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Achenkovil River Quality Monitoring And Remediation Using Gis

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ABSTRACT: This research paper is about to water quality in rivers is of paramount importance for sustaining their many uses. Rivers are invaluable sources of drinking water, as well as recreational and commercial opportunities. Society depends on river water for generating energy, growing crops, running machinery, washing and cleaning, cooking, gardening, and more. To establish a sustainable and optimal use of this natural resource its quality has to be assessed. The present study consists of an analysis of river quality within the watershed of Achenkovil river, one of the most polluted water bodies within the pandalammunicipality . The samples collected from the river located within the study area were tested for various physico-chemical and biological parameters. Water quality index for parameters such as pH, total dissolved solids, hardness, dissolved oxygen, biochemical oxygen demand, chlorides and total coliform have been determined. Spatial distribution maps of all water quality parameters including pollution Index map have been developed using Geographical Information System (GIS). Analysis reveals the present status of river water quality of study area and compares with the results obtained from data, from the year 2018. The study recommends that the river water of the region needs field-specific treatment before putting it to use. Additionally, the authorities need to put a strict regulation of waste disposal along Achenkovilriver

KEYWORDS: pollution index, GIS, Spatial distribution maps, river quality monitoring.

I. INTRODUCTION

Water quality is defined as a measure of the physical, chemical, biological, and microbiological characteristics of water. River monitoring is the long-term, standardized measurement and observation of a river's water quality in order to determine its condition and quality trends. The purpose of river monitoring is commonly related to water quality management, which aims to control the physical, chemical, and biological characteristics of the water through assessment and regulation. Streams and rivers offer an above ground glimpse at the health and hydrology of a watershed, and function as a vital resource for human activity, as well as habitat for a host of non-human animals and plants.

Achankovil River is also known as the Achankovilaaru, enriches Alappuzha and Pathanamthitta district of Kerala and has a length of almost 128 kilometres. Remote sensing and GIS provides effective tools in monitoring of water quality parameter aid with in situ measurement data. From GIS, spatial distribution mapping for various pollutants can be done. The resulting information is very useful for decision-makers to take remedial measures.

A water quality index is a means to summarize large amounts of water quality data into simple terms and makes the surface water quality analysis convenient.

GeographicInformation Systems (GIS) is a tool for collecting, storing, transforming the spatial information and arriving at a decision from the real world for different purposes. It offers an advanced method to study water quality in spatial scale.

In the present study, the groundwater quality along the watershed of Achenkovil River, a river, which is a major water source of Alappuzha and Pathanamthitta districts, was analysed using GIS.

Sabarimala is the largest annual pilgrimage in India with an estimated 45–50 million devotees visiting every year.TheAchenkovil River is a small river not more than 130 kilo meters. Pilgrims use the water of Achenkovil River for various sanitary purposes. The water quality is also disturbed by various other anthropogenic activities by the population living near the river. The study aims to demonstrate the present condition of water quality of the River Achenkovil by developing an integrated groundwater quality map using GIS.

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OBJECTIVES

- To examine the physico - chemical characteristics of water in Achenkovil river
- To generate spatial distribution and IDW interpolation technique of water quality parameters using the application of GIS
- To develop an integrated river water quality map of Achenkovil river using GIS
- To estimate water quality index(WQI) of Achenkovil river using GIS
- To identify location of unsuitable water for drinking according to WQI

STUDY AREA

The study area considered is the watershed of Achenkovil River flowing through Pathanamthitta, Alappuzha and Kollam districts. The river Achenkovil nurtures numerous townships on its fertile banks. Among them, we selected 22 Km stretch of river located between N 9º 14'15" E 76º 39' 50" and N 9°22' 47" E 76°12'0'' in Pathanamthitta district.

