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Study of Water Pollution in Teen Talav, Ashish Talav and Wamanwadi Well in Chembur, South Mumbai Region of Mumbai District

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ABSTRACT

Chembur is the south Mumbai region of Mumbai district of the Maharashtra state of India. In this area big industries like RCF, BPCL, HPLC, and Aegis are located. In addition to this many leather processing, steel processing, food processing and small textile industries are well established in this area. There are many lakes and Wells. The drain water coming from this industry directly discharges to the lakes as well as it enters in well through soil percolation. Water of these sources normally uses for laundry and cleaning purposes, therefore it is necessary to measure the water quality of this source. In the said research project physical parameter like pH, Color, Odor, Turbidity and Chemical parameters like acidity/alkalinity hardness COD, BOD and TDS were studied and the result obtained compared with critical limits.

Keywords: Water Pollution, BOD, COD, TDS, TS, pH.

INTRODUCTION

Water is the most wonderful gift to human kind. As per the Indian Philosophy one of the five fundamental constituents in the universe are the Panchmahabhutas-Air, Sky, Sun, Water and the Earth.

The most essential thing for the existence of any life in any of the form is Water. The use of water by plants, animals and human is universal. The most necessary component for the living being is Water. Life on the earth is not possible without water. For many purposes water is used e.g., Propagation of fish, Industries, Irrigation, Drinking, and other aquatic systems and setting up the hydro-thermal power plants. Water is the main source of energy and the earth surface is covered by 71% of water nearly, the world's water in sea is 96.5% which is salty which is not used for Drinking, Irrigation, and Industrial purposes and Domestic. Less than 1% water is present in ponds, lakes, rivers, dams, etc., which we use for Industrial, Domestic and Agricultural purposes. Every living soul requires water for its survival, good essential requirement of life, health and sanitation [1]. Without food man can live for nearly about two months but he can hardly survive for three to four days without water. The major cause for disaster is monsoon [2]

In the ecosystem the most important component for the life is water but day by day the quality of water is degrading. The factors which are responsible for deterioration of water bodies such as industrialization, increased in the human population, excess use of chemicals & fertilizers in the agriculture and other Man-made activities etc [1]. Contaminated water is responsible for many of the diseases in human being. Water born disease are causing infections during washing, bathing and consumption of contaminated water while preparation of Food. To check the quality of water at regular time of interval is necessary because the financial losses are due to the water born diseases which are having negative impact on the nation.

The surface water is majorly responsible for maintaining ground water level and fresh water resources in the planet. But now a day, due to over exploitation of surface water, improper waste disposal and erratic nature of rainy season, there has been depletion of surface water quality level across the world. The utility of water is limited by its quality, which may make it unsuitable for a particular purpose. Therefore, assessment of surface water quality is an important aspect of water evaluation and the standard of living of the people [1]. Due to the geologic factors leading to chemical contamination like excess fluoride, arsenic, iron, salinity, nitrate, etc. and anthropogenic factors resulting in bacteriological contamination, pose serious public health problems surrounding to the area of pond water systems [3-6].

MATERIALS AND METHODS

Methodology: Water samples are collected from particular selected site (five samples at each site), samples were placed in the sterile glass bottles with a rubber cork for microbiological examination and remaining in a polythene bottle for chemical examination [2]. Collected Samples were immediately transported to the laboratory and in a refrigerator were stored at 15°C for microbiological analysis and at room temperature for chemical analysis [7]. The collected samples were subjected to chemical and microbiological examination. Water samples were analyzed with respect to the parameters like pH Color, Odor, Turbidity and chemical parameters like acidity/alkalinity, hardness, COD, BOD and TDS.

Physicochemical analysis of water

Procedure for water analysis: Following parameters were used for physicochemical analysis of water [6, 7]

Color: For drinking water, the test is carried out by comparison with known standards. The change in color of water is due to the present substance such as a soil particle, fine colloids and industrial effluents etc.

