WATER QUALITY ANALYSIS OF EDAPPALLY CANAL USING GIS MAPPING

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Abstract - *Assessment of seasonal variations in surface water quality characteristics is an essential aspect for evaluating water pollution due to both natural and anthropogenic influences on water resources. In this study, temporal variations of water quality in Edappally canal connecting Muttar puzha and Chitrapuzha were assessed and an integrated water quality map was created. Water samples from eight locations along the stretch of the canal were collected for two seasons and were analyzed for physicochemical and microbiological parameters such as pH, turbidity, COD, DO, Fe, Chloride, MPN. Variations in these properties for the two seasons were analysed and an integrated water quality map was created using ArcGIS software.*

1. INTRODUCTION

Water is a source of life and regarded as the most essential of natural resources. Existing freshwater resources are gradually becoming polluted and unavailable due to human or industrial activities. A growing number of contaminants are entering water supplies from industrialization and human activity like heavy metals, dyes, pharmaceuticals, pesticides, fluoride, phenols, insecticides, detergents and other chemical compounds. Emerging pollutants detected in water may have adverse effects on human health and aquatic ecosystems. Clean water that is free of toxic chemicals and pathogens is essential to human health. In the coming decades, water scarcity may lead to social and political instability, water wars and diseases, unless new ways to supply clean water are found.

2. STUDY AREA

Study area chosen is full stretch of Edappally Canal located in Ernakulam district and it is shown in figure. The study area is located between 9°59’31.67’’and 10°2’36.78’’latitudes and between 76°20’2.65’’and 76°18’11.56’’longitudes. It is 14.45 km long canal which originates near Muttar River and joins the Chitrapuzha. It is one among the canals in the Ernakulam subjected to pollution due to rapid urbanization and encroachments.

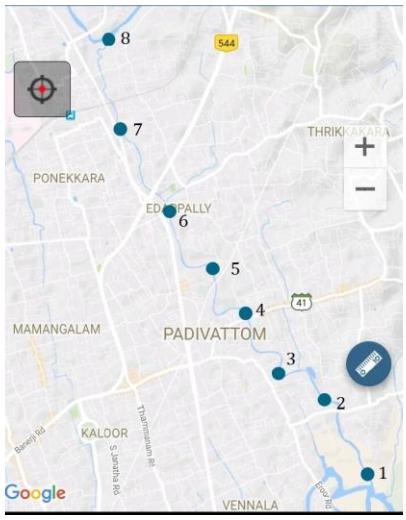

Fig 1: Study area with sampling points

3. METHODOLOGY

3.1 Water Quality Analysis

Here the method adopted for the study of water quality analysis was by collecting water samples from different locations of Edappally canal in two different seasons and analyzing their physical, chemical and microbiological characteristics. The quality of drinking water was analysed in terms of pH, chloride, iron, turbidity, MPN of faecal coliforms, Chemical Oxygen Demand(COD), Dissolved Oxygen(DO). Results were analysed on the basis of Indian Standard specifications for drinking water.

Water Quality Standards (IS: 10500;2012)			
Sl. No.	Parameter	Desirable Limit	Permissible Limit
1	Turbidity	1NTU	5NTU
2	pH	6.5-8.5 Agreeable	No relaxation agreeable
3	Chloride	250 mg/L	1000 mg/L
4	Iron	0.3 mg/L	No relaxation

3.2 Geographic Information System

Geographic Information Systems (GIS) is a computer system capable of creating, storing, managing, analyzing, and displaying geographically referenced information. GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.
GIS incorporates computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. This rapidly growing technological field brings graphical features with tabular data in order to assess real-world problems.

4. RESULTS OF WATER QUALITY ANALYSIS

Result of water quality analysis on post- monsoon season						
Sample points	Turbidity (mg/L)	pH	Chloride (mg/L)	Iron (mg/L)	DO (mg/L)	COD (mg/L)
1	6.7	7.40	90.00	0.25	7.6	220
2	19.1	6.98	50.50	0.40	7.3	202
3	24.2	7.11	50.00	0.65	7.1	240
4	41.5	7.12	48.50	0.85	7.1	235
5	40.8	7.30	50.50	0.65	7.5	190
6	31.5	6.58	200.00	0.50	6.9	205
7	19.7	7.02	300.00	0.50	7.0	195
8	24.4	7.07	150.00	0.75	7.3	186