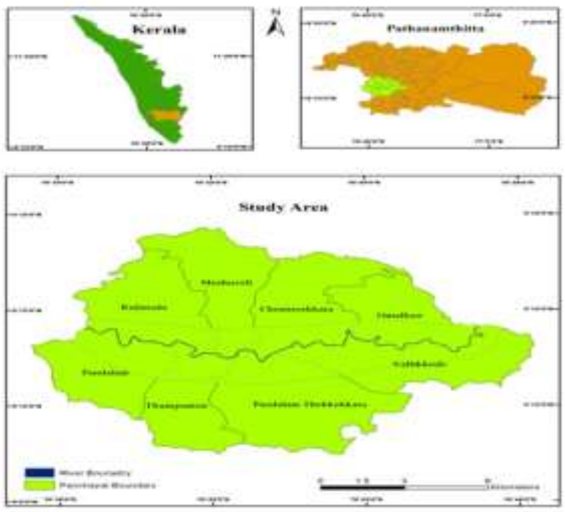
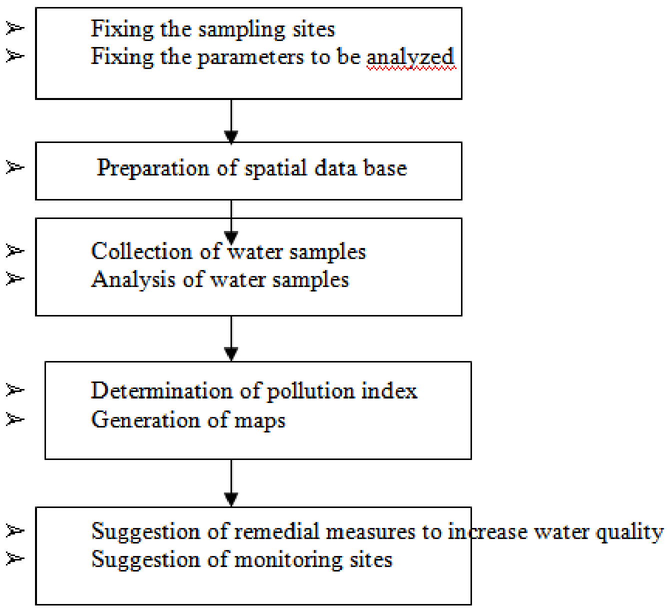


Fig 1: Map of study area

METHODOLOGY



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SAMPLING AND CHEMICAL ANALYSIS

The site visit was conducted along the selected stretch of the river in order to get informed about the present situation of river Achenkovil. The samples were collected from five selected stations and the data used for marking the coordinates was Global Positioning System (GPS) in January 2021. The water samples collected were brought to immediate chemical analysis. The measured chemical parameters include Turbidity, pH, Electrical Conductivity, Acidity, Alkalinity, SO4, TDS, CaCO3, Ca, Mg, Cl, F, Fe, NO3 and Rc. Parameters considered for analysis was based on drinking water quality of the river. The permissible limits of selected parameters were fixed as per IS 10500:2012

All the observed data were analyzed to perform spatial analysis using GIS and for determining WQI.

WATER QUALITY ANALYSIS OF EACH SITES

Station 1:Mahadeva Temple Kadavu

SLNO	CHARACTERISTICS	UNIT	DESIRABLE LIMITS AS PER IS 10500:2012	PERMISSIBLE LIMITS	Results
1	TURBIDITY	NTU	1	5	7.8
2	pH		6.5-8.5	No relaxation	6.63
3	ELECTRICAL CONDUCTIVITY	Ms/cm			62
4	ACIDITY	mg/litre			20
5	ALKALINITY	mg/litre	200	600	17.04
6	SULPHATE	mg/litre	200	400	4.28
7	TOTAL DISSOLVED SOLIDS (TDS)	mg/litre	500	2000	38
8	TOTAL HARDNESS (CaCO3)	mg/litre	200	600	12
9	CALCIUM (Ca)	mg/litre	75	200	3.21
10	MAGNESIUM (Mg)	mg/litre	30	100	0.97
11	CHLORIDE AS(Cl)	mg/litre	250	1000	18.93
12	FLUORIDE AS(F)	mg/litre	1	1.5	0.45
13	IRON(AS Fe)	mg/litre	0.3	No relaxation	0.9626
14	NITRITE (AS NO3)	mg/litre	45	No relaxation	3.33
15	RESIDUAL CHLORINE (Rc)	mg/litre	0.2	1	....

Table 1: Sample analysis report of station 1

Station 2: PandalamValiyakoikal Temple

SLNO	CHARACTERISTICS	UNIT	DESIRABLE LIMITS	PERMISSIBLE LIMITS	RESULTS
1	TURBIDITY	NTU	1	5	8.2
2	pH		6.5-8.5	No relaxation	6.23
3	ELECTRICAL CONDUCTIVITY	Ms/cm			60
4	ACIDITY	mg/litre			20
5	ALKALINITY	mg/litre	200	600	25.56
6	SULPHATE (AS SO4)	mg/litre	200	400	4.12
7	TOTAL DISSOLVED SOLIDS (TDS)	mg/litre	500	2000	32
8	TOTAL HARDNESS (CaCO3)	mg/litre	200	600	20
9	CALCIUM (Ca)	mg/litre	75	200	6.41
10	MAGNESIUM (Mg)	mg/litre	30	100	0.97
11	CHLORIDE AS(Cl)	mg/litre	250	1000	11.36
12	FLUORIDE AS(F)	mg/litre	1	1.5	0.45
13	IRON(AS Fe)	mg/litre	0.3	No relaxation	1.3741
14	NITRITE (AS NO3)	mg/litre	45	No relaxation	3.41
15	RESIDUAL CHLORINE (Rc)	mg/litre	0.2	1	.....

