International Journal of Multidisciplinary Research and Technology
ISSN 2582-7359, Peer Reviewed Journal, Impact Factor 6.325
www.ijmrtjournal.com
https://doi.org/10.5281/zenodo.12645177

ASSESSMENT OF WATER QUALITY OF MOHAN RAM TALAB AND SARFA DAM IN SHAHDOL, MADHYA PRADESH 2021-2022

Varsha Jaiswal[1], M.K. Bhatnagar[2], Laxmi Saket[3]

[1]Department of Chemistry, Pandit S.N. Shukla UniversityShahdol, MP, India
[2]Department of Chemistry, Pandit S.N. Shukla UniversityShahdol, MP, India
[3]Department of Chemistry, Pandit S.N. Shukla University Shahdol, MP, India

ABSTRACT

This research paper presents a thorough assessment of the water quality in Mohan Ram Talab and Sarfa Dam, located in Shahdol, Madhya Pradesh, during the period 2021-2022. The study encompasses a comprehensive analysis of physicochemical and biological parameters, aiming to evaluate the overall health of these water bodies and identify potential sources of pollution. The data collection involved sampling from various points within the water bodies, covering different depths and locations across multiple seasons. Physicochemical parameters, including pH, temperature, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, and total dissolved solids, were analyzed using standard methods. Additionally, the study assessed biological parameters by examining the presence of indicator species, macroinvertebrates, and phytoplankton.Identification of potential pollution sources, including agricultural runoff, industrial discharges, and anthropogenic activities, was a crucial outcome of the study. The implications of water quality degradation on both human health and the environment were discussed, emphasizing the need for continuous monitoring and effective remediation strategies.Comparisons with national and international water quality standards were conducted to gauge the severity of pollution and potential risks to aquatic ecosystems and human health. The paper concludes with insights into the importance of ongoing monitoring to ensure sustainable water management and safeguard these vital water resources in Shahdol, Madhya Pradesh. The findings contribute to the broader understanding of water quality dynamics and provide a foundation for future research and environmental management initiatives.

Keywords:Water quality, Shahdol, Mohan Ram Talab, Sarfa Dam, Physicochemical analysis, Biological assessment, Pollution sources, Environmental health.

Introduction

Water is a fundamental resource essential for all living organisms, playing a vital role in sustaining life on Earth. Its quality, encompassing chemical, physical, biological, and microbiological characteristics, determines its suitability for various purposes **[Son et al., 2020; Khatri et al., 2020]**. Assessing water quality is crucial to ensure its safety and appropriateness for drinking, irrigation, recreation, and maintaining ecological balance **[Maharana et al., 2015; Lee et al., 2022]**. However, human activities have significantly impacted water quality over time **[Misra, 2022]**. Industrialization, urbanization, intensive agriculture, and inadequate waste management practices have introduced heavy metals, minerals, pathogens, pesticides, and emerging contaminants into water bodies **[Paul et al., 2023]**. These pollutants pose threats to aquatic ecosystems, agriculture, economies, and human health **[Singh et al., 2019]**.This study aims to provide a comprehensive analysis of water quality, focusing on assessment techniques, influential variables, impacts of poor water quality on various sectors, and sustainable approaches to water quality management **[Malik et al., 2012]**. By understanding these issues and potential solutions, policymakers, scientists, and communities can make informed decisions and implement effective strategies to safeguard clean and safe water resources **[Tiwari et al., 2016]**.

LITERATURE REVIEW

Verma et al. (2019) conducted a study in the Bokaro district of Jharkhand state, India, where they collected 102 groundwater samples during both pre and post-monsoon seasons of the year 2014-15. These samples were analyzed for various parameters including pH, TDS, TH, Ca^{+2}, Mg^{+2}, Na^{+}, K^{+}, Cl^{-}, SO_4^{2-}, F^{-}, and NO_3^{-}. The aim was to assess the suitability of groundwater for drinking purposes using a Geographic Information System (GIS)-based Water Quality Index (WQI) model.

