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WATER QUALITY ASSESSMENT OF BADA TALAB RESERVOIR OF BURHAR TEHSIL OF SHAHDOL DISTRICT WITH SPECIAL REFERENCE TO POLLUTION LOAD ON PLANKTON DIVERSITY

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Abstract:

Understanding the ecological health and managing reservoirs sustainably require accurate measurement of water quality. This study focuses on the evaluation of the water quality in a particular reservoir situated in the Bada Talab near Druga mandir, Burhar Tahsil of Shahdol District. In the rainy season the water was collected and the physic-chemical parameters was evaluated. Since planktons are crucial indicators of ecosystem health, particular focus on the pollution load and its effects on plankton diversity were driven. In order to help in the creation of effective conservation and management measures, the study intends to shed light on the current condition of water quality, identify sources of pollution, and assess their impact on plankton variety.

Keywords: Bada Tabal, Burhar, Water, Rainy season and Physico-chemical parameters

Introduction:

Freshwater reservoirs are essential components of aquatic ecosystems and offer several ecological, social, and economic advantages and also provide resources for irrigation, hydropower production, drinking water, and leisure activities. Reservoirs' water quality and ecological health, however, can be harmed by water contamination caused by anthropogenic activity in and around them. In reservoir ecosystems, phytoplankton and zooplankton are essential elements that play a key role in energy transmission, nitrogen cycling, and ecosystem function. Changes in water quality, especially those brought on by pollution, can have a considerable impact on plankton diversity, possibly upsetting the balance of the ecosystem and the entire food chain. A notable feature of the Burhar Tahsil in the Shahdol District is its reservoir, which serves as a vital water source for the community and assists in facilitating a variety of activities. However, little research has been done to evaluate the water quality and how it affects the diversity of the plankton in this particular reservoir. Understanding the amount of pollution and the effects it has an plankton community which can give important insights for efficient management and conservation methods to preserve the reservoir's long-term viability.

The chief goals of this study are to evaluate the reservoir's water quality in Bada talab near Durga mandir, Burhar Tahsil and look into the impact of pollution on plankton diversity. Physicochemical characteristics are examined to determine the reservoir's water quality status, locating probable sources of pollution near the reservoir and calculating the loads of pollutants and examining their spatial distribution. Plankton species are sampled and taxonomically identified. Examining the effects of pollution on the variety and organisation of the plankton ecosystem. Identifying indicator species to act as early warning signs of deterioration in water quality.

Study and description

The study focuses on a particular reservoir that is situated in Bada Talab near Durga Mandir, Tahsil: Burhar, District: Shahdol, Madhya Pradesh. The study will take into account the geographical features of the reservoir, the local land use patterns, and human activities. To offer a thorough picture of the current health of the reservoir ecosystem, data on water quality indicators, pollution sources, and plankton diversity will be gathered and analysed. By undertaking this study, there will be better understanding the dynamics of both water quality of Bada Talab in the Burhar Tahsil reservoir. The research will aid in the creation of efficient management techniques to reduce pollution and protect plankton variety, ensuring the reservoir's and its linked ecosystems' continued ecological health.

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Fig. 1 (A) **Fig. 1 (B)**

Figure 1 (A): Location and 1 (B) Image of Bada Talab near Durga Mandir, Tehsil: Burhar, District: Shahdol, Madhya Pradesh.

Methodology:

Site Selection and sampling:

The study site was Bada Talab near Durga Mandir, Tahsil: Burhar, District: Shahdol, Madhya Pradesh. The water was collected from the Bada Talab in rainy season.

Parameters	Containers	Volume	Analysing technique
Temperature	Plastic or Glass	1000 mL and 25 gm	Thermometer
pH	Plastic or Glass	25 mL and 25 gm	Potentiometric
Alkalinity	Plastic or Glass	100 mL	Titration method
Turbidity	Plastic or Glass	100 mL	Nephelometer
Chloride	Plastic or Glass	300 mL	Titration method
Total hardness	Plastic or Glass	100 mL	Titration method
Calcium Hardness	Plastic or Glass	100 mL	Titration method
Magnesium Hardness	Plastic or Glass	100 mL	Titration method
DO	Glass	300 mL	Winkler's Method
BOD	Plastic or Glass	1000 mL	Titrimetric Method
COD	Plastic or Glass	1000 mL	Reflux digestion method

Table 1: Showing Sampling methodology and preservation

Physico-chemical Parameters: Water samples were taken from the reservoir's chosen sampling points. Temperature, pH, conductivity, turbidity, total suspended solids (TSS), nutrients (nitrate, phosphate), and other pertinent physicochemical parameters were measured on-site using suitable field instruments and accepted methodologies.