Table 2 : Sample analysis report of station 2

Station 3: Ambalakadavu Bridge

SLNO	CHARACTERISTICS	UNIT	DESIRABLE LIMITS	PERMISSIBLE	RESULT
1	TURBIDITY	NTU	1	5	8.5
2	pH		6.5-8.5	No relaxation	6.36
3	ELECTRICAL CONDUCTIVITY	Ms/cm			63
4	ACIDITY	mg/litre			20
5	ALKALINITY	mg/litre	200	600	21.3
6	SULPHATE (AS SO4)	mg/litre	200	400	4.26
7	TOTAL DISSOLVED SOLIDS (TDS)	mg/litre	500	2000	31
8	TOTAL HARDNESS (CaCO3)	mg/litre	200	600	16
9	CALCIUM (Ca)	mg/litre	75	200	4.81
10	MAGNESIUM (Mg)	mg/litre	30	100	0.97
11	CHLORIDE AS(Cl)	mg/litre	250	1000	11.36
12	FLUORIDE AS(F)	mg/litre	1	1.5	0.9
13	IRON(AS Fe)	mg/litre	0.3	No relaxation	0.5633
14	NITRITE (AS NO3)	mg/litre	45	No relaxation	2.77
15	RESIDUAL CHLORINE (Rc)	mg/litre	0.2	1	.....

Table 3: Sample analysis report of station 3

Station 4: KaipatoorKadavu

SL.NO	CHARACTERISTICS	UNIT	DESIRABLE LIMITS	PERMISSIBLE	RESULT
1	TURBIDITY	NTU	1	5	8.2
2	pH		6.5-8.5	No relaxation	6.23
3	ELECTRICAL CONDUCTIVITY	Ms/cm			60
4	ACIDITY	mg/litre			20
5	SLNO	mg/litre	200	600	25.56
6	SULPHATE (AS SO4)	mg/litre	200	400	4.12
7	TOTAL DISSOLVED SOLIDS (TDS)	mg/litre	500	2000	32
8	TOTAL HARDNESS (CaCO3)	mg/litre	200	600	20
9	CALCIUM (Ca)	mg/litre	75	200	6.41
10	MAGNESIUM (Mg)	mg/litre	30	100	0.97
11	CHLORIDE AS(Cl)	mg/litre	250	1000	11.36
12	FLUORIDE AS(F)	mg/litre	1	1.5	0.45
13	IRON(AS Fe)	mg/litre	0.3	No relaxation	1.3741
14	NITRITE (AS NO3)	mg/litre	45	No relaxation	3.41
15	RESIDUAL CHLORINE (Rc)	mg/litre	0.2	1	.....

Table 4: Sample analysis report of station 4

Station 5 :ThazhoorKadavu

SLNO	CHARACTERISTICS	UNIT	DESIRABLE LIMITS	PERMISSIBLE	RESULT
1	TURBIDITY	NTU	1	5	8.5
2	pH		6.5-8.5	No relaxation	6.36
3	ELECTRICAL CONDUCTIVITY	Ms/cm			63
4	ACIDITY	mg/litre			20
5	ALKALINITY	mg/litre	200	600	21.3
6	SULPHATE (AS SO4)	mg/litre	200	400	4.26
7	TOTAL DISSOLVED SOLIDS (TDS)	mg/litre	500	2000	31
8	TOTAL HARDNESS (CaCO3)	mg/litre	200	600	16
9	CALCIUM (Ca)	mg/litre	75	200	4.81
10	MAGNESIUM (Mg)	mg/litre	30	100	0.97
11	CHLORIDE AS(Cl)	mg/litre	250	1000	11.36
12	FLUORIDE AS(F)	mg/litre	1	1.5	0.45
13	IRON(AS Fe)	mg/litre	0.3	No relaxation	0.9626
14	NITRITE (AS NO3)	mg/litre	45	No relaxation	3.33
15	RESIDUAL CHLORINE (Rc)	mg/litre	0.2	1	....

