



An Experimental Analysis of Waterquality in Thirumanimutharu River Stretch and Treatment of Wastewater Using Micromediation Process

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ABSTRACT: Water pollution has become a major environmental concern due to the discharge of untreated industrial and domestic wastewater into natural water bodies. The Thirumanimutharu River, which flows through Salem and Namakkal districts of Tamil Nadu, has been severely affected by industrial effluents and municipal sewage. This study focuses on analyzing the water quality of the Thirumanimutharu River and nearby groundwater sources and evaluating the effectiveness of a biological wastewater treatment method known as micromediation using microalgae.

Water samples were collected from various locations along the river stretch as well as groundwater sources located near and away from the river. The collected samples were analyzed for important physicochemical and biological parameters such as pH, Biological Oxygen Demand (BOD), Dissolved Oxygen (DO), Total Dissolved Solids (TDS), Chloride content, and Coliform bacteria. The results were compared with Indian Standard (IS) and World Health Organization (WHO) water quality standards.

The analysis revealed that the river water is highly polluted due to industrial discharges from sago industries, textile dyeing units, and municipal wastewater from Salem city. High BOD, TDS, chloride levels, and bacterial contamination were observed in several sampling locations.

To improve the water quality, a biological treatment method using microalgae was adopted. The micromediation process significantly reduced pollutant concentrations and improved dissolved oxygen levels. The results indicate that microalgae-based wastewater treatment is an environmentally friendly and cost-effective method for improving river water quality.

KEYWORDS: Water Pollution, Thirumanimutharu River, Wastewater Treatment, Microalgae, Micromediation, Water Quality Analysis.

I. INTRODUCTION

Water is one of the most essential natural resources required for the survival of all living organisms. It plays a vital role in domestic, agricultural, and industrial activities. However, increasing industrialization and urbanization have resulted in severe water pollution across many regions of the world.

Rivers are important freshwater resources that support drinking water supply, irrigation, and ecological balance. Unfortunately, many rivers have become highly polluted due to the discharge of untreated wastewater from industries and municipal sources.

The Thirumanimutharu River, a tributary of the Cauvery River, flows through Salem and Namakkal districts of Tamil Nadu. Over the years, the river has been significantly affected by industrial effluents from sago processing units, textile dyeing industries, and untreated municipal wastewater from Salem city.

Polluted river water not only affects aquatic ecosystems but also contaminates groundwater sources through infiltration. As a result, local communities who depend on groundwater for drinking and agricultural purposes are exposed to health risks.



Therefore, it is important to analyze the water quality of the Thirumanimutharu River and identify suitable treatment methods to reduce pollution. This study focuses on evaluating the water quality of the river and groundwater along the river stretch and applying a biological wastewater treatment method using microalgae..

II. LITERATURE REVIEW

Several studies have investigated water pollution and wastewater treatment methods across different regions.

Singh and Dhar (2010) studied the role of microalgae in wastewater treatment and found that microalgae can effectively remove nutrients such as nitrogen and phosphorus from wastewater.

Elangovan and Dharmendirakumar (2011) analyzed groundwater quality along the Cooum River in Chennai and observed that several parameters exceeded WHO drinking water standards.

Rajesh Kumar et al. (2012) conducted a statistical analysis of water quality in the Godavari River and concluded that water quality monitoring is essential for irrigation management.

Abdel-Raouf et al. (2012) highlighted the advantages of microalgae-based wastewater treatment systems in removing nutrients and heavy metals.

These studies indicate that biological treatment using microalgae is an effective and sustainable method for wastewater treatment.

III. RESEARCH METHODOLOGY

The methodology adopted for this research includes field investigation, sample collection, laboratory analysis, and evaluation of wastewater treatment using the micromediation process. The objective of this study is to analyze the water quality of the Thirumanimutharu River and nearby groundwater sources and to evaluate the effectiveness of microalgae in treating polluted wastewater.

Research Design

The study follows an experimental and analytical research design. The experimental approach involves collecting water samples from selected locations and analyzing them for various physicochemical and biological parameters. The analytical approach is used to compare the obtained results with standard drinking water quality limits and to evaluate the effectiveness of the treatment method.

