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COMPARATIVE ANALYSIS OF PHYSICO-CHEMICAL PARAMETERS IN WATER SAMPLES FROM DHOLAWAD DAM AND MAHI BAJAJ SAGAR DAM

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ABSTRACT

The physicochemical properties of water samples from Mahi Bajaj Sagar Dam and Dholawad Dam are compared in this study. Two dams had water samples taken from the surface and a depth of 10 meters for this reason. The water samples were measured for a variety of physico-chemical parameters, including temperature, pH, oxygen saturation, dissolved oxygen, conductivity, salinity, secchi disc depth, nitrate, nitrite, orto-phosphate, sulfate, chloride, total hardness, calcium, and magnesium. Water clarity and nutrient levels are better at Mahi Bajaj Sagar Dam, but dissolved oxygen levels and pH are somewhat higher in Dholawad Dam. Although there is considerable variation in mineral content and nutrient concentrations, the salinity and conductivity values are comparable in the two dams.

Keywords: Water quality, Parameters, Temperature, Conductivity, Oxygen

I. INTRODUCTION

Because of its effects on ecosystems, human health, and economic activity, water quality is an essential part of environmental health. In order to determine the water's quality, scientists look at a number of physicochemical factors that indicate the body's state. Temperature, turbidity, pH, dissolved oxygen (DO), and nutrient levels are all examples of physical characteristics that make up physico-chemical parameters. Many factors, both natural and man-made, affect the physicochemical characteristics of water. Anthropogenic impacts include things like industrial discharges, agricultural runoff, and urbanization, whereas natural variables include things like geological formations, weather patterns, and biological activity. In order to find pollution sources, evaluate water treatment operations, and plan for water conservation and pollution management, these metrics must be monitored.

One of the most basic physical parameters influencing biological and chemical activities in aquatic habitats is water temperature. The solubility of gases and minerals, the metabolic rates of aquatic life, and the quantities of dissolved oxygen can all be affected by changes in temperature. As an example, hypoxic conditions, which can be harmful to aquatic life, might develop when temperatures rise since oxygen is often less soluble in water. The solubility and availability of nutrients and metals are influenced by the acidity or alkalinity of water, which is measured by its pH. A pH between 6.5 and 8.5 is ideal for the majority of aquatic species. Changes in species composition, reproductive success, and physiological stress in aquatic creatures can result from deviations from this range. Environmental factors that are acidic or

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alkaline can amplify the release of harmful metals such as lead and mercury, which further endangers ecosystems and human health.

The conductivity of water is proportional to the concentration of ions in it, since it is a measure of the liquid's capacity to carry an electric current. An increase in conductivity suggests that there are a lot of dissolved salts in the water, which can be caused by either naturally occurring mineral deposits or human activities such as wastewater discharge and agricultural runoff. Even while some ions are necessary for nutrition, too much of them can have negative impacts on the environment and make it difficult to use water for things like farming, manufacturing, and drinking. Another important factor is salinity, which is the amount of salts in water that have dissolved. While evaporation and human activities like irrigation and industrial discharge tend to keep salinity levels low in freshwater systems, these factors can have an impact. Freshwater creatures, biodiversity, and the amount of water available for farming and human use can all take a hit when salinity levels rise.

Aerobic aquatic creatures cannot survive without dissolved oxygen (DO). Temperature, salinity, air pressure, and organic matter all have a role in determining the levels of DO. Increased microbial activity and oxygen consumption, caused by high organic matter from pollution sources, can lead to hypoxia or anoxia. In order to keep aquatic ecosystems healthy and avoid ecological disasters like fish kills, it is essential to keep DO levels at an adequate level. As a measure of water quality, nutrient concentrations—especially those of nitrogen and phosphorus compounds—are crucial. Agricultural runoff, sewage discharge, and industrial activities are some of the ways that nitrogen can enter water bodies in the form of nitrate ($NO3^{-}$) and nitrite ($NO2^{-}$). Excessive algal growth and oxygen depletion are symptoms of eutrophication, which can occur when these nutrients are present at high proportions. The process can lead to the formation of "dead zones" where aquatic life is unable to thrive. Detergents, fertilizers, and naturally occurring mineral deposits are the sources of phosphates ($PO4^{3-}$), which can also lead to eutrophication.

