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ASSESSMENT OF PHYSICAL AND CHEMICAL QUALITY OF WATER FROM SOURCE TO CONSUMER LEVEL A CASE STUDY IN PONDI DAM, BABA POND MAIHAR (M.P.) INDIA

D. P. Prajapati
Assistant Professor, Department of Chemistry
Govt. Vivekanand P.G. College Maihar (M.P) India.

ABSTRACT :- Water quality physical chemical parameters in three water sources namely, Pondi Dam and Baba Pond in Maihar (M.P.), were assessed. two samples from each source were drawn, before water treatment, after treatment and at the consumer level. pH, Chloride, Calcium, conductivity total dissolved solids and the degree of total hardness concentration were determined using standard procedures (WHO). World Health Organization (WHO) acceptable limits for drinking water were used as reference. The mean values pH, total hardness, calcium, chloride, conductivity and TDS for PONDI DAM were 6.822, 21.687mg/l, 6.189mg/l, 7.199mg/, 68.211μs/cm and 33.757 respectively. The mean values pH, total hardness, calcium, chloride, conductivity and TDS for Baba Dam were pH 7.897, 54.22mg/l, 8.078mg/l, 9.10gm/l, 87.611μs/cm 99.156mg/l. respectively. The mean values pH, total hardness, calcium, chloride, conductivity respectively. The measured values for all parameters were the WHO guidelines for drinking water. The results showed that there was a significant different in mean values for some physicochemical parameters between water source and status at $p< 0.05$The differences may be due to the effect of water treatment. It is Concluded that the water sources and water status analyzed were polluted based on the analyzed water quality parameters. Therefore, Baba Pond in Maihar, District Maihar (M.P.) India physicochemical parameter values are not the range intended for no domestic use. It is recommended that drinking water sources for domestic use should be not protected from polluted sources

KEYWORDS: Water quality, physical chemical parameters Pondi Dam and Baba Pond, Maihar.

INTRODUCTION:-

Earth is the planet which accommodates 70% of water resources in its total area. Water is the major source for survival and growth of all living organism. The availability of pure water is an indispensable for precluding disease and improving quality of life. Reservoirs are constructed across the rivers in the form of dams, lakes, ponds etc. The reserved water can be reused for industrial practice, irrigation, navigation, domestic water supply, fish culture, recreation, hydroelectricity generation and during water crises. Ponds are used from the immemorial days for the reservoir in India for multipurpose, such as for irrigation, feeder for animals and domestic usage of humans during drought conditions. It plays a major role in aquatic ecosystem even its smaller in size when compare to lakes, dams etc, and comprises of more living organisms such as aquatic animals, birds and making a balanced ecosystem. Aquatic life depends mainly on the quality of water.

Biodiversity is essential for ecological balance and human surveillances in the earth. It is essential to conserve biodiversity, from the manmade activities climate changes, to save the natural resources from destruction, pollutions for our future generations. Enormous usage of resources by human population, industrialization, sewage addition, fertilizers in agriculture and other mam made activities has polluted the natural resource by waste disposal, pesticide or fertilizer accumulation and this becoming contaminated and harmful to the environment. Fresh water need to have special attention to free from contamination and sustainable for the present and future generations. Physio-chemical parameters are the important component in aquatic system to indicate water quality of aquatic ecosystem (Singh & Singh, 2008). Regular assessment of water quality is now become a critical factor for the conservation of aquatic resource and ecosystem. It should be a continuous process with periodic assessment for sustainability for agriculture, industries, aquaculture etc. Pollution in water is measured primarily by assessing the physiochemical parameters of water. The natural source of pollution and their impact on eco-biological environment can be assessed and remedies for polluted water bodies can be governed with physiochemical analysis. To solve the problems in water resources; quality assessment in periodical manner, planning to maintain ecofriendly environment by implementing new government policies, self-addressing of problems and making solution by every individuals can help it. Therefore present study was conducted to evaluate the assessment of water quality Pondi Dam and Baba Pond in Maihar (M.P.) at different interval of time.