Result of water quality analysis on pre- monsoon season						
Sample points	Turbidity (mg/L)	pH	Chloride (mg/L)	Iron (mg/L)	DO (mg/L)	COD (mg/L)
1	3.9	6.91	3499	0.50	6.0	1094
2	3.6	6.95	2100	0.55	6.1	772
3	3.8	7.05	450	0.60	6.0	754
4	30.3	7.10	200	0.90	2.7	836
5	16.4	7.15	149	0.85	5.5	745
6	40.4	7.01	250	0.55	2.7	882
7	51.8	7.15	450	0.50	0.0	900
8	4.7	6.74	4499	0.70	6.4	340

4.1 Turbidity

Spatial variation map for turbidity in two seasons has been obtained by ArcGIS and presented in figure 4.1 and 4.2

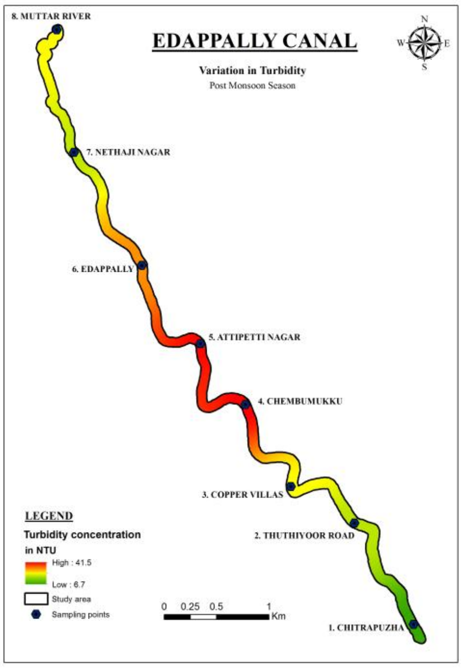

Fig 4.1 Turbidity variation in post-monsoon season

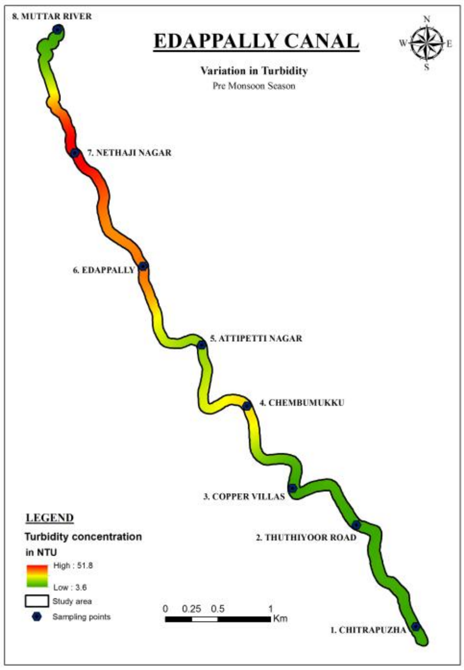

Fig 4.2 Turbidity variation in pre-monsoon season

While considering drinking water standards, the desirable limit of turbidity is 1 NTU and permissible limit in the absence of alternate source is 5 NTU. In the post-monsoon season and pre-monsoon season the turbidity values are above the desirable limit.

4.2 pH

Spatial variation map for pH in two seasons has been obtained by ArcGIS and presented in figure 4.3 and 4.4

