

## RESEARCH ARTICLE

### THE WATER QUALITY OF MUNROE ISLAND, KOLLAM, KERALA

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#### ABSTRACT

Water is essential for life. The amount of fresh water on earth is limited, and its quality is under constant pressure. Water quality refers to the chemical, physical, biological, and radiological characteristics of water. Munroe Island in Kollam District of Kerala is a typical backwater village situated in the confluence of Ashtamudi backwater and Kallada river system has an area of 13.4 sq.km. Almost all parts of the village are characterized by the presence of small streams and creeks so the digging of well is not possible. Only highland areas having wells, but these wells are contaminated or impure with so many minerals and sediments. Ironically, in this island, which is 70 percent water, drinking water is scarce. Water quality is the main problem in the Panchayat. Due to the presence of Ashtamudi Lake and Kallada River the availability of fresh water is less and the available is polluted. Only source is the water supply by the water authority. Due to the presence of chemical elements present in the water leads to some health issues in the inhabitants. The main objective of this paper is to analyze the water quality of Panchayat and identify the impurities and problems associated with it and provide a solution for reducing it. The method used for analysis is scientific water quality testing.

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#### INTRODUCTION

Water is essential for life. The amount of fresh water on earth is limited, and its quality is under constant pressure. Water quality refers to the chemical, physical, biological, and radiological characteristics of water. Munroe Island in Kollam District of Kerala is a typical backwater village situated in the confluence of Ashtamudi backwater and Kallada river system has an area of 13.4 sq.km. Almost all parts of the village are characterized by the presence of small streams and creeks so the digging of well is not possible. Water quality is the main problem in the Panchayat. Due to the presence of Ashtamudi Lake and Kallada River the availability of fresh water is less and the available is polluted. Only source is the water supply by the water authority. The presence of chemical elements present in the water leads to some health issues in the inhabitants.

##### Study area

Munroe Island in Kollam district is an island within the Ashtamudi backwater system and is located at the confluence of Ashtamudi Lake and the Kallada River. The place is named in honour of Resident Colonel John Munroe of the former princely state of Travancore. During his tenure Munroe oversaw the land reclamation efforts in delta where Kallada

River joins Ashtamudi Lake and the reclaimed island was name after him as Munroe Island. Munroe Island, locally known as Mundrothuruth, is an amalgamation of eight small islands in the archipelago of Islands of Kollam. It is a typical backwater island village of Kerala located at the confluence of Ashtamudi Lake and the Kallada River, in Kollam district. Munroe Island has a geographical area of 13.4sq.km. The island extends from 9° 0' 0'' N to 9° 0' 0'' N to 76° 0' 40' 0'' E. Mundrothuruth Panchayat is under the Chittumala Block division in the Kollam Taluk of Kerala state consisting of 12 wards. As per 2011, Mundrothuruth has a total population of 9599, consisting of 4636 males and 4963 females.

