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STUDY OF PHYSICO-CHEMICAL PARAMETERS IN UNDERGROUND WATER OF RURAL AREAS OF PUNE DISTRICT OF MAHARASHTRA

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ABSTRACT

The present work is aimed at assessing various quality parameters of underground water specially from rural areas of pune district. This has been determined by collecting groundwater samples and subjecting the samples to a comprehensive physicochemical analysis. The collected samples were studied for the temperature, pH, Conductivity, Alkalinity, Dissolved Oxygen, Hardness, TDS, Chloride Contents and sulphate contents. The results of analyses have been used to suggest models for predicting water quality. The analysis reveals that the groundwater of the area needs some degree of treatment before consumption, and it also needs to be protected from the perils of contamination.

Keywords: Underground water, potability, TDS, Water Quality

INTRODUCTION

Water samples has been collected especially into sterile containers at four designated points within the Pune District viz. Junnar taluka and Otur Campus. The water samples were immediately subjected to both chemical and microbiological analysis in order to evaluate the quality of potable water in circulation within the city and identify its sources of contamination. Levels of iron, calcium and magnesium detectable in the circulating drinking water. This explains the high incidence of water-borne diseases such

as Dysentry, Diarrhea and Typhoid fever within the rural and urban population. Meanwhile, other microorganisms detected were *E. coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, yeasts and moulds. The pH of potable water in circulation falls within recommended limit **[1]**.

There is the need for adequate changes to be made at points where water distribution systems integrity appeared compromised. The rural and urban community is decide to boil water before drinking in order to avoid consumption of unwholesome biological agents in the water distribution networks. The objective of present investigation work is the study on potablity of drinking water in urban and rural area of Pune to study status of the water supply system in selected grampanchyats in Maharashtra this ultimately improves the metabolic activity or immunity the humans and animal immunity **[2]**.

Literature survey reveals that evaluation of such kind of study is usually done by studying various physico-chemical parameters in drinking water. Physico-chemical parameters such as pH, EC, TDS, Hardness, Salinity, Alkalinity, SO4−2, Cl−1, NO3−,PO4−3, Na, K, Li, Ca, Mg, Ba, Cu, Fe, Mn, Ni, and Zn are determined. In the study, statistical techniques PCA and CA are used to measure variations in water quality. The understudy samples showed significantly higher values of TDS and EC than WHO permissible limits which may greatly influence the health conditions of the residents of this area. Access to safe drinking water and sanitation is essential for both individual and population health as well as for quality of life and dignity. Indeed, improvement in water supply, sanitation, and hygiene has shown substantial influence on reduced water borne diseases such as diarrhea. Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids, and gases from water. The goal is to produce water fit for specific purposes. Most water is purified and disinfected for human consumption (drinking water), but water purification may also be carried out for a variety of other purposes, including medical, pharmacological, chemical, and industrial applications **[3]**. The methods used include physical processes such as filtration, sedimentation, and distillation; biological processes such as slow sand filters or biologically active carbon chemical processes such as flocculation and chlorination; and the use of electromagnetic radiation such as ultraviolet light. Water purification may reduce the concentration of particulate matter including suspended

particles, parasites, bacteria, algae, viruses, and fungi as well as reduce the concentration of a range of dissolved and particulate matter. The standards for drinking water quality are typically set by governments or by international standards. These standards usually include minimum and maximum concentrations of contaminants, depending on the intended use of the water **[4]**.

Visual inspection cannot determine if water is of appropriate quality. Simple procedures such as boiling or the use of a household activated carbon filter are not sufficient for treating all possible contaminants that may be present in water from an unknown source. Even natural spring water – considered safe for all practical purposes in the 19th century – must now be tested before determining what kind of treatment, if any, is needed. Chemical and microbiological analysis, while expensive, are the only way to obtain the information necessary for deciding on the appropriate method of purification. According to a 2007 World Health Organization (WHO) report, 1.1 billion people lack access to an improved drinking water supply; 88% of the 4 billion annual cases of diarrheal disease are attributed to unsafe water and inadequate sanitation and hygiene, while 1.8 million people die from diarrheal disease each year. The WHO estimates that 94% of these diarrheal disease cases are preventable through modifications to the environment, including access to safe water. Simple techniques for treating water at home, such as chlorination, filters, and solar disinfection and for storing it in safe containers could save a huge number of lives each year. Reducing deaths from waterborne diseases is a major public health goal in developing countries **[5]**.

