International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 10 Issue: 08 | Aug 2023 www.irjet.net p-ISSN: 2395-0072

Statistical Analysis of Surface Water Quality along Noyyal River Basin at Western part of Coimbatore City

C. Meiaraj and M. C. Sashikkumar[1]

Department of Civil Engg., Govt. College of Technology, Coimbatore, Tamil Nadu, India.
[1]Department of Civil Engg., College of Engg. Guindy, Anna University, Chennai, Tamilnadu.

Abstract: *Due to increase of population growth and the increased industrial activities near the Noyyal river, resulted in the increased water pollution, which is considered as one of the primary issue of environmental pollution in metropolitan cities of developing countries including Coimbatore city in South India. The present study involves the analysis of various physico-chemical parameters of the water samples collected at ten locations in Coimbatore city along the banks of Noyyal river for various periods. From this study, it was found that the sample taken along the banks of the Noyyal river in the western part of Coimbatore city has not polluted much during the study period except at the location Kuniyamuthur. In this study, mean value of the analysed results has been identified and the relationship among the parameters was established by using correlation analysis.*

Keywords: Noyyal river, Surface water, Physico-chemical Analysis, Correlation Analysis.

1. INTRODUCTION

Water is the second most basic elements for all living organisms present in the earth. It is a prime natural resource, a basic human need and precious natural asset that enables the existence and survival of life on earth. It is a limited and valuable resource. Surface water and groundwater resources are the major sources of water in our country. Large numbers of major rivers are present in India, which act as a source of major drinking water for the people of the country and irrigation purposes. Due to excessive utilization and contamination of the surface water, the need for fresh water has increased. The river beds are contributed for the withdrawal of fresh water which depends upon the monsoon seasons of the respective places and their locations. Due to uneven, non-uniform distribution and temporal variation of rainfall, the necessity is arises to store the excess water during maximum rainfall duration.

It was found that, there are around 17 major rivers with 61 reservoirs were available in the state of Tamil Nadu in India for the conservation of surface water bodies. Out of the total amount of surface water around 90% of water is used for the purpose of irrigation needs. (Saranya and Sashikkumar, 2019) Most of the studies identified that the major reason for the contaminations of surface water bodies due to the agricultural, domestic and industrial activities along the banks of the rivers. Acute short rainfall of monsoon rains, poor watershed management, excessive use of water for domestic and irrigation has led to the depletion of the surface water, especially from the river bodies (Babunath and John, 2017). Hence, this study was attempted to identify the surface water quality of Noyyal River basin in Coimbatore district during the study periods from December 2019 to March 2020.

2. MATERIALS AND METHODS

2.1 Study Area

The present study was carried out along the banks of Noyyal river basin in Coimbatore district, Tamil Nadu, India. River Noyyal is considered as one of the major source of water for both domestic and agricultural activities for the districts of Coimbatore, Tiruppur, Erode and Karur, which has started its journey from the vellingiri hills of Western Ghats in the Coimbatore district and joins to Kaveri River at the place called Noyyal in Karur District. The River Noyyal that is originated at an elevation of about 1800 m above MSL in the pattivasal area of vellingiri hills and periyakunjira hills located in Coimbatore south. The elevation in hilly terrain in the western part of sub-basin varies from 1800 m to 600 m (above MSL) and in the eastern part 600 m to 300 m (above MSL) in the planes. The variation of elevation is due to presence of Western Ghats in the watershed. The methodology includes the collection of the surface water samples along the banks of Noyyal river basin at selected sampling locations which was listed in the Table 1. After the collection of water samples, the analysis of the collected water samples was carried out in Environmental Engineering Laboratory, Government College of Technology, Coimbatore. Periodical monitoring of the water quality parameters of the collected water samples were done for getting the average values. The average values of the water quality parameters were compared with the standard values as per Indian Standards. (Irfan Jamila and Yousuf, 2018) Finally the correlation matrix for the water quality data was generated.

