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# Hydrochemical characterization of Motia Talab: A study of Conductivity, Chloride, Turbidity, BOD and COD variations.

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## Abstract:

This study focuses on the hydrochemical characterization of Motia Talab, Bhopal, Madhya Pradesh, India, to assess the safety of its water and fish. Various physical and chemical parameters of water were analyzed over a three-month period at three different sampling stations. The parameters analyzed were Conductivity, Chloride, Turbidity, Biological Oxygen Demand (BOD), and Chemical Oxygen Demand (COD). Minimum conductivity was recorded at centre as 497µS/cm and maximum at inlet as 595µS/cm. Minimum chloride was recorded at centre as 36.9 mg/L and maximum at inlet as 51.9 mg/L. Minimum turbidity was recorded at inlet as 32 NTU and maximum at outlet as 38 NTU. Minimum BOD was recorded at inlet as 1.0 mg/L and maximum at centre as 1.13 mg/L. Minimum COD was recorded at centre as 35 mg/L and maximum at inlet as 37 mg/L. From the present study, it was observed that the parameters fall within the limits compatible for optimum production.

**Keywords:** Motia Talab, Hydrochemical characterization, Water quality, Conductivity, Chloride, Turbidity, BOD, COD.

## Introduction:

Motia Talab, a prominent water body located in Bhopal, Madhya Pradesh, plays a significant role in the region's ecological and socio-economic framework. This research paper focuses on the study of the hydrochemical characterization of Motia Talab to evaluate its water quality and ecological health. Hydrochemical characterization is a vital tool for understanding the condition of water bodies, as it involves the measurement of various parameters such as Conductivity, Chloride, Turbidity, BOD and COD among others. These indicators not only reflect the water's suitability for various uses like drinking, agriculture, and recreation but also plays an important role in aquaculture. Kant and Vohra (1989) have rightly suggested that the management of any aquatic ecosystem is conservation of freshwater habitat with an aim to maintain the quality or to rehabilitate the physico-chemical and biological quantity of water. Before any step of

environmental management and conservation is taken, the monitoring of water quality is the first requirement. Telang *et al.* (2005) conducted limnological study of Motia Talab during December 2004 to November 2005 to find out its physiochemical conditions and their effect on plankton population. After the observation of various physiochemical factors, it was found that this talab can be utilized for fish culture to a great extent.

Aquaculture has been showing a tremendous growth during past decades (FAO, 2004). Fish contains large amounts of quality amino acids including lysine, methionine and tryptophan as well as substantial quantities of vitamins although poor in vitamins A and C (Lovell T.,1989), (Benitez L.V, De Silva S. S. 1999). Aquaculture is often recommended as a solution to the scarcity of fish protein. Fish fauna form an integral part of aquatic ecosystems, and any change taking place in the medium in which they live can affect their productivity, diversity and distributions. Fishes are dependent on hydrochemical parameters. Any change of parameters may affect the growth, development, maturity, density of the fish (Jhingran,1985). Shafei (2016) observed that optimum fish production is on the physical, chemical, andbiological qualities of water to most of the extent. Hence, successful pond management requires anunderstanding of water quality.

A number of hydrochemical parameters like Conductivity, Chloride, Turbidity, BOD, COD, etc. influence the life patterns and activities of aquatic animals. Relationship between water quality and aquatic productivity is a pre-requisite for obtaining optimum growth and production (Surnar SR et al 2018). It has been found that these hydrochemical parameters have a critical role in fish production. An optimum value should always be maintained for these parameters for good growth and density. The parameters also differ according to seasons and other conditions. Poor hydrochemical characteristics can result in poor growth, poor production and economic loss. It is essential to know the standard level of these parameters and assess the value before using any water body for fish production. These is a need to keep these parameters at the optimum levels to get the plentiful production of fishes in any water body. This study aims to provide baseline data and raise awareness about the importance of preserving urban water odies.

## Methodology:

### Study Area:

Motia Talab is located at 23.16° N and77.36° E; 550 meters above MSL) spreading over 7 hills. The water spread area is 10.89 hectares. The reservoir is located in Bhopal city with a well built tank bund. The reservoir water is used for many purposes including fishing activities.


*Fig.1.Motia Talab Bhopal*

**Morphometric features of Motia Talab**

| | |
|---|---|
| Period of construction | 1899 |
| Type of Dam | Man made perennial lake |
| Latitude | 23.16° N |
| Longitude | 77.36° E |
| Catchment Area | 10.89 hectare |
| Max. Depth | 3 - 6 m |
| Mean Depth | 1.5 - 4.2 m |
| Source of Water | Rain, sewage & wastewater, runoff |
| Main use of Water | Irrigation, Recreation, environmental purposes & Aquaculture. |

**Sampling and Analysis:**

Water samples were collected from three different locations viz. inlet, centre and outlet within the lake to capture spatial variations. Sampling was conducted during the period of November-December. Following the standard method samples were collected in sterile glass bottles, jerry cans, etc. from each station. After collection of the samples the bottles were tightly capped and were immediately transported to the laboratory to avoid any unpredictable changes in the physio-chemical characteristics. Suitable preservation techniques were adopted as per the standard methods described in **APHA (1995**) and **Golterman and Clymo, (1969).**

The parameters analysed included:

**Conductivity:** Measured using a conductivity meter. Since conductivity changes with storage time, the measurement was made right away after the water sample was obtained. Result were given in micro Siemens per centimetre (µS/cm) units.