Krishnan et al. (2016) conducted research to evaluate the Water Quality Index (WQI) of 27 samples collected from the Rajkot District, Gujarat. Seven parameters were considered: pH, TDS, Total hardness, Cl-, F-, NO3-2, and SO43-. The study found a WQI value ranging from 27 (minimum) to 98 (maximum) in the study area. Approximately 51.8% of water samples fell into the "good to excellent" category, while 48.2% fell into the "fair to poor" category, indicating that the water was not suitable for direct consumption and required treatment before being used for drinking purposes.

Chaurasia et al. (2018) conducted a study in the southern portion of the Varanasi district, Uttar Pradesh, India. Sixteen groundwater samples were collected during the pre-monsoon period of May 2015. Twenty-two water quality parameters were considered for the calculation of the Water Quality Index (WQI).

4. Methodology

4.1 Study area

Mohan Ram Talab and Sarfa Dam are located in the district of Shahdol, Madhya Pradesh, India. Shahdol is situated in the northeastern part of Madhya Pradesh and is known for its rich biodiversity and natural resources. The district experiences a subtropical climate with hot summers, moderate rainfall during the monsoon season, and cool winters. Mohan Ram Talab is a prominent water body situated in Shahdol district. It serves as a vital source of water for irrigation, and supporting local biodiversity. The reservoir is surrounded by agricultural land, forests, and residential areas. Mohan Ram Talab plays a crucial role in the socio-economic development of the region by facilitating agriculture and providing water for various activities.Sarfa Dam is another significant water reservoir located in Shahdol district. It is constructed on a river or stream to impound water and create a reservoir for various purposes such as irrigation, drinking water supply, and hydroelectric power generation. Sarfa Dam contributes to the water needs of nearby villages and towns and supports agricultural practices in the region.

Figure 1: (a) Mohan Talab and (b) Sarfa Dam

4.2 Collection of samples

The water is collected at 22.01.2021 and 22.01.2022 from the Mohan Ram Talab and Sarfa Dam, Shahdol, Madhya Pradesh, India. Some results will be recorded in the laboratory of Orient papers Mills.

Table 1:Sampling methodology and preservation

Parameters	Containers	Preservation condition	Volume	Maximum preservation duration
Temperature	Plastic or Glass	-	1000 mL and 25 gm	Analyse immediately
pH	Plastic or Glass	-	25 mL and 25 gm	Analyse immediately
Turbidity	Plastic or Glass	-	100 mL	28 days

International Journal of Multidisciplinary Research and Technology
ISSN 2582-7359, Peer Reviewed Journal, Impact Factor 6.325
www.ijmrtjournal.com
https://doi.org/10.5281/zenodo.12645177

Chloride	Plastic or Glass	-	300 mL	6 months
TDS	Glass	-	300 mL	Analyse immediately
BOD	Plastic or Glass	4^0C	1000	48 hours

5. Result and discussion

5.1 Water Quality Assessment

Evaluating the quality of water involves a structured examination of various elements to determine its chemical, physical, biological, and microbiological characteristics. This analysis is crucial for identifying potential risks to human health and ecosystems, while also providing insights into the water's suitability for different purposes.

5.1.1 Physical Parameters

Temperature, turbidity, color, odor, and conductivity are among the fundamental parameters used to describe the physical properties of water. These factors provide insights into the overall appearance, clarity, and sensory attributes of the water.

Temperature: The temperature of the water can be used to determine if 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: Unpleasant or unusual odors in water might indicate microbial contamination or the existence of organic compounds.

Conductivity: Conductivity, influenced by dissolved salts and minerals, measures the water's ability to conduct an electric current. This property provides insights into salt concentrations and potential pollution levels.

5.1.2 Chemical Parameters

Chemical parameters assess the quantity and composition of various chemicals present in water. These factors help identify potential contaminants and provide insights into the overall chemical composition of the water.

pH: The pH of water, indicating its acidity or alkalinity, is a critical factor for aquatic life. Extreme pH levels can harm aquatic organisms. ThepH in Mohan Ram Talab is7.8 in 2021 and 2022. The pH in Sarfa Dam are7.5 and 7.9, in 2021 and 2022 respectively.