2.2 Sample Collection

The site for the collection of the surface water sample was fixed based on the distance between the two locations (Sabmeet Singh et al., 2018). The distances between the two sampling sites are selected such a way that it should not exceed 4 km so that the concentration of pollutants should be identified. The samples has been collected from surface of the Noyyal river as per the standard methods, from the origin place of river i.e. kovaikutralam to kuniyamuthur in the western part of Coimbatore district which covers the city. The samples were collected in bottles which are made of plastic, usually polythene. The water samples were collected from the surface of the Noyyal River in the centre of the river and at a distance of 30 cm from the surface of the water in plastic bottles of 1 litre capacity after rinsing it with distilled water and with the sample water before collection.

Table 1. Water Sample Locations

Sample Locations		Latitude	Longitude
A	Kovaikutralam	10°56'37"N	76°43'15"E
B	Karunyanagar	10°57'7"N	76°44'42"E
C	Iruttupalam	10°56'54"N	76°46'10"E
D	Alandurai	10°57'26"N	76°43'15"E
E	Boluvampatti	10°57'26"N	76°48'16"E
F	Thenamanallur	10°58'07"N	76°49'18"E
G	Thenkarai	10°58'05"N	76°49'48"E
H	Madampatti	10°58'37"N	76°51'28"E
I	Perur	10°58'48"N	76°55'22"E
J	Kuniyamuthur	10°58'47"N	76°56'26"E

2.3 Analysis of water sample

The collected surface water samples has been analyzed in the Environmental Engineering laboratory for the various physico-chemical parameters such as Color, Odor, Turbidity, pH, Electrical Conductivity, Calcium and Magnesium Hardness, Sodium, Potassium, Alkalinity, Chlorides, SAR, RSC and Phosphorus. The samples were collected for two periods during December 2019 and March 2020 in a single effort and analyzed for the various physico-chemical parameters mentioned above and the mean value of parameters were obtained.

3. RESULTS AND DISCUSSION

The averaged surface water quality parameters of the collected water samples during the study period were tabulated in Table 2. The analyzed water samples values are compared with the permissible limits prescribed as per Indian Standards IS10500:2012 for the suitability of the water for the purpose of domestic and agriculture purposes (Vandhana Devi and Nagendran, 2017; Anchal Rana Bhardwaj and Meena Thakur, 2016). During the sample collection at the site, the surface water samples collected in the Noyyal River was found that, it was free from physical impurities and hence the samples were tested for the chemical parameters. On direct observation in the site the physical parameters such as colour and odour were normal. pH is an important in evaluating in identifying whether the water is in acidity or alkalinity condition. From the average result analysis, it was found that the pH value of the surface water samples varies in range from 6.60 to 8.17. This indicates that the pH value is under the permissible limits due to continuous flowing of water in the entire region except at the Kuniyamuthur location. The Electrical conductivity (EC) of surface water samples has been varied from 0.06 dS/m to 3.26 dS/m. The EC value for irrigation water should be lies between 0.15 dS/m to 1.5 dS/m. From the study, it was observed that all samples were within the limits for irrigation purposes except the last location at Kuniyamuthur. The higher values of EC is identified that it may be the long residence time and factors of lithology of water bodies.

Calcium is one of the most abundant substances of the natural water. The observed Calcium content in the surface water has been varied from 3.26 mg/ L to 501.59 mg/L and the observed Magnesium content in the surface water has been varied from 1.94 mg/L to 226.87 mg/L. The Sodium content in the surface water samples has been found varied from 4.26 mg/L to 726.11 mg/L and the Potassium content in the surface water has been varied from 1.95 mg/L to 16.41 mg/L. All the samples were within the permissible limit except at Kuniyamuthur location.

The carbonates content in the surface water samples has been varied from BDL to 276 mg/L. The bicarbonates content in the surface water has been varied from 24 mg/L to 268.4 mg/L. The chlorides content in the surface water has been varied from 28.30 mg/L to 468.06 mg/L. The residual sodium carbonate (RSC) content in the surface water has been varied from 8.41 mg/L to 291.1 mg/L. The Turbidity content in the surface water has been varied from 22.4 NTU to 41.6 NTU. This content of turbidity is mainly due to surface flow in the river and roughness along the banks. The Phosphorus content in the surface water has been varied from 0.13 mg/L to 0.80 mg/L. The present study shows that almost all the samples are well within the permissible limits. The Sodium Absorption Ratio (SAR) is a measure of sodium hazard in the surface water samples. It is calculated based on sodium, calcium and magnesium concentrations in the water samples. The SAR value of the water samples varied between 2.42 and 4.68 which are in the ranges of 0 to 10 and at Kuniyamuthur location very high SAR value of 358.89 is estimated. All the surface water samples are suitable for irrigation

purposes except at Kuniyamuthur location due to more domestic activities and small scale industrial activities in that study area.

