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Water Quality Study of Water Supply Scheme Case Study-Bhongwali Village

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ABSTRACT: The water sample have been collected from well which is located in Bhongwali village and analyzed for various water quality parameters during dry and monsoon periods. The study was conducted only for Bhongwali village This study involves determination of physical, biological and chemical parameters of subsurface of water at different points. The study was carried out to assess the ground water quality and its suitability for drinking purpose in most rural habitations. For this purpose, 24 water samples collected from well, hand pump, lake of village of study area were analyzed for different physic -chemical parameters such as pH, electrical conductivity, total alkalinity, total hardness, calcium hardness, magnesium hardness, chloride, and total dissolved solids. pH value in the study area was found from 6.3 to 6.8. Total alkalinity between 190 to 980 mg/L. Total hardness ranged from 60 to 200.

KEYWORDS: Portable water, Index, Review, Quality Scale, Water Parameter

I. INTRODUCTION

The purpose of the study is to take advice and guidance on the maturity improvement of request document a project plan to Indian counterpart organization Pune municipal council study conducts on-site survey from professional on technical view on the formulation of water supply project based on information on the potential needs and specific issues about water supply management, facilities improvement and there operation and maintenance in Bhongwali village TQ- Bhore District-Pune Maharashtra state India. The population of bhongwali village is 3500 people. The Area is 2151.00 Hacters. 18.1883°N, 74.0000°E. At the same time, through the consideration for detailed measurement to solve the issues together with Indian water supply officials and staffs, the study contributes to improve the ability of the Indians Central Government to make water supply project plan and water supply policy, as well as to improve water services management.(1)

Water plays a significant role in maintaining the human health and welfare. Clean drinking water is now recognized as a fundamental right of human beings. As a result, around 6–8 million people die each year due to water-related diseases and disasters. Therefore, water quality control is a top-priority policy agenda in many parts of the world in the today world, the water use in household supplies is commonly defined as domestic water. This water is processed to be safely consumed as drinking water and other purposes. Water quality and suitability for use are determined by its taste, odor, colour, and concentration of organic and inorganic matters. Water supply system get water from a variety of locations after appropriate treatment, including groundwater (aquifers), surface water (lakes and Dam). The water treatment steps are included, in most cases, purification, and disinfection through chlorination. Treated water then either flows by gravity or is pumped to reservoirs, which can be elevated such as water tower or on the groundwater quality is also dependent of the quality and level of pollution of water source. The water quality evaluation may be complicated practice in compound parameters causing numerous anxieties in general quality of water. It not easy to assess water quality for huge sample containing concentration for many parameters. The advantage of number of water quality indices developed is they give efficiently the overall water quality of a specific area. Water is perhaps the most precious natural resource after air. Though the surface of the earth is mostly consisting of water, only a small part of it is usable, which makes this resource very limited. This precious and limited resource, therefore, must be used with prudence. As water is required for different purposes, the suitability of it must be checked before use. Also, sources of water must be monitored regularly to determine whether they are in sound health or not. Poor condition of water bodies are not only the indicator of environmental degradation, it is also a threat to the ecosystem. In industries, improper quality of water may cause hazards and severe economic loss. Thus, the quality of water is very important in both environmental and economic aspects. Thus, water quality analysis is essential for using it in any purpose(2)



Fig. Bhongwall Village

II. LITURATURE REVIEW

The extensive literature review was carried out by referring standard journals, reference books and conference proceedings.