##### Objectives

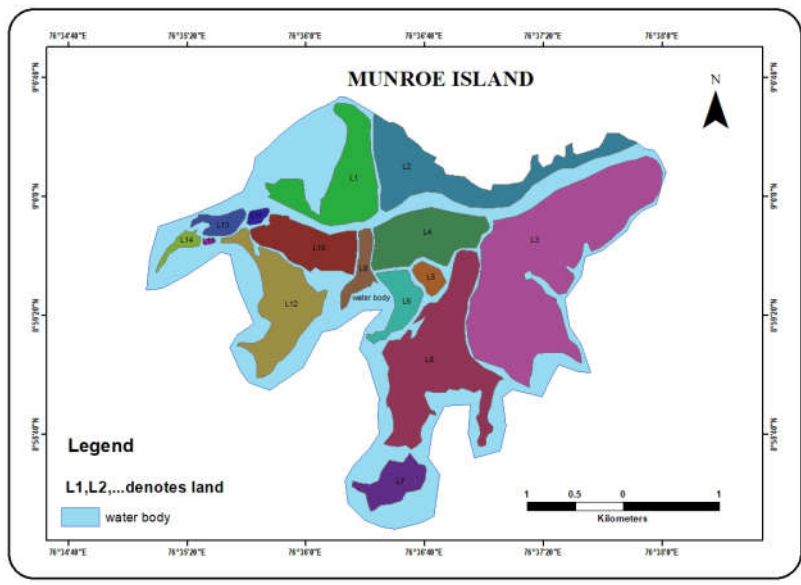
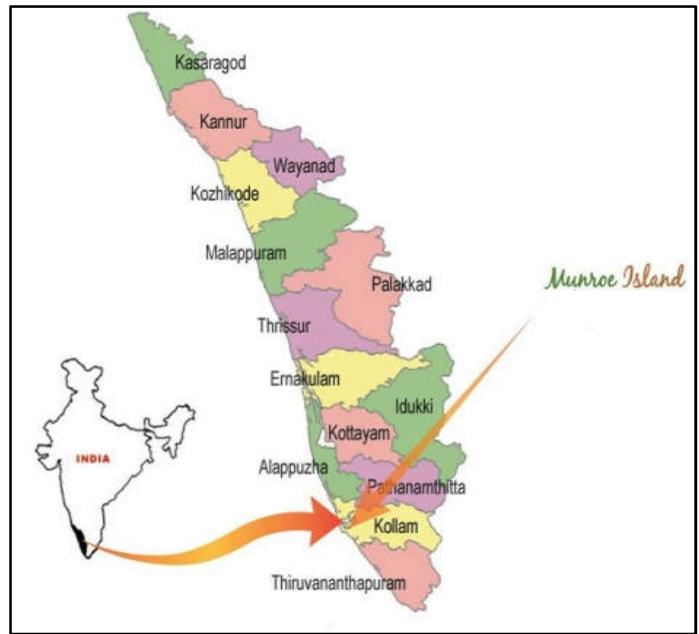
The main objective of this paper is to analyze the water quality of Panchayat and identify the impurities and problems associated with it and provide a solution for reducing it. The reason for selecting this objective is that the land is submerged in to the water after tsunami (2004) (Jha et.al 2016). The actual elevation of the island is 3m above mean sea level and it is dipped to .5 to 1m.

#### MATERIALS AND METHODS

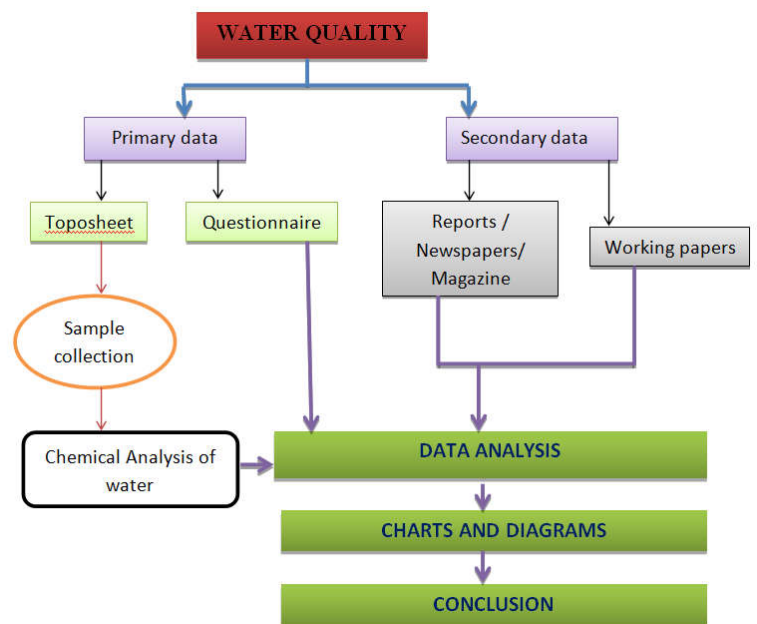
Both primary and secondary data is used for the study. The methodology used is as follows:

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Source: Toposheet 1975



## RESULT AND DISCUSSION

Results and discussion includes the details regarding the drinking water facilities, its testing and interpretation and generating suitable diagrams and charts.

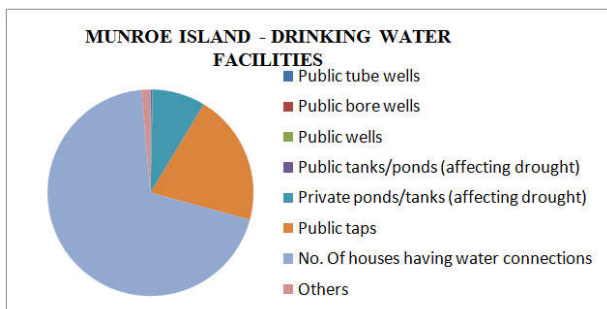
### Drinking Water

According to the Bureau of Indian Standards, drinking water is water intended for human consumption for drinking and cooking purposes from any source. It includes water supplied by pipes or any other means for human consumption by any supplies. Munroe Island is a typical backwater village situated in the confluence of Ashtamudi backwater and Kallada river system. Almost all parts of the village are characterized by the presence of small streams and creeks so the digging of well is not possible. Only highland areas having wells, but these wells are contaminated or impure with so many minerals and sediments. Ironically, in this island, which is 70 percent water, drinking water is scarce. The following tables show the main source of drinking water facilities available in the Panchayat.