Table 5: Sample analysis report of station 5

GENERATION OF MAPS

1. Digitizing the boundary of the Achenkovilriver in QGIS 3.10.10 by calling Google Earth Pro.
2. Set the Scale to 1:1000
3. Project the layer to UTM43N.(Convert xyz coordinate file to xy coordinate.)
4. Check Topology
   - Must not have gaps`
   - Must not overlap
5. Project the sample points file to UTM43N

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6. The parameter values (non spatial data) is linked to the sampling location (spatial data) to generate various thematic maps.
7. Spatial analysis variation

The approach/methodology used in the spatial analysis variation is the Inverse distance weighted (IDW) interpolation technique, which produces spatial variation maps for determining the contributing parameter pollution load and nutrient concentration level in mg/l. The IDW traditionally follows a deterministic model approach whereby unknown values are computed based on the nearness by points other than values far off. This is based on the principle of first law of geography. This technique of interpolation has a wide application in the field spatial analysis for describing distribution of contaminants and physicochemical determinant patterns in time and space.

MAP GENERATION OF EACH PARAMETERS

QGIS functions as geographic information system (GIS) software, allowing users to analyze and edit spatial information, in addition to composing and exporting graphical maps.QGIS supports both raster and vector layers; vector data is stored as either point, line, or polygon features. Multiple formats of raster images are supported, and the software can geo referenceimages.QGIS supports shapefiles, coverages , personal geo databases, dxf, mapInfo, post GIS, and other formats.web services, including web map service and web feature service, are also supported to allow use of data from external sources.

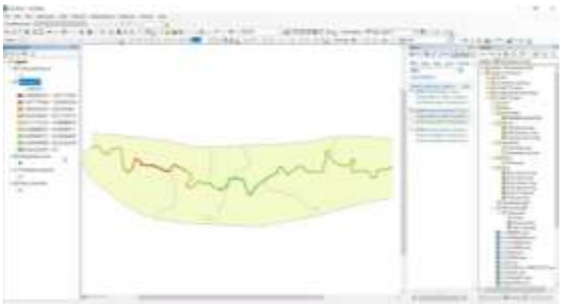

Fig 2. River network drawn using ARC GIS 3.10

1. Turbidity

Turbidity is the measure of relative clarity of a liquid. It is an optical characteristic of water and is a measurement of the amount of light that is scattered by material in the water when a light Is shined through the water sample . Turbidity is measured in Nephelometric Turbidity Units (NTU). From the map1, station number 3and5 have the higher value and station number2 have the lower value

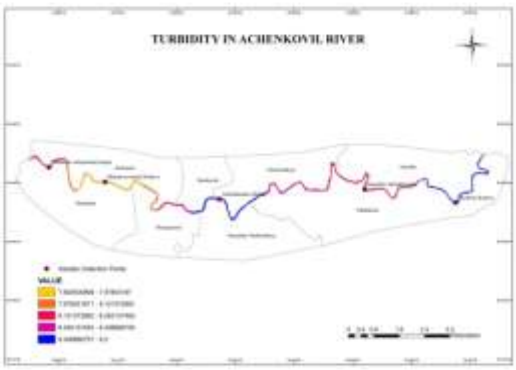

Fig 3. Spatial distribution of turbidity in study area

2. Ph

pH is a measure of how acidic/basic water is. Since pH can be affected by chemicals in the water. pH is an important indicator of water that is changing chemically. As per IS specifications for drinking, the acceptable limit of pH is 6.5 – 8.5. pH was determined using pH paper with standard color code references.

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From the map, station number3 and 5 have the higher value and station number 1 and 4 have the lower value.

Fig 4. Spatial distribution of pH in study area

3. Electrical Conductivity

The conductivity of water refers to the ability of water to conduct an electrical current. A material like copper has a high electrical While pure water has very low conductivity, sea water comes with much higher conductivity.
From the map, station number 3 and 5 have the higher value and station number1and5 have the lower value

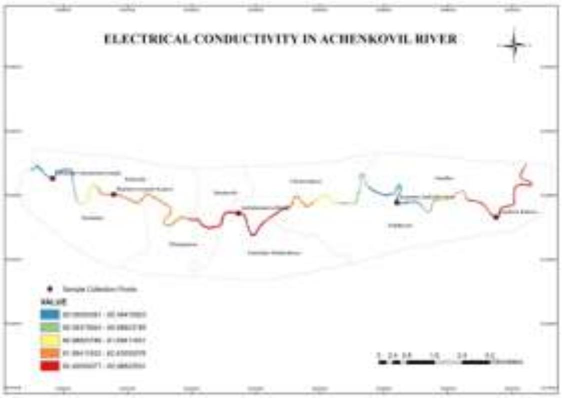

Fig 5. Spatial distribution of Electrical conductivity in study area

4. Acidity

Acidity is the quantitative capacity of a water or solution to neutralize an alkali. In layman'sterms that means pH is a measure of the acidity or basicity of an aqueous solution. Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline.From the map,All stations had the same value.