K.C.Khare et.al [10] he was done water quality assessment of Katraj Lake, pune. He was done water analysis for the parameters like pH, DO, BOD, COD, TDS, Calcium, Magnesium and Hardness for lake water. The analysis of Water quality indicates the temperature in the range of 240 C.The pH was 7.3 to 8.45.It shows slightly alkaline water. The DO varied from 4.8 to 5.7 mg/l.The total hardness ranged from 160 to 298 mg/l which is higher than permissible limit. The turbidity of water was 28 to 42 NTU which is higher as per the APHA limit.(3)

V. Pradhan, M. Mohsin, B. H. Gaikwad have studied, water quality of Chilika Lake was determined during the month of January 2012. It was observed that all the parameters are above permissible limit except at the sample site S2. The results are discussed in the light of findings of other workers.(4)

S. Chandra, A. Singh and P. K. Tomar have described, lake water is a source of drinking and domestic use water for rural and urban population of India. The main goal of the present study was to assess drinking water quality of various lakes i.e., Porur lake Chennai, Hussain Sager Hyderabad Vihar Lake Mumbai in India. For this, lakes water samples were collected from six different sites and composite sample prepared were analyzed for pH, turbidity, 1. Kate S, Kumbhar S, Jamale P. Water quality analysis of Urun-Islampur City, Maharashtra, India. Appl Water Sci [Internet]. 2020;10(4):1–8. Available from: <https://doi.org/10.1007/s13201-020-1178-3>

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electrical conductivity (EC), total dissolved solids (TDS), total alkalinity (TA), total hardness (TH)and calcium hardness (Ca-H), chemical oxygen demand (COD), biochemical oxygen demand (BOD), dissolved oxygen (D.O.)

Shimaa M. Ghoraba et.al [08] collected 120 groundwater samples from 29 Districts of Balochistan, Pakistan. The various parameters are selected for the testing of samples. All samples were analyzed for pH, Calcium, Carbonate, Magnesium, Sodium, Potassium, Chlorides, Sulphate and Nitrate, TDS, and bicarbonate. The results revealed highly variable hydrochemistry. The chloride is found to be most predominating.

III. PROPOSED WORK/SYSTEM

Material and Methodology:

The water samples were collected from the Bhongwali village Pune region samples were from well, lake, tap, and bore well, in Feb 2022. The collected water samples were stored in a clean bottle for analysis. The tests for BOD and DO were conducted on the same day of collection. The pH was determined using the pH meter. The oxygen content was measured by Wrinkler's method. All the other parameters were found using APHA.

pH

pH is one of the most important parameters of water quality. It is defined as the negative logarithm of the hydrogen ion concentration. It is a dimensionless number indicating the strength of an acidic or a basic solution. Actually, the pH of water is a measure of how acidic/basic water is. Acidic water contains extra hydrogen ions (H^+) and basic water contains extra hydroxyl (OH^-) ions. The pH ranges from 0 to 14, with 7 being neutral. The pH of less than 7 indicates acidity, whereas a pH of greater than 7 indicates a base solution. Pure water is neutral, with a pH close to 7.0 at 25°C. Normal rainfall has a pH of approximately 5.6 (slightly acidic) owing to atmospheric carbon dioxide gas. Safe ranges of pH for drinking water are from 6.5 to 8.5 for domestic use and living organisms' needs.

Turbidity

Turbidity is the cloudiness of water. It is a measure of the ability of light to pass through water. It is caused by suspended material such as clay, silt, organic material, plankton, and other particulate materials in water.

Turbidity in drinking water is aesthetically unacceptable, which makes the water look unappetizing. The impact of turbidity can be summarized in the following points:

1. It can increase the cost of water treatment for various uses
2. The particulates can provide hiding places for harmful microorganisms and thereby shield them from the disinfection process. Suspended materials can clog or damage fish gills, decreasing its resistance to diseases, reducing its growth rates, affecting egg and larval maturing, and affecting the efficiency of fish catching method
3. Suspended particles provide adsorption media for heavy metals such as mercury, chromium, lead, cadmium, and many hazardous organic pollutants such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and many pesticides
4. The amount of available food is reduced because higher turbidity raises water temperatures because suspended particles absorb more solar heat. Consequently, the concentration of dissolved oxygen (DO) can be decreased since warm water carries less dissolved oxygen than cold water.