**Table 1. Munroe Island – drinking water facility**

MUNROE ISLAND - DRINKING WATER FACILITIES		
Source	Number	Percentage
Public tube wells	4	0.24737
Public bore wells	0	0
Public wells	1	0.06184
Public tanks/ponds (affecting drought)	1	0.06184
Private ponds/tanks (affecting drought)	134	8.28695
Public taps	332	20.5318
No. Of houses having water connections	1122	69.3878
Others	23	1.42239
Total	1617	100

Source: District Census Hand Book of Kollam (2011) and field survey



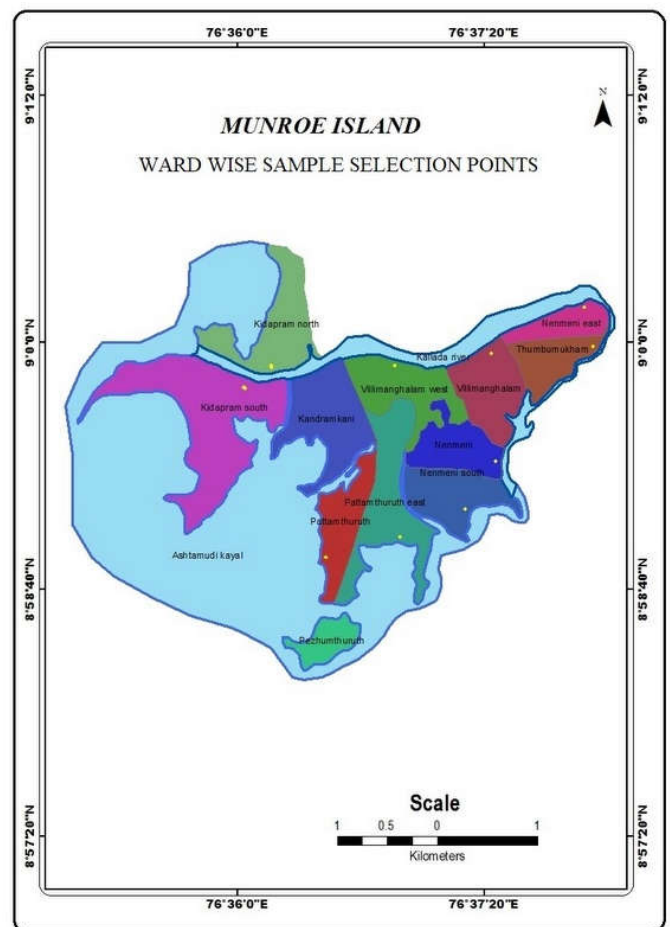
**Figure 1. Drinking Water Facility**

The drinking water facilities of Munroe Island are categorized under:

- Public drinking water facility
- Private drinking water facility

**Public Drinking Water Facility:** The public drinking water facilities include public tube wells, public bore wells, public wells, public tanks/ponds and public taps. In Munroe Island the total number of drinking water facility available is 1617. In that there are 4 public tube wells, include 1 public well, 1 public tank/ponds it is affected by draught, 332 public taps, 1122 houses having water connections and other are by 23. These facilities are carried out to all areas. Treated tap water is provided to the inhabitants through pipes within their premises or to the peoples through common taps.

**Private Drinking Water Facility:** Private drinking water facility means that the facility is owned by individuals not by the government. The receiving of this function can be carried out with the consent of the owners. Private tube wells, ponds and tanks are come under this section. In Munroe Island the availability of private drinking facility is nil. There are 134 private ponds and tanks in this area and this is also affected to drought. Mainly the private ponds/tanks are used for shrimp cultivation. These are the main drinking water facilities of the island. The main problem in drinking water is the presence of iron, dissolved sediments etc. Distribution of drinking facility is through different ways but the quality of water is unknown. There are 10 samples collected for testing the water quality from the 12 wards and that sources are located near to the water body. The remaining 2 wards have public tap from same source of State Public Work Department (PWD) because these two areas are fully covered by water and digging of well is not possible. The samples collected were analyzed to find out the biological and chemical parameters which affect the quality of water. The chemical parameters present in the samples were chloride, sulphate, nitrate, phosphate, calcium, magnesium, sodium, potassium, and iron. Biological parameters including coliform and e coli were also identified from the sample. The following map shows the ward wise sample selection points. In that the yellow colour shows the sample site.