REVIEW OF LITERATURE:-

Water is recognized as a fundamental substance that sustains life on Earth (Yu and Boyd, 1994). Water is essential for life; existence is impossible without it, and it constitutes a major component of living organisms, being present in significant quantities in most of them. Physiologically, water is crucial; it plays a vital role in regulating the body temperature of organisms and acts as a solvent in which gases, minerals, organic nutrients, and metabolic wastes dissolve. Water quality refers to the physical, chemical, and microbiological characteristics of water that determine its suitability for use (Boyd and Tucker, 1992). Many of these properties are governed or influenced by substances dissolved or suspended in the water.

Total hardness

Boyd (1990) define hardness as a characteristic of water representing the total concentration of calcium and magnesium expressed as their calcium carbonates equivalent when other polyvalent metal ions are present in a significant level. They are also determined and reported as hardness. The hardness of water was originally defined in term of its ability to precipitate soap. Calcium and Magnesium ions are the principal causes, although, Iron, Aluminium, Manganese, Strontium, Zinc and Hydrogen ions are capable of producing the same effect (Stednick, 1991). Hardness does not affect the sanitary quality but is of importance in domestic use such as laundry, boiler water with high hardness value are referred to as hard while those with low hardness value are soft (Horan, 1991). There are two forms of water hardness as explained here under

Calcium and Magnesium Hardness.

here are two types of hardness in water, permanent and temporary. One is due to calcium ion and the other is due to magnesium ion. Permanent hardness is due to sulphate ions of $Ca2+$ and $Mg2+$ and temporary hardness is due to carbonate ion. $Ca2+$ and $Mg2+$ are identified by the minerals present in it. The hardness caused by calcium sulphate is called calcium hardness and the hardness caused by magnesium is called magnesium hardness.

Therefore total hardness = calcium hardness + magnesium hardness (Hem, 1970).

Carbonate and non-carbonate hardness.

Water hardness is caused by bicarbonate ($HCO3-$) salts of calcium ions ($Ca2+$) as well as common salts of calcium and magnesium ions. Carbonate hardness arises primarily from calcium and magnesium bicarbonates; the hardness caused by these salts can be removed by boiling. According to Gallagher and Miller (1996), calcium and magnesium ions combine with carbonates to produce carbonate hardness. A WHO (2008) report indicates that the acceptability of water hardness levels can vary significantly among different communities, depending on local conditions. In particular, consumers may perceive changes in hardness. The taste threshold for calcium ions ranges between 100 and 300 mg/L, depending on the associated anion, while the threshold for magnesium is likely lower than that for calcium. In some instances, consumers accept water with hardness levels exceeding 300–400 mg/L.

Chloride in water

The chloride ion (Cl^-) is a negatively charged chlorine atom (Cl) (atomic mass: 35.5 g/mol) formed when a chlorine atom gains an electron. Chloride ions are never found in a free state in the environment (Nagpal et al., 2003). They typically occur in the form of salts; common examples include NaCl, KCl, $MgCl_2$, $CaCl_2$, and $AlCl_3$. Chloride compounds are highly soluble in water (for instance, the solubility of NaCl is 35.7 g/100 g of water at 0°C); consequently, they readily dissociate and remain in their ionic forms (such as Na^+ and Cl^-) (Meyer et al., 1999). High concentrations of chloride ions can impart a salty, unpleasant taste to water. Water with high chloride levels may also have a laxative effect on some individuals. Additionally, elevated chloride levels in drinking water can serve as an indicator of potential fecal contamination arising from sources such as human sewage, animal manure, or industrial waste (Roxon and Tom, 2012).

Calcium in water.

Calcium is the fifth most abundant element found in nature, particularly in the Vindhya region—spanning districts such as Satna, Rewa, Sidhi, Maihar,and Katni.. This element is present in all natural water sources (Dixon and Goett, 1994). The primary source of calcium in groundwater is the weathering of rocks such as limestone and dolomite, which occur in the form of calcite and magnesite. Calcium can have beneficial effects on the body; it can inhibit the absorption of heavy metals and is believed to increase bone density and protect against certain types of cancer (Nova Scotia Environment, 2008). However, excessive calcium intake can adversely affect the absorption of other essential minerals from the digestive tract; notably, high calcium levels are a significant factor in the formation of kidney stones (Marke et al., 2003).