Odor: Due to the presence of decaying material, microscopic organisms, dissolved gases like ammonia, organic matter, and many agents are present in water which gives different odors and can be defect simply with nose with this we can have different types of odor like septic, fishy, earthy, milky grassy, etc.

Total Solids (TS): After the evaporation of unfiltered water sample, from the residue left, Total Solids was determined [8]. A suitable size and weight of evaporating dish is to be taken. On water bath or hot plate put 50-100 mL unfiltered water sample and shake well. In an oven at 105°C dry for some time after evaporating. Finally, in desiccators cool it and note down the final weight.

Total Dissolved Solids (TDS): The toxicity in TDS is caused due to increases in salinity, changes in the ionic composition of the water and toxicity of individual ions [1]. Increases in the salinity have been shown to cause shifts in biotic communities, limit biodiversity, exclude less-tolerant species and cause a chronic effect at specific life stages. Total dissolved solids denote in Water there are many kinds of minerals present [3]. After the evaporation of the filtered sample the left residue can be determined.

Total hardness: Water sample (100 mL) was placed in a conical flask, add two drops of Eriochrome-T indicator into it. And add a drop of buffer-9 (i.e. amino chloride and amino sulphate). Titrate the solution against N/50 EDTA. End point from wine red to sky blue.

Calcium hardness: Water sample (100 mL) was placed in a conical flask, add two drops of mureoxide indicator. Add a drop of Buffer–12 (NaOH) The resulting solution was then titrated against N/50 EDTA solution which was filled in burette solution.

Magnesium hardness: Deduced by obtaining the difference between the values of total hardness and calcium hardness of each water sample.

Procedure: A suitable size and weight of evaporating dish is to be taken. Through what man filter paper. Filter the sample, take care that the no turbidity should be present in the filtrate. On hot plate or water bath evaporate the clear filtrate in the evaporating dish. Heat it at 103°C for 10 min after evaporating in an oven then cool it in desiccators and note down the final weight.

Total Suspended Solids (TSS): Suspended solids provide the adsorption surfaces and a route of transmission for many organic contaminants, heavy metals, and some other nutrients. The greater the amount of total suspended solids higher the turbidity, thus suspended solids are having relation with the clearness of water [3]. The difference between total solids and Total Dissolved Solids to determine the TSS

$$\text{TSS mg lit}^{-1} = \text{TS–TDS}$$

Dissolved oxygen (DO): The presence of dissolved oxygen is required to prevent odor and is used by the aquatic plants and in the other life forms [8]. Higher the rate of decomposition of organic matter and limited flow of water leads to consumption of O_2 from the water [3].

Requirement: Sodium Thiosulphate (0.025 N) $Na_2S_2O_3$, (Manganese Sulphate Solution) $MnSO_4$
Alkaline potassium iodine solution (KI), Starch Solution and Conc. H_2SO_4

Procedure: In BOD bottle of 300 mL carefully collected the sample. Two reagents one MnO_4 add 2 mL and alkaline KI add 2 mL solution by using 2 different pipettes of two reagents, then a precipitate will appear. First place a stopper and then shake the contents well allow the bottle to settle down the precipitate. After adding 2 mL of Conc. H_2SO_4 we will obtain a clear solution. Then pipette out 5 mL from BOD bottle and place in conical flask and using starch indicator titrate it against sodium thiosulphate, dark blue to colorless will be the end point.

pH: The average pH of the two lakes ranged from 6.9-8.5. It is indicating that the alkalinity is throughout the study period. Due to high pH levels they impart a bitter taste to the water. Due to high degree of mineralization associated with alkaline water it will result in the encrustation of water pipes and water-using appliances. The combination of high alkalinity with low pH levels it is less corrosive than water rather than combination of high pH with low alkalinity content. High pH levels also depress the effectiveness of disinfection by chlorination, thereby requiring the use of additional chlorine or longer contact times [3].

Standardization of pH meter: In a 100 cm^3 beaker take 3 standard buffer solution having pH-4.0, On the pH position Set 'pH – mV' knob. Set the temperature control knob at temperature of buffer solution. The slope knob is such to be adjusted so that the display reads pH = 4.0.

