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RESEARCH ARTICLE

A STUDY ON THE VARIATION OF WATER QUALITY PARAMETERS ACROSS DIVERSE WATER SAMPLES

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Abstract

This study, titled "A Study on the Variations of Water Quality Parameters Across Diverse Water Samples," focuses on the quality of water collected from four different sources: Orai Dam, Bassi Dam, Gosunda Dam, and the Berach River. The main objective was to analyze and compare various physical and chemical properties of water, such as odour, turbidity, pH, and hardness. Water samples were taken from these locations and tested using laboratory methods.Results showed that the pH ranged from 7.54 to 8.25, falling within the acceptable range of 6.5 to 8.5 for drinking and irrigation. Turbidity was highest in the Berach River (with poor clarity and yellowish tint). Orai Dam water was also found to be unclear and slightly dull, while Bassi and Gosunda Dams had clear water. An unpleasant odour was detected only in the Berach River sample, indicating possible pollution. Notably, total hardness values ranged from 2,181.96 ppm to 5,524.97 ppm, which is significantly above the BIS safe limit of 600 ppm, making all sources unfit for drinking without treatment.These findings help us understand how clean and safe the water is from different sources. The study highlights the need for regular water testing to ensure the health and safety of the community.

Introduction:-

Water is one of the most important natural resources on Earth. Every living thing-humans, animals, andplants-needs water to survive. People use water in many ways, such as for drinking, cooking food, bathing, washing clothes, cleaning houses, watering plants, and farming. Access to clean water is essential for maintaining good health and overall well-being.

Nowadays, in many places, water quality is getting worse day by day. Water sources like rivers, lakes, and dams are being polluted by waste from homes, factories, and farms. This waste includes chemicals, plastics, dirty water, and harmful substances. When these mix with clean water, they make it unsafe for people to use. Drinking or using polluted water can cause many health problems such as stomach pain, skin rashes, and even serious diseases.

Many studies have looked at water quality in Rajasthan, but this study is different because it compares water from still sources like dams and flowing sources like rivers in our local area. This helps us understand how water quality

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changes between these types of water. Also, there isn't much recent information about the water quality of Orai Dam, Bassi Dam, Gosunda Dam, and the Berach River.
The first three are dams, which store still water. The fourth is a river, which has flowing water. This study will show how water quality may change between still water and flowing water.

Study Aim:-

This study checks four water quality parameters:
1. **Odour** – Smell of water
2. **Turbidity** – How clear or cloudy the water is
3. **pH** – Whether the water is acidic or basic
4. **Hardness** – Mineral content in the water

Objectives of the Study:-

The main aims of the study are:
1. To check the odour, turbidity, pH, and hardness of water from each of the four sources.
2. To compare the results and see how water quality changes at different places.
3. To find out if the water is safe based on WHO and BIS standards.

Why This Study Is Important?

This study is helpful for many reasons:
1. It helps people know what type of water they are using every day and whether it is clean and safe.
2. It can help the government take steps to clean the water if pollution is found.
3. It provides useful information for future studies on water quality.
4. It helps protect the health of people who drink or use water from these sources.

Scope and Limitations

Scope:
1. It includes water samples from only four places.
2. It checks only four water quality parameters: odour,turbidity, pH, and hardness.

Limitations:
1. It does not test for harmful bacteria, heavy metals, or other dangerous chemicals.
2. The study area is small, and only a few samples were taken, so the results may not apply to other nearby locations.

Literature Review:-

Overview

In the present study, we focus on assessing the water quality of four different water sources: Orai Dam, Bassi Dam, Gosunda Dam, and the Berach River. The water quality is assessed by measuring four key parameters:odour, turbidity, pH, andhardness.
These studies provide valuable information about water quality in different environments and under various conditions.

Studies on Odour of Water

Odour refers to the smell that water emits. Ideally, drinking water should have no odour or only a mild, natural smell. An unpleasant odour in water is often one of the first signs of contamination. It can result from the presence of organic waste, sewage, decaying plant material, algae, or chemical pollutants.

