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## Assessment of Water Quality of Meenachil River During Summer Season at Kottayam District, Kerala, India

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### Abstract

This study evaluates the water quality of the Meenachil River, Kerala, during summer season, with a focus on physico-chemical and heavy metal concentration in the river water. Water samples were collected twice monthly from five selected stations—Bharananganam, Panachippara, Pala, Punnathura East and Munroe Light House. The parameters pH, turbidity, alkalinity, hardness, total dissolved solids, dissolved oxygen, biochemical oxygen demand and selected trace metals were assessed and compared with the prescribed standards of CPCB. The results indicate slightly acidic conditions and predominantly soft-water characteristics across all sampling locations, suggesting low mineral content influenced by regional rainfall patterns. The results indicated that turbidity, alkalinity and dissolved solids, with downstream stations exhibiting comparatively higher values. Munroe Light House showed elevated turbidity, total dissolved solids, iron levels and microbial contamination, reflecting the combined effects of anthropogenic pressures, surface runoff and domestic sewage discharge during the summer months. The study highlights the importance of regular seasonal monitoring, strengthened sanitation infrastructure and effective catchment-level management to safeguard the ecological integrity and public health significance of the Meenachil River.

**Keywords:** management, dissolved, alkalinity, comparatively, CPCB

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### 1. Introduction

River systems represent critical freshwater resources that sustain ecological processes while supporting agriculture, industry and human settlements. In Kerala, rivers play a main role in meeting domestic water demands and maintaining regional biodiversity. The Meenachil River, which drains through the Kottayam District, is one such important river system that contributes significantly to irrigation, drinking water supply and overall ecosystem functioning in the region (CWRDM, 2015). Due to its socio-economic importance, the river serves as a lifeline for both rural and urban communities along its course. The Meenachil River basin supports extensive agricultural activities, particularly rubber, paddy and plantation crops, which form the backbone of the local economy. In addition to agricultural use, the river is a major source of municipal and domestic water supply for several towns and villages in Kottayam District (CPCB, 2014; KSPCB, 2019). The riverine environment and adjoining wetlands also provide habitats for a wide range of aquatic organisms, riparian vegetation, fish species

and migratory birds, thereby contributing to regional biodiversity and ecological stability. In recent decades, however, the water quality of the Meenachil River has been increasingly affected by anthropogenic pressures. Rapid population growth, unplanned urban expansion, land-use changes and intensified agricultural practices have collectively altered the natural characteristics of the river system. Runoff from agricultural fields, discharge of domestic wastewater and other human activities have introduced pollutants that threaten the river's water quality and ecological health (Singh and Nath, 2019). These growing pressures underline the need for systematic assessment and monitoring of the river water quality, particularly during low-flow periods when the impact of pollution is more pronounced.

## 2. Materials and Methods

Samples were collected twice a month from Bharananganam, Panachippara, Pala, Punnathura East and Munroe Light house were taken along the Meenachil River during the period of January to April 2024. Standard methods (APHA, 2017) were used for analyzing physico-chemical and biological parameters. Parameters measured included pH, turbidity, alkalinity, calcium, magnesium, total hardness, chloride, sulphate, nitrate, phosphate, dissolved oxygen (DO), biochemical oxygen demand (BOD<sub>5</sub>), total dissolved solids (TDS), total coliform, and trace metals (Fe, Cr, Pb, Zn). Data were compared with Bureau of Indian Standards (BIS 10500:2012) and Central Pollution Control Board guidelines.