The research process consists of the following stages:

- Selection of study area
- Collection of water samples
- Laboratory analysis of water quality parameters
- Treatment of polluted water using microalgae
- Evaluation of treatment efficiency

This systematic approach helps in understanding the pollution level of the river and the potential of biological treatment methods.

Study Area Selection

The study was conducted along the Thirumanimutharu River, which flows through Salem and Namakkal districts in Tamil Nadu. The river originates from the Shevaroy Hills near Manjavadi and flows through Salem city before joining the Cauvery River at Nanjai Edayar.

The river receives wastewater from several sources including:

- Industrial effluents from sago industries
- Textile dyeing and processing units
- Municipal sewage from Salem city
- Agricultural runoff

Due to these discharges, the river water quality has deteriorated significantly over the years. Several groundwater sources located near the river are also affected by contamination.

Sampling Locations

Water samples were collected from multiple locations along the river and surrounding areas to evaluate the pollution level. The sampling locations were selected based on the following factors:

- Proximity to industrial areas
- Discharge points of municipal wastewater
- Agricultural activities near the river
- Groundwater sources used by local communities

Some of the major sampling locations include:

- Manjavadi
- Kuppanur
- Mookaneri
- Salem Old Bus Stand
- Uthamasolapuram
- Veerapandi
- Attayampatti
- Mathiyampatti
- Idumbankulam
- Nanjai Edayar

Approximately 30 water samples were collected from both river water and groundwater sources.

Sample Collection Procedure

Water samples were collected using clean polyethylene bottles of 1-liter capacity. Before collecting the samples, the bottles were washed thoroughly and rinsed with distilled water to avoid contamination.

For groundwater sampling, water was allowed to flow for a few minutes before collection to ensure that stagnant water in the pipes was removed. The samples were collected carefully and labeled with details such as location, date, and sample number.



The collected samples were transported to the laboratory in ice containers and analyzed within 24 hours to maintain sample integrity.

Water Quality Parameters

The collected water samples were analyzed for important physicochemical and biological parameters. These parameters were selected because they provide information about the pollution level and suitability of water for various uses.



The parameters analyzed in this study include:

Ph

pH indicates the acidity or alkalinity of water. It is an important parameter that affects chemical reactions and biological processes in water bodies.

Biological Oxygen Demand (BOD)

BOD measures the amount of oxygen required by microorganisms to decompose organic matter present in water. High BOD values indicate high levels of organic pollution.

Dissolved Oxygen (DO)

DO represents the amount of oxygen available in water for aquatic organisms. Low DO levels indicate poor water quality and may affect aquatic life.

Total Dissolved Solids (TDS)

TDS represents the total concentration of dissolved substances such as salts and minerals in water. High TDS values indicate contamination from industrial or domestic sources.

Chloride

Chloride concentration is an indicator of wastewater contamination. High chloride levels are commonly observed in water affected by industrial discharge.

Coliform Bacteria (MPN)

Coliform bacteria are used as indicators of microbial contamination in water. Their presence suggests contamination from sewage or human waste.

Laboratory Analysis

All water quality tests were conducted in accordance with standard laboratory procedures recommended by the American Public Health Association (APHA).

The laboratory tests were performed using appropriate instruments and equipment to ensure accuracy and reliability of results. The obtained results were compared with Indian Standard (IS 10500) drinking water standards and World Health Organization (WHO) guidelines.

Micromediation Treatment Process

To reduce the pollution level of the river water, a biological wastewater treatment method called micromediation was adopted. This method uses microalgae to remove pollutants from wastewater.

Microalgae have the ability to absorb nutrients such as nitrogen and phosphorus from water while producing oxygen through photosynthesis. This process helps improve water quality and reduce pollution.

In this experiment, polluted river water samples were collected and placed in transparent containers. A natural culture of microalgae was introduced into the wastewater samples. The samples were exposed to sunlight for approximately 15 days to allow algae growth and pollutant removal.

During this period, the microalgae absorbed nutrients and organic pollutants present in the wastewater. After the treatment period, the water samples were analyzed again to evaluate improvements in water quality.

Data Analysis

The results obtained from laboratory analysis were compared before and after treatment to determine the effectiveness of the micromediation process.

