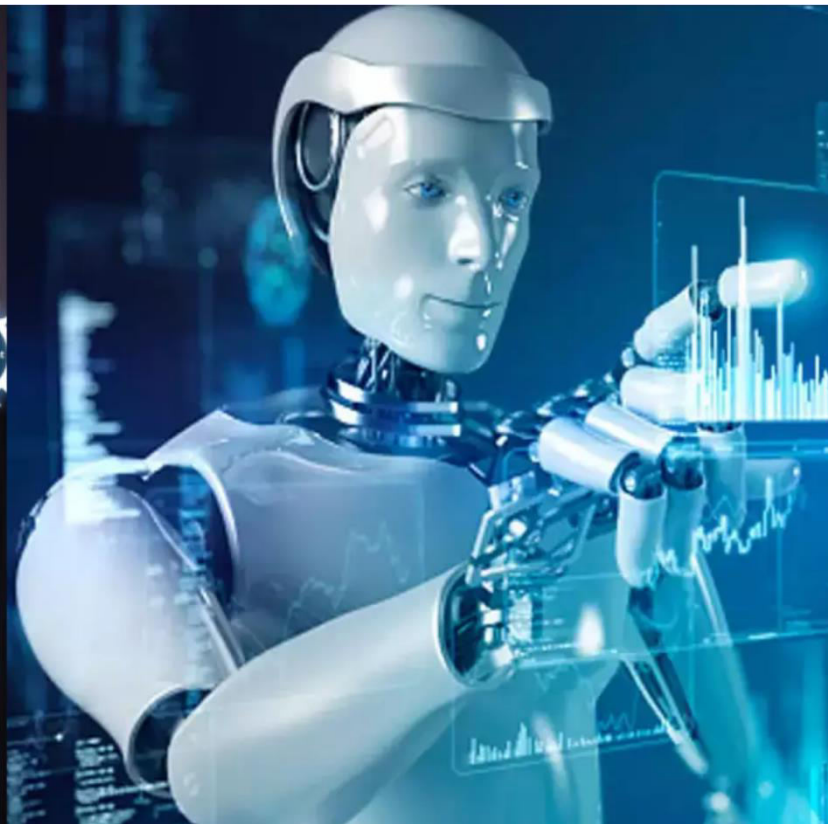




# International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

*(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)*



**Impact Factor: 8.699**

**Volume 14, Issue 4, April 2025**

# Water Quality Assessment of Vembanad Lake, Alappuzha

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**ABSTRACT:** Vembanad Lake, the largest freshwater lake in Kerala, India, plays a crucial role in the region's ecosystem and economy. However, increasing anthropogenic activities have led to significant water quality degradation, necessitating a comprehensive assessment. The water quality of Vembanad Lake, Alappuzha, was assessed by analyzing key physicochemical parameters such as pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), turbidity, total dissolved solids (TDS), nitrates, phosphates, temperature and fecal coliform. Water samples were collected from multiple locations and tested to evaluate pollution levels and overall aquatic health. The obtained values were compared with standard permissible limits set by the Bureau of Indian Standards (BIS) to determine the lake's suitability for drinking, domestic, and aquatic life purposes. The results indicate significant variations in water quality, with certain parameters exceeding safe limits, highlighting the impact of urbanization, industrial discharge, and agricultural runoff. This study emphasizes the need for effective conservation strategies and sustainable management practices to protect the ecological balance of Vembanad Lake.

**KEYWORDS:** Vembanad Lake, water quality assessment, physicochemical parameters, pollution, standard permissible limits, aquatic health, environmental management.

## I. INTRODUCTION

Vembanad Lake, located in Alappuzha, Kerala, is the largest freshwater lake in India and a vital ecosystem supporting biodiversity, fisheries, tourism, and local livelihoods. However, rapid urbanization, industrial discharge, agricultural runoff, and tourism-related activities have led to increasing pollution levels, threatening the lake's water quality and ecological balance. Assessing the water quality of Vembanad Lake is essential to understand the extent of pollution and its potential impact on aquatic life and human health. This study focuses on analyzing key physicochemical parameters, including pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), turbidity, total dissolved solids (TDS), nitrates, phosphates, temperature and fecal coliform. These parameters provide insights into the lake's pollution levels, organic matter decomposition, and overall water health.

