International Journal of Research in Pharmacy and Pharmaceutical Sciences
ISSN: 2455-698X
Impact Factor: RJIF 5.22
www.pharmacyjournal.in
Volume 3; Issue 1; January 2018; Page No. 17-20

Surface water analysis in selected rivers of Pathanamthitta district, Kerala

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Abstract
Water is the major source for drinking in both urban and rural parts of India. Clean water is absolutely essential for healthy living and is a precious gift of nature. Water is being polluted with increased population, agricultural needs and industrial purpose. The polluted water on drinking may cause serious effect in human beings, domestic animals and even in the case of aquatic organisms. The physicochemical parameters of water samples from Pathanamthitta district were assessed. Water samples were collected from rivers such as Pamba, Manimala, Achankovil, and Kallada. The surface water was analyzed for various physicochemical parameters like colour, odour, taste, turbidity, pH, temperature, total alkalinity, total hardness, calcium, sulphate, nitrate, sodium, potassium, iron, aluminium, conductance, total dissolved solid and chloride after following the methods of American Public Health Association 1995. The results were compared with Bureau of Indian Standard and World Health Organization. The total alkalinity of surface water samples of Achankovil and Manimala rivers flowing through Pathanamthitta district were above desirable limit and also the quality of the surface water should be continuously monitored and can be used for cooking and drinking only after proper treatment.

Keywords: surface water analysis, standards, physico chemical analysis

Introduction
Water quality is fundamental for good river health. Water quality sustains ecological processes that support native fish populations, vegetation, wetlands, birdlife. Human beings depend on water for irrigation, drinking, fishing, recreation and to meet cultural and spiritual needs.
Water analysis is crucial whenever a process requires water of a specific quality. Dangerous level of micro organisms and mineral deposits can make a water source unfit and only water analysis can afford the proper insight necessary to determine the relative safety of a source. Due to the necessity of quality water, both in current process and for future environmental quality, water analysis is a critically important scientific process.

Surface water
Water present on the surface of earth in the form of oceans, rivers, lakes, ponds and streams is called surface water. The water in rivers and lakes comes from rain and melting of snow on mountain. Rivers flow into the sea.
If water quality is not maintained, it is not just the environment that will suffer. The commercial and recreational value of our water resources will also diminish.

Aim of our study
A) To analyze the physicochemical parameters of
Surface water from four different rivers flowing through Pathanamthitta district.
- Pamba river
- Manimala river
- Achankovil river
- Kallada river

B) To compare the results with BIS and WHO standards and to examine water pollution

Study Area [11]
Pathanamthitta district is formed on 1 Nov 1982. It is spreaded over an area of about 2,462 square kilometres. The districts lies on the latitudes of 9.27° and longitudes 76.78 divided into 5 taluks named ad Adoor, Kozhencherry, Mallappally, Ranni and Thiruvalla. Pathanamthitta town is the place where district headquarters is located. Kottayam, iddukki, Kollam are the districts which are bordering Pathanamthitta.
Pathanmthitta is a famous for the pilgrim centres and so it is also known as headquarters of pilgrimage tourism.