Determination of pH of Water: Water sample of 25 cm^3 is to be taken. In the solution dip the pH meter. Measure the pH of solution.

Electrical Conductivity: Conductivity of water depends upon the concentration of ions and its nutrient status and variation in dissolve solid content [1]. Seasonal variation in the conductivity is mostly due to increased concentration of salt because of evaporation. By sing conductivity meter measure the water sample [3].

Standardization of Conductivity meter: Keep the 'standard conductance' switch at down position and set the range 2 mm position. Until the digital display reads 1.000 keep adjusting the knob

Determination of the conductance of water sample: Take 25 cm^3 of water sample. In the water sample dip conductivity cell. Measure the conductance.

Chlorides: Chloride is widely distributed in nature in the form of salts of sodium, potassium and calcium [3]. The status of chloride in the lake water is indicative of pollution, especially of animal origin. In conical flask collect 50 mL water sample and add 2 mL of 5% K_2CrO_4 solution as an indicator and titrate it against 0.02 N $AgNO_3$ till the color change appear from yellow to brick red.

Determination of Total Hardness of Water: Due to the magnesium and calcium ions present in water hardness is caused [8]. Polyvalent ions of some other metals like aluminum, iron, strontium, magnesium and zinc can also precipitate soap which leads to hardness. However, in natural waters the concentration of these ions is very low. So hardness is generally measured as concentration of only calcium as calcium carbonate and magnesium, higher the quantities over other hardness producing ions. Thus, titrating the sample of hard water against standard EDTA solution also by maintaining proper pH the hardness is calculated.

Hardness of water is not a specific constituent but it is a variable and complex mixture of cations and anions. It is caused by dissolved polyvalent-metallic ions. Hardness is high due to regular addition of large quantities of sewages and detergents into the lakes from the nearby residential localities [3].

Standardization of EDTA Solution: In 250 cm^3 conical flask pipette out 25 cm^3 of the 0.01 M calcium ion ($CaCl_2$) solution and dilute it with about 25 cm^3 of distilled water, 4-6 drops of Eriochrome Black–T indicator and add 2 cm^3 buffer (pH =10). Titrate with the standard 0.01 M EDTA solution the color will change from wine red to sky blue. At the equivalence point No tinge of reddish blue should remain. Titrate carefully near the end point. Take two more readings and find out constant burette reading.

Determination of hardness of water: In a 250 cm^3 conical flask take 25 cm^3 of water sample.

1. Add 2 cm^3 of buffer solution to it. Add 4-6 drops of Eriochrome Black – T indicator, the solution turns wine red. Titrate the contents against the standard solution of 0.01 M EDTA solution. End point color is change from wine red to sky blue. Three more readings were taken to get the constant burette reading.

Calcium: In 100 mL of ammonium acetate extract add 2 mL water sample. For intermittent mixing the solution was kept for one hour, using Murexide indicator and 5 mL of 1.0 N NaOH were titrated against 0.01M EDTA until the color changes from pink to purple color. The volume of EDTA required was noted and calculated the amount of calcium [8].

Magnesium: 20 mL of water sample and 2 mL ammonia buffer and 100 mg Eriochrome Black T indicator added in conical flask and shake the flask for two minutes. Titrate the solution against 0.01M EDTA solution the color changes from red to blue. The volume of EDTA required is noted. Calculated the amount of magnesium [8]

COD: Determining the amount of oxygen required for chemical oxidation of organic and inorganic matter [3]. In flat bottom Flask place 20 mL of diluted sample and add 10 mL of dichromate solution.

Then slowly add 30 mL H_2SO_4**.** After each addition mix thoroughly and add about 10 mg $MgSO_4$ crystals. To fridrich condenser attach the flask and reflux excess of dichromate with standard ferrous ammonium sulphate using ferroin indicator. The color changes are from bluish green to wine red [**8, 9**].