Total hardness, sulfate ($SO4^{2-}$), and chloride (Cl^{-}) are other significant chemical characteristics. Geological formations or industrial discharges can cause sulfates to be present in natural waterways. While sulfate is necessary in small doses, it can be toxic to aquatic life and make drinking water smell and taste bad if used in large quantities. Aside from affecting the flavor of drinking water and causing osmotic stress on freshwater creatures, chloride can be a byproduct of saltwater intrusion, road de-icing, and industrial processes. The amount of calcium (Ca^{2+}) and magnesium (Mg^{2+}) in water determines its total hardness, which in turn affects the water's acceptability for both residential and commercial use. Although hard water isn't usually dangerous to humans, it can lead to scaling in plumbing and heating systems. The amount of suspended particles, algae, and dissolved organic matter that affect the Secchi disc depth—a measure of water transparency—is significant. Turbid water may be an indication of runoff contamination, erosion, or phytoplankton blooms, whereas clear water usually indicates low amounts of suspended particles and algal biomass. When studying photosynthetic activity and light penetration in aquatic habitats, transparency is a crucial metric to consider.

II. REVIEW OF LITERATURE

Jain, Nidhi et al., (2022) A wide variety of human activities are having a significant influence on the hydrologic cycle, altering the quality of naturally occurring water. Growing pollution is reducing water availability, which in turn poses risks to human and environmental health through toxicity and disease. The purpose of conducting the water quality impact assessment was to identify the ways in which pollution has affected the natural world. One of the most fundamental methods for assessing the state of bodies of water is the water quality examination. Water quality and efficient use of water resources can be better understood with the aid of this research. Parameters of waste water that impact water quality and pose hazards are the primary focus of the investigation. This will provide an interpretation of the Mula Mutha river's status, which will aid the Pune city authorities in identifying pollution sources and improving water quality in the area. For this comparative analysis, we collected data from 2013 to 2018 and produced the water quality index to account for changes that have occurred throughout that time.

Dev, Surya et al., (2015) The goal of this study is to provide a description of the bacteriological analysis and physico-chemical characteristics of drinkable water in Dhankuta municipality, Nepal. The outcomes were contrasted with aquatic quality requirements set by the World Health Organization and the Environmental Protection Agency. Water quality was assessed using a battery of physico-chemical parameters, including pH, alkalinity, TDS, DO, BOD, salinity, turbidity, heavy metals, and anion readings. The paper's discussion chapter explains the results of such an investigation, which showed tolerable to higher values according to WHO recommendations. The fecal and organic contaminants in the drinking water resources were determined by analyzing the water samples for total coliform and fecal coliform levels.

Thambi, Mity et al., (2015) In 2014, before the monsoon season, researchers analyzed the groundwater quality of key town locations in the Thrissur district. Temperature, turbidity, electrical conductivity, total dissolved solids, pH, alkalinity, chloride, salinity, total harness, calcium, magnesium, iron, phosphate, sulphate, dissolved oxygen, biological oxygen demand, chemical oxygen demand, total coliform count, and E. coli were among the physicochemical and biological parameters uncovered. The majority of the physicochemical parameters were found to be above the acceptable range, although they were below the legal limit set by the World Health Organization (WHO) for drinking water. The values of the total coliform bacteria count in the various samples are within the acceptable range. Thrissur town (T), Guruvayoor (G), and Laloor (L) samples all tested positive for E. coli bacteria, according to the study. No E. coli germs were detected in any of the other samples. Groundwater becomes more polluted as a result of human activities such as dumping trash by roadsides, flooding caused by severe rains, and inadequate waste management in public spaces like hospitals, marketplaces, and apartments. They were compared to the desirable limits for drinking water set by the Bureau of Indian Standards (IS: 10500, 1991) and the World Health Organization (WHO), 2006 standards.