Chloride: The concentration of chloride (Cl-) serves as an indicator of water quality and potential contamination sources. In India, the Central Pollution Control Board (CPCB) hasn't established specific criteria for chloride levels in river water. However, it's generally assumed that without significant human activities or industrial discharges, chloride concentrations in river water should remain within natural background levels.Internationally, several organizations provide recommendations for chloride levels in water. To prevent taste and odor concerns, the World Health Organization (WHO) and the United States Environmental Protection Agency (EPA) suggest a maximum chloride concentration of 250 mg/L in drinking water. In the case you mentioned, the chloride concentrations in Mohan Ram Talab are 482 mg/L and 494 mg/L, in 2021 and 2022 respectively. The chloride concentrations in Sarfa Dam are 59.18 mg/L and 69.5 mg/L, in 2021 and 2022 respectively.

The high chloride level in Mohan Talab area suggests potential contamination or anthropogenic inputs, highlighting a concern for water quality in that region.

Biochemical Oxygen Demands (BOD):

BOD (Biochemical Oxygen Demand) levels are crucial for the viability of aquatic organisms. Hypoxia, resulting from low BOD levels, can be detrimental to fish and other aquatic life forms. The Central Pollution Control Board (CPCB) in India has established BOD standards for different water bodies based on specified best use classes.

According to these standards:

For drinking water sources, the BOD should not exceed 2 mg/L without treatment.

For outdoor bathing, the BOD should not exceed 3 mg/L.

For fisheries and wildlife reproduction, the BOD should be limited to 3 mg/L.

During irrigation, the BOD should not surpass 6 mg/L.

In the case mentioned, the BOD levels in Mohan Ram Talab are 6.8 mg/L and 5.8 mg/L, in 2021 and 2022 respectively. The BOD levels in Sarfa Dam are 0.2 mg/L and 0.4 mg/L, in 2021 and 2022 respectively. The high BOD level in the Mohan Ram Talab area indicates significant water pollution, posing a threat to the health of aquatic ecosystems in that region.

Chemical Oxygen demand (COD):

COD (Chemical Oxygen Demand) serves as an indicator of the overall organic and oxidizable pollutant load in water. It measures the amount of oxygen required to chemically oxidize both organic and inorganic substances present in water.

The Central Pollution Control Board (CPCB) in India has established COD standards for different water bodies based on specified best use classes:

For drinking water sources, the COD should not exceed 10 mg/L without treatment.

For outdoor bathing, the COD should not exceed 10 mg/L.

For fisheries and wildlife reproduction, the COD should be limited to 30 mg/L.

During irrigation, the COD should not surpass 50 mg/L.

In the case mentioned, the COD levels in Mohan Ram Talab are 123 mg/L and 129 mg/L, in 2021 and 2022 respectively. The COD levels in Sarfa Dam are 5 mg/L and 7 mg/L, in 2021 and 2022 respectively. The high COD level in the Mohan Ram Talab area indicates significant pollution from water pollutants, posing a threat to the water quality and ecosystem health in that region.

Table 2: Mohan Ram Talab 2021

SN	Characteristic	Unit	A	B	C	D
1	Temperature	ºC	22.8	23.5	23.2	23.2
2	Appearance	-	Clear	Clear	Clear	Clear
3	Colour	-	Colorless	Colorless	Colorless	Colorless
4	Odour	-	Odourless	Odourless	Odourless	Odourless
5	pH	-	7.86	7.97	7.8	7.82
6	Total Solids	mg/L	400	395	398	401
7	Total Dissolved solids	mg/L	273	269	271	271
8	Total Suspended Solids	mg/L	413	410	411	411
9	Chloride	mg/L	482	482.8	483.4	484.8

10	BOD	mg/L	6.8	6.3	6.2	6.3
11	COD	mg/L	123	120	121	121
12	Hardness	mg/L	340	340.6	341	339
13	Alkalinity	mg/L	400	401	399	401