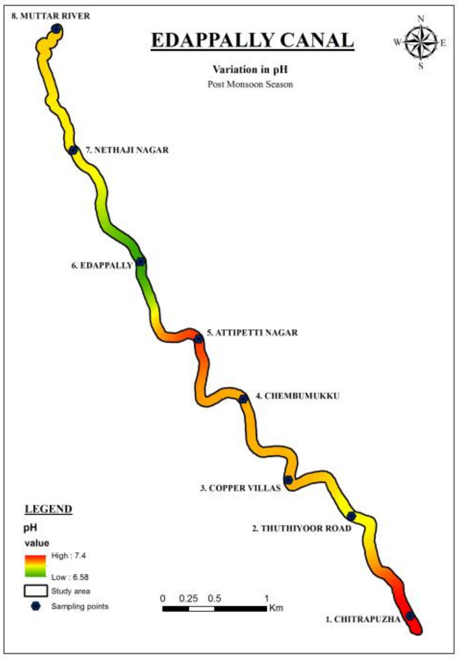

Fig 4.3 pH variation in post-monsoon season

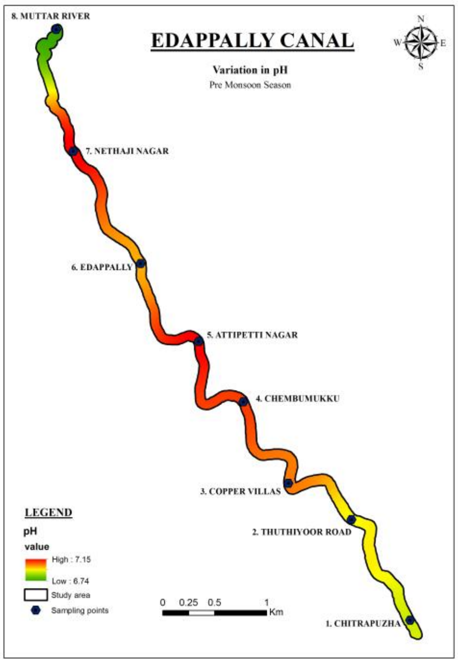

Fig 4.4 pH variation in pre-monsoon season

The desirable value of pH is between 6.5 and 8.5. In both the seasons obtained values of pH from the sampling points lies within the desirable limit and also there is no considerable variation in both season.

4.3 Chloride

Spatial variation map for chloride in two seasons has been obtained by ArcGIS and presented in figure 4.5 and 4.6

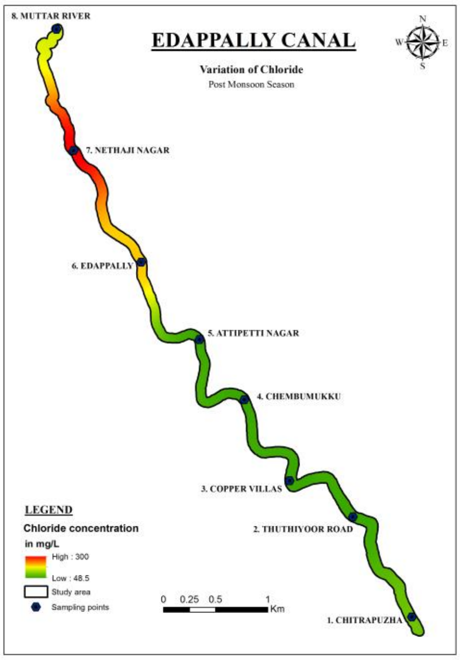

Fig 4.5 Chloride variation in post-monsoon season

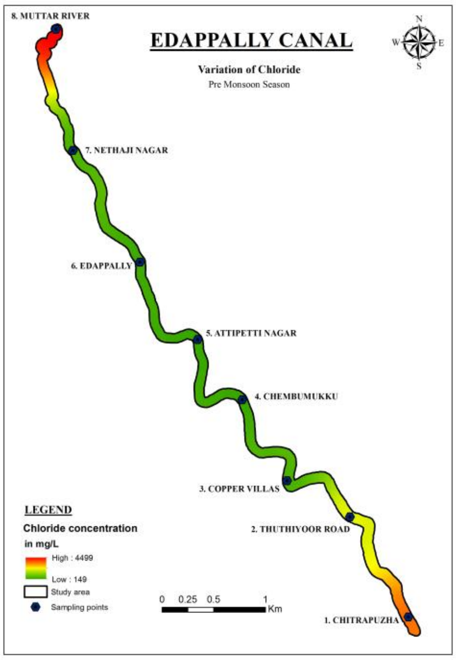

Fig 4.6 Chloride variation in pre-monsoon season

A desirable limit of 250 mg/L and permissible limit in the absence of alternate source of 1000mg/L has been set for the chloride ions as per the IS 10500 specifications. In the pre-monsoon season, chloride content is increased to a very high value when compared with the post-monsoon season.