For example, a study conducted in the canals of Delhi reported strong foul odours near sewage discharge points due to untreated domestic and industrial waste.

This study follows the same observational approach for odour assessment; however, the geographic context and pollution sources differ. For instance, odours detected at the Bassi Dam and the Gosunda Dam in our samples were mild and earthy, suggesting natural organic presence, unlike the intense anthropogenic pollution observed in Delhi canals. This contrast in odour intensity and source highlights regional differences in pollution load and land-use practices.

Studies on Turbidity of Water

Turbidity refers to how clear or cloudy the water appears. High turbidity means that there are many suspended particles in the water, such as clay, silt, organic matter, plankton, and microorganisms. Clear water has low turbidity, while murky or muddy water has high turbidity.

Patel and Joshi (2017) found that urbanization increased turbidity in the Sabarmati River due to industrial effluents. In comparison, our findings show that the Berach River, which flows closer to urban settlements, exhibited higher turbidity levels than the dams, which are more isolated. This aligns with Patel and Joshi's conclusions, confirming that urban proximity correlates with turbidity.

pH of Water

The pH of water measures its acidity or alkalinity. The acceptable pH range for drinking water is 6.5 to 8.5, as per BIS standards. Kumar et al. (2019) reported pH values of 7.2–8.4 in the Yamuna River, influenced by industrial discharge and dissolved salts.

This study recorded similar slightly alkaline pH values, especially in the Orai and Bassi Dams, possibly due to geological formations and seasonal evaporation rather than direct industrial discharge.

Studies on Hardness of Water

Water hardness is mainly caused by the presence of calcium and magnesium ions. Hard water affects daily life by reducing the efficiency of soap, leaving mineral deposits in water heaters and pipes, and sometimes giving water a bitter taste. According to BIS guidelines, the acceptable limit for water hardness is 200 mg/L, and the maximum permissible limit is 600 mg/L.

A study by Mehta et al. (2018) in the Udaipur district found that the borewell water was very hard, especially during the summer months. This was due to the evaporation of water, which left behind high concentrations of dissolved minerals.Hardness levels were higher in dam water during late summer, especially in the Gosunda Dam, suggesting mineral concentration from evaporation.

Methodology:-

Description of Study Areas

The water samples in this study were collected from four different sources in Chittorgarh, Rajasthan. Each source represents a unique aquatic environment and is important for local use:

1. **Orai Dam** – A man-made reservoir mainly used for irrigation and domestic purposes.
2. **Bassi Dam** – A large dam in the region, known for agriculture and water storage.
3. **Gosunda Dam** – Located near hilly regions, possibly influenced by rainwater and natural runoff.
4. **Berach River** – A flowing river that could be affected by surrounding settlements, human activities, and discharge from nearby areas.

Collection of Water Samples

To ensure data reliability and reproducibility, standard sampling protocols were followed based on APHA (American Public Health Association) 2017 – Standard Methods for the Examination of Water and Wastewater, particularly methods outlined in sections 1060 B (Sampling Techniques) and 1060 C (Sample Containers and Preservation)

1. **Timing**: Samples were collected between 9:00 AM and 12:00 PM.
2. **Containers:** Clean, sterilized 1-litre polyethylene bottles were used.
3. **Procedure:**

a. Each bottle was rinsed three times with the same source water.
b. Water was taken from about 30 cm below the surface to avoid surface debris.
c. Bottles were labelled with sample ID, location, date, and time.
d. Samples were kept in cool boxes and sent to the lab for testing within 24 hours.

Parameters Analysed and Methods Used

i. Odour

Odour indicates if water has any unpleasant or chemical smell. Although it is a **subjective parameter**, it gives a quick idea about pollution (Sharma & Bhatt, 2018).