To determine the suitability of the lake water for various uses, the obtained values are compared with the standard permissible limits set by regulatory body such as the Bureau of Indian Standards (BIS). The findings of this study can aid in formulating effective conservation strategies and sustainable management practices to protect Vembanad Lake from further degradation.

## II. LITERATURE SURVEY

Harikumar and Nasir [1] conducted a study focusing on the water quality status of Vembanad Lake. The results indicated that pollution from domestic sewage, industrial effluents, and agricultural runoff had significantly deteriorated the water quality.

According to Bhuvaneshwari and Subashini [2], multivariate statistical techniques such as Principal Component Analysis (PCA) and Cluster Analysis (CA) were effective in identifying the major sources of pollution in the Vembanad Lake region.

The Water Quality Index (WQI) method was applied by Jayasree and Ajith Kumar [3] to classify the water quality of the lake into different categories. The study reported that most regions of the lake fell under poor to very poor quality levels.

Sajeev et al. [4] used GIS-based techniques for the spatial variation analysis of water quality in the Vembanad Lake, highlighting the areas most affected by pollution.

### III. METHODOLOGY

The water quality assessment methodology for Vembanad Lake begins with identifying strategic sampling locations to ensure comprehensive data collection across diverse environments. Key regions such as Pathiramanal Island, Muhamma Boat Jetty, Mannancherry, Aaryad, and Ambalakkadavu are mapped, alongside pollution hotspots near urban and industrial discharge points. A preliminary site survey is conducted to examine hydrological factors influencing water quality, such as flow patterns, shoreline characteristics, and human activity. This step establishes baseline data and aids in developing effective monitoring strategies by identifying key pollutants and contamination sources.

Water samples are collected as per Indian Standards, ensuring representative analysis. Samples are taken midstream at a depth of 15–20 cm and tested in laboratories using standard methods. Essential pollution parameters, including dissolved oxygen, ph, nitrates, phosphates, turbidity, temperature and faecal coliform are analyzed to understand the extent of pollution and its ecological impact. Physical, chemical, and biological analysis are performed to assess visible changes, contamination levels, and microbial activity, offering a holistic view of the lake's health and biodiversity. Finally, the results are compared with permissible limits outlined in IS 10500:2012 to determine the safety of water for environmental and human health. This comparison helps identify risks from toxic substances like heavy metals, tracks contamination trends, and evaluates the effectiveness of pollution control measures. The scientific insights derived support targeted interventions, enforce environmental regulations, and promote the sustainable management of Vembanad Lake's ecosystem.

### IV. EXPERIMENTAL RESULTS

The water quality assessment of Vembanad Lake revealed key physical, chemical and biological parameters such as pH, dissolved oxygen (DO), biological oxygen demand (BOD), temperature, Total Dissolved Solids (TDS), Faecal Coliform, turbidity, Phosphate and nitrates. The findings indicated that while some parameters in certain areas fell within the permissible limits set by BIS standards. The results of the analysis revealed a noticeable decline in water quality in several parts of Vembanad Lake. This deterioration was attributed primarily to pollution from various sources, including industrial effluents, agricultural runoff, and untreated domestic sewage. These pollutants lead to the depletion of dissolved oxygen, increased nutrient loading, and microbial contamination, all of which affect aquatic ecosystems negatively.

The table 4.1 shows the water quality parameters at various locations of Vembanad lake and following figures shows the comparison of observed value with permissible limits.

Table 4.1 Water Quality Parameters at various locations of Vembanad Lake

Parameters	Units	Aaryad	Mannanchery	Ambalakkadavu	Muhamma Boat Jetty	Pathiramanal Island	Permissible Limit
Temperature	°C	31	29	29.9	28.9	29.36	10-22.22°C
pH @25°C	-	6.71	6.62	6.61	5.8	6.09	6.5-8.5
Turbidity	NTU	6.8	3.13	1.5	1.53	1.04	5 NTU
Total Dissolved	mg/L	282.06	253.5	361.63	1380.3	1656	500ppm