MATERIAL AND METHODS

Portable water purification

Potable water purification devices and methods are available for disinfection and treatment in emergencies or in remote locations. Disinfection is the primary goal, since aesthetic considerations such as taste, odour, appearance, and trace chemical contamination do not affect the short-term safety of drinking water **[6]**.

Table 1 Collection of Samples (Underground Water) for Analysis

Source (Bore well)	Location	Society
BW 1	Spocp College Campus	Spcop college Building
BW 2	Dumberwadi	Dumberwadi village
BW 3	Kolmatha, Domewadi	Domewadi
BW 4	Khamundi	Khamundi Village
BW 5	Otur, South	Shubha Shanti Apartment

Additional treatment options

1. Water fluoridation: in many areas fluoride is added to water with the goal of preventing tooth decay. Fluorides is usually added after the disinfection process. In the U.S., fluoridation is usually accomplished by the addition of hexafluorosilicic acid, which decomposes in water, yielding fluoride ions.
2. Water conditioning: This is a method of reducing the effects of hard water. In water systems subject to heating hardness salts can be deposited as the decomposition of bicarbonate ions creates carbonate ions that precipitate out of solution. Water with high concentrations of hardness salts can be treated with soda ash (sodium carbonate) which precipitates out the excess salts, through the common-ion effect, producing calcium carbonate of very high purity. The precipitated calcium carbonate is traditionally sold to the manufacturers of toothpaste. Several other methods of industrial and residential water treatment are claimed (without general scientific acceptance) to include the use of magnetic and/or electrical fields reducing the effects of hard water.
3. Plumbo- solvency reduction: In areas with naturally acidic waters of low conductivity (i.e. surface rainfall in upland mountains of igneous rocks), the water may be capable of dissolving lead from any lead pipes that it is carried in. The addition of small quantities of phosphate ion and increasing the pH slightly both assist in greatly reducing plumbo-solvency by creating insoluble lead salts on the inner surfaces of the pipes.
4. Radium Removal: Some groundwater sources contain radium, a radioactive chemical element. Typical sources include many groundwater sources north of the Illinois River in Illinois. Radium can be removed by ion exchange, or by water conditioning. The back flush or sludge that is produced is, however, a low-level radioactive waste.
5. Fluoride Removal: Although fluoride is added to water in many areas, some areas of the world have excessive levels of natural fluoride in the source water. Excessive levels can be toxic or cause undesirable cosmetic effects such as staining of teeth. Methods of reducing fluoride levels are through

treatment with activated alumina and bone char filter media.

6. Environmental pollutants affect the aquatic ecosystem in a synergistic manner, which cannot be detected comprehensively by determination of selected physical-chemical parameters alone. Whereas, biological system can integrate all environmental variables over a long period two times of effects which can be easily measured and quantified **[7]**.

Physico-Chemical Assessment

The physico-chemical parameters of water quality are analyzed using standard methods given by APHA (American Public Health Association). The work was carried out on the following lines (1) Physico chemical characterization and (2) Data Processing **[8]**.

RESULTS AND DISCUSSION

Parameters Included In Water Quality Assessment

Following different physico-chemical parameter are tested regularly for monitoring quality of water.

1. **Temperature**:

   Temperature is the most importance environment factor with effect on plants and animals. Water has several unique thermal properties which combine to minimize temperature change. The Water temperature depends on the depth of the water column, climatic and topographic changes.

2. **pH:**

   pH one of the most common analyses in soil and water testing, is the standard measure of how acidic or alkaline a solution is. It is measured a scale from 0 -14. pH of 7 is neutral, pH is less than 7 is acidic and pH greater than 7 is basic. Aquatic organisms need the pH of their water body to be certain range optimal growth and survival. The presence of acid rain can lower the pH in lakes making them more acidic.

