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39. Indigenous Knowledge System and Sustainability: Local ecological practices and their implication for sustainability

(Physicochemical Analysis of Motipur Pond of Kanti Block at Muzaffarpur District, Bihar, India)

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ABSTRACT

The present paper deals with pond water quality of Motipur pond of kanti block at Muzaffarpur district, Bihar. Motipur pond is near Kanti station. The pond water parameters such as temperature, ph, turbidity, electrical conductivity, alkalinity, dissolved oxygen, biochemical oxygen demand, total hardness, calcium, magnesium, phosphate, carbon, iron, chloride and fluoride were estimated in the samples to evaluate their quality. Our result revealed that the concentration of total hardness, calcium, magnesium, sulphate, turbidity. alkanity, phosphate, iron, do, bod and chloride are within permissible limits and iron, phosphate are negligible in this pond. The concentration of from 20mg/I to 60mg/I which is higher the permissible limit of who health-based guide line values. The higher concentration of nitrate needs proper treatment before the use for drinking purposes and irrigation purposes. Finally, it can be suggested that an intensive study may be carried out before the domestic consumption.

Keywords: Pond Water, Water Quality, Dissolved Oxygen

Introduction

It is well-known that the physico-chemical characteristics of aquaculture ecosystems are inherently unstable, influencing the distribution and abundance of fresh water life. These dynamic environments are hotspots of biogeochemical activity, providing abundant food resources. Consequently, many larvae of nektonic and benthic organisms seek refuge in the neritic zone, leading to diverse Indian carps coastal waters and industrial areas. However, increasing human activities, particularly in urbanized urban areas, are degrading water quality. This, coupled with sewage and industrial effluents, significantly alters the physico-chemical properties of the urban waters. It is a single value that reflects the combined influence of various ecological parameters on the water's quality.

Parameter Categories: These parameters typically fall into three categories:

- **Physical parameters:** Temperature, turbidity, pH, etc.
- **Chemical parameters:** Dissolved oxygen, biochemical oxygen demand (BOD), chemical oxygen demand (COD), nutrients, etc.

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- **Biological parameters:** Presence of aquatic organisms like algae, bacteria, etc.
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The physico-chemical characteristics of coastal waters significantly impact the distribution and abundance of freshwater organisms. To understand these effects, coastal areas around Motipur have been studied extensively over the years. Bal & Pradhan (1946) Jayaram & Gogate (1957)Jayaraman et al. (1961) Naidu & Shrinapure (1975) Govindan & Desai (1980-81) Krishnakumari & Nair (1984-85) Zingde (1985) Josanto & Sarma (1985)Swami et al. (2000). The existing research on water quality in East Motipur is limited. To address this gap, this study aims to monitor water quality during both high and low tides to assess the current state of water quality in Motipur.

Materials and Methods

Surface water samples were collected every two weeks from two selected different (Motipur Pond) during both low and high tide. These samples were then transported to a laboratory for analysis using standard methods. Surface water samples were collected using clean polythene buckets. The following physico-chemical parameters were analyzed. Temperature, pH, Free Carbon Dioxide, Dissolved Oxygen,Biological Oxygen Demand (BOD) (methods by Martin, 1968, and Ramesh and Anbu, 1996), Nitrate (method by Grasshoff et al., 1983) Silicate (method by Grasshoff et al., 1983) were analyzed. Hydrogen sulfide was measured using a titrimetric method (Ramesh and Anbu, 1996). Total suspended solids were determined by filtering the water samples through Whatman filter paper.

Results

The water analysis revealed seasonal variations in the following parameters. Dissolved oxygen, Dissolved carbon dioxide, Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Nitrate, Phosphate, Silicate, Hydrogen sulfide, Total suspended solids, Salinity as observed seasonally. The study found that the pH of the water at the selected sites was slightly alkaline, ranging from 7.7 to 8.0. The water temperature varied between 26 and 31°C, with no significant seasonal variation. Salinity levels were relatively low, with a minimum of 19.92 ppt and 21.55 ppt observed in July for high and low tide water, respectively. A notable observation was the variation in dissolved oxygen (DO) levels. While Motipur Pond coast exhibited normal DO levels, Motipur Pond showed significant monthly fluctuations. The lowest DO level of 0.40 mg/L was recorded

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at Motipur during post-monsoon in high tide water. This highlights the need for sustainable practices during religious festivals to minimize the impact on water bodies. The study found the following variations in water quality parameters Carbon Dioxide: 6.4 and 18.6 mg/lit at Motipur Pond. BOD Both sites Low and within permissible limits. COD 69.4-120.4 mg/L (high tide), 74.4-136.4 mg/L (low tide). Phosphate High levels during monsoon, especially in low-tide water. Nitrate High levels in low-tide water. Silicate High levels in low-tide water, especially during monsoon. Hydrogen Sulfide (H_2S) High levels in low-tide water, particularly during post-monsoon .Total Suspended Solids (TSS) High levels in pre-monsoon high-tide water. The study found that high concentrations of hydrogen sulfide (H_2S) were detected during the post-monsoon season at Motipur Pond sites. The physico-chemical characteristics of water at Motipur Pond showed significant changes after idol immersion. Oxygen: Increased from 3.35 mg/L on the first day to a higher level after 15 days. Carbon Dioxide: Decreased from 30.8 mg/L on the first day to 19 mg/L after 2 days and further to 14.6 mg/L after 15 days. Nitrate and Phosphate: Increased on the first day but decreased after 15 days. Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Silicate, Total Suspended Solids (TSS), and Salinity: Did not show significant changes. These findings suggest that idol immersion had a noticeable impact on the water quality at Motipur Pond, particularly in terms of oxygen, carbon dioxide, nitrate, and phosphate levels.

