

Seasonal assessment of river Kodayar with reference to Physico-chemical parameters

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Abstract—Urbanisation, improper disposal of waste and industrialisation are affecting water resources both quantitatively and qualitatively. Seasonal variation study of physico-chemical parameters like pH, EC, TDS, DO and BOD along kodayar river basin was carried out. The values are under the permissible limit. Correlation analysis of the result showed good positive correlation between various parameters while some has negative correlation as expected.

Keywords- River kodayar, seasonal variation, correlation, ANOVA

I. INTRODUCTION

Water plays a vital role in human livelihood and quality of life. It is also important in sustaining and ensuring the survival of ecosystems. Industrialisation is considered to be the cornerstone of development strategies, but it carries inevitable problems in terms of pollution on natural resources. Water bodies near to industrial area were usually affected due to disposal of waste, which adversely alter the physical, chemical and biological nature of receiving water.

Water is primarily used for domestic needs like drinking, washing, bathing and cooking etc. But due to industrial and urban development, requirement of water for these activities has increased along with domestic purpose. Water of good quality is required for living organisms. The quality of water is assessed from its physical, chemical and microbial characteristics. If correlations were possible among these parameters, then it could be a significant one which is useful to indicate the quality of water^[1].

Kodayar river basin drains towards to the southernmost tip of Indian peninsula. This is the important river in Kanyakumari district of Tamil Nadu. Outflow from small scale industries, recreational activities and discharge of human and animal wastes deteriorate the quality of water^[2]. This study was carried out to analyse the seasonal variation along kodayar river basin, focussing six stations viz., Paechiparai (S1), Thirparapu (S2), Chitharal (S3), Melpuram (S4), Kuzithurai (S5) and Othachikotttai (S6). The parameters chosen for this study were pH, EC, TDS, DO and BOD. Correlation analysis was done to examine the relationship among the parameters. One way analysis of variance (ANOVA) test was performed to measure the significant difference in parameters between stations.

II. MATERIALS AND METHODS

The water samples were collected from the six chosen stations for physico-chemical analysis; collection and handling of samples were adopted based on standard procedures^[3]. Standard methods were used for the analysis of the water quality parameters^[4, 5, 6].

III. RESULTS AND DISCUSSION

The results were summarised in the table given below. The range of various water parameters for the four seasons with their mean values are given in the table 1, 2 and 3. The mean values of the parameters in the five stations are furnished in the Table 4.

A. pH

pH is a measure of the acidity or alkalinity of water. Extreme values of pH can cause problems for aquatic fauna. pH values of the water samples were observed in the range of 6.80 – 7.19 during pre-monsoon,

7.11-7.72 (southwest) and 7.29 – 7.66 (northeast) during monsoon and 6.45 – 6.87 during post-monsoon (Table 1, 2 and 3). pH showed positive correlation with EC (0.8761) and TDS (0.9231). One-way ANOVA showed no significant variation of pH values between stations ($P=0.148$).

B. Electrical Conductivity

Conductivity is a measure of conductance of electric current and is mainly due to dissolved salts in water. EC values varied from 67.67-114.33 during pre-monsoon, 60-93.5 during post-monsoon and 61.5-113 (southwest), 60-97 (northeast) in monsoon (Table 1, 2 and 3). EC showed positive correlation with pH (0.8761) and TDS (0.9841). Analysis of ANOVA showed significant variation between stations ($p<0.001$).

C. Total Dissolved Solids (TDS)

TDS is used to estimate the quality of drinking water as it represents the amount of ions in water. The TDS values of water samples for the three seasons were found to be in the range of 48.66-87.37 (pre-monsoon), 48.81-90.5 (southwest), 38.07-78 (northeast) and 37.59-76.52 (post-monsoon) (Table 1, 2 and 3). It showed positive correlation with pH (0.9231) and EC (0.9841). One-way ANOVA analysis showed significant difference between stations ($p<0.001$).

D. Dissolved oxygen

Amount of oxygen in water (DO) indicates the degree of pollution in water bodies. The threshold limit for DO is 5mg/l in drinking water and should be greater than 5mg/l to be used for agricultural purposes^[7]. DO values were in the range of 5.26-6.92 in pre-monsoon, 4.44-7.07 in post-monsoon and 5.09-8.71 (southwest), 5.09-7.36 (northeast) in monsoon season (Table 1, 2 and 3). It showed negative correlation with pH (-0.2276), TDS (-0.1367), EC (-0.0512) and BOD (-0.9498) (Table 5). Significant difference between stations was given by one-way ANOVA analysis ($p<0.05$).