1. **Method:** Sensory evaluation (based on APHA Method 2150 B – Taste and Odour)

2. **Steps:** About 100 ml of water was smelled and categorised as:
a. No odour
b. Slight odour
c. Strong odour
d. Unpleasant (sewage, fishy, chemical).
3. Bad odour may come from organic matter, sewage, or chemicals and usually suggests contamination.

Turbidity
Turbidity shows how clear or cloudy the water is. It increases when small particles like mud, silt, or microbes are present.

Method:
Visual inspection with a black and white symbol(analogous to the Jackson Candle Method, APHA 2130 A)

Steps:
1. A letter or symbol was placed at the bottom of a clear container.
2. Water was poured slowly until the symbol became unclear.
3. The water height was measured.
4. More height = higher turbidity
5. Less height = clearer water

Turbidity is important for detecting suspended solids and pollutants.

pH
pH tells us whether the water is acidic, neutral, or basic. According to BIS standards, safe drinking water should have a pH between 6.5 and 8.5.
Instrument: Digital pH meter(APHA 4500-H+ B)
Steps:
1. Calibrate meter with buffer solutions (pH 4.0, 7.0).
2. Insert electrode into 100 ml of sample water.
3. Note the pH once it stabilizes.
4. Rinse electrode after each use.

The pH is affected by pollution, industrial waste, and environmental factors.
Total Hardness
Hardness is due to calcium and magnesium ions. Hard water affects washing, drinking taste, and pipe scaling. The BIS recommends hardness below 200 mg/L (acceptable) and 600 mg/L (maximum).
Method: EDTA titration (APHA 2340 C – Hardness by EDTA Titration)
Reagents: Buffer solution (pH ~10), Eriochrome Black T (indicator), 0.01 M EDTA
Steps:
1. Add 50 ml sample in a conical flask.
2. Add 2 ml buffer and 2–3 drops of indicator.
3. Titrate with EDTA until color changes from wine red to blue.
4. Note EDTA volume used.

Calculation:

$$\text{Total Hardness (ppm)} = \frac{V_{(EDTA)} \times M \times 1000 \times 100.09}{50}$$

Coordinates of four Water Resources
Orai Dam
Orai Dam is situated within the **Bassi Wildlife Sanctuary** in the Chittorgarh district of Rajasthan, India. This sanctuary, established in 1988, spans approximately 15,290 hectares and encompasses both the Orai and Bassi dams. The habitat surrounding Orai Dam plays a crucial role in supporting the ecological balance of the region. The combination of aquatic and terrestrial ecosystems provides breeding grounds and food sources for various species.

Figure 1:- Location of Orai Dam (Map View)25.0267° N, 74.8396° E.

Bassi Dam

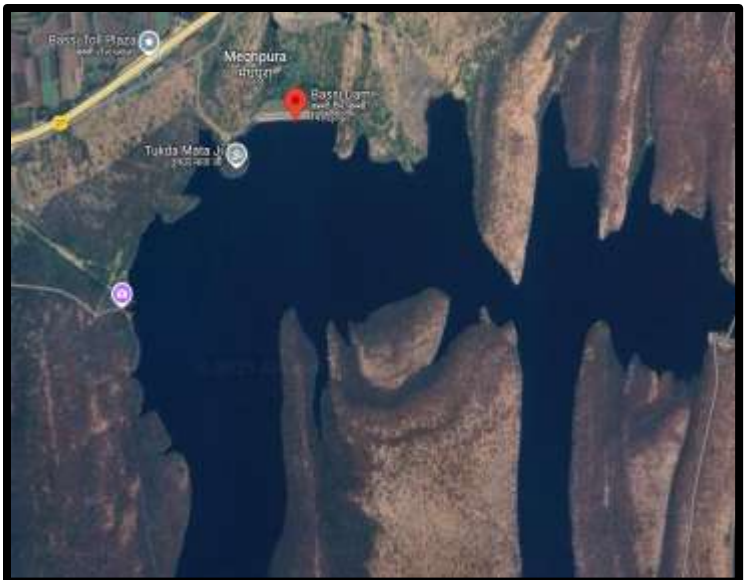

Figure 2:- Location of Bassi Dam (Map View) 25.0321° N, 74.8230° E.

