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Comparative Physicochemical Analysis of Gomti River Water and *Trichoderma* sp. Treatment: Unveiling Water Quality Insights

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Abstract:

Water quality assessment is crucial for maintaining ecological balance and supporting life on Earth. This study conducts a detailed physicochemical analysis of Gomti River water in Lucknow, India, specifically focusing on water sourced from Dhobi Ghat, Khadra. The investigation includes a comparative evaluation of untreated river water and water treated with *Trichoderma* sp., a fungal microorganism from CSIR NBRI. The study assesses various parameters such as pH, temperature, electrical conductivity (EC), total dissolved solids (TDS), oxidation-reduction potential (ORP), salinity, resistivity, turbidity, phosphate, calcium, and cellulase enzyme activity.

Untreated Gomti River water exhibited a pH of 6.1, while *Trichoderma*-treated water showed a significant increase to 7.66, indicating a shift towards neutral conditions. Temperature, EC, and TDS variations were observed, with treated water demonstrating higher values. The ORP, salinity, and resistivity levels decreased after treatment. Turbidity increased due to treatment agents affecting particle suspension. Phosphate levels decreased, while calcium levels increased post-treatment. Cellulase enzyme activity showed enhancement, suggesting *Trichoderma* sp.'s potential for organic material degradation.

The study highlights the intricate interactions between treatment agents and aquatic ecosystems. While *Trichoderma* sp. displays promising cellulase activity, parameter shifts raise considerations about unintended consequences. This research underscores the importance of interdisciplinary approaches in understanding treatment impacts on water bodies like the Gomti River. As water quality concerns grow, responsible environmental management and further research are imperative for preserving vital water resources and ecosystems.

Keywords

Gomti River, water quality, *Trichoderma* sp., physicochemical analysis, comparative study, pH, temperature, electrical conductivity, total dissolved solids, oxidation-reduction potential, salinity, resistivity, turbidity, phosphate, calcium, cellulase enzyme activity, environmental management, aquatic ecosystems, interdisciplinary research, water resources, sustainability.

Introduction

Water, the lifeblood of our planet, sustains ecosystems and serves as a crucial resource for all living organisms. In the context of water quality assessment, the Gomti River in Lucknow, India, holds immense significance due to its pivotal role in supporting the region's ecological and human systems. In a pioneering endeavour, this study embarks on an in-depth exploration through a physicochemical analysis of Gomti River water from Dhobi Ghat, Khadra, Lucknow. Furthermore, this analysis is juxtaposed with an examination of the effects of *Trichoderma* sp., a fungal microorganism sourced from CSIR NBRI, on the water's composition and quality. This comprehensive study encompasses a spectrum of pivotal parameters including temperature, pH, electrical conductivity (EC), total dissolved solids (TDS), oxidation-reduction potential (ORP), salinity, resistivity, turbidity, phosphate, calcium, and enzyme activity.

Figure: 1 Dhobi Ghat, Gomti River

Methodology and Experimental Setup

The focal point of this study involved the collection and subsequent examination of two distinct samples: untreated Gomti River water from Dhobi Ghat, Khadra, Lucknow and Gomti River water subjected to treatment with *Trichoderma* sp. The primary objective was to gauge the impact of *Trichoderma* sp. treatment on cellulase enzyme activity, an important indicator of organic material degradation. To complement this, an experiment involving the immersion of a piece of cotton fabric in the river water was conducted to explore the potential for fabric degradation under the treatment conditions. The cellulase enzyme assay adhered to the Miller 1959 protocol, a widely accepted standard for quantifying enzyme activity.

Comparative Analysis Results

1. pH: The pH measurement, a reflection of the water's acidity or alkalinity, yielded a value of 6.1 for the untreated water sample. In contrast, the treated water showcased a pH of 7.66, indicative of a significant shift towards neutral conditions. This noteworthy increase in pH post-treatment underscores the transformative nature of *Trichoderma* sp. treatment on water chemistry.

2. Temperature: The analysis revealed that the temperature of untreated water registered at 33°C. Such temperature variations play a pivotal role in shaping biochemical processes within the water ecosystem.

3. Electrical Conductivity (EC) and Total Dissolved Solids (TDS): The untreated water demonstrated an EC value of 744, whereas the treated water exhibited a substantially higher EC value of 1052. This difference in electrical conductivity corresponded to an analogous increase in total dissolved solids (TDS), reflecting changes in ion concentration due to treatment.

4. Oxidation Reduction Potential (ORP) and Salinity: The untreated water showcased an ORP value of 167.5, while the treated water exhibited a lower ORP value of 102. This trend was mirrored in salinity levels, which have a profound influence on aquatic life and ecosystem dynamics.

5. Resistivity: An examination of resistivity, inversely correlated with conductivity, indicated a decrease in the treated water sample from 0.0014 for untreated and 0.0010 for treated water samples. This decrease, echoing the increase in conductivity observed in the same sample, signifies the intricate relationship between these parameters and the treatment process.

6. Turbidity: Turbidity, a measure of water clarity, experienced a pronounced increase in treated water (41.0) in comparison to untreated water (18.8). This elevation can be attributed to the introduction of treatment agents impacting the suspension of particles within the water column.

7. Phosphate and Calcium: Both phosphate and calcium levels underwent substantial changes after treatment. Phosphate levels decreased from 3.16 in the untreated sample to 1.35 in the treated sample, signifying a shift in nutrient dynamics. Calcium levels, in contrast, increased from 26 to 43, indicating the transformative influence of the *Trichoderma* sp. treatment.

8. Cellulase Enzyme Activity: The enzyme assay demonstrated a higher cellulase enzyme activity in the treated water sample compared to the untreated water. This finding underscores the potential of *Trichoderma* sp. to enhance cellulose degradation processes, suggesting applications in waste management and environmental restoration.

9. Calcium Carbonate: The presence of calcium carbonate ($CaCO_3$), a critical indicator of water hardness and quality, exhibited a significant increase in treated water (106) in comparison to untreated water (64).

	Untreated River Water	Treated River water
Resistivity	0.0013	0.0009
Salinity	0.36	0.52
ORP (oxidation reduction potential)	167.5	102.4
TDS	370	524
Electrical conductivity	744	1052
Turbidity	18.8	41.0

Table 1: Data

Discussion and Implications

The comprehensive analysis of Gomti River water and the subsequent treatment with *Trichoderma* sp. yield valuable insights into the multifaceted interactions between treatment agents and the aquatic environment. The shifts observed in pH, EC, TDS, ORP, turbidity, phosphate, calcium, and cellulase activity provide a nuanced understanding of the potential transformative effects of *Trichoderma* sp. treatment. While the heightened cellulase enzyme activity indicates the organism's capacity for organic material degradation, other parameter changes raise questions about potential unintended consequences.

Conclusion

This study exemplifies the significance of holistic research in comprehending the intricate relationships between treatment agents and aquatic ecosystems. As concerns about water quality intensify, interdisciplinary studies become paramount in guiding environmental management decisions. Further research is essential to unravel the broader implications of such treatments, ensuring the responsible stewardship of water resources and ecosystems. By amalgamating scientific inquiry with environmental mindfulness, humanity can forge a path toward safeguarding the health and sustainability of vital water bodies like the Gomti River.

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