Table 3: Mohan Ram Talab 2022

SN	Characteristic	Unit	A	B	C	D
1	Temperature	°C	23.8	23.7	23.8	23.8
2	Appearance	-	Clear	Clear	Clear	Clear
3	Colour	-	Colorless	Colorless	Colorless	Colorless
4	Odour	-	Odourless	Odourless	Odourless	Odourless
5	pH	-	7.86	7.97	7.8	7.82
6	Total Solids	mg/L	410	409	410	411
7	Total Dissolved solids	mg/L	257	257	256	258
8	Total Suspended Solids	mg/L	425	424	423	424
9	Chloride	mg/L	494	493.8	494.4	494.8
10	BOD	mg/L	5.8	5.3	5.2	5.3
11	COD	mg/L	129	128	130	129
12	Hardness	mg/L	345	345.6	345	346
13	Alkalinity	mg/L	410	411	409	411

Table 4: Sarfa Dam 2021

SN	Characteristic	Unit	A	B
1	Temperature	°C	25	24.9
2	Appearance	-	Clear	Clear
3	Colour	-	Colorless	Colorless
4	Odour	-	SI Unplesent	SI Unplesent
5	pH	-	7.59	7.58
6	Total Solids	mg/L	266	265
7	Total Dissolved solids	mg/L	248	247
8	Suspended Solids	mg/L	18	18
9	Chloride	mg/L	59.1	58.9
10	BOD	mg/L	0.2	0.21
11	COD	mg/L	5.0	5

Table 5: Sarfa Dam 2022

SN	Characteristic	Unit	A	B
1	Temperature	ºC	24	24.1
2	Appearance	-	Clear	Clear
3	Colour	-	Colorless	Colorless
4	Odour	-	SI Unplesent	SI Unplesent
5	pH	-	7.99	8
6	Total Solids	mg/L	256	255
7	Total Dissolved solids	mg/L	238	237
8	Suspended Solids	mg/L	15	15
9	Chloride	mg/L	69.1	68.9
10	BOD	mg/L	0.4	0.41
11	COD	mg/L	7	7

5.2 Discussion

In this research, reveal that there are several parameters exceeds the normal level. The chloride level in Mohan talab is concern for water quality shown in **Figure 2**. High chloride levels in the water of the Mohan Talab could be caused by several factors, most of which are related to human activities and natural processes. Chloride is a common ion that can be found in water due to various sources. Here are some potential reasons for the elevated chloride levels: industrial discharges, municipal wastewater and agricultural practices.

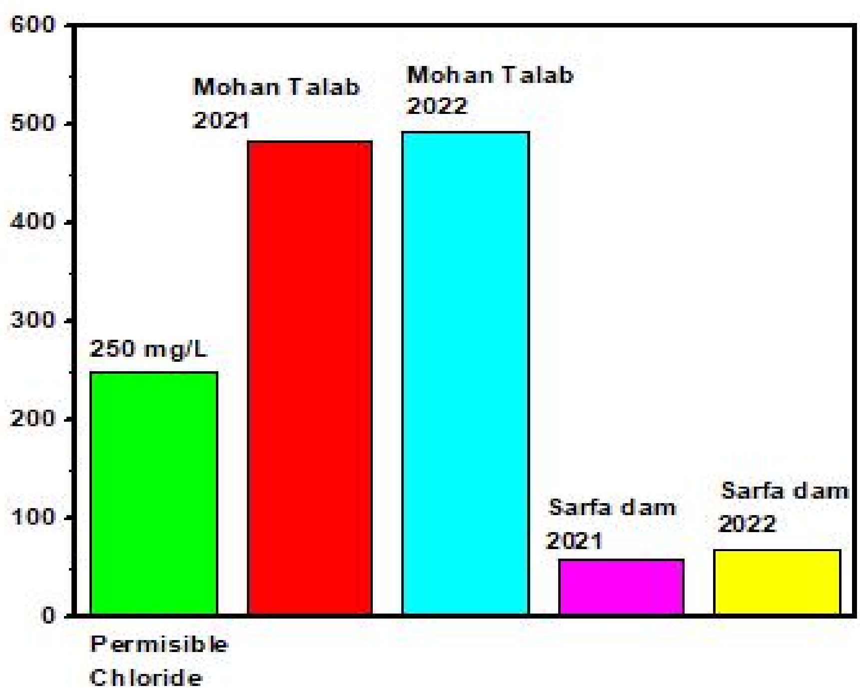

Figure 2: Chloride level in Mohan talab and Sarfa Dam

The BOD and COD Mohan talab are very high than that of normal level shown in **Figure 3** and **4**. The high levels of BOD and COD in the Mohan talab could be attributed to various factors related to pollution and environmental degradation. Both BOD and COD are indicators of water pollution and the organic content present in water bodies. Here are some possible reasons for the elevated BOD and COD levels, like industrial discharges, domestic sewage, agricultural runoff and and soil erosion.