Nighojkar, Abhineet & Dohare, Devendra. (2014) One of the most important resources for human survival, water is also one of the most finite. Water pollution is a result of the altered river regimes caused by human activities, which alter the local landscape. The majority of enterprises are disposing of their trash directly into the surrounding stream without treatment, violating the regulations for standards set forth for the same, which is a big problem when it comes to the pollution of surface water. This is happening as a result of fast industrialization for sustainable growth. The available water from various surface sources must be maintained since, despite efforts by organizations like the state pollution control board, the net result shows that pollution is increasing due to the tremendous population growth. At its source and at its confluence, the Khan River is an excellent river. The Khan River receives the vast majority of Indore city's untreated household trash. Farmers run the risk of polluting the food chain when they use river water for vegetable cultivation further downstream. It is just before the Khan River meets the Kshipra that it dries up. However, its water reaches Kshipra during the monsoon season, which impacts the quality of the river water in Ujjain city. This research followed the grab sample principle and was carried out in the middle of the river. Within three hours of sample collection, all samples were sent to the laboratory for analysis in accordance with I.S. 3025.All of the experimental work was completed the day after that. Tests for water quality included measuring pH, EC, TDS, turbidity, DO, BOD, COD, TA, TH, Ca H, Mg H, Na +, K +, Cl-, F-, NO-3, SO 2-4, PO 3-4, SAR, % Na, and boron parameters. At the spot, the temperature, color, and þH were measured.

Patil, P. et al., (2012) Unwanted changes in the physical, chemical, and biological features of the air, water, and soil pose a great threat to the world's population. Water is heavily contaminated with many hazardous chemicals as a result of human activities such as industrialization, fertilizer use, and population growth. Mineral processing, rock weathering, soil leaching, and other natural processes all contribute to water contamination. Humans contract a wide range of water-borne diseases when they drink water that is polluted in some way, thus it's crucial that water quality be monitored on a regular basis. One of the most important factors in illness prevention and general well-being is access to clean water. When testing water quality, it's important to know specifics about many physico-chemical characteristics including temperature, color, acidity, hardness, pH, sulphate, chloride, DO, BOD, COD, and alkalinity. Particularly worrisome are heavy metals like lead, cadmium, iron, mercury, etc., which can cause acute or chronic poisoning in aquatic organisms. There are a few water analysis reports that have been provided for the parameter investigation that explores physic-chemical parameters. In order to compare the value of actual water samples, guidelines for various physicochemical parameters have also been provided.

RESEARCH METHODOLOGY

Data from March 2021 water quality assessments at Dholawad Dam and Mahi Bajaj Sagar

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Dam constituted the basis of the current investigation. Surface and 10-meter depth water samples were obtained for this objective. From the two dams, water samples were taken between 13:15 and 14:45 pm. Fifteen different physicochemical parameters were examined in the water samples that were obtained. A number of parameters were measured during the field sample, including water temperature, pH, dissolved oxygen, oxygen saturation, conductivity, salinity, and secchi disc depth. A pH meter (HANNA, HI 8314) was used to measure the pH and temperature of the water, while a WTW LF330 conductivity meter was used to measure the conductivity. A water quality meter (YSI 85) was used to test salinity, dissolved oxygen, and oxygen saturation, while a secchi disc was used to assess the depth in the field. Using prewashed polyethylene bottles, water samples were taken from each dam for chemical testing. All samples were examined no later than 24 hours following collection. In accordance with the APHA (1998) standard methodology for the assessment of water and wastewater, the following parameters were measured in the laboratory: nitrate, nitrite, orto-phosphate, sulfate, chloride, total hardness, calcium, and magnesium.

III. RESULTS AND DISCUSSION

Table 1: Comparing the Physico-chemical parameters of Dholawad dam and Mahi Bajaj Sagar Dam obtained from analysis of water samples

Physico-chemical parameters	Dholawad dam and		Mahi Bajaj Sagar Dam	
	Surface	10 m	Surface	10 m
Water temperature (°C)	17.86	16.22	17.63	16.50
pH	7.79	7.81	7.58	7.60
Conductivity (µmhos cmG1)	335.00	339.00	342.00	341.00
Salinity (ppt)	0.18	0.18	0.18	0.18
Dissolved oxygen (O2 mg LG1)	9.74	9.29	9.08	8.68
Oxygen saturation (%)	102.78	95.13	95.03	88.68
Nitrate (NO3-N mg LG1)	0.77	0.49	0.43	0.34
Nitrite (NO2-N mg LG1)	0.005	0.003	0.003	0.003