Bassi Dam, located in the Chittorgarh district of Rajasthan, lies within the protected boundary of the Bassi Wildlife Sanctuary.

Bassi Dam is encompassed within the **Bassi Wildlife Sanctuary**, which spans over 15,290 hectares. The sanctuary is home to a diverse range of flora and fauna, including species such as panthers, jackals, hyenas, crocodiles, and various migratory birds.

Gosunda Dam

Gosunda Dam, located approximately 10 kilometers from Chittorgarh in Rajasthan, is an artificial reservoir constructed on the Berach River. Beyond its primary role in water storage and supply, the dam and its surrounding areas hold significant ecological importance, supporting diverse habitats and species. It serves as a vital ecological zone in Rajasthan, supporting a diverse range of aquatic and terrestrial life forms.

Figure 3: Location of Gosunda Dam (Map View)24.8265° N, 74.5232° E.

Figure 4: Location of Berach River (Map View) 25°15′N, 75°02′E.

Berach River

The **Berach River**, a significant tributary of the Banas River in Rajasthan, India, originates in the hills of Udaipur district and traverses through Udaipur, Chittorgarh, and Bhilwara districts before merging with the Banas River near Bigod village. Spanning approximately 157kilometres and draining a basin of 7,502 square kilometres, the Berach River plays a vital role in the region's ecology and hydrology.

Representativeness and Reliability of Sampling

1. We chose four different water sources to cover different types of water environments.
2. Taking three samples from each site helps make the results more reliable.
3. Using clean containers, collecting samples at the same time, and following lab procedures carefully reduces errors.
4. Following APHA and BIS standards ensures that our methods are trustworthy and comparable to other studies in India.

Results:-

Odour Test

The odour of the water samples was checked by smelling them directly. This helped identify if there was any bad or unusual smell, which could indicate pollution.

Water Source	Odour
Orai Dam	Slight odour
Bassi Dam	Slight odour
Gosunda Dam	Slight odour
Berach River	Unpleasant odour

Turbidity Test

Turbidity indicates how clear or cloudy the water is. Clear water is better. Water samples were checked using a simple turbidity test.

Water Source	Turbidity
Orai Dam	Unclear and slightly dull
Bassi Dam	Clear and colorless
Gosunda Dam	Clear and colorless
Berach River	Poor clarity and slightly yellowish

pH Test

The pH value indicates whether the water is acidic, neutral, or alkaline. Safe drinking water should have a pH between 6.5 and 8.5.

Water Source	Measured pH
Orai Dam	7.54
Bassi Dam	8.06
Gosunda Dam	8.25
Berach River	7.57

Hardness Test

Water hardness comes from minerals like calcium and magnesium. Very hard water can damage pipes, reduce soap foam, and affect taste.

Water Source	Total Hardness (ppm)	Interpretation
Orai Dam	2922.628	Extremely hard
Bassi Dam	2181.962	Extremely hard
Gosunda Dam	2642.376	Extremely hard
Berach River	5524.968	Extremely hard

Overall Comparison

Parameter	Orai Dam	Bassi Dam	Gosunda Dam	Berach River
Odour	Slight odour	Slight odour	Slight odour	Unpleasant odour
Turbidity	Unclear (slightly dull)	Clear (colorless)	Clear (colorless)	Poor clarity (yellowish in color)
pH	7.54 (neutral)	8.06 (slightly alkaline)	8.25 (slightly alkaline)	7.57 (neutral)
Total Hardness (ppm)	2922.63 (extremely hard)	2181.96 (extremely hard)	2642.38 (extremely hard)	5524.97 (extremely hard)

Is the Water Fit for Agriculture?