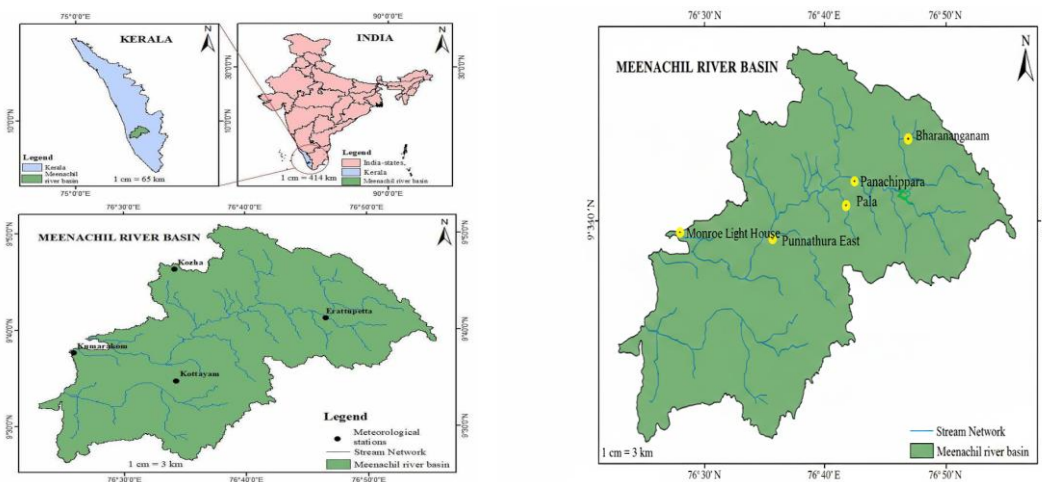


Fig. 1: Meenachil River Basin along with sampling location in the map

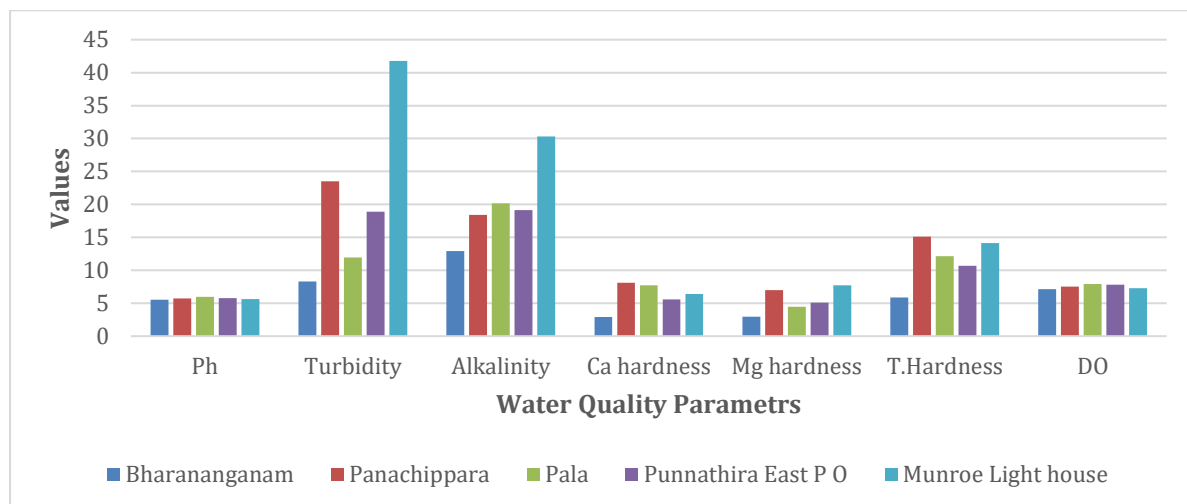
### 2.1. Analysis of River water Samples

River water samples were collected from selected stations along the study area and transported to the laboratory of the School of Environmental Sciences, Mahatma Gandhi University, Kerala, for detailed analysis. Care was taken to preserve the samples and analyze them following standard procedures. The pH and dissolved oxygen were measured immediately after sample collection at the site. All physico-chemical analyses were carried out in accordance with the Standard Methods for the Examination of Water and Wastewater. Turbidity was determined using the nephelometric method (2130 B), while alkalinity was analyzed by titration (2320 B). Total hardness was estimated using the EDTA titrimetric method (2340 C). Calcium hardness was determined by EDTA titration (3500-Ca B), and magnesium hardness was calculated by subtracting calcium hardness from total hardness. Dissolved oxygen was analyzed using the Winkler iodometric method (4500-O C), and biochemical oxygen

demand ( $BOD_5$ ) was determined using the 5-day incubation method (5210 B). Nitrate concentration was estimated using the UV spectrophotometric method (4500- $NO_3^-$  B), while phosphate was analyzed by the ascorbic acid method (4500-P E). Iron was determined using the phenanthroline method (3500-Fe B), and chromium was analyzed using the diphenyl carbazide method (3500-Cr B). Heavy metals such as lead and zinc were analyzed using Atomic Absorption Spectrophotometry (3111- B). All analyses were performed under laboratory-controlled conditions to ensure accuracy and reliability of the results.