DISCUSSION

The findings of this study on the physico-chemical characteristics of Motipur Pond site shore indicate seasonal variations. These results align with previous studies by Valarmathi et al. (2002) and Mahapatro & Padhy (2002) who also observed seasonal variations in shore waters along the East coasts of Muzaffarpur Bihar . The seasonal monsoons, specifically the southwest monsoon on the west coast and the northeast monsoon on the east coast, significantly influence the hydrological features of estuarine and coastal ecosystems. Several researchers, including Naidu et al. (1975), Zingde et al. (1979), and Govindanand Desai (1980-81), have reported similar seasonal variations in the physico-chemical characteristics of shore waters in Muzaffarpur. Fluctuations in salinity, dissolved oxygen, and nutrients like phosphate and nitrate in coastal waters are often linked to rainfall and freshwater discharge. Temperature also plays a significant role in maintaining oxygen levels. During this study, a notable decrease in oxygen levels (2.13 ± 2.12 mg/L) was observed in the post-monsoon period. This temporary decline is likely due to increased oxygen consumption during the decomposition of domestic waste released into the water. Generally, higher oxygen levels were observed at Motipur Pond compared to Motipur Railway Station. This difference may be attributed to the higher amount of domestic sewage released into the waters for Agricultural Purpose. Biochemical Oxygen Demand (BOD) is a crucial parameter used to assess the organic pollution in water bodies. It measures the amount of oxygen consumed by microorganisms to decompose organic matter. A lower BOD value indicates better water quality. In this study, the observed BOD levels in Motipur coastal waters suggest that the

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passive distribution of domestic sewage is contributing to organic pollution. Chemical Oxygen Demand (COD) measures the total amount of oxygen required to oxidize all organic and inorganic substances present in water. A higher COD value indicates a higher level of organic pollution. The elevated COD levels observed, especially during pre-monsoon, suggest a significant amount of oxidizable organic matter in the coastal waters. This could be attributed to various factors, including industrial effluents and domestic sewage. The lower COD levels during the monsoon season might be due to dilution caused by increased rainfall and freshwater inflow. In conclusion, both BOD and COD levels indicate that the coastal waters of Motipur Pond are impacted by organic pollution, primarily from domestic sewage. To improve water quality, effective sewage treatment and management practices are essential. Regular monitoring of these parameters can help track changes in water quality and inform necessary interventions.

Salinity is a crucial ecological factor influencing the distribution of fresh water organisms in coastal waters. During the monsoon season, increased rainfall leads to a significant influx of freshwater into coastal areas, resulting in a decrease in salinity levels. This study's findings on salinity variations align with previous research by Bal & Pradhan (1946), Jayaraman and Gogate (1957), Krishnakumari and Nair (1984-85), Anirudhan and Nambisan (1990), and Valdes and Real (1998), who also reported lower salinity levels during the monsoon season in coastal waters. The elevated levels of phosphate and nitrate observed in the coastal waters of Motipur pond indicate a significant input of nutrients from domestic effluents. These nutrients can fuel algal blooms, which can have detrimental effects on fresh water ecosystems. Zingde et al. (1985) reported a substantial amount of nitrogen pollution, exceeding 40 tons per day, in the area. This significant input of nutrients, combined with the increasing population and associated human activities, likely contributes to the elevated levels of nitrate and phosphate observed in this study. The presence of high levels of hydrogen sulfide in the coastal waters of Motipur Area further supports the nation of pollution. This indicates the presence of organic matter decomposition, which can occur in water bodies with high organic loads, often associated with pollution. To address these issues and improve water quality, it is crucial to implement effective sewage treatment and management practices. Additionally, proper waste disposal and pollution control measures are necessary to mitigate the impact of human activities on fresh water ecosystems.

The annual immersion of Motipur District in Muzaffarpur fresh waters, particularly at Motipur, often sparks controversy regarding its potential impact on water quality. To assess the actual impact, this study analyzed the physico-chemical characteristics of the water at the immersion point. While the study found some fluctuations in parameters like dissolved oxygen, carbon dioxide, BOD, COD, hydrogen sulfide, and nutrients, these variations were within the normal range observed in other areas of the Motipur fresh water. The reduced oxygen levels were considered a temporary phenomenon, likely due to the decomposition of idol materials. The study suggests that proper dispersion and dilution of idol materials, aided by tidal currents, contribute to the relatively normal

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physico-chemical characteristics at the immersion point. However, it's important to note that long-term monitoring and sustainable practices are crucial to minimize the potential environmental impact of idol immersions.

CONCLUSION

The baseline study, conducted across various ponds in different pond over different time periods, revealed significant variability in their physiochemical properties. The similar physico-chemical characteristics of the water before and after idol immersion suggest that the materials released during the immersion process are effectively dispersed and diluted within the fresh water environment. Clarity Removed redundant phrases and simplified sentence structure. Focus on Emphasized the key concern of nutrient pollution and its potential impact on fresh water life. More explicitly stated the conclusion about the dispersion and dilution of materials after idol immersion.All water samples were found to be bacteriologically contaminated, exceeding permissible limits.

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