1. **Odour:** Slight odour in dams is usually safe, but the unpleasant smell in the Berach River may signal pollution that could harm crops or soil.
2. **Turbidity:** High turbidity can clog irrigation systems and reduce soil absorption; filtration is advised before use.
3. **pH:** All samples (7.5–8.25) are within the suitable range for most crops, so pH is acceptable.
4. **Hardness:** Extremely hard water (>2000 ppm) may cause soil alkalinity and reduce nutrient uptake, negatively affecting crop growth over time.

Discussion:-

The water samples were tested for four main parameters: odour, turbidity, pH, and total hardness. These are essential indicators that help us understand whether the water is safe for human use, agriculture, or needs treatment.

Odour

Odour tells us if water has a smell and whether that smell is natural or caused by pollution. In this study:

1. Water from the Orai, Bassi, and Gosunda Dams had a slight odour, which could be due to the presence of natural materials like algae, decaying plants, or organic matter. This kind of odour is generally not harmful.
2. The Berach River, however, had a strong and unpleasant smell. This could be due to pollution caused by sewage, industrial waste, or decaying substances in or near the river.
3. This aligns with findings from other river studies in semi-urban Indian regions where river odour correlates with sewage inflow and organic pollution (e.g., Sharma et al., 2019). The odour thus serves as an indirect indicator of microbial and chemical pollution that requires further microbiological and chemical testing.

Turbidity

Turbidity indicates how clear or cloudy the water is. Water becomes cloudy when it contains **suspended** solids like silt, clay, organic waste, or microorganisms. In this study:

1. Water from the Orai Dam and the Berach River was found to have high turbidity, which means it was not clear and may contain dirt or germs.
2. This finding is consistent with other studies in arid and semi-arid regions where surface runoff during rains causes sediment and pollutant influx, increasing turbidity (Kumar & Singh, 2021). The clearer but still slightly turbid water in the Bassi and Gosunda Dams could indicate less disturbance or better sediment settling conditions, though some particulate contamination remains.

pH

The pH of water indicates whether it is acidic, neutral, or alkaline. The ideal pH range for drinking and agriculture is **6.5 to 8.5**.

1. All the water samples are within the safe range. Water from the Bassi and Gosunda Dams was slightly alkaline, possibly due to the presence of natural minerals.
2. Since the pH in this study was in the normal range, the water is safe for both human consumption and agricultural use based on this parameter.

Total Hardness

Hardness of water depends on the amount of calcium and magnesium salts in it. The Bureau of Indian Standards (BIS) states that:

1. Ideal hardness for drinking water: 200 ppm
2. Maximum safe limit: 600 ppm
3. All four water samples are extremely hard, especially the Berach River water.
4. Although hard water is not always dangerous in the short term, it is not recommended for regular drinking or farming. Over time, it can lead to poor crop growth and soil imbalance.
5. In addition to natural geological sources, anthropogenic factors such as agricultural runoff containing fertilizers and industrial discharges may contribute to hardness. Seasonal variations, including evaporation during the hot dry months, can concentrate dissolved salts, increasing hardness further. This mechanistic explanation fits with the observed data, as water hardness tends to peak during dry seasons when water volume is low, and mineral concentrations rise.
6. The extremely hard water poses challenges for domestic use, agriculture, and soil health. Prolonged irrigation with hard water can lead to soil alkalinity and nutrient imbalances, affecting crop yields. For households, hard water may cause scaling in pipes and reduce the effectiveness of soaps and detergents.

Limitations of the Study

Odour Judgement Was Subjective:

The smell of water was judged by people, which can vary from person to person. No lab tests were done to confirm the cause of the smell.

Few Parameters Were Tested:

The study only looked at four things—odour, turbidity, pH, and hardness. Other important factors like harmful bacteria, heavy metals, and nitrates were not tested.

Limited Sample and Time:

Water was tested only once at each place. Since water quality can change with weather and seasons, the results show just one point in time.

Small Study Area:

The study was done only in a small part of Chittorgarh, so the findings may not apply to other areas nearby.