E. Biological Oxygen Demand

BOD is the most commonly used parameter for determining the oxygen demand on the receiving water from municipal or industrial discharge. The range of BOD values during pre-monsoon season was found to be 1.46-2.81 and for post-monsoon period it was found to be 1.07-1.69. BOD values ranged from 1.26-3.07 (southwest) and 0.98-2.55 (northeast) during monsoon season (Table 1, 2 and 3). BOD showed negative correlation with DO (-0.9498). One-way ANOVA analysis showed insignificant difference between stations ($p>0.05$).

pH, TDS, DO and BOD plays a crucial role in enabling the normal biological and chemical processes that occur within the river^[8]. There was no significant variation in the pH values in five stations. Maximum value of EC and TDS was found in S6. Gradual increase could be seen in the TDS values when moving from station S1 to S6. Increase in S6 may be due to natural or human activities. Comparing to all the other stations, DO value was found to be less in S6. Even though this was within the permissible limit, this value shows the interference of various human activities (discharge of effluents from brick industries and domestic wastes) in the water quality of this river^[2]. This was supported by the high value of BOD in S6 which indicates the discharge of various pollutants in to this river from nearby area.

EC and TDS were found higher during pre-monsoon period. Conductivity increases with evaporation of water and decreases with addition of rain water^[9]. The DO values showed a general increasing trend during monsoon periods^[10]. DO was found to be less during pre-monsoon period. This was due to the fact that increase in temperature (summer) decreases the oxygen content in water^[11].

IV. CONCLUSION

Based on the results obtained it was concluded that the water quality along the kodayar river basin in the six stations selected for this study was good and safe for consumption and other activities. Even though it is recommended that careless disposal of wastes should be avoided to save the river water from further deterioration. Continuous monitoring is an essential process for maintaining the water quality along the river system studied.

Table-1: Statistical evaluation for physico-chemical parameters of water samples in Pre-monsoon along kodayar river basin

Parameters	pH	EC	TDS	DO	BOD
Minimum	6.80	67.67	48.66	5.26	1.46
Maximum	7.19	114.33	87.37	6.92	2.81
MEAN±SD	6.99±0.27	91±32.9	68.01±27.4	6.09±1.2	2.14±0.95

Table-2: Statistical evaluation for physico-chemical parameters of water samples in monsoon along kodayar river basin

Parameters		pH	EC	TDS	DO	BOD
Minimum	SW	7.11	61.5	48.81	5.09	1.26
	NE	7.29	60	38.07	5.09	0.98
Maximum	SW	7.72	113	90.5	8.71	3.07
	NE	7.66	97	78	7.36	2.55
MEAN±SD	SW	7.42±0.43	87.25±36.42	69.66±29.48	6.9±2.6	2.17±1.28
	NE	7.48±0.26	78.5±26.16	58.04±28.23	6.23±1.61	1.77±1.11

SW: South West monsoon and NE: North East monsoon

Table-3 Statistical evaluation for physico-chemical parameters of water samples in Post-monsoon along kodayar river basin

Parameters	pH	EC	TDS	DO	BOD
Minimum	6.45	60	37.59	4.44	1.07
Maximum	6.87	93.5	76.52	7.07	1.69
MEAN±SD	6.66±0.29	76.75±23.7	57.1±27.5	5.75±1.9	1.38±0.44

Table-4: Statistical evaluation for physico-chemical parameters of water samples in the five stations

Parameters	Stations	pH	EC	TDS	DO	BOD
Mean±SD	S1	7.04±0.29	62.5±7.38	45.04±8.71	7.15±1.75	1.56±0.66
Mean±SD	S2	7.12±0.34	74.33±9.3	52±11.26	6.35±1.22	1.67±0.74
Mean±SD	S3	7.05±0.39	101.7±25.1	63.15±9.8	6.09±1.06	1.51±0.44

Mean±SD	S4	7.15±0.29	95.42±10.03	83.25±11.09	6.05±0.82	1.78 ±0.49
Mean±SD	S5	7.27±0.31	342.42±241.5	179.44±141	6.48±1.28	1.68±0.38

The graphs showing the variation of parameters during various seasons and also between stations were given below:

Fig:1 Variation of parameter during pre-monsoon period

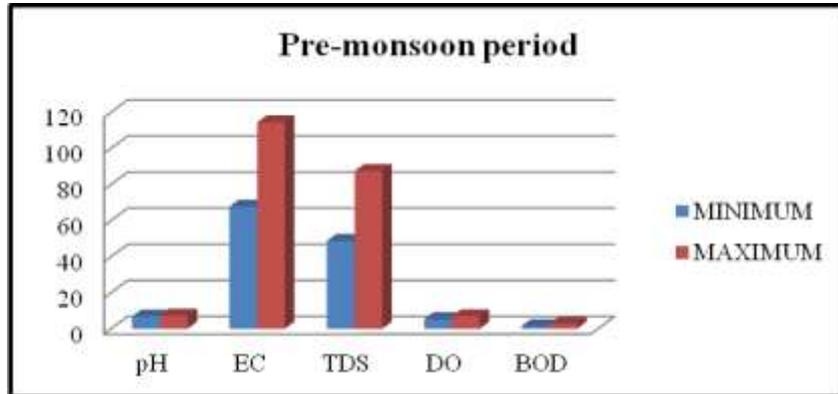


Fig: 2 Variation of parameters during monsoon period

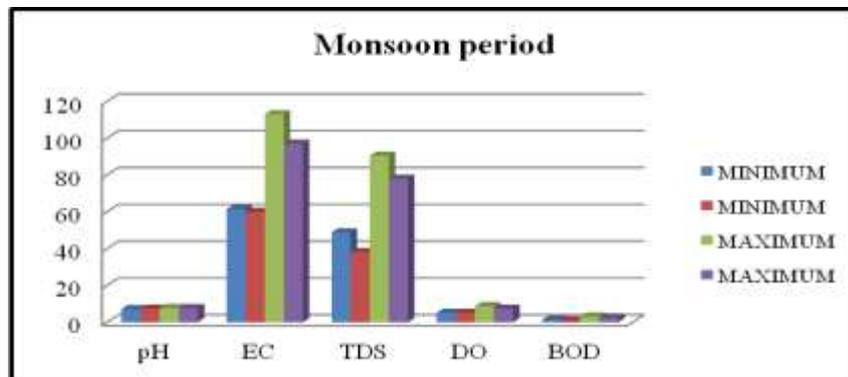


Fig:3 Variation of parameters during post-monsoon period

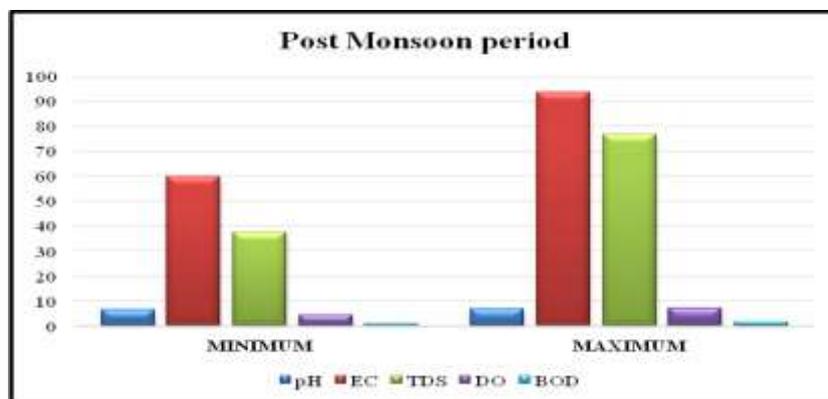
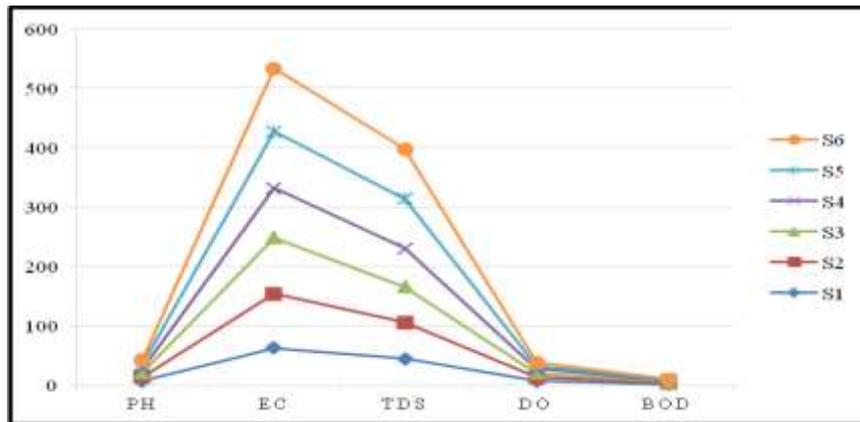


Fig:4 Variation of parameters between stations



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