The treatment efficiency was evaluated by measuring the reduction in parameters such as:

BOD

TDS

Chloride

Coliform bacteria



The improvement in dissolved oxygen levels was also analyzed to determine the positive impact of the treatment process.

The final results were interpreted to understand the pollution level of the river and the effectiveness of the biological treatment method.

IV. RESULTS AND DISCUSSION

The analysis of water samples revealed significant variations in water quality parameters.

PH

The pH values of groundwater ranged from **7.2 to 8.64**, while river water ranged from **7.4 to 8.3**. These values fall within acceptable limits according to Indian standards.

Biological Oxygen Demand (BOD)

The BOD values of river water were found to be extremely high, reaching up to **341 mg/L**, indicating severe organic pollution.

Dissolved Oxygen (DO)

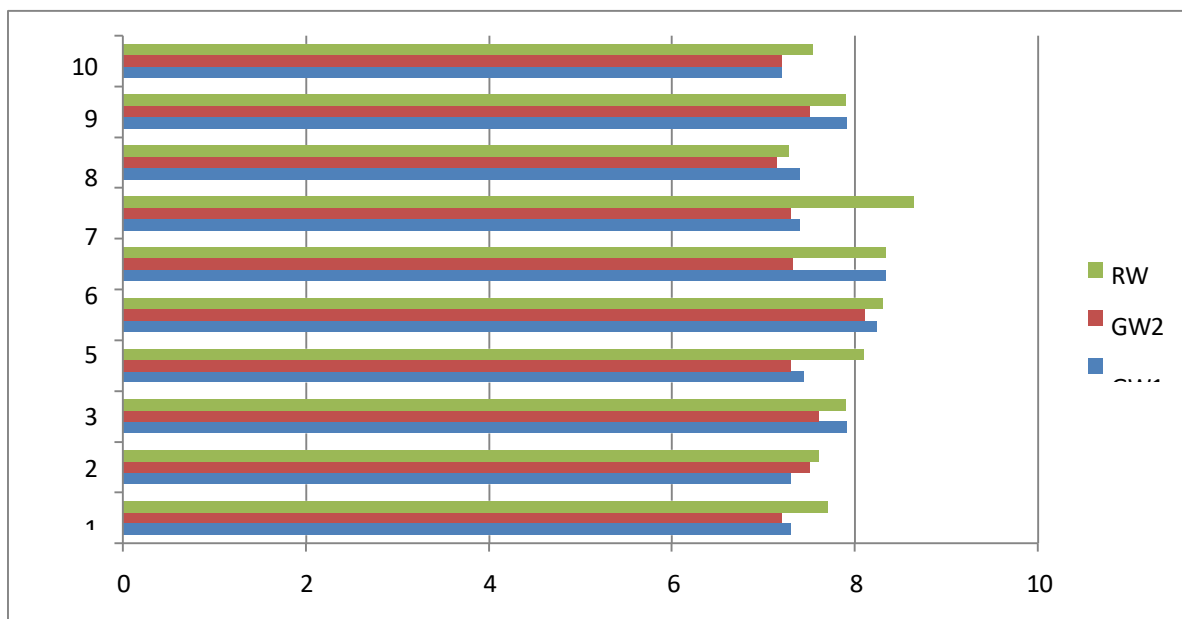
DO levels were very low in several river water samples, indicating poor water quality and reduced aquatic life.

Total Dissolved Solids (TDS)

TDS values ranged from **950 mg/L to 3328 mg/L**, which exceeds the permissible limits for drinking water.

Chloride

Chloride concentrations were found to be very high due to industrial discharges and municipal wastewater.



V. DISCUSSION

The results obtained from the water quality analysis clearly indicate that the Thirumanimutharu River is significantly polluted due to the continuous discharge of untreated industrial and municipal wastewater. The study showed variations in several important water quality parameters such as pH, Biological Oxygen Demand (BOD), Dissolved Oxygen (DO), Total Dissolved Solids (TDS), chloride content, and bacterial contamination.

The pH values observed in most of the samples were within the acceptable limits, indicating that the water is slightly alkaline in nature. However, the high values of Biological Oxygen Demand (BOD) indicate the presence of a large amount of organic matter in the river water. High BOD levels are mainly caused by industrial effluents from sago industries, textile dyeing units, and domestic sewage discharge from nearby urban areas.