Conclusion:-

This study compared water quality from four sources—Orai Dam, Bassi Dam, Gosunda Dam, and the Berach Riverby testing odour, turbidity, pH, and hardness to assess their suitability for drinking, household, and agricultural use.

1. **Odour:** The water from the Orai, Bassi, and Gosunda Dams had a slight smell, probably from natural things like algae or dead leaves. This slight odouris usually not harmful. However, the Berach River water smelled very bad, which could be from sewage, waste, or decaying matter. Water that smells badusually means it is dirty and should not be used for drinking or farming without cleaning first.
2. **Turbidity:** All four water samples were cloudy, especially from Orai Dam and the Berach River. This means the water has tiny particles like dirt, clay, or dead plants. Cloudy water is hard to see through, can hide germs, and can block irrigation pipes. So, it should be filtered before using.
3. **pH:** The pH of all water samples was between 7.54 and 8.25, which means the water is neutral to slightly basic. This pH is safe for drinking and farming. None of the water was too acidic or too alkaline.
4. **Total Hardness:** All the water samples were very hard, much higher than the safe limit of 600 ppm. The Berach River had the hardest water, maybe because of minerals or pollution. Very hard water can harm the soil and plants, so it is not good for daily use unless treated.

Based on these findings, the following recommendations are suggested:

For Local Authorities:

- **Regular Monitoring:** Set up a routine water quality testing program, especially for the Berach River, to monitor pollution levels and hardness changes over time.
- **Pollution Control:** Implement stricter regulations to control sewage and industrial waste discharge into the Berach River. Promote wastewater treatment before releasing it into natural water bodies.
- **Public Awareness:** Educate communities about the risks of using untreated river water for drinking or farming and encourage the use of safer water sources or treatment options.

For Farmers:

- **Water Treatment:** Use water softening or filtration methods to reduce hardness before irrigation to protect soil and crops.
- **Alternative Sources:** Whenever possible, use water from dams with lower turbidity and odour for irrigation.

References:-

1. Bureau of Indian Standards. IS 10500: Drinking Water – Specification. New Delhi: BIS; 2012.
2. World Health Organization. Guidelines for Drinking-Water Quality. 4th ed. Geneva: WHO Press; 2017.
3. Sawyer CN, McCarty PL, Parkin GF. Chemistry for Environmental Engineering and Science. 5th ed.
4. New York: McGraw-Hill Education; 2003.American Public Health Association. Standard Methods for the Examination of Water and Wastewater.
   23rd ed. Washington, D.C.: APHA; 2017.SpringerLink
5. Central Pollution Control Board. Water Quality Monitoring Reports. 2019. Available from: https://cpcb.nic.in
6. Rajasthan State Pollution Control Board. Water Quality Status of Major Water Bodies in Rajasthan. 2020. Available from: https://environment.rajasthan.gov.in
7. Ministry of Jal Shakti. Water Quality Assessment Manual. Government of India; 2021. Available from: https://jalshakti-ddws.gov.in
8. Patel R, Shah M. Analysis of physico-chemical parameters of water in different sources. J Environ Stud. 2020;12(3):45–52.
9. Sharma S, Bhattacharya A. Drinking water contamination and treatment techniques. Appl Water Sci. 2017;7(3):1043–1067.
10. Kumar A, Singh M. Assessment of groundwater quality for agricultural use: A case study. Int J Sci Res. 2018;7(4):101–105.
11. Sharma A, Singh R. Analysis of physicochemical parameters of groundwater in Rajasthan. J Environ Res. 2020;12(3):45–52.
12. Google Maps. Orai Dam location. 2025. Available from: https://www.google.com/maps
13. Google Maps. Bassi Dam location. 2025. Available from: https://www.google.com/maps
14. Google Maps. Gosunda Dam location. 2025. Available from: https://www.google.com/maps
15. Google Maps. Berach River location. 2025. Available from: https://www.google.com/maps.