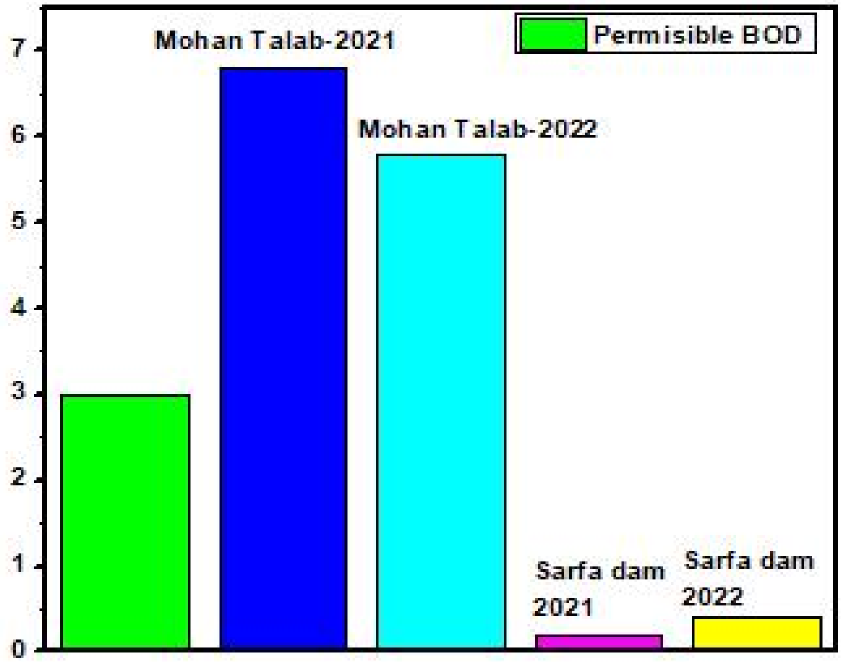

Figure 3: BOD level in Mohan talab and Sarfa Dam

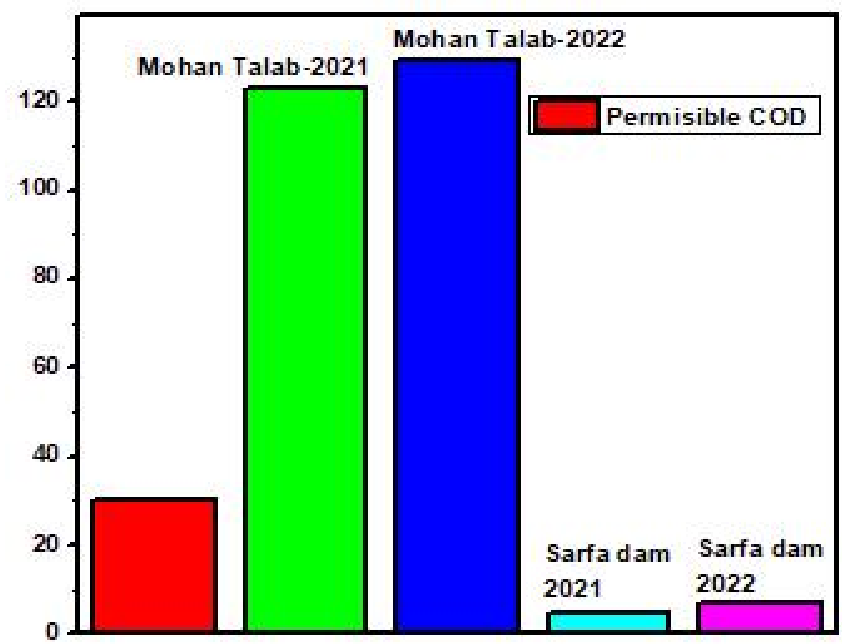

Figure 4: COD level in Mohan talab and Sarfa Dam

6. Conclusion

This research paper offers a thorough review of the assessment of water quality, the elements impacting water quality, the effects of poor water quality on various sectors, and sustainable methods for efficient management of water quality. In the winter season 2021-2022, elevated chloride levels observed in the Mohan talab are a cause for concern. This increase can potentially be attributed to various factors including industrial discharges, the release of municipal wastewater, and certain agricultural activities. In the winter season 2021-2022, BOD and COD level is very high in Mohan Talab which is harmful for aquatic and human. There are several potential explanations for the heightened levels of BOD and COD in the area, including the discharge of industrial effluents, untreated domestic sewage, runoff from agricultural activities, and erosion of soil. The results highlight the significance of coordinated efforts by governments, businesses, communities, and people to protect water resources and guarantee a sustainable and healthy future. To solve the issues caused by declining water quality and achieve long-term water security, more study and funding for novel technologies and policies is needed.

REFERENCES

1. Chourasia, L. P., (2018), 'Assessment of Groundwater Quality Using Water Quality Index in and Around Korba City, Chhattisgarh, India', *American Journal of Software Engineering and Applications*, vol. 7(1), pp. 15-21
2. Krishan, G., Singh,S., Kumar, C.P., Garg, P.K., Suman Gurjar, Ghosh, N.C ., Chaudhary, A.,(2016), 'Assessment of Groundwater Quality for Drinking Purpose by Using Water Quality Index (WQI) in Muzaffarnagar and Shamli Districts, Uttar Pradesh, India', *Hydrology Current Research*, vol. 7(1), DOI: 10.4172/2157- 7587.1000227
3. Khatri, N., Tyagi, S., Rawtani, D. and Tharmavaram, M., 2020. Assessment of river water quality through application of indices: a case study River Sabarmati, Gujarat, India. *Sustainable Water Resources Management*, *6*(6), p.101.