Turbidity is measured by an instrument called a nephelometric turbidimeter, which expresses turbidity in terms of NTU or TU. A TU is equivalent to 1 mg/L of silica in suspension

Turbidity of more than 5 NTU can be visible to the average person while turbidity in muddy water, exceeds 100 NTU. Groundwater normally has very low turbidity because of the natural filtration that occurs as the water penetrates through the soil

Total Dissolved Solids

Solids occur in water either in solution or in suspension. These two types of solids can be identified by using a glass fiber filter that the water sample passes through. By definition, the suspended solids are retained on the top of the filter and the dissolved solids pass through the filter with the water

If the filtered portion of the water sample is placed in a small dish and then evaporated, the solids as a residue. This material is usually called total dissolved solids or TDS

Total solid(TS)=Total dissolved solids (TDS)+Total suspended solid(TSS)Total solidTS=Total dissolved solidTDS+Total suspended solidTSSE2

Water can be classified by the amount of TDS per liter as follows:

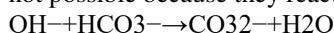
- freshwater: <1500 mg/L TDS;

- brackish water: 1500–5000 mg/L TDS;
- saline water: >5000 mg/L TDS.

The residue of TSS and TDS after heating to dryness for a defined period and at a specific temperature is defined as fixed solids. Volatile solids are those solids lost on ignition (heating to 550°C).

Alkalinity

The alkalinity of water is its acid-neutralizing capacity comprised of the total of all titratable bases [10]. The measurement of the alkalinity of water is necessary to determine the amount of lime and soda needed for water softening (e.g., for corrosion control in conditioning the boiler feed water) [22]. The alkalinity of water is mainly caused by the presence of hydroxide ions (OH^-), bicarbonate ions (HCO_3^-), and carbonate ions (CO_3^{2-}), or a mixture of two of these ions in water. As stated in the following equation, the possibility of OH^- and HCO_3^- ions together are not possible because they react together to produce CO_3^{2-} ions:



Alkalinity is determined by titration with a standard acid solution (H_2SO_4 of 0.02 N) using selective indicators (methyl orange or phenolphthalein).

The high levels of either acidity or alkalinity in water may be an indication of industrial or chemical pollution. Alkalinity or acidity can also occur from natural sources such as volcanoes. The acidity and alkalinity in natural waters provide a buffering action that protects fish and other aquatic organisms from sudden changes in pH. For instance, if an acidic chemical has somehow contaminated a lake that had natural alkalinity, a neutralization reaction occurs between the acid and alkaline substances; the pH of the lake water remains unchanged. For the protection of aquatic life, the buffering capacity should be at least 20 mg/L as calcium carbonate.

Biochemical oxygen demand (BOD)

Bacteria and other microorganisms use organic substances for food. As they metabolize organic material, they consume oxygen. The organics are broken down into simpler compounds, such as CO_2 and H_2O , and the microbes use the energy released for growth and reproduction.

When this process occurs in water, the oxygen is consumed in the DO in the water. If oxygen is not continuously replaced by natural or artificial means in the water, the DO concentration will reduce as the microbes decompose the organic materials. This need for oxygen is called the biochemical oxygen demand (BOD). The more organic material there is in the water, the higher the BOD used by the microbes will be. BOD is used as a measure of the power of sewage; strong sewage has a high BOD and weak sewage has a low BOD.

The complete decomposition of organic material by microorganisms takes time, usually 20 d or more under ordinary circumstances. The quantity of oxygen used in a specified volume of water to fully decompose or stabilize all biodegradable organic substances is called the ultimate BOD or BOD_L .

BOD is a function of time. At time = 0, no oxygen will have been consumed and the $\text{BOD} = 0$. As each day goes by, oxygen is used by the microbes, and the BOD increases. Ultimately, the BOD_L is reached and the organic materials are completely decomposed.

$$\text{BOD}_t = \text{BOD}_L \times (1 - 10^{-kt})$$

where BOD_t = BOD at any time t , mg/L; BOD_L = ultimate BOD, mg/L; k = a constant representing the rate of the BOD reaction; t = time, d.