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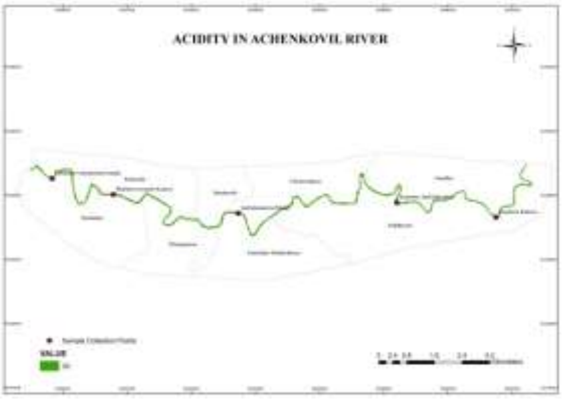

Fig 6. Spatial distribution of Acidity in study area

5. Alkalinity

Alkalinity is water's capacity to resist acidic changes in pH, essentially alkalinity is water's ability to neutralize acid. This ability is referred to as a buffering capacity.

From the map, station number1and 4 have the higher value and station number 2 have the lower value.

Fig 7. Spatial distribution of Alkalinity in study area

6. Sulphate

Sulfate gives a bitter or medicinal taste to water if it exceeds a concentration of 250 mg/l. This may make it unpleasant to drink the water.

From the map, station number 2, 3 and5 have the higher value and station number1and4 have the lower value.

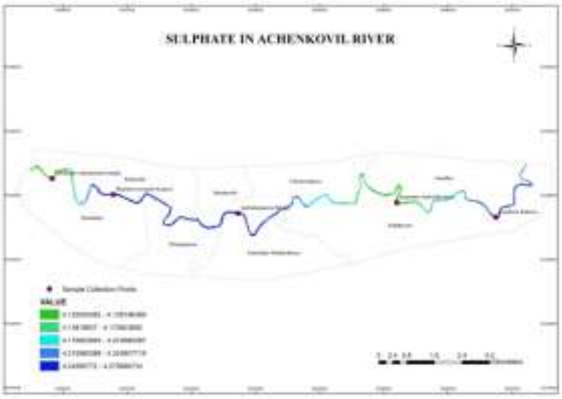

Fig 8. Spatial distribution of Sulphate in study area

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7. Total Dissolved Solids (TDS)

TDS is a measure of the dissolved combined content of all inorganic and organic substances present in a liquid in molecular, ionized, or micro-granular suspended form. The sample is filtered and the filtrate evaporates in a weighed dish on a steam bath, the residue left after evaporation is dried to constant weight in an oven at either 103-105°C. The increase in weight over that of the empty dish represents the total dissolved solids and includes all materials, liquid or solid, in solution or otherwise which pass through the filter and not volatized during the drying process.

From the map, station number 2 have the higher value and station number3,4 and5 have the lower value

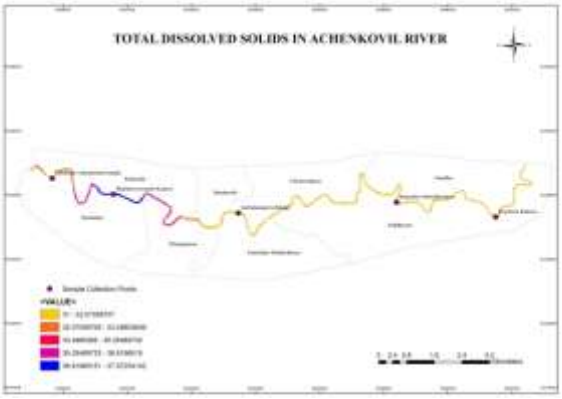

Fig 9. Spatial distribution of Total Dissolved Solids in study area

8. Total hardness as Caco3

Hardness is the amount of dissolved calcium and magnesium in the water. Hard water is high in permanent hardness can be removed by treatment using ion exchange or reverse osmosis. Total hardness was determined by titration method. The sample was titrated against standard EDT A solution with ammonia buffer and Ferrochrome Black-T indicator till the wine-red color turns blue. dissolved minerals, largely calcium and magnesium. There are two types of hardness; temporary and permanent hardness.

From the map, station number 2 have the higher value and station number 3,4 and 5 have the lower value.