4. Lee, H.W., Kim, M., Son, H.W., Min, B. and Choi, J.H., 2022. Machine-learning-based water quality management of river with serial impoundments in the Republic of Korea. *Journal of Hydrology: Regional Studies*, *41*, p.101069.
5. Maharana, C., Gautam, S.K., Singh, A.K. and Tripathi, J.K., 2015. Major ion chemistry of the Son River, India: weathering processes, dissolved fluxes and water quality assessment. *Journal of earth system science*, *124*, pp.1293-1309.
6. Malik GM, Raval VH, Zadafiya SK, Patel AV. Idol immersion and physico-chemical properties of South Gujarat Rivers, India. Research Journal of Chemical Sciences. 2012;2(3):21-5
7. Misra, A.A., 2022. Lineament analysis in a part of the Son River valley, Madhya Pradesh, India. *Atlas of Structural Geological and Geomorphological Interpretation of Remote Sensing Images*, pp.217-228.
8. Paul, A.Q., Dar, S.A., Singh, B.P., Kumar, H. and Ahmad, M., 2023. Geochemistry of recent sediments of the Kurheri basin, Son River, Madhya Pradesh, Central India: implications for source area weathering, sediment provenance, maturity, and sorting. *International Journal of Earth Sciences*, pp.1-19.
9. Singh, S., Kanhaiya, S., Singh, A. and Chaubey, K., 2019. Drainage network characteristics of the Ghaghghar river basin (GRB), Son valley, India. *Geology, Ecology, and Landscapes*, *3*(3), pp.159-167.
10. Son, C.T., Giang, N.T.H., Thao, T.P., Nui, N.H., Lam, N.T. and Cong, V.H., 2020. Assessment of Cau River water quality assessment using a combination of water quality and pollution indices. *Journal of Water Supply: Research and Technology-Aqua*, *69*(2), pp.160-172.
11. Tiwari M, Kisku GC. Impact assessment of Gomti river water quality after immersion of idols during Durga Utsav. Biochem Anal Biochem. 2016;5(287):2161-1009.
12. Verma, P., Singh, P. K., Sinha, R. R., Tiwari, A. K., (2019), 'Assessment of groundwater quality status by using water quality index (WQI) and geographic information system (GIS) approaches: a case study of the Bokaro district, India', *Applied Water Science*, vol. 10, no.27.