Observation:

Physical Parameters:

Temperature, turbidity, colour, odour, and conductivity are a few of the basic metrics that characterise the physical characteristics of water. These variables shed light on the general look, clarity, and sensory qualities of the water.

Temperature: The temperature of the water can be used to determine whether it is thermally suitable for aquatic life and to detect the presence of thermal pollution sources such as industrial discharges.

Turbidity: Water that has suspended particles causes turbidity, which is a measurement of cloudiness or haziness. The growth of aquatic plants, light penetration, and aquatic creature health can all be impacted by high turbidity levels.

Colour: The presence of natural organic matter or the leaching of contaminants like metals, tannins, or industrial wastes can be indicated by the colour of the water.

Odor: Odd or unpleasant odours in water could be a sign of microbial contamination or the presence of organic substances.

Conductivity: Conductivity, which is affected by dissolved salts and minerals, gauges the water's capacity to carry an electric current. It can offer information about salt levels and possible pollution.

SN	Characteristic	Unit	A
1	Temperature	^{o}C	29
2	Appearance	-	Clear
3	Colour	-	Colorless
4	Odour	-	Odourless
5	Turbidity	NTU	49.95
6	Conductivity	ms	0.84

Table 2: Showing Physical parameters of River Sone at Amlai bank Chemical Parameters:

Chemical parameters measure the quantity and composition of different chemicals present in water. These variables aid in locating potential contaminants and figuring out the general chemical make-up of water.

SN	Characteristic	Unit	Value
1	pH	-	7.54
2	Chloride	mg/L	149.95
3	Alkalinity	mg/L	64
4	Total Hardness	mg/L	756
5	Calcium	mg/L	500
6	Magnesium	mg/L	256
7	Total Solids	mg/L	154.4

8	Suspended Solids	mg/L	416
9	Dissolved oxygen	mg/L	1128
10	BOD	mg/L	7.2
11	COD	mg/L	9.6

Table 3: Permissible limits of Chemical parameters

pH: Water's pH, which shows how acidic or alkaline it is, is a crucial factor for aquatic life. Aquatic creatures can be harmed by pH variation at extremity. The pH value in rainy season is 7.54. The pH is normal in rainy season.

Chloride: An indicator of the water's quality and probable contamination sources is the concentration of chloride (Cl^-), a common ion. The Central Pollution Control Board (CPCB) in India has not established any precise criteria for chloride in river water. However, unless there are considerable anthropogenic inputs or industrial discharges, it is generally believed that the concentration of chloride in river water will be within natural background levels. Internationally, a number of organisations offer recommendations for the amount of chloride in water. To avoid concerns with taste and odour, the World Health Organisation (WHO) and United States Environmental Protection Agency (EPA) suggests a maximum chloride concentration of 250 mg/L in drinking water. 149.95 mg/L amount of chloride is present in Bada talab in rainy season shown in **Figure 2**. Chloride level is minimum than drinking water. Therefore, water of Bada talab can't be used for drinking purposes.

Alkalinity:

The Environmental Protection Agency (EPA) in the US has created water quality standards for a variety of uses, including irrigation, drinking water, and the preservation of aquatic life.Although the EPA does not have a set limit for alkalinity, it does offer recommendations for acceptable ranges based on the water's intended usage.To ensure flavour and avoid severe scaling in water pipes and appliances, alkalinity levels are often advised to be below 200 mg/L as calcium carbonate equivalents for drinking water. The alkalinity is 64 mg/L in the water of Bada talabshown in **Figure 2**. The level of alkalinity in the water of Bada tabal is normal.

