# Seasonal Physico-Chemical Study of Misir Pond Water in Birkona, Bilaspur Chhattisgarh

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**Abstract:-** Life on Earth would be impossible without water, as it is a vital component of our environment. This study aimed to evaluate the quality of water in Misir pond, located in the Birkona panchayat village of Bilaspur District in Chhattisgarh state. The assessment was conducted seasonally from May 2019 to January 2020. Water samples were analyzed for various physico-chemical characteristics, including transparency, temperature, pH, total dissolved solids (TDS), and electrical conductivity. The parameter ranges obtained were as follows: Transparency (15-27 cm), pH (7.9-8.5), Temperature (24-28°C), TDS (176-266), and Electrical conductivity (259-573 μs/cm). The experimental values for these physico-chemical parameters mostly fell within the standards set by the World Health Organization (WHO) and the Indian Council of Medical Research (ICMR).

**Keywords:** Physicochemical parameters; Water quality; purification treatment

## Introduction :

Life on Earth would be impossible without water, as it is one of the most vital components of our environment. While water covers a significant portion of the planet, less than 1% of it is found in ponds, lakes, rivers, dams, and other bodies of water, which is essential for various industrial, domestic, and agricultural purposes. Ponds serve multiple functions and are even used as a means for artificially replenishing underground water sources. The quality of water within an aquatic ecosystem is influenced by a multitude of physical, chemical, and biological factors, as discussed by Nayar R. et al. in 2019 [1]. The term "water quality" was introduced to assess how suitable water is for human consumption [2].

The majority of the population in Birkona resides in rural areas, where agriculture and animal husbandry are the primary livelihoods. Village ponds serve as the primary source of fresh water for the residents, catering to their needs for drinking, livestock bathing, fisheries production, and irrigation [3]. Unfortunately, the current state of water quality in these village ponds is deteriorating rapidly. This decline is attributed to several factors, including encroachments by villagers, improper disposal of domestic waste, accumulation of cow dung cakes around the periphery, consequences of land infilling and drainage, alterations in their traditional uses, and the disposal of industrial waste from urban areas [4]. Additionally, there is a noticeable absence of a legal and institutional framework for the management of small water bodies, resulting in their neglect when compared to larger water bodies such as lakes and rivers.

All these factors contribute to the deterioration of village ponds, with temporary ponds being particularly vulnerable. These temporary ponds are often overlooked and poorly understood due to their transient nature and small size, making them frequent targets of anthropogenic activities [5]. As a result of using contaminated water from these ponds, both the human and livestock populations are consistently exposed to various waterborne diseases. It is imperative to prioritize the conservation and management of village ponds as a matter of national and international significance, on par with or even surpassing the importance placed on a country's national or economic development [6]. Therefore, this study was undertaken to evaluate the condition and water quality of Misir pond in Birkona, Bilaspur, Chhattisgarh.

## Review of literature

Water is an essential element of human existence. In rural areas, both surface and groundwater sources are utilized, with open wells and tube wells being prevalent. Surface water is particularly valuable as a source of fresh drinking water. This discussion will delve into the crucial parameters that determine the quality of drinking water, including temperature, transparency, pH, and TDS.

Chakrabarty and Sarma (2011) conducted an analysis of drinking water quality in the Kamrup district of Assam, India. They assessed various parameters including Temperature, pH, Electrical conductivity, Total Solid (TS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Turbidity, Dissolved Oxygen (DO), Total Hardness (TH), Calcium Hardness (CH), Magnesium Hardness (MH), Chloride (Cl), Sulphate (SO4), Sodium (Na), and Potassium (K). The study encompassed forty-six different sampling stations. Data analysis revealed that the studied parameters exhibited a non-uniform distribution, often characterized by a long asymmetric tail on either the right or left side of the median. Descriptive statistics such as mean, variance (V), standard deviation (SD), standard error (SE), median, range of variation, and percentiles at 95%, 75%, and 25% (P95%, P75%, P25%) were computed and summarized to provide insights into the dataset.

