of dissolved oxygen along the river is made in Chart 8. It was observed that the DO varied from 2.61 to 6.57 mg/l during low stream flow and 3.016 to 8 mg/l during high stream flow conditions. The COD of water course was analyzed and its variation along the river stretch is represented in Chart 9.

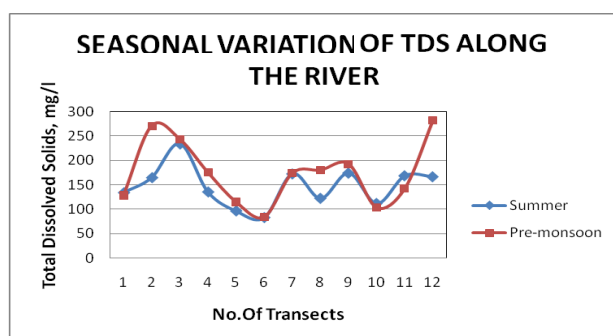


Chart 5: Seasonal variation of TDS along the river.

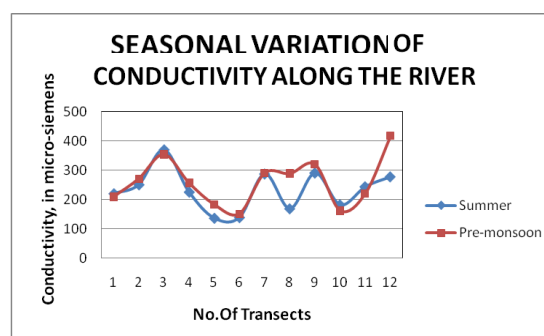


Chart 6: Seasonal variation of conductivity along the river.

The turbidity of the river at each sampling port is represented in Chart 7. It was found that turbidity of the water was more during pre-monsoon. The turbidity was ranging from 0 to 14 NTU during April and 0 to 18 NTU during May. A detailed representation of the concentration of dissolved oxygen along the river is made in Chart 8. It was observed that the DO varied from 2.61 to 6.57 mg/l during low stream flow and 3.016 to 8 mg/l during high stream flow conditions. The COD of water course was analyzed and its variation along the river stretch is represented in Chart 9.

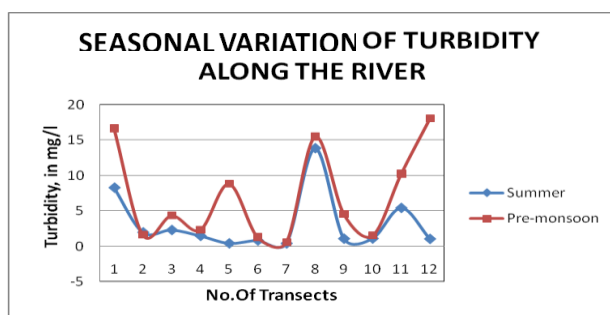


Chart 7: Seasonal variation of Turbidity along the river.

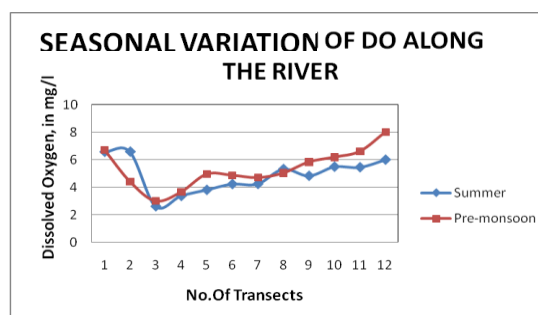


Chart 8: Seasonal variation of DO along the river.

The COD of water was found to be varying from 22.2 to 170.77 mg/l during summer and 21.04 to 80.77 mg/l during pre-monsoon. The analysis of BOD confirmed non-uniform distribution along the river. Chart 10 shows the BOD profile of the river course. The BOD varied from 0.88 to 10.65 mg/l during first month of sampling and 1.026 to 20.66 mg/l during second month of sampling

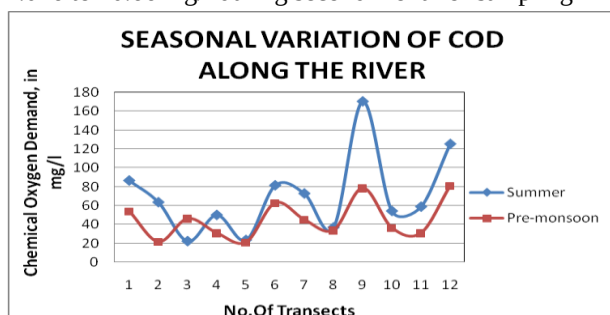


Chart 9: Seasonal variation of COD along the river.