Another important observation is the low level of Dissolved Oxygen (DO) in several river water samples. Low DO levels affect aquatic organisms and indicate poor water quality. When organic pollutants increase in water, microorganisms consume more oxygen for decomposition, which reduces the dissolved oxygen content in the water.

The Total Dissolved Solids (TDS) and chloride concentrations were also found to be higher than the permissible limits in many locations. These high values indicate the influence of industrial wastewater, chemical discharges, and sewage contamination. Excessive TDS in water can affect the taste and quality of drinking water and may also have harmful effects on human health.

Groundwater samples collected near the river also showed signs of contamination. This indicates that polluted river water is infiltrating into nearby groundwater sources, which may affect drinking water quality in surrounding villages.

The micromediation treatment using microalgae showed promising results in reducing pollution levels. After treatment, significant reductions were observed in BOD, TDS, chloride, and bacterial contamination. At the same time, dissolved oxygen levels improved, indicating better water quality.

Microalgae play an important role in wastewater treatment by absorbing nutrients and producing oxygen through photosynthesis. This natural biological process helps reduce pollutants and improves overall water quality.

Overall, the results of this study highlight the urgent need for proper wastewater treatment and pollution control measures along the Thirumanimutharu River. Implementing sustainable treatment methods such as microalgae-based systems can help restore river water quality and protect both environmental and human health.

Micromediation is a biological wastewater treatment process that uses microalgae to remove pollutants.

Microalgae can absorb nutrients such as nitrogen and phosphorus while producing oxygen through photosynthesis.

Treatment Process

Wastewater samples were collected from the polluted river.

Natural algae culture was added.

The samples were exposed to sunlight for 15 days.

Water quality parameters were analyzed before and after treatment.

Results

Parameter	Before Treatment	After Treatment
pH	8.1	7.3
BOD	129	45.4
DO	1.5	5.4
TDS	3328	924
Chloride	942	448
MPN	54224	<1

The results show significant improvement in water quality.

VI. CONCLUSION

The study revealed that the Thirumanimutharu River is heavily polluted due to industrial effluents and municipal wastewater discharge.

The analysis of water samples showed high levels of BOD, TDS, chloride, and bacterial contamination. These pollutants negatively affect both river water and groundwater quality.

The micromediation process using microalgae proved to be an effective and environmentally friendly method for wastewater treatment. The treatment significantly reduced pollutant levels and improved dissolved oxygen concentrations.

Therefore, the implementation of microalgae-based wastewater treatment systems can help improve water quality and protect the environment.



Further research is required to develop large-scale micromediation systems for practical implementation.

VII. FUTURE WORK

The present study focused on analyzing the water quality of the Thirumanimutharu River and evaluating the effectiveness of micromediation using microalgae for wastewater treatment. Although the results show that microalgae can significantly improve water quality, there are several areas that can be explored in future research.

Future studies can focus on increasing the number of sampling locations along the entire stretch of the river to obtain a more detailed understanding of pollution sources and water quality variations. Seasonal monitoring can also be carried out to analyze how water quality changes during summer, monsoon, and winter seasons.

Further research can also investigate the large-scale implementation of micromediation systems for treating industrial and municipal wastewater before it enters the river. Pilot treatment plants using microalgae can be developed to evaluate their efficiency under real field conditions.

Another important area of future research is the combination of micromediation with other wastewater treatment technologies, such as constructed wetlands, biofilters, or advanced oxidation processes. This integrated approach may improve the overall efficiency of wastewater treatment.

Future studies can also analyze the removal of heavy metals and toxic chemicals from industrial wastewater using microalgae. Since many industries discharge complex pollutants into the river, advanced biological treatment methods need to be explored.

Researchers can also focus on developing low-cost and sustainable wastewater treatment systems suitable for small towns and rural areas where conventional treatment plants are not available.

In addition, modern technologies such as remote sensing, GIS mapping, and real-time water quality monitoring systems can be used to monitor river pollution more effectively.

The outcomes of such future studies will help in developing better pollution control strategies, sustainable wastewater treatment systems, and effective river management plans to restore and protect the water quality of the Thirumanimutharu River.

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