Water pH

pH indicates the concentration of hydrogen ions (H+) in water; it is determined by the levels of alkalinity and acidity present. Boyd (1990) proposed the pH scale—ranging from 1 to 14—to measure acidity levels. A low pH indicates acidity, while a high pH indicates alkalinity; a pH of 7 is neutral. Roxann and Scherer (2012) noted that chemicals present in water can influence pH, making it a crucial indicator of chemical changes within the water. Generally, drinking water with a pH between 6.5 and 7.5 is considered acceptable. Acidic water can damage plumbing and taps, particularly when the pH falls below 6. Water with a pH above 7.5 may have a bitter or soda-like taste (WHO, 2008). Water with a pH between 7 and 8.5 requires more chlorine to eliminate pathogens (disease-causing organisms) compared to slightly acidic water (Scherer, 2012). Although pH does not directly affect the consumer, it is one of the most critical operational parameters regarding water quality. Controlling pH at all stages of water treatment is essential to ensure effective purification and disinfection (WHO, 2008).

Total Dissolved Solids (TDS)

The total dissolved solid is a measure of the total amount of all the materials that are dissolved in water. These materials, both natural and anthropogenic (made by humans) are mainly inorganic solids and a minor amount of organic material. Total dissolved solids can vary greatly from a few milligrams per litre to percent levels (tens of thousands of milligrams per litre) depending on the type of water (Ben, 2004). Drinking Water Standards recommend that the total dissolved solids concentrations in drinking water not exceed 500 mg/L, based on taste and aesthetics (Ashim, 1998). The total dissolved solids givean indication of the degree of dissolved substances. Dissolved oxygen (DO) is very crucial for survival of aquatic organisms and it is also used to evaluate the degree of freshness of a river (Fakayode 2005).

Conductivity of water

According to Mark (2006), conductivity is a measure of water's ability to conduct an electric current. Water conductivity is influenced by dissolved inorganic solids, such as chloride, nitrate, sulfate, and phosphate anions, or sodium, magnesium, calcium, iron, and aluminum cations. Temperature also affects conductivity; the higher the water temperature, the higher the conductivity (Bain, 2004). The presence of organic substances—such as oils, phenols, alcohols, and sugars—results in lower conductivity. Significant changes in conductivity can indicate the introduction of a discharge or another source of pollution into the water (APHA, 1992).

MATERIAL AND METHODS

Location of the study

'Pondi Dham' is a spiritual site located in the Maihar district of Madhya Pradesh, India. It is situated near the village of Pondi (also spelled 'Podi') along NH 30

(Katni-Maihar Road). The location lies at approximately 24.2596° North latitude and 80.7584° East longitude. Location details: Village/Area: Pondi; Tehsil/District: Maihar, Madhya Pradesh; PIN Code: 485771. Nearby landmark: Situated on the main Katni Road (NH 30), near Hotel Vrinda. Telephone Code/STD: 07672. Pondi Dam—often referred to locally as Baihar Dam (or Naktara Dam)—is a beautiful lake and reservoir located near Podi village in the Maihar district. Developed as the Pondi Dam, this site is situated just 10 km from the main town of Maihar on the Katni Road and has become a popular, offbeat destination known for its peaceful scenery.