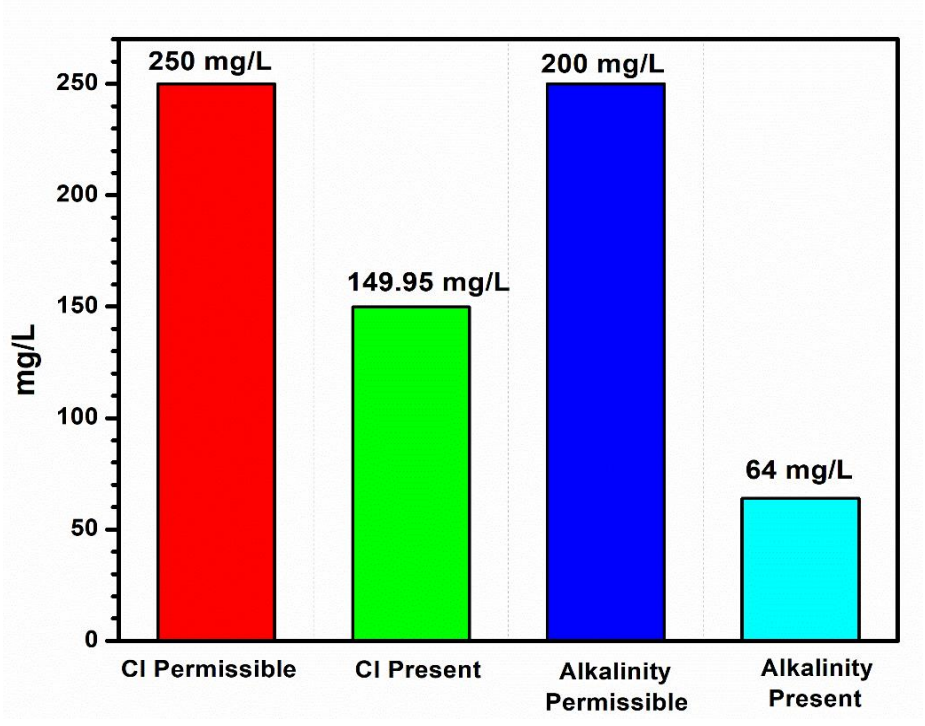

Figure 2: Showing Cl^- and Alkalinity in Bada Talab in Rainy season Total Hardness:

The amount of total hardness that is permitted in water is determined by its intended use and the relevant regulatory standards established by local or national authorities.The amount of dissolved calcium and magnesium ions in water is referred to as total hardness. It is typically stated in terms of calcium carbonate (CaCO3) equivalents.The Environmental Protection Agency (EPA) in the US has created water quality standards for a variety of applications, including drinking water and the preservation of aquatic life.The EPA advises that total hardness in drinking water should typically be less than 120 mg/L. The total hardness of the water of Bada talab is 756 mg/L **(Fig-3)** which is very high rather than permissible. The calcium and magnesium are 500 and 256 mg/L respectively.

Total Solids:

The highest permitted quantities of total solids (TS) are often laid forth in recommendations or rules that apply to drinking water.These restrictions are in place to guarantee the water's quality, flavour, and safety.Typically, less than 500 mg/L of total solids are allowed in drinking water. TS value in Bada talab is 154.4 mg/L **(Fig-3)** which is normal.