Solids							
Nitrate	mg/L	0	0	0	0	0	45 mg/l
Phosphate	mg/L	0	0.03	0	0.013	0.036	0.1 mg/l
Feacal Coliform	Cfu/100ml	34.66	9	56.66	0	0	0/100ml
Dissolved Oxygen	mg/L	5.63	5.1	5.46	4.167	3.53	5 mg/l
BOD @27°C (5 days)	mg/L	1.23	1.7	1.66	1.5	1.76	<5 mg/l

#### COMPARISON OF OBSERVED VALUE WITH PERMISSIBLE LIMITS

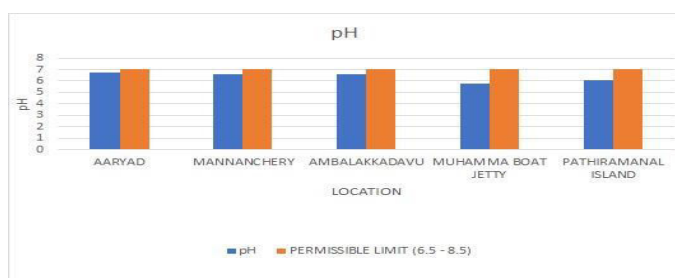


FIG 4.1:Ph

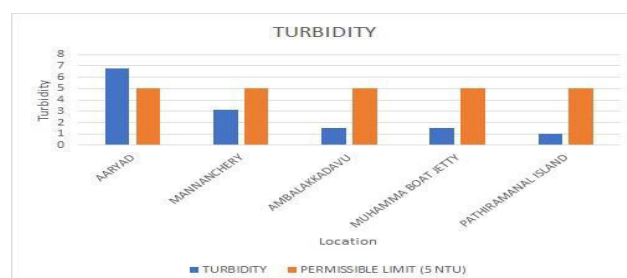


FIG 4.2:TURBIDITY

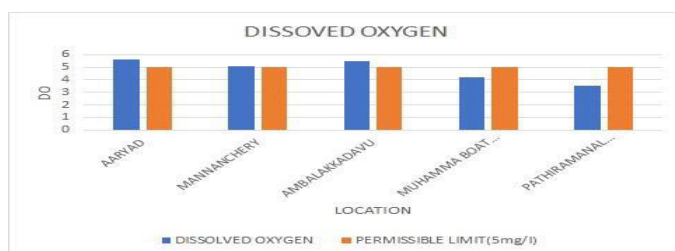


FIG 4.3: DISSOLVED OXYGEN

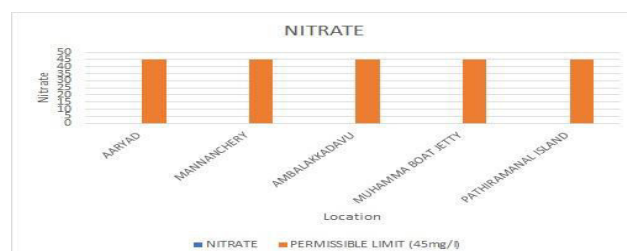


FIG 4.4: NITRATE

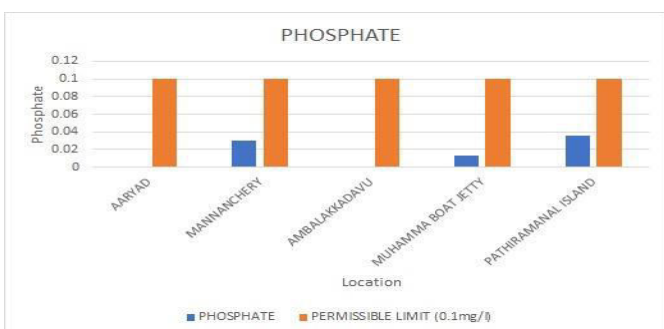


FIG 4.5:PHOSPHATE

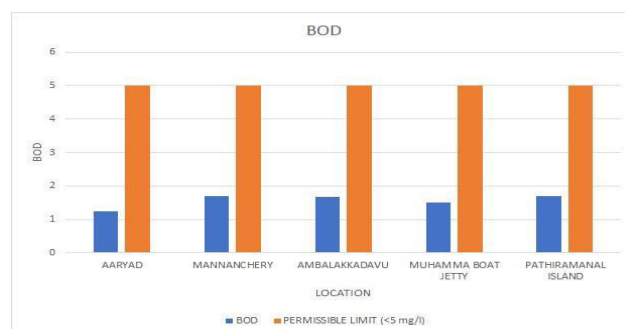


FIG 4.6:BIOLOGICAL OXYGEN DEMAND

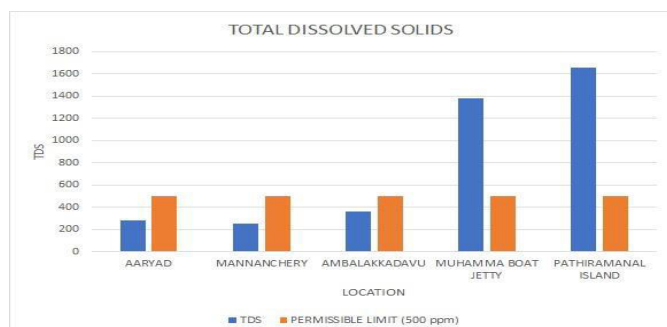


FIG 4.7:TOTAL DISSOLVED SOLIDS

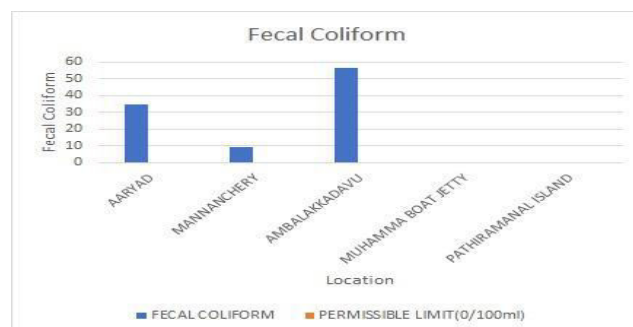


FIG 4.8:FEACAL COLIFORM

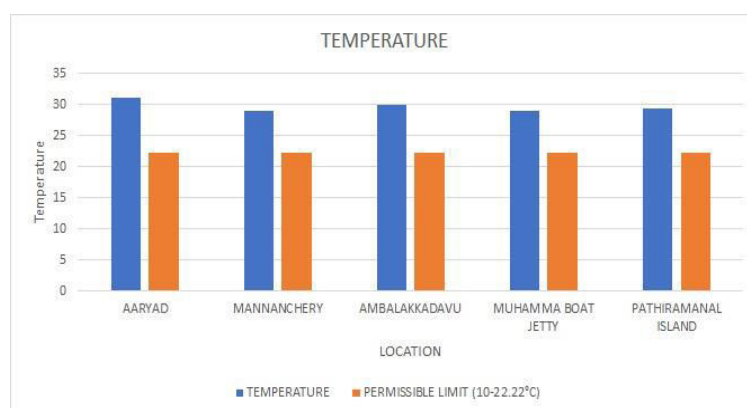


FIG 4.9:TEMPERATURE

## V. CONCLUSION

The test results from five sampling locations — Aarvad, Mannanchery, Ambalakkadavu, Muhamma Boat Jetty, and Pathiramanal Island — indicate that most parameters exceed the permissible limits set for safe water quality. Temperature levels are consistently higher than the permissible range, indicating thermal pollution. pH levels in most sites are within limits except at Muhamma Boat Jetty, which shows acidic conditions. Turbidity levels are above permissible limits in Aarvad and Ambalakkadavu, indicating suspended particles' presence. Total Dissolved Solids (TDS) exceed permissible limits in Ambalakkadavu, Muhamma Boat Jetty, and Pathiramanal Island, reflecting higher levels of dissolved substances. While nitrate levels are within limits, phosphate levels slightly exceed the permissible limit in some locations, indicating nutrient pollution. Fecal coliform bacteria are present in Aarvad, Mannanchery, and Ambalakkadavu, suggesting contamination by human or animal waste. Dissolved oxygen levels in most sites are within limits, although slightly lower in Muhamma Boat Jetty and Pathiramanal Island. Biochemical Oxygen Demand (BOD) values across all sites remain within permissible limits, indicating moderate organic pollution. Overall, the water quality analysis reveals that the study area is experiencing varying degrees of pollution, mainly due to high TDS, turbidity, fecal contamination, and nutrient loading, requiring urgent attention and proper water management practices.

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