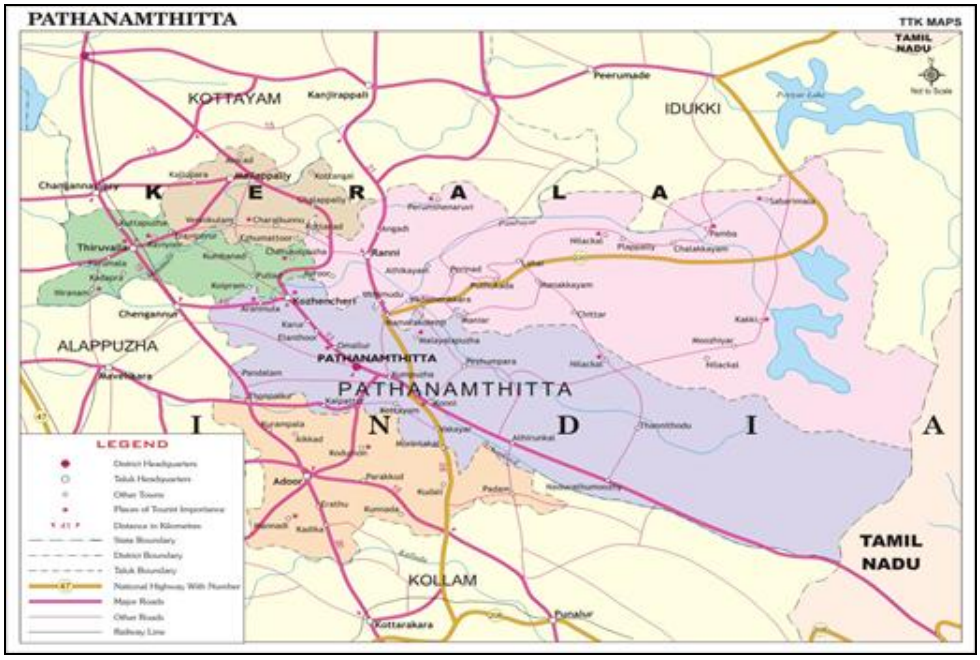

Fig 1: Map of Pathanamthitta

Methodology

Sampling: Samples were collected in good quality polythene bottles of 1L capacity during the month of June – July 2016. The bottles were well rinsed before sampling.

Surface water: Three different samples were collected from three different places of the following rivers flowing through Pathanamthitta district,

Procedure for phsicochemical parameters of water analysis [2]: The procedure for chemical analysis of water was based on 'Standard Methods for the Examination of Water and Wastewater' (Standard Methods), 19th edition, APHA, AWWA, WEF, 1995.

Results and Discussion

Table 1: Colour and Odour

Parameter	Place	Colour			Odour		
			Std.			Std.	
			Bis	Who		Bis	Who
Colour and Odour	Pamba Manimala Achankovil Kallada	CL CL CL CL	-	-	OL OL OL OL	-	-

CL- Colour less OL- Odour less

Table 2: Taste and Turbidity

Parameter	Place	Taste			Turbidity		
			STD.			STD.	
			BIS	WHO		BIS	WHO
Taste and turbidity	Pamba Manimala Achankovil Kallada	N N N N	-	-	CLR CLR CLR CLR	-	-

Table 3: pHand Temperature

Parameter	Place	pH			Temperature (°C)		
		pH	STD.			STD.	
			BIS	WHO		BIS	WHO
pH AND TEMP	Pamba Manimala Achankovil Kallada	7.26 7.22 6.83 7.13	6.5-8.5	6.5-8.5	26.0 25.93 25.9 25.9	-	-

Table 4: Iron and Aluminium content

Parameter	Place	Iron (mg/l)			Aluminium (mg/l)		
			STD.			STD.	
			BIS	WHO		BIS	WHO
Iron and aluminium	Pamba Manimala Achankovil Kallada	0.012 0.025 0.031 0.028	0.3	0.1	0.00243 0.0018 0.00196 0.0002	0.03	-

Table 5: Alkalinity and Chloride

Parameter	Place	Alkalinity (mg/l)			Chloride (mg/l)		
			STD.			STD.	
			BIS	WHO		BIS	WHO
Alkalinity and chloride	Pamba Manimala Achankovil Kallada	400.0 1800.0 1966.0 600.0	200-600	250.0	BDL 31.3 62.3 94.5	250.0	250.0

Table 6: Calcium and Total hardness

Parametr	Place	Calcium (mg/l)			Hardness (mg/l)		
			STD.			STD.	
			BIS	WHO		BIS	WHO
Calcium and total hardness	Pamba Manimala Achankovil Kallada	3.2 2.4 5.5 1.6	75.0	75.0	325.0 482.0 485.0 392.3	300-600	500.0

Table 7: Electrical conductivity and total solid contents

Parameter	Place	EC (µs/cm)			TDS (mg/l)		
			STD.			STD.	
			BIS	WHO		BIS	WHO
Electrical conductivity and total solids	Pamba Manimala Achankovil Kallada	1883.0 1862.0 1799.0 1821.0	750-2250	500.0	340.0 316.6 546.1 359.3	500.0	500.0

Table 8: Sodium and Pottasium content, Sulphate and Nitrogen, Nitrate content

Parameter	Place	Sodium (mg/l)			Potasium(mg/l)		
			STD.			STD.	
			BIS	WHO		BIS	WHO
Sodium and Pottasium	Pamba Manimala Achankovil Kallada	BDL BDL BDL BDL	100.0	100.0	BDL BDL BDL BDL	12.0	10.0

Table 9: Sulphate and Nitrogen content

Parameter	Place	Sulphate (mg/l)			Nitrogen(mg/l)		
			STD.			STD.	
			BIS	WHO		BIS	WHO
Sulphate and Nitrogen or Nitrate	Pamba Manimala Achankovil Kallada	1.53 1.6 4.5 4.5	200.0	250.0	BDL BDL 0.01 BDL	45.0	45.0

The surface water samples analyzed were found to be clear and odourless. The taste is found to be normal.