3.1 Formation of Pearson Correlation Matrix

Correlation Matrix will give information about the relationship between the two physico-chemical parameters or simply the comparison between two parameters. It is the statistical measure that indicates the extent to which two or more variables fluctuate together. It is widely used in the sciences. It was developed by Karl Pearson from a related idea introduced by Francis Galton in the 1880s. (Samantray et al., 2009; Sidhardhan and Adish Kumar, 2019) The range of correlation and nature of correlation with each parameter is listed in the Table 3. From the observed average values of all the parameters, the Pearson correlation matrix has been developed and it was presented in the Table 4. From the correlation analysis, it was found that most of the parameters were positive correlation to each other and some parameters were negatively correlated to other parameters.

Table 2. Mean value of the water quality parameters

PARAMETERS	A	B	C	D	E	F	G	H	I	J
pH	6.60	6.76	7.07	7.56	6.95	7.31	7.08	7.47	7.19	8.17
EC(dS/m)	0.06	0.08	0.15	0.24	0.25	0.24	0.23	0.71	0.64	3.26
Ca(mg/L)	3.26	5.71	9.79	24.31	25.31	22.86	22.56	69.39	67.76	501.59
Mg(mg/L)	1.94	3.40	6.26	7.66	9.12	8.63	7.57	26.81	20.61	226.87
Na(mg/L)	4.37	4.26	8.40	10.70	9.43	11.04	10.77	33.24	31.05	726.11
K(mg/L)	1.95	2.34	3.51	3.91	4.01	4.30	3.80	6.06	5.65	16.41
CO_3 (mg/L)	BDL	BDL	BDL	24.00	31.00	26.50	28.00	36.00	31.00	276.00
HCO_3 (mg/L)	23.00	24.20	27.40	48.80	61.00	48.80	49.20	134.20	122.00	268.40
Cl (mg/L)	28.30	29.30	33.75	36.78	40.85	34.55	40.73	78.01	56.69	468.06
SAR	3.06	2.42	2.98	2.67	2.27	2.78	2.78	4.79	4.68	358.59
RSC (mg/L)	10.57	8.41	15.54	48.12	46.97	49.77	34.01	76.99	84.15	291.10
Turbidity (NTU)	39.25	25.85	29.60	25.20	22.80	27.80	22.40	40.85	22.60	41.60
Phosphorus (mg/L)	0.13	0.23	0.37	0.18	0.37	0.39	0.18	0.48	0.22	0.80

Table 3. Correlation Coefficient and its Relationship

Correlation Coefficient	Relationship
0.70 to 1.00	Very Strong Positive Relationship
0.40 to 0.69	Strong Positive Relationship
0.30 to 0.39	Moderate Positive Relationship
0.20 to 0.29	Weak Positive Relationship
0.01 to 0.19	No or Negligible Relationship
0	No Relationship
-0.01 to -0.19	No or Negligible Relationship
-0.20 to -0.29	Weak Negative Relationship
-0.30 to -0.39	Moderate Negative Relationship
-0.40 to -0.69	Strong Negative Relationship
-0.70 to -1.00	Very Strong Negative Relationship

Table 4. Pearson Correlation Matrix

	pH	EC	Ca	Mg	Na	K	CO_3	HCO_3	Cl	SAR	RSC	P
pH	1	0.981	-0.156	-0.078	0.976	0.980	0.983	0.821	0.982	0.975	-0.332	0.776
EC		1.000	-0.093	-0.014	0.984	0.993	0.988	0.876	0.992	0.982	0.945	0.797
Ca			1.000	0.970	-0.270	-0.025	-0.196	0.086	-0.209	-0.281	-0.384	-0.053
Mg				1.000	0.193	0.522	-0.123	0.159	-0.123	-0.198	-0.277	0.090
Na					1.000	0.965	0.991	0.831	0.997	0.999	0.993	0.772
K						1.000	0.980	0.858	0.776	0.961	0.918	0.820
CO_3							1.000	0.831	0.992	0.990	0.955	0.804
HCO_3								1.000	0.852	0.829	0.809	0.655
Cl									1.000	0.996	0.974	0.784
SAR										1.000	0.984	0.775
RSC											1.000	0.751
P												1.000