### 3.0 Results and Discussion:

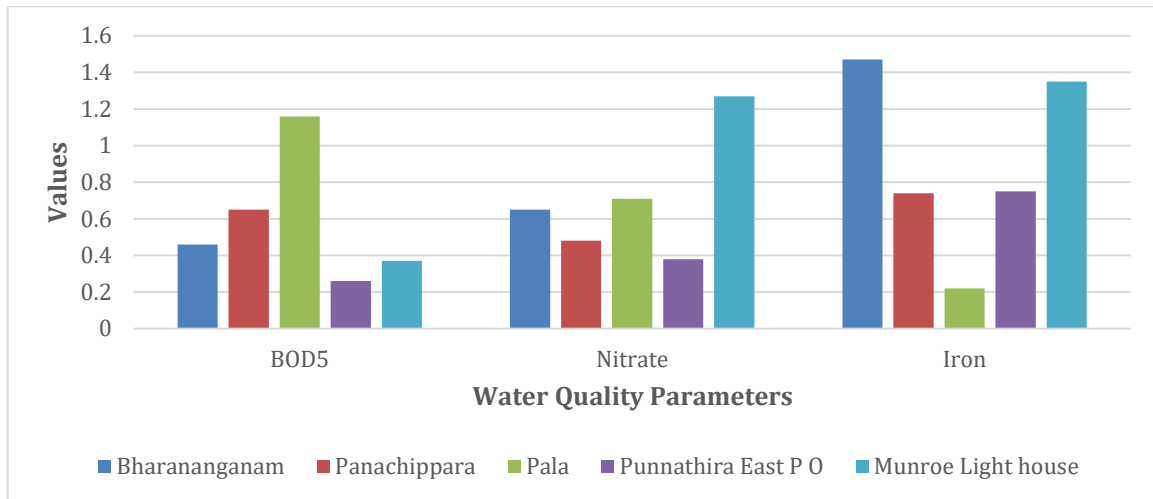
During the summer season, the Meenachil River exhibited slightly acidic to near-neutral pH values (5.55–5.98) across all stations, which is typical of rivers draining lateritic soils and organic-rich catchments in Kerala (Meybeck, 2003). Turbidity showed marked spatial variation, with the lowest values at upstream stations and the highest at Munroe Light House, indicating sediment resuspension and increased anthropogenic influence under low-flow conditions (Venkatesharaju et al., 2010; CPCB, 2014).



*All values expressed in mg/l except pH and turbidity*

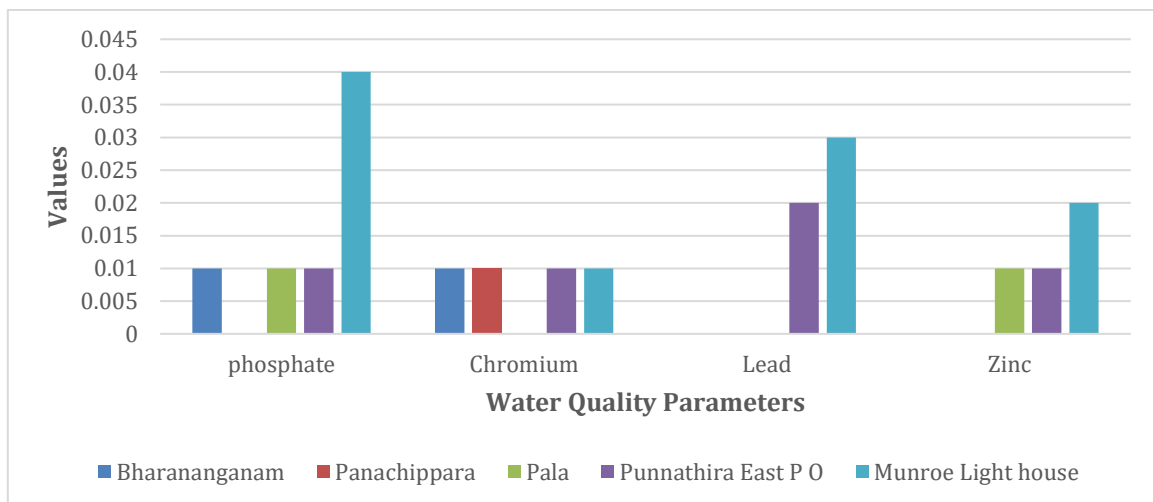
**Fig.2: Variation of physio chemical water quality parameters in river Meenachil at different sampling stations**

Alkalinity, calcium, magnesium, and total hardness values remained low at all stations, confirming the soft-water nature of the river and reflecting limited mineralization dominated by rainfall-derived inputs rather than geological weathering (Hem, 1985; Meybeck, 2003). Dissolved oxygen levels were consistently high (7.13–7.93 mg/L), while low  $BOD_5$  values indicate minimal organic pollution and absence of oxygen stress during the summer season (Singh and Nath, 2019; Nath et al., 2024). All values of the parameters are expressed in mg/l except pH and Turbidity,



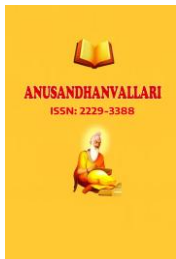
**Fig.3: Variation of water quality parameters in river Meenachil at different sampling stations**

The variation of BOD<sub>5</sub> (0.2-1.2 mg/l) at selected stations, less BOD<sub>5</sub> indicated the organic pollution load during summer season is low indicated in Fig 3. Nitrate concentrations were generally low, indicated that it is less affected by agricultural runoff. However, elevated iron levels are likely associated with natural geochemical processes, sediment–water interactions, and channel disturbances, which may be intensified by sand mining activities reported in the basin (Hem, 1985; Kondolf, 1997).