Likewise, Ugwn and colleagues (2012) conducted an analysis to assess the influence of the increasing population in Abuja, Nigeria, by examining the seasonal physicochemical characteristics of the Usma River. The findings indicated that all the parameters measured fell within the permissible limits, with the exception of total suspended solids, which exceeded these limits for all seasons.

Sreeja and colleagues (2012) conducted an evaluation of the physicochemical parameters of the Kodayar River in Tamil Nadu. The study was carried out at seven sampling stations between June 2010 and June 2011. Several parameters, including temperature, electrical conductivity (EC), and total dissolved solids (TDS), were assessed. The data obtained from the sample analysis was compared to the standards recommended by various agencies, including the WHO and ISI.

Venkatesharaju and colleagues (2010) conducted a study to investigate

the seasonal and spatial variations in the surface water quality of the Cauvery River stretch in Karnataka. The study concluded that, based on physicochemical assessments, the river water in the study area was not polluted. However, bacteriological studies indicated that the river water was not suitable for drinking due to elevated coliform counts. This suggests the need for ongoing monitoring and treatment processes if the water is intended for drinking purposes. It is essential to implement steps and awareness programs to educate local villagers about the importance of safeguarding the precious river and its surrounding environment.

## Materials and Method

## Study period:

Water samples were analysed from to time morning 8.00 a.m.to 10 a.m. on and from May 2019 to January 2020.

## Analysis of the sample:

Water samples were analysed by digital parameter on the study site .Pond sample also analysed in four different direction [North, West ,East South]

Seasonal samples were systematically gathered for the analysis of physicochemical parameters in the chosen pond. During the fieldwork, transparency was assessed using a Secchi Disk, and both temperature and pH levels of the pond water were recorded using a thermometer and a digital pH meter, respectively. Furthermore, the water's conductance was determined through the use of a digital conductivity meter, while total dissolved solids (TDS) were measured with a digital TDS meter.

Physico-chemical parameters of these samples were determined by using standard procedures

Table:1- Standard Method of Physico-Chemical Parameter

| S.No. | Parameter | Method |
|---|---|---|
| 1 | Temperature | Measured with a mercury the Thermometer |
| 2 | Transparency | Measured by Secchi Disk |
| 3 | pH | Measured by Digital pH Meter |
| 4 | TDS | Measured by Digital TDS Meter |
| 5 | Conductivity | Measured by Digital Conductivity meter |

**Temperature**
Water temperature was monitored using a standard mercury thermometer, which had a precision of ±0.1°C. The process involved immersing the thermometer bulb directly into the water surface, and then recording the temperature reading.

**Transparency**
Water transparency was assessed in the field by submerging a 20 cm diameter Secchi Disc into the water and visually observing it. The average of the measurements taken at the point where the disc just disappeared from view and then reappeared was calculated using the equation provided below.
Secchi Disc light penetration = A+B / 2
Where,
A = Depth of which Disc disappeared
B = Depth of which Secchi Disc reappeared
The extinction co-efficient was calculated by using the following formula
K = 1.7 D
Where,
K = Extinction co-efficient
D = Secchi-Disc reading and
1.7 = constant factor

**Hydrogen ion concentration (PH)**

The pH level of water dictates its acidity, alkalinity, or neutrality. To determine the pH of the water sample, a digital pH meter was employed.

**Total Dissolve solid (TDS)**

Total Dissolve solid was measurerd by digital TDS meter.

**Conductivity**

Conductivity is assessed using a digital conductivity meter.