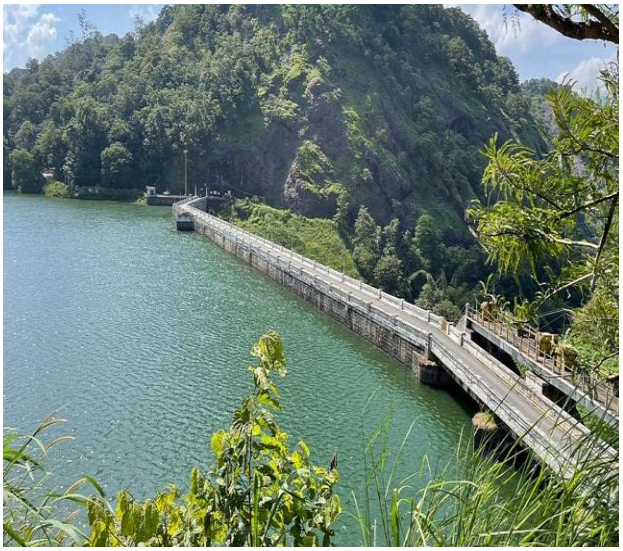

Plate 1: The Pondi Dam Maihar (M.P.) India

Plate 2: The Baba Pond Maihar (M.P.) India

Sample collection.
Water samples were collected from two distinct locations—specifically from the water source and the entry point prior to treatment—and were designated as Sample A and Sample B, respectively. Samples were obtained from Pondi Dam and Baba Dam. Before collection, the water was allowed to flow for 30 to 40 seconds. The collected samples were placed in a bucket containing ice to prevent temperature fluctuations from altering their original state. These chilled samples were immediately transported to the science laboratory at Government P.G. College, Maihar, for the analysis of their physicochemical parameters..

Experimental Design.
A 'Completely Randomized Design' (CRD) was employed. 'Analysis of Variance' was performed for each variable using the MSTAT C program (Freed et al., 1990). Means were separated using the 'Duncan Multiple Range Test' to check for significant differences at $p<0.05$.

Analyses.
The analyses of water samples were conducted using standard method (WHO, *2025-26)*

Measurement of water pH levels
The measurement of pH was done by using a table pH meter in center Laboratory of science at government P.G. College Maihar. The meter was calibrated with standard buffer solutions of pH 4. The electrode was removed from the buffer and rinsed with the sample and after adjustment, the pH was recorded. The electrode was rinsed with distilled water between successive measurements**.**

Measurement of Total hardness of water.
To determine the total hardness of the collected water samples, they were titrated against a 0.01N Ethylenediaminetetraacetic acid (EDTA) solution. Eriochrome Black T was used as the indicator, and the titration was continued until the color changed completely from violet to blue. Approximately 50 ml of the water sample was carefully transferred to a 250 ml conical flask, and 2 ml of buffer solution was added. Subsequently, the Eriochrome Black T indicator was added, and the contents were mixed thoroughly. The mixture was then titrated against the 0.01N EDTA solution until the color shifted entirely from violet to blue. This procedure was repeated three times; the readings were recorded, and the total hardness of the

water samples was calculated using the given formula. The results were recorded in Table 01.

Calculation. Total hardness (Mg/L as $CaCo_3$ =

$$\frac{(T-S) * C * 1000/}{\text{Volume of sample.}}$$

Analysis of calcium.

The calcium content was also determined using the titration method. For this, a 250 ml conical flask was first taken, into which 50 ml of the sample was poured. Then, 5 ml of 8N sodium hydroxide solution and a small amount of 2-hydroxy-1-(2-hydroxy-4-sulfo-1-naphthylazo)-3-naphthoic acid—which acts as a calcium indicator—were added. The sample solution was then titrated against 0.01N EDTA solution until the color changed to blue. This procedure was repeated three times. Finally, the calcium content in the sample solution was calculated using the formula given below and recorded in Table 1.

Calcium hardness (mg/L) =

$$\frac{\text{Volume of EDTA*N* 50* 1000}}{\text{Volume of sample used}}$$

Calcium in water sample =

$$\frac{\text{calcium hardness in mg/L as } CaCO_3 * \text{molecular weight of Ca}}{\text{Molecular weight of } CaCO_3}$$

Analysis of chloride.

The chloride content is also determined using the titration method. For chloride analysis, a 50 ml sample was transferred into a 250 ml conical flask using a pipette, and 1 ml of K2CrO4 solution was added and mixed thoroughly. This solution was titrated against silver nitrate solution until a brownish color appeared. This procedure was repeated three times. Subsequently, the chloride content in the sample solution was calculated using the formula provided below and recorded in Table 1.

$$CL\ (mg/L) = \frac{\text{volume of } AgNO_3 \text{ used *N*35.45* 1000}}{\text{Volume of sample (50ml)}}$$

Conductivity

Conductivity was measured by conductivity meter (digimeter L21) from soil science laboratory, recorded in micro siemens per centimeter (µs/cm).

Total Dissolved Solids

Total Dissolved Solids was measured by colorimeters. Required equipment and materials: multi-parameter colorimeter, sample cuvette, specific reagent for TDS, distilled water (for blank/zero reference), and the water sample. Fill the cuvette with the sample and thoroughly wipe its exterior clean. Place it in the colorimeter, close the lid, and press the "READ" or "TEST" button. Recording the result: the instrument measures light attenuation and automatically converts it into a reading; note down the final TDS value displayed on the screen (in mg/L or ppm) in Table 01.