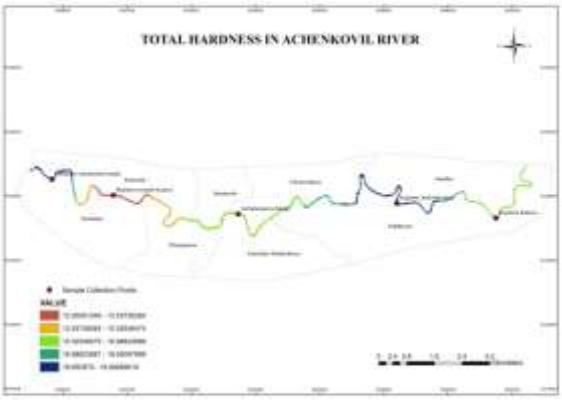

Fig 10. Spatial distribution of Total Hardness in study area

9. Calcium

Calcium occurs in water naturally. Seawater contains approximately 400 ppm calcium. One of the main abundance of calcium in water is its natural occurrence in the earth's crust. Calcium is also a constitute of coral. Rivers generally contain 1-2 ppm calcium, but in lime areas rivers may contains calcium concentrates high as 100ppm

From this map, station number 2 have lower value and station number1and 4 higher value.

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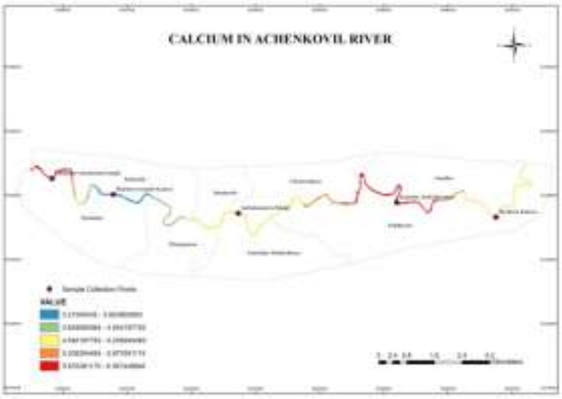

Fig 11. Spatial distribution of calcium map in study area

10. Magnesium

In addition, fear of cerebrovascular disease should not deter anyone from drinking water with low magnesium levels. In conclusion, the results of the present study show that there is a significant protective effect of magnesium in take from drinking water on the risk of cerebrovascular disease.

From the map all the stations have the same value.

Fig 12. Spatial distribution of Magnesiumin study area

11. Chloride

Chloride is one of the most common anions found in tap water. Chloride is determined in a natural or slightly alkaline solution by titration with standard silver nitrate using potassium chromate as an indicator. Silver chloride is quantitatively precipitated before red silver chromate

Fig 13. Spatial distribution of Chloride in study area

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12. Fluoride

Water fluoridation is the controlled adjustment of fluoride to a public water supply solely to reduce too the decay. Fluoridated water contains fluoride at a level that is effective for preventing cavities; this can occur naturally or by adding fluoride**.**

From the map, station number3and 5 have the higher value and station number1,2 and 4 have the lower value.

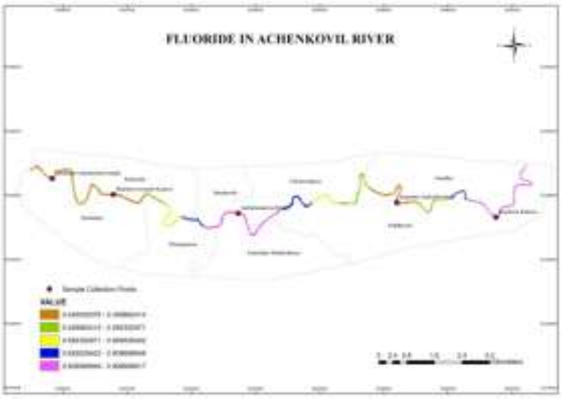

Fig 14. Spatial distribution of Fluoride in study area

13. Iron

The Environmental Protection Agency considers iron in well water as a secondary contaminant, which means it does not have a direct impact on health. The Secondary Maximum Contaminant Level set out by the EPA is 0.3 milligrams per liter, but this is merely a guideline and not a federal standard. Typically around 15mg/L, Idaho's well water does contain quite high amounts of iron, but the level is still not enough to cause physical harm.