**Results and Discussion: -Table: 2**

| Parameter | Pre Monsoon | Monsoon | Post Monsoon | Winter |
|---|---|---|---|---|
| Temperature | 28 | 26 | 27 | 24 |
| Transparency | 25 | 15 | 23 | 27 |
| pH | 8.4 | 8.1 | 7.9 | 8.5 |
| TDS | 252 | 266 | 254 | 176 |
| Conductivity | 573 | 259 | 565 | 464 |

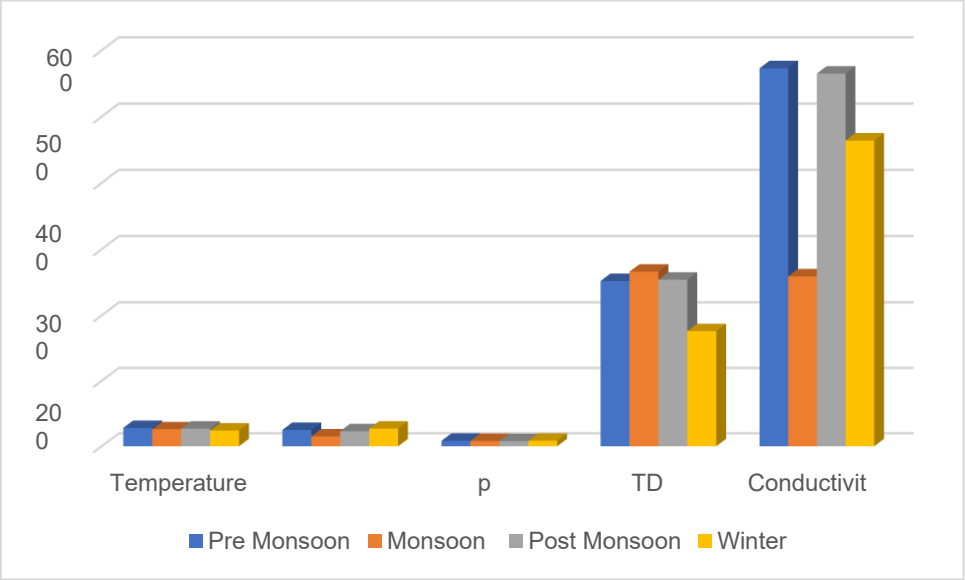


Figure 1: seassonal Variation in Physico-Chemical parameters of water samples from in of Misir pond during month May 2019-Jan2020

Water temperature plays a crucial role in influencing the chemical and biochemical reactions in aquatic organisms. The recorded temperature range varied between 24°C and 28°C. Site S-W had the lowest temperature value (24°C), while site S-N recorded the highest temperature value (28°C). It's important to note that water bodies, including wastewater, can be significantly influenced by ambient temperatures, often becoming warmer during the summer months.

Transparency is a metric that quantifies the presence of suspended minerals, bacteria, plankton, and dissolved organic and inorganic substances in water. This parameter is typically linked to surface water sources. In most waters, turbidity is due to Colloidal and extremal fine dispersions. The values varied between 15 cm to 27 cm except for S-N the results showed the transparency of North direction is very turbid and 15 cm recorded in month of May as maximum suspended particles are present in North direction.

pH is a measurement of the concentration of free hydrogen ions and hydroxyl ions in water, providing valuable insights into its chemical characteristics. In the context of drinking water, a pH range of 7.9-8.2 is typically recommended. In the study, it was observed that the highest pH value, 8.2, was recorded at station S-N, indicating a basic nature of the water in the northern area of Misir pond. Conversely, the lowest pH value, 7.9, was documented at station S-E. It's worth noting that the recorded pH values exceeded the permissible limits set by WHO.

The Total Dissolved Solids (TDS) exhibited variations ranging from 176 mg/l to 266 mg/l, with the highest value of 266 mg/l observed in the month of July.

Conductivity is a measure of an aqueous solution's ability to conduct electric current, and it serves as a valuable tool for assessing water purity. In this study, water conductivity ranged from 259 µs/cm to 273 µs/cm.

## Conclusion

The study revealed variations in the water quality parameters across all the examined physico-chemical parameters. Based on the analysis, it was determined that the water in Misir pond within the study area exhibited moderate pollution levels with respect to the assessed parameters. The pH and TDS levels were within permissible limits. However, the elevated levels of conductivity indicated that the pond water was not suitable for drinking due to its lack of cleanliness. It is essential to raise awareness among local villagers to protect this valuable pond and its surrounding environment.

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