Source: GPS Points, Toposheet (1965) and prepared by investigator

The Bureau of Indian Standards (BIS) has specified drinking water quality standards in India to provide safe drinking water to the people. It is necessary that drinking water sources should be tested regularly to know if it meets the prescribed standards for drinking.

Table 2. Munroe Island – vulnerability assessment of water pollution

VULNERABILITY ASSESSMENT OF WATER POLLUTION IN MUNROE ISLAND, KOLLAM										
Parameters	Sample Code									
	MI G1	MI G2	MI G3	MI G4	MI G5	MI G6	MI G7	MI G8	MI G9	MI G10
Ph	5.25	5.05	6.48	4.97	5.94	4.54	6.12	6.10	5.98	5.38
Temperature (°c)	28.1	28.5	29.3	28.8	29.6	29.6	28.7	28.5	30.2	28.3
Electrical Conductivity(us/cm)	207	385	220	181.5	230	302	1265	662	244	280
Total Dissolved Solids (mg/l)	147	273	157	129	163	214	896	470	173	207
Salinity (ppt)	0.11	0.20	0.12	0.10	0.12	0.16	0.67	0.34	0.13	0.15
Total Hardness (mg/l)	23.52	15.68	35.28	19.60	54.88	78.4	203.84	148.96	74.48	50.96
Total Alkalinity (mg/l)	4.12	4.12	37.08	8.24	24.72	8.24	24.72	45.32	32.96	12.36
Chlorides (mg/l)	38.29	93.59	29.78	29.78	38.29	76.57	382.86	144.64	42.54	72.32
Sulphates (mg/l)	7.12	3.64	10.72	21.2	15.52	2.64	44.48	58.88	28.24	17.80
Nitrate (mg/l)	19.98	31.19	22.28	4.92	20.29	26.8	3.99	11.08	3.99	2.17
Phosphate (mg/l)	0.18	0.12	0.03	0.06	0.09	0.06	0.06	0.03	0.03	0.03
Calcium mg/l	6.27	4.70	6.27	6.27	1.57	9.41	45.47	43.90	28.22	18.81
Magnesium (mg/l)	1.90	0.95	4.76	0.95	12.38	13.33	21.9	9.52	0.95	0.95
Sodium (mg/l)	21.40	60.44	14.19	16.96	16.69	35.19	160.48	61.80	17.84	31.48
Potassium (mg/l)	4.92	0.72	8.10	8.79	7.94	3.53	2.72	6.16	1.74	2.35
Iron (mg/l)	BDL	0.06	BDL	BDL	0.01	BDL	0.12	BDL	BDL	BDL
Total Coliform (MPN/100ml)	28	≥2400	≥2400	≥2400	≥2400	20	≥2400	≥2400	≥2400	≥2400
E coli	P	A	P	P	P	A	P	P	A	A

Source: sample test and Prepared by the investigator

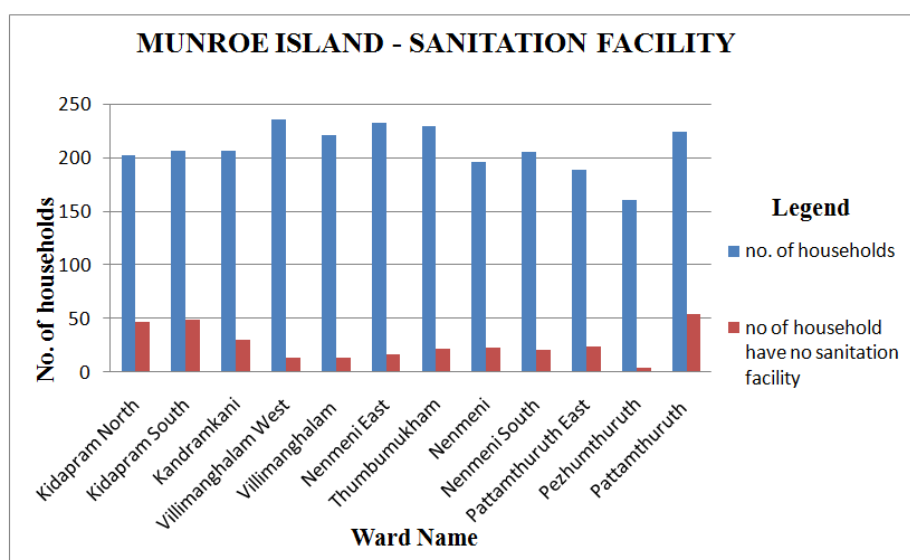


Figure 2. Munroe Island – Sanitation and Households (source: census report 2011 and survey)