BOD: It is a test for measuring the amount of biodegradable organic material present in a sample of water. BOD is an important factor of organic pollution to measure the amount of DO required by microbial community in decomposing the organic matter present in a water sample by aerobic biochemical action [**3**]. Wrinkling method was used for Biological Oxygen Demand (BOD) [**8**].

Take 25 mL of water sample in BOD bottle. Fill it with dilution water. Incubate it for 5 days at 20°C and after 5 days remove the BOD bottle from incubator and add 2.2 mL of manganese sulphate, alkaline iodide azide and add 1mL of conc.H_2SO_4. Take the flask and titrate it against 0.05N sodium thiosulphate solution.

Turbidometry: During rainy season silt, clay and other suspended particles are responsible for the turbidity values, while during winter and summer seasons settlement of silt, clay shows low turbidity [**8**]. During rainy season silt, clay and other suspended particles contribute to the turbidity values, while during winter and summer seasons settlement of silt, clay results low turbidity [**3**].

Stock turbidity suspension: Weigh 1 g hydrazine sulphate and dissolve it in water and dilute up to 100 mL using distilled water. Weigh 10 g hexamethylene telramine and dissolved in distilled water and dilute up to 100 mL. Add 5 mL hydrazine sulphate solution with 5 mL hexamethylene tetramine solution in 1:1, and allow to standing for 24 h at room temp and dilute up to 100 mL using D/W. then this solution will have turbidity of 400 NTU.

1.

Procedure: Preparation of calibration curve, Different concentration solution of 400 NTU was prepared as shown in the table. by using distilled water as a blank solution zero turbidance is adjusted and for higher concentration solution 100 was adjusted. For each solution of different concentration, the turbidity is measured. Graph of observed NTU Vs mL of 400 NTU solution added is plotted and found the turbidity of unknown solution.

RESULTS AND DISCUSSION

Performing the above experiment it is found that, the turbidity of given water sample is negligible.
The collected experimental data were compared with world global water pollution data. The data is collected, properly complied, classified and compared and presented in a systematic manner in the form of table 1 and 2. For this reason, analysis and comparison, observation of data and physico–chemical analysis methods are required

Table 1. Observation Table

S.No.	MI of 400 NTU Solution	Final volume in mL	NTU Calculated	NTU Observed
1	25	50	200	212
2	18.75	50	150	171.1
3	12.5	50	100	123.4
4	4.25	50	50	42.7
5	2.5	50	20	23.8
6	Teen Talav*	50	-	0.3
7	Ashish Talav*	50	-	0.4

*Average analysis of Five Samples

Table 2. Physico-chemical parameter at selected areas*

Parameter	Teen Talav (ppm)	Ashish talav (ppm)	Waman Well (ppm)	Critical Limits (ppm)
pH	6.9	7.2	6.7	6.5-8.4
Conductivity	990	860	776	250-750
Alkalinity	383	505	374	200
Turbidity	22	25	15	5-55
Total Hardness	1010	840	730	300
COD	500	592	601	156-400
BOD	258	259	263	80-250
Chloride	490	505	414	250
Nitrate	190	200	98	45

*Average analysis of five samples

By comparison of all these experimental results with standard, it has been observed that water in Talav and Waman Wadi well is highly polluted and it is not suitable for drinking purposes.

APPLICATION

Present study provides the detailed physico-chemical parameters of Teen Talav, Ashish Talav and Waman Wadi Well. Above findings can be useful for the local communities to get idea about water quality of the water reservoirs in their premises.

CONCLUSION

From the Results obtained it has been concluded that the turbidity of given water sample is negligible as well as pH of the water is in normal range. Conductivity, Alkalinity, Total Hardness, COD, BOD, Chloride and Nitrate Content of water samples are above critical limits. The experimental data is collected and compared with critical limits fixed by Maharashtra Pollution Control Board. Hence, Finding of the present research project suggest Water Quality in the resources Teen Talav, Ashish Talav and Waman Wadi Well are not fit for domestic as well as industrial purposes.

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