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Orto-Phosphate (PO4-P mg LG1)	0.008	0.009	0.018	0.006
Sulfate (SO4 mg LG1)	43.00	43.00	43.00	43.00
Chloride (ClG mg LG1)	6.26	6.26	6.26	6.26
Total hardness (CaCO3 mg LG1)	156.00	156.00	156.00	156.00
Calcium (Ca+2 mg LG1)	37.69	38.69	34.52	36.52
Magnesium (Mg+2 mg LG1)	15.23	14.64	17.13	15.88
Secchi disc depth (m)	1.88		2.07	

There are some parallels and some variances when looking at the physico-chemical parameters in water samples from Dholawad Dam and Mahi Bajaj Sagar Dam. Water temperatures at both the surface (17.86°C) and 10 meters depth (16.22°C) of Dholawad Dam are somewhat higher than those at Mahi Bajaj Sagar (17.63°C at surface and 16.50°C at 10 meters), while both dams show comparable water temperatures. When comparing Dholawad Dam (7.79 surface, 7.81 at 10m) to Mahi Bajaj Sagar Dam (7.58 surface, 7.60 at 10m), the slightly higher pH levels in Dholawad Dam suggest slightly more alkaline conditions.

Comparing the two dams, Dholawad Dam displays conductivity values of 335 µmhos cm^{-1} at surface and 339 µmhos cm^{-1} at 10 meters, whereas Mahi Bajaj Sagar Dam shows marginally higher values of 342 µmhos cm^{-1} at surface and 341 µmhos cm^{-1} at 10 meters. At all depths tested, the saline levels of the two dams are 0.18 parts per thousand.

The oxygen saturation percentages in Dholawad Dam (102.78% at surface, 95.13% at 10m) and Mahi Bajaj Sagar Dam (95.03% at surface, 88.68% at 10m) are higher, indicating that the former has higher dissolved oxygen (DO) levels than the latter. The surface DO concentrations in Dholawad Dam are 9.74 mg L^{-1} and 9.29 mg L^{-1}, respectively, while those in Mahi Bajaj Sagar Dam are 9.08 mg L^{-1} and 8.68 mg L^{-1}, respectively.

Varying nutrient concentrations are observed; for example, nitrate levels are higher in Dholawad Dam (0.77 mg L^{-1} at surface, 0.49 mg L^{-1} at 10m) and nitrite levels are lower in Mahi Bajaj Sagar Dam (nitrate: 0.43 mg L^{-1} at surface, 0.34 mg L^{-1} at 10m; nitrite: 0.003 mg L^{-1} at both depths). On the other hand, Dholawad Dam has ortho-phosphate levels of 0.008 mg L^{-1} at surface and 0.009 mg L^{-1} at 10m, while Mahi Bajaj Sagar Dam has greater levels at the surface (0.018 mg L^{-1}).

Total hardness (156 mg L^{-1}), chloride (6.26 mg L^{-1}), and sulfate (43 mg L^{-1}) levels are same in both dams. While Dholawad Dam has slightly higher calcium concentrations (37.69 mg L^{-1} at surface, 38.69 mg L^{-1} at 10m) and magnesium concentrations (17.13 mg L^{-1} at surface, 15.88 mg L^{-1} at 10m) than Mahi Bajaj Sagar Dam and Mahi Bajaj Sagar Dam, respectively, Mahi Bajaj Sagar Dam and Dholawad Dam have slightly lower magnesium concentrations and slightly lower calcium concentrations.

Finally, water transparency is measured by the Secchi disc depth, which shows that Mahi Bajaj Sagar Dam (2.07 m) has clearer water than Dholawad Dam (1.88 m). The need for reservoir-specific water management strategies is underscored by this thorough comparison, which reveals differences in water quality metrics between the two dams.

IV. CONCLUSION

Significant variations in water quality, impacted by a wide range of natural and man-made variables, were shown by comparing the physico-chemical parameters of Dholawad Dam with Mahi Bajaj Sagar Dam. The slightly more alkaline pH and greater dissolved oxygen levels in Dholawad Dam imply improved aeration, while the higher amounts of nitrate and nitrite reflect a potentially higher organic load. Water clarity is better and nutrient levels are lower at Mahi Bajaj Sagar Dam, in contrast to its slightly higher conductivity and magnesium content. To ensure the long-term viability and ecological balance of dams, these results highlight the need for tailored monitoring and management approaches to tackle the unique water quality issues faced by each dam. To keep these important bodies of water free of pollution and in good condition, it is necessary to conduct regular assessments and use adaptive management strategies.

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