The turbidity in water is the reduction of transparency due to the presence of particulate matter such as clay or slit, finely divided organic matter, plankton or other microscopic organisms. The turbidity of samples was found to be clear.

The PH of the samples ranges from 6.83 to 7.26. The temperature of the samples fell between 25.9 -26.0^0 C.

Main cause of alkalinity is the mineral which dissolves in water from soil. Hydroxides carbonates, bicarbonates and organic acids contribute to alkalinity of water. The desirable limit for total alkalinity is 200- 600mg/l (BIS). Total alkalinity

of surface water from Achankovil river & Manimala river are 1966 mg/l and 1800mg/l respectively and were above the desirable limit. Alkalinity is harmful for human being and industries. If the alkaline water is used in the boiler for steam generation may leave to the precipitation of sludge, deposition of scales and cause the caustic embrittlement.

Chloride is considered to be an indicator of organic pollution of animal origin. The desirable limit of chloride in BIS & WHO is 250-1000mg/l and 250mg/l. The chloride content in surface water was found in the range of 31.3 – 94.5 mg/l.

The BIS standards value for Sodium and Potassium are 100mg/l and 12mg/l respectively. All the samples analysed were found to be below the dectectable limit.

The BIS & WHO standard for nitrate is 45 mg/l. All the samples analysed were within the limit.

The total dissolved solids test measures the total amount of dissolved minerals in water. The solids can be iron, chloride, sulphate, calcium or other minerals found on the earth's surface. The desirable limit for TDS in BIS & WHO is 500 - 2000 mg/l and 1000mg/l respectively. Surface water samples ranges from 316.6 - 546.1mg/l and were within the limit.

Calcium is the major constituent of various types of rock. Calcium is a cause for hardness in water and incrustation in boilers. The calcium value for BIS & WHO is 75mg/l. All the samples analysed were within the limit.

Hardness is caused by the presence of calcium and magnesium. The BIS & WHO standards for hardness are 300 mg/l and 500 mg/l respectively. All the samples analysed were within the limit.

Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals. The standard values for sulphate in BIS & WHO are 200 and 250 mg/l respectively. Water with about 400mg/l sulphate has a bitter taste and those with 1000mg/l or more of sulphate cause intestinal disorders. Surface water samples were found within the desirable limit of BIS & WHO.

Iron in drinking water can be objectional because it can give a rusty colour and may affect taste. The BIS & WHO of iron is 0.3 and 0.1 mg/l respectively. The concentration ranges from 0.012-0.031 and were within the limit.

The standard value for aluminium in BIS is 0.03mg/l. The concentration of the samples were found in the range of 0.0011 – 0.00236 which is within the limit.

Conductivity is a measure of how conductive the water is to electrical current. Greater the ion concentration, greater is the electrical conductivity. Generally higher the electrical conductivity, higher is the total dissolved solids. The BIS standard for electrical conductivity is 750 - 2250µs/cm. All the samples analyzed were within the limit.

Conclusion

This study provides an informative data and helps to understand the physico-chemical characteristics of surface water samples in selected rivers of Pathanamthitta district. Since people living near these rivers depend too much on these rivers and the water from these rivers are commonly used for household purposes, agricultural irrigation,industrial purpose,drinking,production of edible fishes, etc..A healthy environment is one in which the water quality supports a rich and varied community of organisms and protects public health. The total alkalinity of surface water samples of Achankovil and Manimala rivers flowing through Pathanmthitta district were above the desirable limit.

Therefore all samples of rivers in Pathanamthitta district are not potable. The quality of surface water should be continuously monitored and water can be used for cooking and drinking purpose only after proper treatment to ensure the quality of living.

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