The value of the constant rate k depends on the temperature, the type of organic materials, and the type of microbes exerting the BOD.

Chemical oxygen demand (COD)

The chemical oxygen demand (COD) is a parameter that measures all organics: the biodegradable and the non-biodegradable substances. It is a chemical test using strong oxidizing chemicals (potassium dichromate), sulfuric acid, and heat, and the result can be available in just 2 h. COD values are always higher than BOD values for the same sample.

Exemplar based Inpainting technique is used for inpainting of text regions, which takes structure synthesis and texturesynthesis together. The inpainting is done in such a manner, that it fills the damagedregion or holes in an image, with surrounding colour and texture. The algorithm isbased on patch-based filling procedure. First find target region using mask image and then find boundary of target region. For all the boundary points it defined patch andfind the priority of these patches. It starts filling the target region from the highestpriority patch by finding the best match patch. Thisprocedure is repeated until entire target region is inpainted.

IV. RESULT AND DISCUSSIONS

The water sample is collected from the lake, 2 wells, 3 Handpumps, 3 water samples taken from the elevated storage tank, and 3-3 Water samples is taken in between themid-point of the location inthe village of Bhongwali were tested for pH, Turbidity, conductivity, TDS, Chloride, and Hardness. The result shows that the water quality is good in a village, but the water distribution system is too old so the water quality may be affected.

Table 1 shows the inclusive result of the water sample. From the result, it was observed that pH, turbidity, conductivity, TDS, Chloride, and Hardness as per between the permissible limit.

Description	pH	Turbidity	TDS	Chloride	Hardness	Conductivity (μMho/cm)	Alkalinity
Permissible Limit	6.5-8.5	5	500mg/l	250mg/l	300mg/l	750	500mg/l
River	7.1	0.9	220	5	60	0.681	34
Well 1	7.3	1.3	405	20.50	590	0.591	62
Well 2	7.2	1.5	409	22.30	580	0.52	68
Hand Pump 1	7.0	0.9	415	23.5	580	0.74	72
Hand Pump 2	6.9	1.1	428	22.5	582	0.73	74
Hand Pump 3	6.8	1.4	440	21.5	590	0.75	75
ESR 1	7.2	0.6	455	24.3	405	0.58	61
ESR 2	7.2	0.9	456	25.2	409	0.58	65
ESR 3	7.2	0.7	458	25.3	418	0.58	64
Sample 10	7.4	0.5	470	26.2	415	0.60	67
Sample 11	7.4	0.6	485	28.2	425	0.62	66
Sample 12	7.6	0.8	499	27.1	432	0.63	64
Sample 13	7.8	1.1	510	27.6	444	0.65	63
Sample 14	7.5	0.7	513	25.4	456	0.65	61
Sample 15	7.6	0.5	525	26.2	462	0.67	60
Sample 16	7.9	0.8	540	25.3	467	0.69	62
Sample 17	7.7	0.9	560	28.4	480	0.71	63
Sample 18	8.0	1.2	573	29.1	485	0.73	64



V. CONCLUSION

The lake water is of course not advisable for drinking as well as for washing or any other purposes. One of the reasons affecting the quality of water in bhongwali Lake is that the wastewater and industrial effluents are discharged untreated directly into the river. which ends up in the Bhagwati Lake, which thus pollutes the water body. The values of the parameters apply to changes, according to the time of collection, because the water in bhongwali Lake is always flowing thus giving new samples every time. From the values, interestingly corporation water seems very good for drinking and other human use. The borewell of the Thevara region, from the values of the parameters, is comparable to Lake water. The well water seemed a bit advisable though never will be recommended.

The purpose of this project is to better understand the environmental impacts of our actions on the local streams and rivers, the scientific studies of water quality, and the understanding are to make the significance of the results. Water analysis and monitoring are very important aspects of water conservation and protection. Water is a vital resource that runs more quickly over time. To ensure a continued supply of safe, clean drinking water, we must work together as a community to protect and to this vital resource.

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