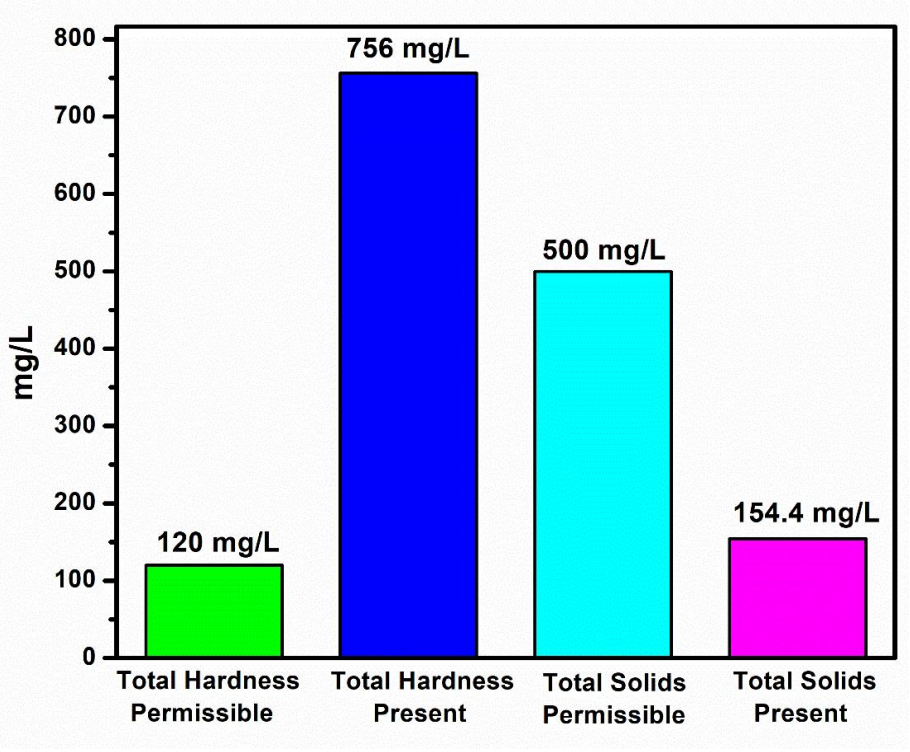

Figure 3: Showing Total hardness and total solids in Bada Talab in Rainy season Suspended Solids:

Typically incorporating fine sediments, organic compounds, and other particulate debris, suspended solids refer to solid substance or particles that are suspended in water. Generally speaking, the acceptable level of suspended solids in drinking water is between 10 and 30 mg/L, depending on the particular rules or specifications established by the responsible regulatory authority. The suspended solids in the water of Bada Talab is 416 mg/L, **(Fig-4)** which is very high.

Dissolved Oxygen

The amount of oxygen gas that has been dissolved in water is known as dissolved oxygen (DO), and it is essential for aquatic species to survive. Most aquatic creatures benefit from higher concentrations of dissolved oxygen since it supports their respiration and general health. The precise allowed level, however, can change based on elements like temperature, altitude, and the species that live in the pond. Dissolved oxygen concentrations above 5 mg/L are typically regarded as sufficient in freshwater habitats to support a variety of aquatic life. Certain species, like trout or other cold-water fish, may need larger concentrations, usually over 6-8 mg/L. When the dissolved oxygen level

falls below the minimal threshold, hypoxia can result, which can be dangerous for aquatic species and possibly result in stress or even death. DO in the water of Bada Talab in rainy season is 1128 mg/L **(Fig-4)**. It is crucial to remember that dissolved oxygen levels might change during the day as a result of things like the photosynthesis of aquatic plants, temperature changes, and the breakdown of organic materials. Therefore, it is advised that dissolved oxygen levels be continuously monitored to guarantee the ecosystem of the Bada talab's health and wellbeing.

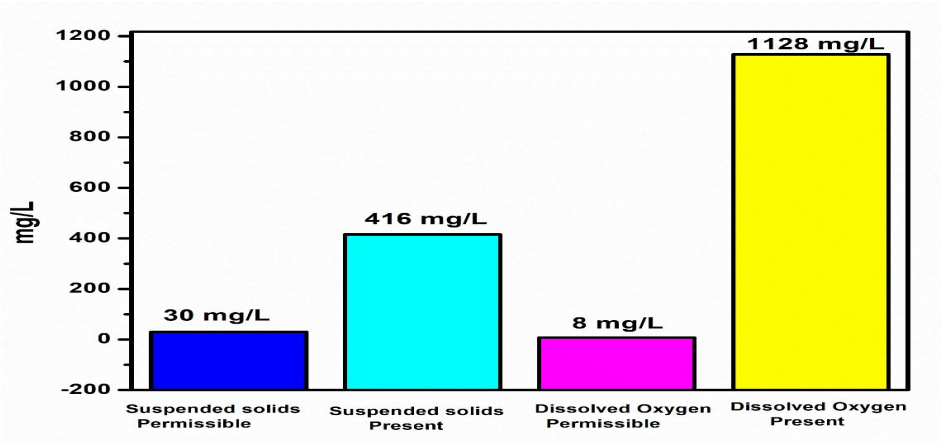

Figure 4: Showing Suspended solids and dissolved oxygen in Bada Talab in Rainy season

Biochemical Oxygen Demands (BOD):

BOD levels are essential for aquatic creature viability. Hypoxia brought on by low BOD levels can be harmful to fish and other aquatic life. The Central Pollution Control Board (CPCB) in India has established the following BOD standards for different water bodies with specified best use classes. Without treatment, a drinking water source's BOD shouldn't be more than 2 mg/L. When bathing outside, BOD shouldn't be more than 3 mg/L. Fisheries and wildlife reproduction: BOD shouldn't be more than 3 mg/L. BOD should not exceed 6 mg/L during irrigation. The BOD of Bada talab in rainy seasonis7.2 mg/L which indicates water is highly polluted.