3. **Electrical conductivity:**

   Electrical conductivity (EC) a measure of the electric current that solution carries. Electrical conductivity used to quickly estimate the ionic or soluble salt concentration in soils, water supplies, fertilizer solution and chemical solution. It is measured with the help of EC meter which measures the resistance offered by the water between two plasticized electrodes. The instrument is standardized with known values of conductance

observed with a standard KCl solution.

4. **Alkalinity:**

Alkalinity is a chemical measurement of water's ability to neutralize acid. Alkalinity is also a measure of water buffering capacity or its ability to resist changes in pH upon the addition of acids or bases. Alkalinity of natural water is due to primarily to the presence of weak acid salts, although strong bases may also contribute (i.e. OH-) in the extreme environment. Bicarbonate represents the major form of alkalinity in natural water, so its source being the partitioning of CO_2 from the atmosphere and the weathering of carbon at minerals in rocks and soil. Other salts of weak acids, such as borate, silicates, ammonia, phosphate, and organic bases from natural organic matter may be present in small amounts.

5. **Dissolved Oxygen:**

The amount of oxygen dissolved in water, such as a lake, river or stream. Dissolved oxygen is the most important indicator of the health of water bodies and its capacity to support a balanced aquatic ecosystem of plants and animals. Warm water released from industrial outlets, flowages or storm sewers can also reduce dissolved oxygen levels. Dissolved oxygen may play a large role in the survival of aquatic life in temperature lakes and reservoirs during summer months.

7. **Total Hardness:**

Total hardness is defined as the sum of calcium and magnesium hardness in mg/L as $CaCO_3$. Total hardness in fresh water is usually in the range of 15 to 375mg/L as $CaCO_3$. Calcium hardness in freshwater is in the range of 10 to 250 mg/L, often double that of magnesium hardness (5 to 125 mg/L) and total hardness of 6630 mg/L as $CaCO_3$. A high concentration of hardness may be due to leaching from of the soils or due to the high background concentration of the waters. WHO permissible limit for total hardness of water is 150 mg L-1 and ISI desirable limit was 300mg L-1. Suggested that the value between 150 and 300 mg L-1of TH means the water was hard, and TH greater than 300 mgL-1 means the water is very hard. High concentration of hardness

may cause the problem of heart disease and kidney stones.

8. **Total dissolved solid:**

Total dissolved solids are the total amount of mobile charged ions, including minerals, salts or metal dissolved in a given volume of water in mg/L. TDS is directly related to the purity of water and the quality of water purification system and affects everything that consumes, lives in, or uses water, whether organic or inorganic, whether for better or for worse **[9, 10]**.

Table 2: Water Sample Analysis

Sr. No.	Parameter	Instrument used for determination	BW1	BW2	BW3	BW4	BW5
1.	Temperature (^oC)	Thermometer	25.4	26.3	25.6	25.2	25.2
2.	pH	pH meter	8.2	6.9	7.1	7.3	7.6
3.	Electrical conductivity	Conductivity meter	0.810	0.813	0.816	0.808	0.805
4.	Alkalinity	Titration method (C.B.R.)	18.6	11.5	16	18	15.2
5.	Dissolved oxygen	Iodometric method	5.3	5.2	5	5.2	5.4
6.	Total Hardness	EDTA method burette method	150	125	205	160	250
7.	TDS	TDS meter	36	38	36	35	38
8.	Odour	Smelling by Different Human Volunteers	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
9	Chlorides	Gravimetric	8.2	8.1	8.2	8.1	8.2
10	Sulfates	SOP	N.D.	N.D.	N.D.	N.D.	N.D.

CONCLUSION

The study was designed to check potability and palatability of water from various sources of underground water, specially from rural areas of Pune district. The collected samples were studied for the temperature, pH, Conductivity, Alkalinity, Dissolved Oxygen, Hardness, TDS, Chloride Contents and sulphate contents. The results obtained in this research shows that the water samples collected from all the resources was found potable as well as palatable. Further studies are required to be designed to check the comparative analysis with water samples in the Industrial areas of district.

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