From the map, station number1and 4 have the higher value and station number 3 and 5 have the lower value

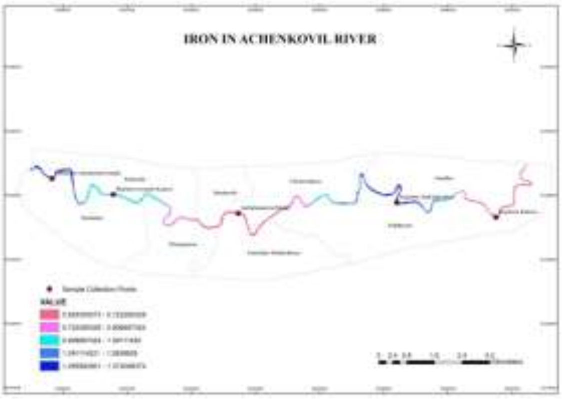

Fig 15. Spatial distribution of Iron in study area

14. Nitrite

Any excess nitrate in the water is a source of fertilizer for aquatic plants and algae. In many cases, the amount of nitrate in the water is what limits how much plants and algae can grow. If there is an excess level of nitrates, plants and algae will grow excessively.

From the map, station number 1and 4 have the higher value and station number 3 and 5 have the lower value

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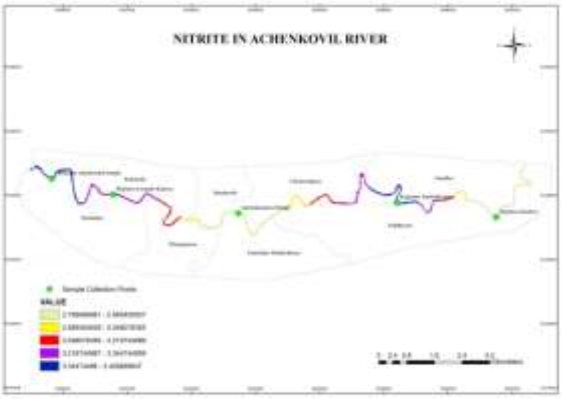

Fig 16. Spatial distribution of Nitrite in study area

WATER QUALITY INDEX (WQI)

A water quality index provides a value that expresses overall water quality at a location, based on several water quality parameters. The objective of an index is to turn complex water quality data into information that is understandable and useable by the public. An attempt has been made to develop water quality index (WQI), using thirteen water quality parameters.

Relevant studies on water quality index (WQI) and its modeling were reviewed. WQI is valuable and unique rating to depict the overall water quality status in a single term that is helpful for the selection of appropriate treatment technique to meet the concerned issues (Tyagietal.2013).

A WQI typically comprises four processes or components. First, the water quality parameters of interest are selected. Second, the water quality data are read and for each water quality parameter the concentrations are converted to a single-value dimensionless sub-index. Third, the weighting factor for each water quality parameter is determined and fourth, a final single value water quality index is calculated by an aggregation function using the sub-indices and weighting factors for all water quality parameters (Md. Galal Uddin et al., 2020).

The study is intended to estimate water quality index of study area is determined using the selected parameters. water quality index of the study area determined by weighted arithmetic water quality index method (D. Satish Chandra, SS. Asadi and M.V.S. Raju et al.,2017)

CALCULATION OF WATER QUALITY INDEX (WQI)

Methodology in Calculating WQI Using WAWQI Method

Step 1:
Collect data of various physico- chemical water quality parameters.

Step 2:
Calculate Proportionality constant "K" value using formula $K = (1/(\sum 1/S_n))$
where "Si" is standard permissible for nth parameter.

Step 3:
calculate quality rating for nth parameter (q_n) where there are n parameters.
This is calculated using formula
$qn=100 \{ (v_n - v_{io})/(s_n - v_{io}) \}$.
Whereas v n = Estimated value of the nth parameter of the given sampling station
.vio= Ideal value of nth parameter in pure water.
sn=Standard permissible value of the nth parameter.

Step 4:
Calculate unit weight for the nth parameters.
$W_n=(k/ S_n)$.

Step 5:
Calculate Water Quality Index (WQI) using formula, $WQI = ((\Sigma w_n x\ q_n)/\Sigma\ w_n)$.
Water Quality Index (WQI) and Status of water quality (Chatterji and Raziuddin,2002)

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Water Quality Index Level Water Quality Status	Water Quality Status
0-25	Excellent Water Quality
26-50	Good Water Quality
51-75	Poor Water Quality
76-100	Very Poor Water Quality
>100	Unsuitable for drinking

Table 6. Water Quality Index (WQI) and Status of water quality (Chatterji and Raziuddin,2002)