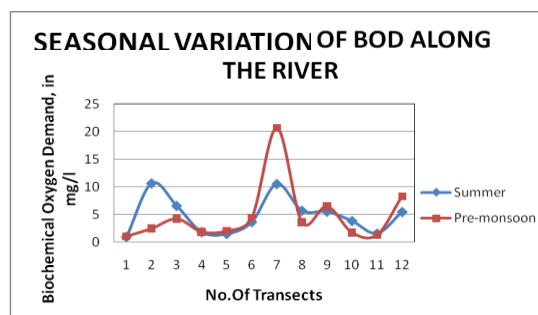


Chart 10: Seasonal variation of BOD along the river.

The Laboratory analysis of the water samples for sulphate, phosphate and nitrate showed that their concentration along the river varied from 12.37 to 33.28 mg/l, 0.74 to 1.69 mg/l and 0.24 to 0.32 mg/l respectively during low stream flow whereas during high flow conditions it was found to vary between 8 to 43.66 mg/l, 0.23 to 2.63 mg/l and 1.46 to 1.79 mg/l. The concentration of sulphate, phosphate and nitrate all along the river stretch is represented in Chart 11, Chart 12 and Chart 13 respectively. When the chloride content was

analyzed, its concentration varied from 6.53 to 62.2 mg/l during April and 4.6 to 67.55 mg/l during May. The result of the same is shown in Chart 14.

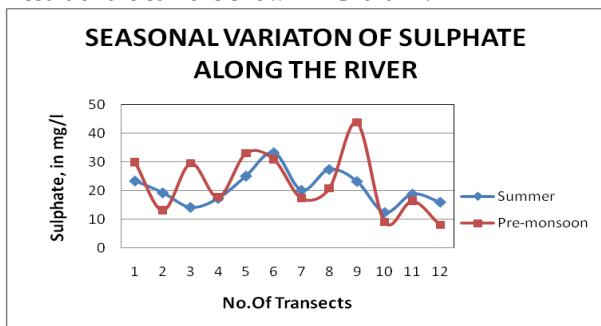


Chart 11: Seasonal variation of Sulphate along the river.

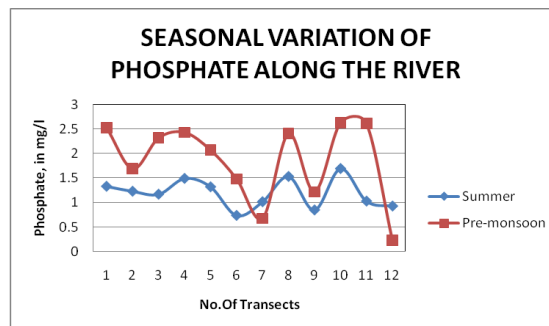


Chart 12: Seasonal variation of Phosphate along the river.

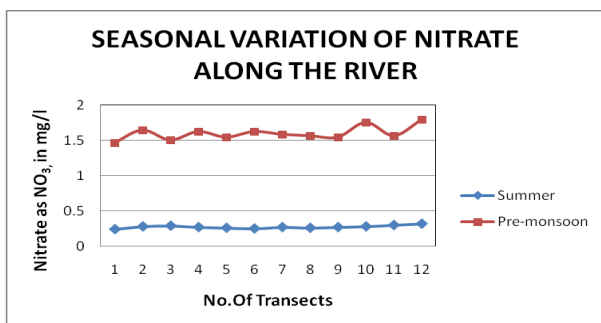


Chart 13: Seasonal variation of Nitrate along the river.

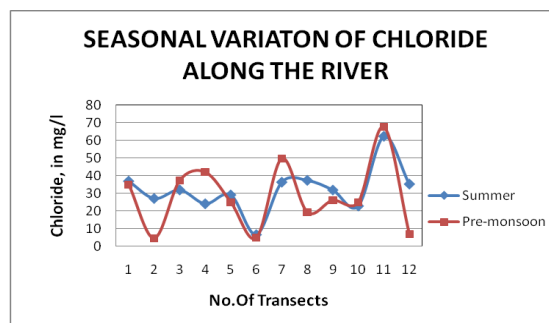


Chart 14: Seasonal variation of Chloride along the river.