**Chloride:** Determined by argentometric titration. The sample was titrated using standard solution of $AgNO_3$ as titrant. Potassium chromate was used as indicator.

$$\text{Chloride (mg/l)} = \frac{ml\ of\ titrant\ used \times N \times 35.46}{ml\ of\ sample} \times 1000$$

**Turbidity:** The turbidity of water refers to the level of cloudiness or haziness in the water. It is caused by suspended particles like sediments, algae or other impurities. It was measured using a nephelometer and expressed in NTU.

**Biological Oxygen Demand (BOD):** Assessed using the 5- day BOD test. During this incubation, microorganisms break down organic matter and consumed oxygen concentration was then measured, and the BOD value was calculated.

**Chemical Oxygen Demand (COD):** Determined using the dichromate reflux method. 20 ml of water sample was taken in a COD bottle, then 10 ml of potassium dichromate (0.25 N) and 30 ml of COD reagent (conc. Sulphuric acid and pinch of silver sulphate) and pinch of mercuric

sulphate was added and refluxed for two hours on a hot plate. After two hours it was cooled down and 90 ml distilled water was added. After that 2 or 3 drops of ferrion indicator were added to refluxed sample, mixed thoroughly and titrated with 0.1 N ferrous ammonium sulphate to a brick colour end point. A blank was run with distilled water.

$$\text{COD (mg/l)} = \frac{(B-A)\times N\times 1000\times 8}{ml\ of\ sample}$$

Where, A = ml of titrant used with sample

B = ml of titrant used with blank

N = Normality of titrant

## Results and Discussion:

The analysis of water samples from Motia Talab revealed significant variations in hydrochemical characterization across the three different sampling sites during the period of November & December as shown in table 1.

| Parameter | Station 1(inlet) | Station 2(center) | Station 3(outlet) | Standard Range |
|---|---|---|---|---|
| Conductivity | 595 µS/cm | 497 µS/cm | 499 µS/cm | 100 - 2000 µS/cm |
| Chloride | 51.9 mg/L | 36.9 mg/L | 37.9 mg/L | 30 – 180 mg/L |
| Turbidity | 32 NTU | 34 NTU | 38 NTU | 10 – 50 NTU |
| BOD | 1.0 mg/L | 1.13 mg/L | 1.04 mg/L | Below 5 mg/L |
| COD | 37 mg/L | 35 mg/L | 36 mg/L | 50 – 200 mg/L |

*Tab. 1 Variation in parameters at different sampling stations.*

### Conductivity:

Variation in Conductivity at different stations of Motia Talab is shown is *Tab. 1.* During the period of investigation i.e. November-December minimum conductivity was recorded at centre as 497µS/cm and maximum at inlet as 595µS/cm.

Conductivity is an index of the total ionic content of water, and therefore indicates the freshness of the water (Ogbeibu & Victor, 1995). Conductivity of water is due to ionization of dissolved substance. Conductivity is proportional to the amount of dissolved substance in the form of ions, act as conductors. Therefore, it measures the concentration of substance in solution but does not indicate the nature of these substances. Chemically pure water has low conductivity values. High values of conductivity show presence of ionic substance in water.

### Chloride:

Variation in Chloride at different stations of Motia Talab is shown is *Tab. 1*. During the period of investigation i.e. November-December minimum chloride was recorded at centre as 36.9 mg/L and maximum at inlet as 51.9 mg/L.

Chlorides occur in all natural waters in widely varying concentration. High concentration of chlorides is considered to be the indicator of pollution which is either due to organic wastes or due to industrial effluent.

**Turbidity:**

Variation in Turbidity at different stations of Motia Talab is shown is *Tab. 1*. During the period of investigation i.e. November-December minimum Turbidity was recorded at inlet as 32 NTU and maximum at outlet as 38 NTU.

Turbidity is caused by the presence of suspended particles in the water. High level of turbidity can have several negative effects on a lake like reduced light penetration, decreased oxygen levels, harm to aquatic life and aesthetic concerns.