**Fig.4: Variation of water quality parameters in river Meenachil at different sampling stations**

Fig. 4. Showed that slightly elevated phosphate levels at Munroe Light House suggest localized nutrient enrichment from domestic wastewater inputs under reduced dilution conditions (Minz & Nath, 2023). Trace metals such as chromium, lead, and zinc were detected at very low concentrations at all stations, indicating negligible industrial contamination in the Meenachil River during the summer season (WHO, 2017; Venkatesharaju et al., 2010).



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## Conclusion

The present study demonstrates that the water quality of Meenachil River shows generally acceptable physico-chemical water qualities during the summer season, with slightly acidic pH, adequate dissolved oxygen levels, and low biochemical oxygen demand across the sampling stations. Most nutrient and trace metal concentrations remained within permissible limits, indicating limited industrial influence and reduced risk of chemical pollution. However spatial variations were observed, particularly at downstream stations, were elevated turbidity, total dissolved solids, iron concentrations under low-flow summer conditions. These findings highlight the need for improved sanitation infrastructure, effective wastewater management, and sustained seasonal monitoring of the river to help the betterment of drinking, bathing and aquatic life ensure public health safety, in line with national and international water quality guidelines (CPCB, 2020; WHO, 2017).

## References

- [1] Alfa Omega Minz and Satyendra Nath (2023) Assessment of River Water Quality during Summer Season in Prayagraj, Uttar Pradesh, India, International Journal of Environment and Climate Change, 13, Issue11, 487-497, DOI 10.9734/IJECC/2023/v13i113192
- [2] American Public Health Association (APHA). (2017). Standard methods for the examination of water and wastewater (23rd ed.). APHA, AWWA, WEF, Washington, DC.
- [3] Central Pollution Control Board (CPCB). (2014). Status of water quality in India. Central Pollution Control Board, Ministry of Environment, Forest and Climate Change, Government of India, New Delhi.
- [4] Central Pollution Control Board (CPCB). (2020). Primary water quality criteria for bathing waters. Central Pollution Control Board, New Delhi.
- [5] Centre for Water Resources Development and Management (CWRDM). (2015). Water resources of Kerala: Status, issues and management perspectives. CWRDM, Kozhikode, Kerala.
- [6] Hem, J. D. (1985). Study and interpretation of the chemical characteristics of natural water (3rd ed.). U.S. Geological Survey Water-Supply Paper 2254.
- [7] Kerala State Pollution Control Board (KSPCB). (2019). River water quality monitoring report of Kerala. Kerala State Pollution Control Board, Thiruvananthapuram.
- [8] Kondolf, G. M. (1997). Hungry water: Effects of dams and gravel mining on river channels. Environmental Management, 21(4), 533–551.
- [9] Meybeck, M. (2003). Global analysis of river systems: From Earth system controls to anthropogenic syndromes. Philosophical Transactions of the Royal Society of London, Series B, 358, 1935–1955.
- [10] Nath, S., Pandey, J., Nath, S., Jacob, S. S., and Masih, S. (2024). Water Quality of Yamuna River at Prayagraj, U.P., India. ShodhKosh: Journal of Visual and Performing Arts, 5(3), 491–497. DOI: 10.29121/shodhkosh. V 5.i3.2024.2094
- [11] Shrestha Singh and Satyendra Nath (2019) Assessment of ganga river water quality in Allahabad, U.P. Indian Journal of Environmental Protection, Vol. 39(8), pp. 770-775
- [12] Venkatesharaju, K., Ravikumar, P., Somashekar, R. K., & Prakash, K. L. (2010). Physico-chemical and bacteriological investigation on the river Cauvery of Kollegal stretch in Karnataka. Environmental Monitoring and Assessment, 161(1–4), 1–12.
- [13] World Health Organization (WHO). (2017). Guidelines for drinking-water quality (4th ed., incorporating the 1st addendum). World Health Organization, Geneva.