During summer, the concentration of calcium hardness and total hardness were found to vary from 103.63 to 208 mg/l and 159.4 to 263 mg/l respectively. However, during pre-monsoon it was found to be varying from 104.9 to 237 mg/l and 76.7 to 204 mg/l respectively. Chart 15 and Chart 16 shows the concentration of calcium and total hardness at each transect of sampling respectively.

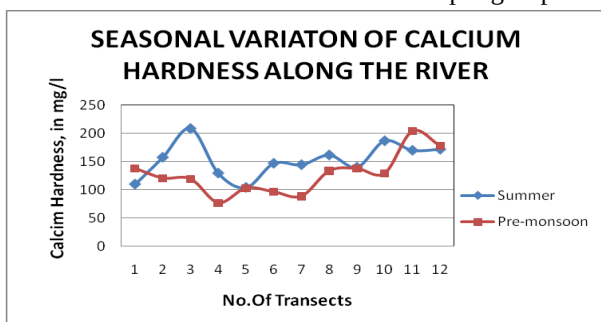


Chart 15: Seasonal variation of Calcium along the river.

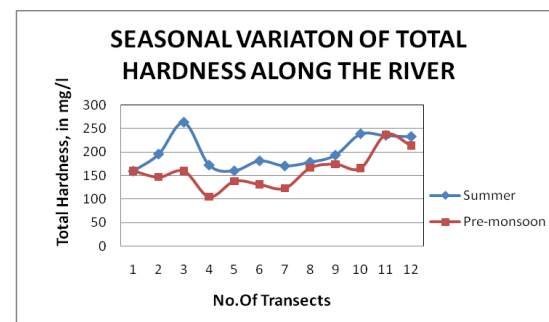


Chart 16: Seasonal variation of Total Hardness along the river.

When total coliform organisms analysis was carried out, it was observed that the number of total coliform varied from 400 to 2800 MPN/100 ml and 600 to 2000 MPN/100 ml during April and May month of sampling respectively. The number of total coliform organisms observed at each transect is as shown in Chart 17. During low flow and high flow conditions, the water sample at transect 3 and at transect 12 (*Sangama*) showed the presence of Total Coliform organisms beyond the prescribed limits. The total coliforms at both the stations were found to be greater than 1600 MPN/100 ml.

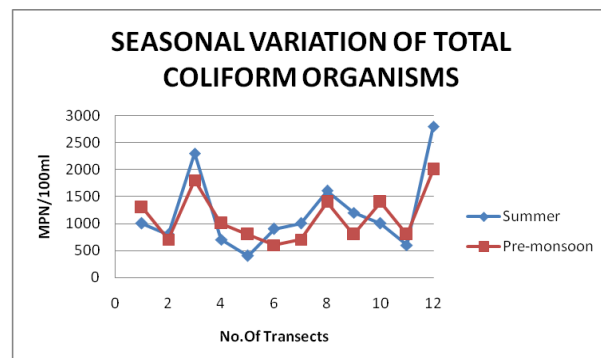


Chart 17: Seasonal variation of Total Coliform along the river.

The monitoring results of River *Cauvery* during low and high flow conditions shows that all the parameters are within the prescribed standards except DO, BOD and Total coliform. Hence we can estimate that during average flow conditions also DO, BOD and Total coliform can be above the prescribed standards and can be in the range of 2.81 to 6.99 mg/l, 0.95 to 12.59 mg/l and 500 to 2400 MPN/100 ml respectively.

IV. Summary

The presence of less dissolved oxygen and increase in the BOD concentration and total coliform organisms may be because, the entire river expanse supports lots of human activities, like fishing, washing of animals, utensils, clothes, bathing and the unauthorized wastewater discharges from the near-by residences through the thick bushes which are grown on either side of the bank. If proper treatment is given prior to the disposal of municipal wastewater into the river, then not only the water quality of the river will improve but also the self-purification capacity of the river can be certainly regained.

V. Recommendations

- The wastewater from the sewer drains has to be properly treated before it enters the river channel.
- The dumping of the solid waste near the river banks should be avoided in order to reduce the river contamination.
- Unauthorized wastewater discharges into the river needs to be banned and
- All the houses are required to be connected with the sewer lines and all those sewer lines to be connected with the main sewer outlet which should be given proper treatment and then let into the river course.
- More number of samples replica can be collected to have appropriate field data especially at the confluence points.

VI. Limitations of the Study

The samplings are done for three days in a month and hence the samples may not represent the exact water quality for the entire month or season.

VII. References

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