4.4 Iron

Spatial variation map for Iron in two seasons has been obtained by ArcGIS and presented in figure 4.7 and 4.8

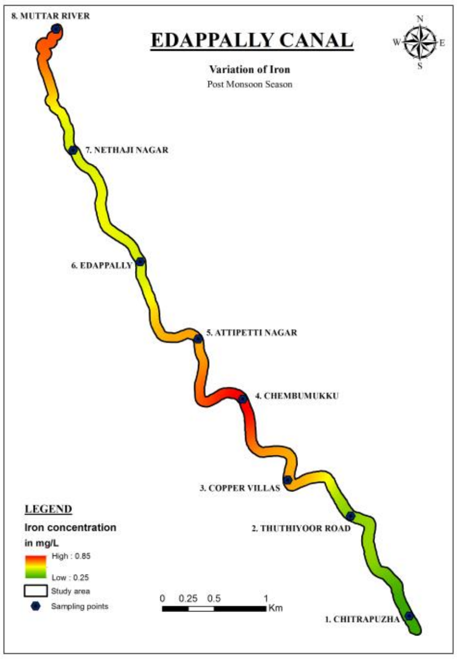

Fig 4.7 Iron variation in post-monsoon season

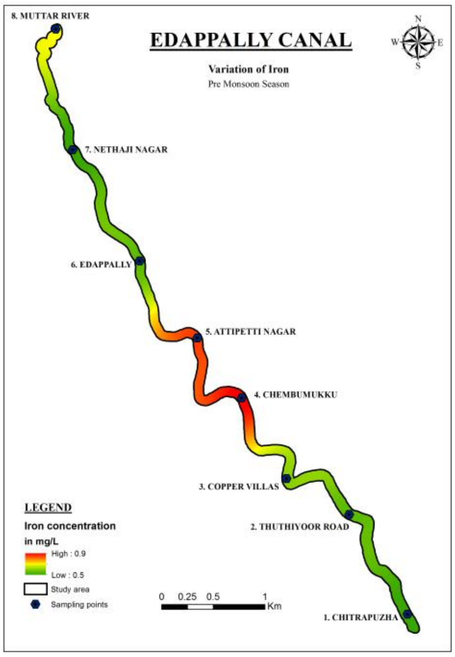

Fig 4.8 Iron variation in pre-monsoon season

A desirable limit of iron in drinking water is 0.30 mg/L. Beyond this limit taste/appearance is affected, has adverse effects on domestic uses. No relaxation for the desirable limit since it is a heavy metal. When comparing the two seasons there is no considerable variation in the values.

4.5 Dissolved Oxygen (DO)

Spatial variation map for DO in two seasons has been obtained by ArcGIS and presented in figure 4.9 and 4.10

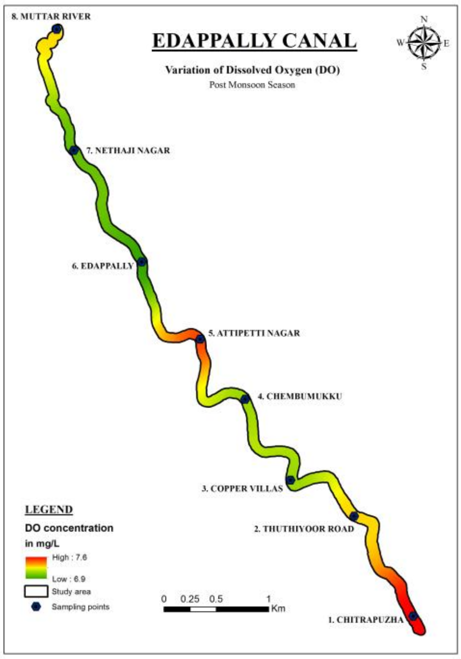

Fig 4.9 DO variation in post-monsoon season

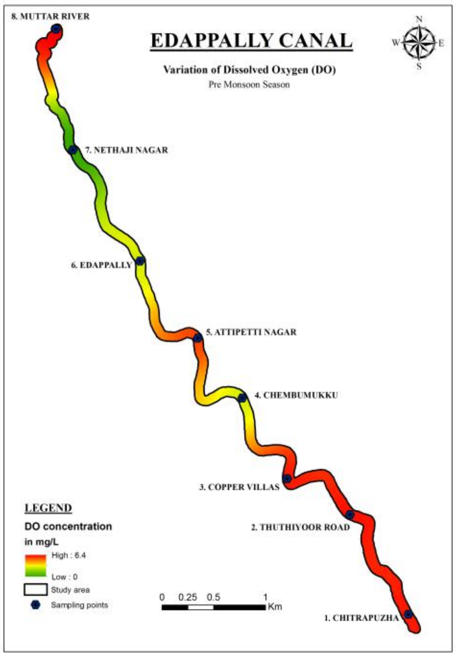

Fig 4.10 DO variation in pre-monsoon season

Dissolved oxygen values greater than 7 mg/L is considered as healthy ecosystem. The desirable range of DO is between 7-9 mg/L. DO values less than 5 mg/L adversely affect the functioning of the ecosystem. In the post-monsoon season the values obtained are within the desirable limits and in pre-monsoon season, values are below the desirable range and it indicates that the water is highly polluted.