RESULTS AND DISCUSSION:-

pH level

The average pH value of water from Pondi Dam was found to be between 6.0 and 7.3, placing its quality within the acceptable limits set by the WHO (June 2026 guidelines) and the Bureau of Indian Standards (BIS - IS 10500). In contrast, the average pH value of water from Baba Talab ranged from 8.50 to 10.3; based on the same WHO and BIS standards, this falls outside the acceptable range, rendering the water unfit for drinking. The mean pH values for Pondi Dam and Baba Talab are 6.65 and 9.40, respectively. Statistical analysis indicates a significant difference in the average pH value of Pondi Dam water. According to Fakayode (2005), a pH level close to neutral implies that the water is neutral and free from pollution, aligning with WHO's acceptable limits for drinking water; conversely, water from Baba Talab exceeds WHO standards and is unsuitable for consumption. A significant difference was observed between the average pH values of the two water sources—6.65 and 9.40—across the stages of pre-treatment, post-treatment, and the consumer level. Following treatment, a slight decrease in the pH level of Pondi Dam water was noted, and a minor reduction was also observed at the consumer level. In contrast, the average pH value of water from Baba Talab increased from the source to the consumer level.

Total Hardness

The quantitative assessment of Total Hardness (TH) in the studied water bodies revealed significant variations, reflecting distinct hydro-chemical characteristics. The water samples collected from Pondi Dam exhibited a Total Hardness value of 300 mg/L . According to the Bureau of Indian Standards (BIS: 10500) and the World Health Organization (WHO) guidelines, this value exceeds the desirable limit of 200 mg/L but remains well within the permissible limit of 600 mg/L in the absence of an alternative source From an ecological and domestic standpoint, Pondi Dam water falls under the "hard water" category, which is generally acceptable for community supply but requires routine monitoring to prevent scaling in distribution systems. Conversely, the water quality of Baba Talab demonstrated a critical level of contamination, with a Total Hardness value reaching 700 mg/L. This significantly surpasses the maximum permissible threshold of 600 mg/L established by BIS regulations and the recommended limit of 500 mg/L by the WHO . Water with a hardness level exceeding 700 mg/L is classified as "very hard water" and is deemed highly unsuitable for direct human consumption and domestic activities. The elevated concentration of calcium Magnicium ions in Baba Talab suggests a high rate of mineral leaching, anthropogenic runoff, or extensive evaporation. Prolonged consumption of such hyper-hard water poses potential risks of gastrointestinal distress and encrustation in plumbing infrastructure, thereby necessitating immediate remediation strategies such as Reverse Osmosis (RO) or ion-exchange water softening before any public utilization.

CALCIUM

Pondi Dam results: Titrimetric analysis revealed a calcium hardness level of 80 mg/L (equivalent to 32.04 mg/L of free Ca^{2+} ions). This constitutes 26.6% of the total hardness load, confirming a balanced mineral profile within BIS (IS 10500) and WHO safety limits. Baba Talab results: A high calcium hardness level of 400 mg/L was observed at this site (equivalent to 160.19 mg/L of free Ca^{2+} ions). This represents 57.1% of the total hardness baseline of 700 mg/L. This elevated mineral content approaches the BIS maximum permissible limit of 200 mg/L, indicating significant limestone leaching or the impact of municipal runoff. High calcium levels can cause gastrointestinal distress—such as chronic diarrhea, abdominal cramps, and localized irritation—particularly in unacclimatized populations. There is also a risk of urolithiasis (kidney stones). The resulting scum clogs epidermal pores, strips away natural lipids, and exacerbates conditions like atopic dermatitis (eczema). Furthermore, excessive calcium accumulation on the hair shaft increases porosity, leading to hair calcification, brittleness, and accelerated hair loss.