Chemical Oxygen demand (COD):

An indicator of the overall organic and oxidizable pollutant load, COD measures the quantity of oxygen needed to chemically oxidise both organic and inorganic components in water. The Central Pollution Control Board (CPCB) in India has established the following COD standards for different water bodies with specified best use classes. Without treatment, a drinking water source's COD shouldn't be more than 10 mg/L. When bathing outside, CODshouldn't be more than 10 mg/L. Fisheries and wildlife reproduction: COD shouldn't be more than 30 mg/L. COD should not exceed 50 mg/L during irrigation. The COD of Bada talab in rainy season is9.6 mg/L which is permissible.

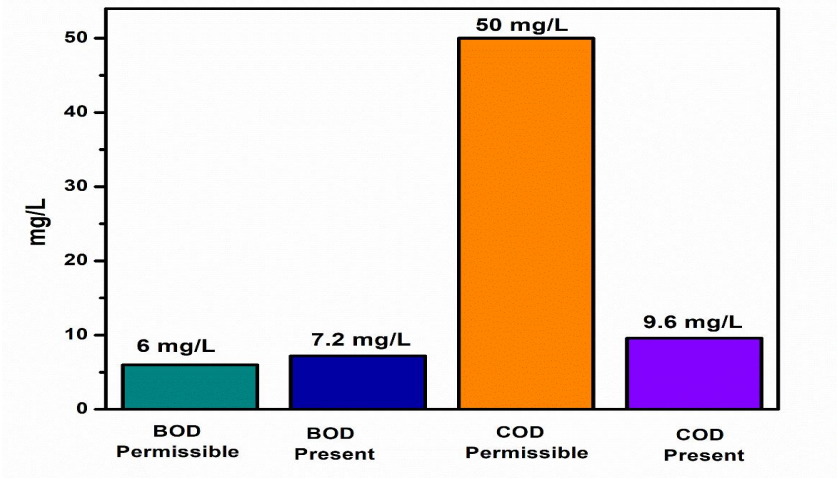

Figure 5: Showing BOD and COD in Bada Talab in Rainy season

Conclusion:

The study of the reservoir's water quality in Bada Talab near Durga Mandir, Burhar Tahsil, Shahdol District, reveal important information about the ecosystem's ecological health and pollution load. Alkalinity, total solids and COD are in permissible limits. Total hardness, chloride, suspended solids, DO and BOB level are expected to very high. The results of this study help in comprehend the current water quality situation and how it affects plankton communities. Pollutants were found in the reservoir after the examination of physicochemical properties, which pointed to possible contamination sources in the neighbourhood. Significant sources of water contamination were found to include home sewage, industrial discharges, and agricultural runoff. These results underline the necessity of putting in place suitable wastewater treatment procedures as well as efficient pollution control measures. Potential effects of water pollution on plankton communities were discovered by the examination of plankton diversity patterns. We noticed modifications in community organisation, a decrease in richness, and changes in species composition.The identification of indicator species that are vulnerable to pollution highlights the significance of ongoing surveillance to find early indications of deterioration in water quality.The implementation of conservation and management techniques is essential to safeguarding the reservoir environment, according to the research findings.To reduce pollution sources, advance sustainable practises, and increase understanding of the value of maintaining water quality, cooperation between government organisations, local communities, and industries is required. In conclusion, this study emphasises the significance of measuring water quality and how it affects the variety of plankton in the Bada talab near Durga Mandir, Burhar Tahsil reservoir. The results serve as a basis for the creation and use of management methods that are both efficient and long-term sustainable for the reservoir and the ecosystems that surround it.The reservoir can keep offering vital services and supporting the health of the neighbourhood and the environment by addressing pollution sources and safeguarding plankton variety.

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