4.6 Chemical Oxygen Demand (COD)

Spatial variation map for Chemical Oxygen Demand in two seasons has been obtained by ArcGIS and presented in figure 4.11 and 4.12

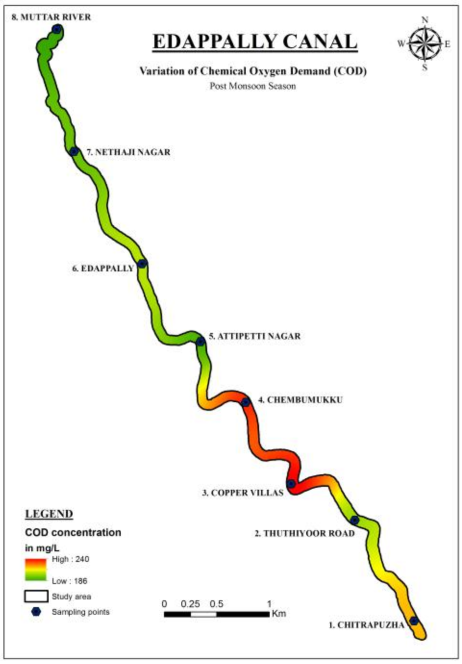

Fig 4.11 COD variation in post-monsoon season

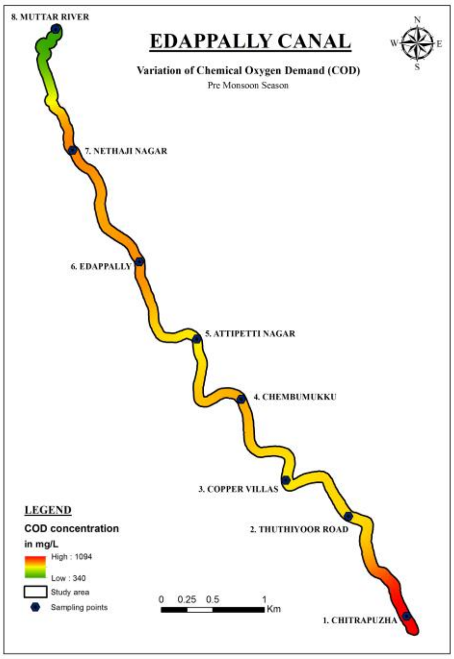

Fig 4.12 COD variation in pre-monsoon season

Chemical Oxygen Demand is an important water quality parameter which provides an index to assess the effect discharged wastewater will have on the receiving environment. COD for drinking water should be nil. Wastewater discharge limits are given by CPCB Effluent Discharge Standards, which mention permissible limits for disposal into inland surface water is COD<250 mg/L. While comparing two seasons, COD value in the pre-monsoon season is higher than post monsoon. That indicates water is more polluted in the pre monsoon season.

4.7 Data Integration using GIS

The spatial variation map of water quality parameters such as turbidity, pH, chloride, iron, dissolved oxygen, chemical oxygen demand was integrated and water quality map along the full stretch of canal was prepared using GIS. Integrated map shows the broad idea about the points of low, medium and high concentration of various parameters.

5. CONCLUSIONS

The present study has been undertaken to analyse the spatial variation of the canal water quality parameters such as pH, Iron, Chloride, Turbidity, DO, MPN, COD using GIS approach. It was reported that the canal water quality has been reduced due to pollution. The study was carried out by collecting samples from almost eight locations with an interval of almost one meter. The results of water samples were analysed. The results show that the concentration of DO and Turbidity reduced in some location due to the growth of water Hyacinth, the properties such as Chloride and COD increase due to decrease in rate of flow. The concentration of Iron and pH almost remains the same in all locations. An integrated water Quality map was also created showing these variations.

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