**Biochemical Oxygen Demand:**

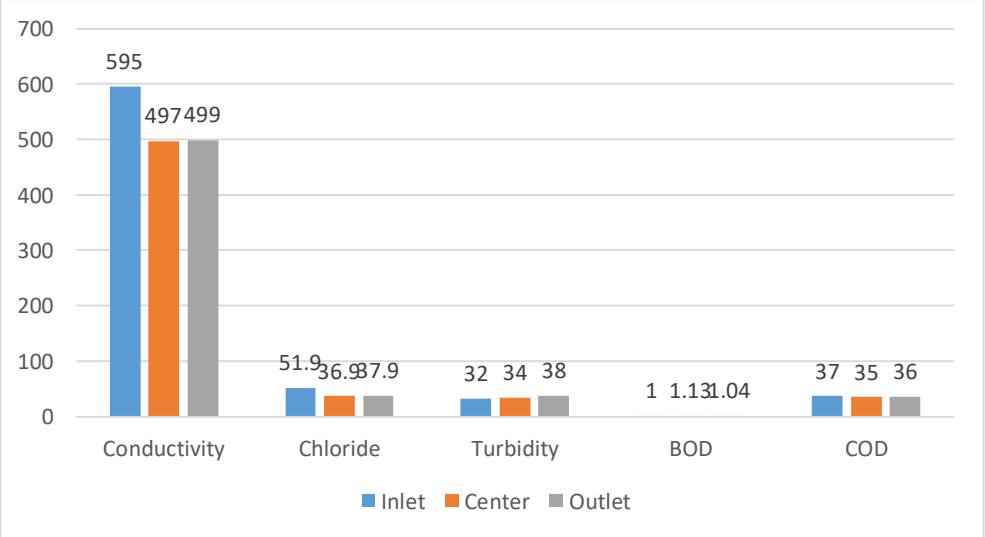
Variation in BOD at different stations of Motia Talab is shown is *Tab. 1*. During the period of investigation i.e. November-December minimum BOD was recorded at inlet as 1.0 mg/L and maximum at centre as 1.13 mg/L.

BOD is the key indicator of water quality, particularly in assessing the level of pollution from organic materials. High BOD levels mean there is a lot of organic matter in the water leading to depleted oxygen and poor water quality.

**Chemical Oxygen Demand:**

Variation in COD at different stations of Motia Talab is shown is *Tab. 1*. During the period of investigation i.e. November-December minimum COD was recorded at centre as 35 mg/L and maximum at inlet as 37 mg/L.

COD is the crucial measure of water quality. High COD levels indicate a large amount of organic pollutants in the water. This can deplete dissolved oxygen and indicate pollution.




*Graph-1: Graphical representation shows variation in Conductivity, Chloride, Turbidity, BOD and COD of Motia Talab at different stations during November-December.*

## Conclusion:

This study focuses on the hydrochemical characterization of Motia Talab, Bhopal, Madhya Pradesh, India, to assess the safety of its water and fish.Various hydrochemical parameters of water were analyzed over a three-month period at three different sampling stations. The present study was undertaken to understand the water quality status of Motia Talab of Madhya Pradesh. It receives large amount of sewage from its catchment area. The municipal waste water and drains join it directly and indirectly at many places. Water samples analyzed for physicochemical parameters including, Conductivity, Chloride, Turbidity, BOD and COD. The values of these parameters are compared with standard values given by CPCB guideline. The result showed variations in the analyzed at different stations during month of November and December. Some key hydrochemical parameters affect fish production:

Conductivity: Conductivity measures the total dissolved salts in the water. Research indicates that a desirable range for fish culture is generally within 100 - 2000 µS/cm. High conductivity can indicate poor water quality and may negatively impact fish growth. In the present observation the range value of conductivity was found compatible with the growth of fish species.

Chloride: A standard chloride range for fish is generally considered to be between 30 - 80 mg/L. In the present observation the range value of Chloride was found compatible with the growth of fish species.

Turbidity: A standard Turbidity range for fish is generally considered to be between 10 - 50 NTU. Turbidity levels up to 200 NTU without significant negative impacts on growth rates. In the present observation the range value of Turbidity was found compatible with the growth of fish species.

Biochemical Oxygen Demand (BOD): A standard acceptable BOD range for fish culture is generally considered to be below 5 mg/L; exceeding this level can indicate excessive organic waste and stress for the fish population. In the present observation the range value of BOD was found compatible with the growth of fish species.

Chemical Oxygen Demand (COD): The standard COD range for fish falls between 50 -200 mg/L. However, optimal levels should be below 100 mg/L to ensure good water quality and fish health. Higher COD levels indicate excessive organic matter, which can deplete dissolved oxygen and harm fish. In the present observation the range value of COD was found below the standard range indicating low organic pollution which is also compatible with the growth of fish species.

The hydrochemical analysis of water from Motia Talab, reveals that the lake maintains favorable conditions for aquatic life, particularly for fish production. By understanding and managing these physicochemical parameters, fish farmers can create a healthy environment for tilapia, leading to improved growth rates and higher production yields.

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