If the standards are not achieved then the extent of contamination/ unacceptability has to be identified and the follow-ups have to be done required. The above table shows the water quality result of Munroe Island. Sample 1 (MI G1), which was collected from a household shows the chemical parameters are normal except Potassium (4.92 mg/l). It is higher than the normal level (0.5mg/l). The biological parameters such as total coliform and e coli are identified from the sample. Sample 2 (MI G2) was collected from a public well where all the chemical parameters are normal but the micro biological parameter Total Coliform is presented in a huge amount. Sample 3 (MI G3) which was drawn from a public tap shows the chemical parameters are normal except Potassium and also biological contaminants are present. Sample 4 to 10 (MI G4 to MI G 10) were collected from households because so many people depends this house holds for drinking purpose. Sample 4 to 6 shows normal chemical condition except Potassium and sample 4 and 5 shows the presence of biological contaminants. In sample 6 all the parameters (both biological and chemical) are in normal level and e coli are absent. In sample 7 all the parameters are in dangerous state, chemical as well as the biological parameters in this sample are highly vulnerable to the life of humans.

In sample 8 the chemical parameters such as Sodium and Potassium are identified higher than the normal. In sample 9 and 10, all the chemical parameters are normal and the biological contaminants such as Total Coliform are present and E Coli are absent. In these samples except sample 7, chemical parameters such as sodium and potassium are presented. The presence of sodium and potassium in water leads to some health issues. Potassium toxicity has been studied in relation to the use of high doses of salt substitutes. The symptoms have been chest tightness, nausea and vomiting, diarrhea, hyperkalemia, shortness of breath and heart failure (WHO, 2009). The presence of biological contaminants causes gastrointestinal illness. In sample 7 all the parameter are present, undesirable effect outside the acceptable limit of Total Hardness leads to encrustation in water supply structure and adverse effects on domestic use, presence of Chloride leads to high blood pressure, skin irritation and boiled meat and food become poor in quality, salty taste. Sulphate presence leads to taste and laxative affected and gastro intestinal irritation. The Nitrate in high amount leads to methemoglobinemia or blue baby disease in infants. Phosphate leads to algal growth.

Excess limit of calcium results in encrustation in water supply structure and adverse effects on domestic use. Magnesium leads to poor lathering and deterioration of clothes. Problems and issues are occurred due to physical, human and biological factors. Like other parts of areas in the world, this island also faces the waste disposal activities. Those waste disposals are in the form of human and solid substances. This leads to series issues. The sample test results shows that all the water in and around the island are contaminated with the presence of some harmful chemical and biological contaminants. That completely affects the health of the people. From the total 10 samples 6 samples shows the presence of bacteriological contaminants that is total coliform and e coli (sample 1,3,4,5,7,8). The presence of these bacteria seriously affects the health conditions and results ingastrointestinal illness. Mainly these bacteria are released from the digestive tracts of animals, including humans, and are found in their wastes. The island is surrounded by water and proper tract or channel for collecting or removing these wastes. The sanitation facility of the island is very poor. There were 2505 households in the island and in that 319 households have no sanitation facility. The following diagram shows the sanitation and households of the island.

### Recommendations to be implemented

By analyzing the tables and charts, it is evident that the island is under water and sswater quality issues. The problems can't be stopped immediately so practically implemented some measures to reduce the effect. Some of the recommendations are:

- To check the quality of public water within 3 months and provide measures to keep the quality of water.
- To create awareness programs among the islanders about the importance of water quality and rainwater harvesting.
- Construct separate channels and pits for collecting the human wastes and animal wastes for reducing the bacteriological contaminants.
- Provide floating pipe for pumping water in the water logged areas.
- Planting and improve the concentration of mangroves in the very low land areas.

### Conclusion

Munroe Island is a typical backwater peninsula and the quality of drinking water is very low. Both chemical and biological contaminants are present in the water samples and these leads to several contagious and harmful diseases.

The best way to reduce the effect is toadopt proper planning actions and water purification methods to overcome the issues. Moreover the upgradation of infrastructure facilities is important. The island faces environmental issues such as sinking, pollution, salinity due to the lowering of the land. These issues directly or indirectly affect the life of the people and one of the main issues which affect the people is the water quality problems.

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