4. CONCLUSIONS

Based upon the analysed report most of the samples were within the permissible limits for irrigation activity in that region. The region from the origin of River Noyyal i.e. from Kovaikutralam to Perur is not much affected due to less domestic and industrial activities (Usharani et al., 2010). Therefore it could be used for the domestic and agricultural purposes in that region. The Kuniyamuthur location is alone polluted and this may be due to the untreated dumping of the domestic and industrial waste into the Noyyal River (Udayakumar et al., 2011). From the study, it was found that the Noyyal river water was unsuitable for use at the starting point of Kuniyamuthur region. The study has also revealed that how the river water is contaminated because of the domestic and industrial activities in the western part of city limits. This is indentified that it may be due to the inadequate and insufficient treatment technologies and improper disposal methods. Hence, necessary steps to be taken to improve the surface water quality of the Noyyal River at Kuniyamuthur location in order to conserve the existing surface water quality of that study area.

REFERENCES

S. K. Anchal Rana Bhardwaj and Meena Thakur, "Surface Water Quality and Associated Aquatic Insect Fauna under Different Land-Uses in Solan, Himachal Pradesh", Indian Journal of Ecology , 2016, 43(1):58–64.

R. Babunath and John G , "A Study on Physico Chemical and Heavy Metals Characteristics of River Noyyal, Tamilnadu, India", Environmental Science: An Indian Journal, 2017 13(1): 1-10.

Irfan Jamila and Yousuf A R ,"Seasonal Variations in Physico Chemical Characteristics of Dal Lake Kashmir", Indian Journal of Ecology, 2018, 45(1):33–42.

Sabmeet Singh, Priyadarshini Sorokhaibam, Ramandeep Kaur and Rahul Singh, "Assessment of Physicochemical Parameters to Investigate Pollution Status of White Bein: A Tributary of Sutlej River", Indian Journal of Ecology, 2018, 45(4):898–900.

Samantray, Pradyusa, Basanta K. Mishra, Chitta R. Panda, and Swoyam P. Rout ,"Assessment of Water Quality Index in Mahanadi and Atharabanki Rivers and Taldanda Canal in Paradip Area", India. Journal of Human Ecology, 2009, 26(3):153–61.

A. Saranya and Sashikkumar M C ," Hydrochemical Analysis of Groundwater Quality in Virudhunagar District", Tamil Nadu, India. Indian Journal of Ecology, 2019, 46(1):39–48.

S. Sidhardhan and Adish Kumar S ,"Physico-Chemical Characteristics of Groundwater in and Around Tirunelveli Corporate Dumpsite", Indian Journal of Ecology,2019, 46(1):55–59.

Udayakumar P, Dhanakumar S and Lekshmanaswamy M,"Impact of Textile Dyeing and Bleaching Effluents on Surface Water Quality of River Noyyal at Tirupur, Tirupur Dist, Tamil Nadu, India", Indian Journal of Natural Sciences, 2011, 11(9):976–97.

Usharani, K., Umarani. K, Ayyasamy P M, Shanthi K, and Lakshmanaperumalsamy P. ,"Physico-Chemical and Bacteriological Characteristics of Noyyal River and Ground Water Quality of Perur, India", Journal of Applied Sciences and Environmental Management, 2010, 14(2):35.

Vandhana Devi V and Nagendran R,"Spatial Assessment of Water Quality in Kondurupalem Lagoon Inlet, South East Coast of India", Indian Journal of Ecology, 2017, 44(4):687–96.

BIOGRAPHIES

Dr. C. Meiaraj,
Professor, Department of Civil Engineering, Govt. College of Technology, Coimbatore.

Dr. M.C. Sashikkumar
Associate Professor, Department of Civil Engineering, College of Engineering, Guindy,
Anna University, Chennai.