Charecteristics	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Turbidity	7.8	8.2	8.5	8.3	8.1
pH	6.63	6.23	6.36	6.3	6.28
Electrical conductivity at 25ºC	62	60	63	61	61
Acidity	20	20	20	20	20
Alkalinity	17.04	25.56	21.3	22.45	19.15
Sulphate (as SO_4)	4.28	4.12	4.26	4.25	4.18
Total Dissolved solids (TDS)	38	32	31	34	30
Total Hardness (as $CaCO_3$)	12	20	16	18	18
Calcium (as Ca)	3.12	6.41	4.81	5.51	4.81
Magnesium (as Mg)	0.97	0.97	0.97	0.97	0.97
Chloride (as Cl)	18.93	11.36	11.36	11.25	11.65
Flouride (as F)	0.45	0.45	0.9	0.9	0.9
Iron (as Fe)	0.9626	1.3741	0.5633	0.5633	0.7256
Nitrate (as NO_3)	3.33	3.41	2.77	2.65	2.76
WQI	**245.83**	**341.25**	**160.58**	**161.63**	**199.54**

Table 7. shows the water quality index values at the selected stations

GIS Analysis

Fig shows the variation in WQI at selected stations along the selected stretch of river. In which on flowing from station 1 to station 2 WQI rises and at here it shows maximum values among these five.station 3 and 4 shows almost same WQI range ,on flowing station 5 shows a raised WQI value. Among these lower value is at station 3

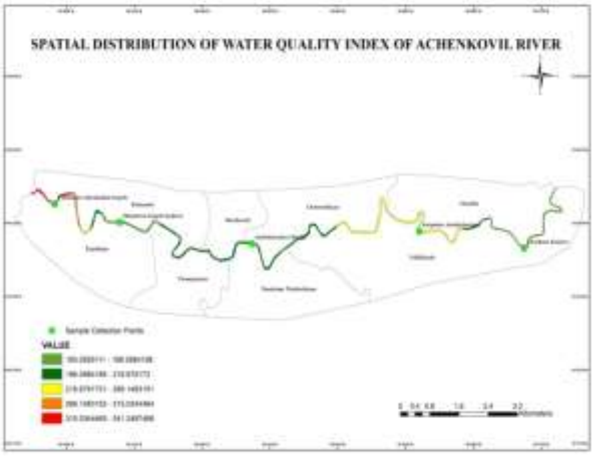

Fig 17. Spatial distribution of WQI in study area

II. CONCLUSIONS

Therefore, in this paper, the evaluation method combining with Weighted arithmetic water quality index method and GIS approach was successfully applied to evaluate water pollution variability of major water pollutants at monitoring sites of the river Achenkovil, Kerala, India. Turbid water with excessive iron and pH were the main pollutants.

According to the classification standards of pollution index, the whole water quality was comparatively poorer. The main reasons to the watershed pollution were the discharge of industrial and agricultural wastes, domestic sewage such as people and livestock excrements around the watershed.

GIS approach helped to evaluate the water pollution. The water quality of the river is generally unfit for drinking. As a large number of people are dependent on river water, poor WQI could be considered as a definite health hazard to regular users. Thus, it is recommended that the river water of the region needs field-specific treatment before putting it to use. Additionally, the authorities need to put a strict regulation of waste disposal along Achenkovilriver especially in pilgrim season because pollution may rise probably in that time.

It is believed that these reliable results could be very useful and valuable to act as a model analysis to perform pollution prevention strategies. as well as future plan and management on the watershed.

REFERENCES

[1]. YasuyukiZushi, Shigeki Masunaga. GIS-based source identification and apportionment of diffuse water pollution: Perfluorinated compound pollution in the Tokyo Bay basin, Chemosphere 85 (2011) 1340–1346.

[2]. Chang-An Yan, Wanchang Zhang, Zhijie Zhang, Yuanmin Liu, Cai Deng, NingNie.Assessment of Water Quality and Identification of Polluted Risky Regions Based on Field Observations & GIS in theHonghe River Watershed, China (2015)

[3]. Geeja K George1, Arundev R, ParvathyManoj, Seethal P V, Sanjith P. Water quality analysis of Edappalli canal using GIS mapping IRJET Volume: 04 Issue: 04 | Apr -2017

[4]. D. Satish Chandra, SS. Asadi, M.V.S. Raju .Estimation of water quality index by Weighted arithmetic water quality index method: A model study, Volume 8, Issue 4, April 2017, pp. 1215–1222 Article ID: IJCIET_08_04_136

[5]. A. KC, A. Chalise, D. Parajuli, N. Dhital, S. Shrestha and T. Kandel. Surface Water Quality Assessment Using Remote Sensing, Gis and Artificial Intelligence, TECHNICAL JOURNAL Vol 1, No.1, July 2019