Table 1: Mean values of water source

PHYSICOCHEMICAL PARAMETERS						
WATER SOURCE	**pH**	**TOTAL.HARDNESS (mg/l)**	**CALCIUM (mg/)**	**CHLORIDE (mg/l)**	**CONDUCTIVITY (µs/cm)**	**TDS (mg/l)**
PONDI DAM	6.650	300	80	8.199	61.211	89.667
BABA POND	9.400	700	400	10	98.611	130.156

Chloride concentration

Neither BS nor WHO has established a limit for the average chloride content in the samples tested. Significant variations were observed in the average levels across water sources; the average chloride concentrations for Pondi Dam and Baba Talab were 8.199 mg/l and 10 mg/l, respectively (Table 1). Differences were also noted in the results; the average chloride levels in water before treatment, after treatment, and at the consumer level were 9.943 mg/l and 8.478 mg/l, respectively (Table 2). Statistical analysis indicated a significant difference at the 0.05 level. Aremu et al. (2011) reported that chloride is one of the most stable constituents in water and that its concentration is largely unaffected by natural physicochemical and biochemical processes.

Table 2: Mean value of water status

PHYSICOCHEMICAL PARAMETERS						
STATUS	**pH**	**TOTAL. H (mg/l)**	**CALCIUM (mg/l)**	**CHLORIDE (mg/l)**	**CONDUCTIVITY (µs/cm)**	**TDS (mg/l)**
Before treatment	6.909	39.00	9.644	9.000	90.097	50156
After treatment	6.848	26.667	6.378	11.000	53.65	30.667
Consumer level	6.839	25.333	6.111	9.433	50.368	30.797

Total dissolved solids (TDS)

The water samples collected from Pondi Dam, TDS (Total Dissolved Solids) levels were within the limits prescribed by the WHO and BIS; however, in samples from Baba Talab, TDS levels exceeded the limits set by the WHO and BIS (500 mg/L and 1200 mg/L, respectively). The average TDS values for Pondi Dam and Baba Talab are 59.757 mg/L and 130.156 mg/L, respectively. Based on the mean differences revealed by the DMR test (Table 3), the average value for Pondi Dam was significantly different. The average TDS values representing the water quality before treatment, after treatment, and at the consumer level are 89.156 mg/L and 130.667 mg/L, respectively. The average TDS value before treatment showed a significant difference at the 0.05 level (Table 3). It was observed that TDS levels consistently decreased from the water source to the consumer level. The WHO (1996) states that water with a TDS level below 600 mg/L is generally considered to have a good taste; at levels exceeding approximately 1000 mg/L, drinking water becomes increasingly unpalatable. High TDS levels can cause excessive scaling in water pipes, heaters, boilers, and household appliances, potentially causing inconvenience to consumers.

Table 3: Separated mean values of physicochemical parameters for water source samples

WATER SOURCE		
PARAMETERS	**PONDI DAM**	**BABA POND**
pH	6.650^{b}	9.650^{a}
TH (mg/l)	300^{b}	700^{a}
CALCIUM	300^{b}	400^{a}
CNDUCTIVITY (µs/cm)	61.211^{b}	100.611^{a}
TDS (mg/l	100.757^{b}	300.156^{a}

Mean superscripted by different lower case letter in the same row are significant different following a separation by Duncan multiple Range Test at P <0.05

Table 4: Separated mean values of physicochemical parameters for water status samples

WATER STATUS			
PARAMETERS	**Before Treatment**	**After Treatment**	**Consumer level**
TH (mg/l)	37.00^{a}	27.667^{b}	24.333^{b}
CALCIUM (mg/l)	8.644^{a}	5.378^{b}	5.111^{b}
CONDUCTIVITY (µs/cm)	92.097^{a}	54.650^{b}	49.368^{b}
TDS (mg/l)	49.156^{a}	32.667^{b}	29.979^{b}

Mean superscripted by different lower case letter in the same row are significant different following a separation by Duncan multiple Range Test at P <0.05

Conductivity

The conductivity levels of the water samples—ranging from the source to the consumer—do not fall within the acceptable standards for drinking and domestic use. The average conductivity values for Pondi Dam and Baba Talab are 61.211 μs/cm and 98.611 μs/cm, respectively. Statistically, the results differed significantly, with higher conductivity values observed for Baba Talab. The average conductivity values of the water before treatment, after treatment, and at the consumer level are 92.0972 μs/cm and 54.560 μs/cm, respectively. For Pondi Dam, the average conductivity values showed a significant difference. The results indicate a decrease in conductivity from the water source to the consumer level.able 5: Mean values of water source and status interaction.

Table No. 05- Physical Chemical Parameters of Pondi Dam and Baba Talab Maihar

Physicochemical parameters							
WATER SOURCE	**STATUS**	**pH Level**	**TH (mg/l)**	**CALCIUM (mg/l)**	**CHLORIDE (mg/l)**	**CONDUCTIVITY (mg/l)**	**TDS (mg/l)**
PONDI DAM	Before treatment	6.757	37.333	10.600	9.16	103.000	**52.000**
	After treatment	6.763	15.667	4.400	7.40	42.500	23.933
	Consumer level	6.797	15.000	4.167	8.03	38.1333	22.337
BABA POND	Before treatment	7.19	53.667	11.767	11.30	130.433	71.800
	After treatment	6.747	41.333	8.033	10.40	86.067	54.733
	Consumer level	6.753	37.667	7.433	8.30	79.333	50.933
	After treatment	7.033	26.000	3.700	7.63	35.383	19.330
	Consumer level	6.967	20.333	3.733	8.967	30.637	16.667

Table 6: **Separated mean values of physico-chemical parameters for water sourcestatus**

PHYSICOCHMEICAL PARAMETERS				
WATER SOURCE	**STATUS**	**pH Level**	**CONDUCTIVITY (μs/cm)**	**TDS (mg/l)**
PONDI DAM	Before treatment	6.757^{c}	42.5^{c}	23.93^{b}
	After treatment	6.763^{c}	38.13^{c}	22.34^{b}
	Consumer level	6.797^{c}	130.4^{a}	71.8^{a}
BABA POND	Before treatment	7.19^{a}	86.07^{b}	54.73^{a}
	After treatment	6.747^{c}	79.33^{b}	50.93^{a}
	Consumer level	6.753^{c}	42.86^{c}	23.67^{b}

Mean superscripted by different lowercase letter in the same Colum are significant different following a separation by Duncan multiple Range Test at 0.05.

CONCLUSION:-

Pondi Dam: The water parameters of Pondi Dam—including a total hardness of 300 mg/L and a calcium content of 24.204 mg/L—fall within the maximum permissible limits set by the Bureau of Indian Standards (BIS: 10500) and the World Health Organization (WHO) From a health perspective, the balanced divalent cation matrix (Ca^{2+} and Mg^{2+}) presents no structural or physiological risks, making the water highly suitable for domestic distribution and drinking after standard filtration. Baba Talab: In contrast, Baba Talab is an aquatic system in a severely degraded state, characterized by hyper-mineralization. Its excessive total hardness of 700 mg/L and very high calcium level of 61.122 mg/L far exceed standard regulatory limits [neptjournal.com, ijmrtjournal.com]. Similarly, its electrical conductivity (EC) is extremely high. Utilizing water from Baba Talab without advanced treatment poses significant operational challenges, such as scale encrustation in plumbing networks and thermal utility systems. More importantly, long-term consumption poses distinct health risks, including gastrointestinal issues, skin irritation, and metabolic susceptibility to urolithiasis (kidney stones) among local consumers. immediate technical measures for Baba Talab: Implement centralized water softening—processing the water through ion-exchange chromatography or a lime-soda softening method is essential. Install Reverse Osmosis (RO) systems. Infrastructure-level prevention: Point-of-entry polyphosphate feed systems or magnetic water conditioners should be installed in the pipelines supplying water from Baba Talab to mitigate severe thermal encrustation and prevent the premature clogging of domestic geysers, boilers, and industrial cooling loops. Management strategies for Pondi Dam: To address aesthetics and prevention, a basic multimedia sand filter or an activated carbon filtration system is recommended to manage physical debris, organic odors, and minor fluctuations in hardness. Environmental regulatory authorities should enforce strict catchment management around Baba Talab to prevent runoff containing agricultural fertilizers, detergents, and municipal wastewater. Local environmental monitoring agencies should establish a bi-monthly or seasonal sampling program for both sites to monitor fluctuations in alkalinity, heavy metals, Biochemical Oxygen Demand (BOD), and microbial indicators. The local health department should conduct public awareness campaigns for communities residing near Baba Talab.

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