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Water Quality Analysis in Chandigarh

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Abstract: Water is one of the most valuable natural resources on the planet and is crucial for the survival of both plant and animals. Water quality is just as crucial as water availability. Glaciers should be taken into account when calculating the amount of water on earth, which is 97 percent ocean and 3 percent fresh water. There are surface and subterranean water bodies that contain 2% of fresh water, which is suitable for human consumption. So, when we drink water, it is important to assess its quality and regulate it in a disciplined manner. Water's physical, chemical, and biological properties all have an impact on its quality.These characteristics of water are impacted by water contamination brought on by numerous human activities. Depending on the activities, pollutants are disposed of in water bodies, changing the characteristics of water's standard amount.This present study collected water samples from 18 different places in Chandigarh area Then the data have been taken of different parameters like Temperature, pH, Turbidity, Total Dissolved Solids, and Electrical Conductivity and visualize the data on the dashboard in the form of graphs.

Keywords: Water quality, physical, chemical, biological properties, Temperature, pH, Turbidity, Total Dissolved Solids, and Electrical Conductivity.

I. INTRODUCTION

Most living things on the planet, including humans, depend on the inorganic, clear, and odourless chemical substance known as water for their existence. The ability to survive depends on access to water of appropriate quality. Only a limited quantity of pollution will not harm aquatic animals. Certain species' existence and survival are affected by exceeding these limits, which also endanger their survival. For a stable and secure water supply to be maintained, groundwater monitoring is essential. As the economy has developed and urbanisation has risen, water pollution has become a more serious issue. Any hydrophyte system's analysis has a challenging component: predicting water efficiency parameters. It has theoretical as well as practical ramifications to investigate different methods for estimating reservoir water quality[1].Water efficiency can be impacted by a several factors, like the calcium content of natural water, stones, industrial waste, and tainted sewage, all of which can be regarded as sources of calcium and result in low-quality water. In addition, hard water has been related to a number of serious and chronic ailments, including heart disease. The most frequent cause of water pollution is the taint of water sources caused by chemical, physical, and radioactive contaminants [2]. In reality, the effects of contaminated drinking water are highly negative, posing a severe threat to infrastructure, the environment, and human health. United Nations (UN) research claims that 1.5 million people pass away every year as a resulted in production of diseases on by polluted water. According to estimates, contaminated water causes 80 percent of health problems in developing countries. There are 2.5 billion diseases and 5 million fatalities recorded each year [3]. Numerous metrics, including nitrate, pH, temperature, electrical conductivity (EC), dissolved oxygen (DO), biochemical oxygen demand (BOD), total coliform, and other elements of water quality, have been suggested for measurement. In table 1. Number of parameters present in water with its description.

The health, ecology, and economy all suffer when water quality deteriorates. David Malpass, the President of World Bank, is concerned about the economic impact: "Deteriorating water quality is impeding economic progress and increasing poverty in many countries." If the biological oxygen demand, an indicator used to quantify organic pollution in water, exceeds the threshold, the GDP growth of the constituency surrounding by the associated water basins would be cut in half. Water pollution and poor water quality have a variety of impacts.

- **Destroying biodiversity**: Water pollution weakens aquatic ecosystems and contributes to an unchecked increase

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of algae in water sources.

- **Contamination of Food chain**: Using dirty infected or waste water for agricultural purposes and for fishing and cattle husbandry in contaminated source of water may result in the injection of toxins or contaminants to foods that are dangerous to ingest.
- **Drinkable water shortage**: Both rural and urban areas will run out of clean potable water, healthcare, or sanitation if water pollution increases or drinkable water quality declines.
- **Illness**: The WHO has reported that about 2 billion people over the world lack clean water access and must drink water which is tainted with feces, making them susceptible to a number of diseases.
- **Infant mortality**: According to the WHO, diarrheal illnesses brought on by poor hygiene kill nearly 1,000 babies worldwide every day.

Monitoring water quality is the process of gathering data at preset sites and at predetermined times in order to produce data that can be used to describe the present water conditions.The following arethegoalsofthe smartwaterquality monitoringsystem:

1. To assess potentially dangerous quality metrics such as physical, chemical, and microbiological qualities.
2. To detect variations in measured metrics and issue timely alerts when dangers or hazards are detected.
3. Provide real-time sensor data analysis and offer necessary remedial actions.

The importance of user involvement in water quality preservation, as well as other considerations including hygiene, sanitation facilities, disposal, and management, cannot be overstated when it comes to water bodies.

Table 1. Description table of Water parameters

S.	Parameter	Description
1.	Potential of Hydrogen(pH)	A measure called pH is used to evaluate the neutrality of water. Water below 7 is acidic, while Water over 7 is alkaline. It is measured as a number from 1 to 14, with 7 being the usual value.
2.	Temperature	Water's relative hotness or coldness is determined using the temperature parameter. It is quantified in either Celsius or Fahrenheit.
3.	Dissolved Oxygen (DO)	One crucial factor to consider while evaluating the survival of aquatic life is DO. Water typically has a Dissolved Oxygen (DO) concentration of 4 mg/L or more.
4.	Electrical Conductivity (EC)	A measure called conductivity is used to evaluate how well water conducts heat and electricity. It is measured in millimhos per centimetre (mmho/cm) and Siemens per metre (S/m) in SI.
5.	Nitrate	The indicator used to determine if there is nitrogen in water, which is essential for aquatic plants to survive, is NO3. The life of aquatic organisms may be endangered by an excess of NO3 in the water. It is expressed in mg/L and ought to be below 1 mg/L in water.
6.	Biochemical Oxygen Demand (BOD)	The BOD parameter is used to determine how much DO is necessary for aerobic organisms to decompose the organic material in water. It is expressed in mg/L and should range from 3 to 5 ppm.
7.	Total Dissolved Solids (TDS)	The TDS parameter is used to determine how much metal, salt, cation, or anion is dissolved in water. It is expressed in mg/L, with a 500 mg/L acceptable range.

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8.	Turbidity	Turbidity is a measure used to evaluate the relative clarity of a liquid. When light is flashed through a water sample, the amount of light dispersed by the water's constituents is measured. It is a characteristic of water's optics. With an increase in diffused light intensity, the turbidity rises. It is stated in NTU, with a range of permissible values of 5 NTU.

II. STUDY AREA

One of India's most developed cities is Chandigarh, sometimes known as the "city of beauty." It may be found in the Shivalik Foothills in latitudes of 300 40 and 300 46 and longitudes of 760 42 and 760 51. Chandigarh, a metropolis intended to support a 0.5-million-person population, reached it carrying capacity ten years ago. The city's estimated population is 1.05 million, giving it a density of 9252 people per square kilometre (Census, 2011). Its boundaries with Punjab in the north and the state of Haryana in the south total around 114 square kilometres. well-designed, roomy residential communities, and square marketplaces. There are 56 independent sectors in Chandigarh. Each neighbourhood in the city is planned with its own stores, academic and medical facilities, hospitals, and houses of worship in addition to open areas, vegetation, and residential sections. 1110.7 mm of rain precipitation occurs in Chandigarh per year. Winter rains in the city are another intermittent effect of the Western Disturbance. However, the city has been dealing with a water problem for a while, particularly in the summer.

III. PROCEDURE OF WATERQUALITY ANALYSIS

The steps for water quality analysis in general is mentioned in Fig. 1

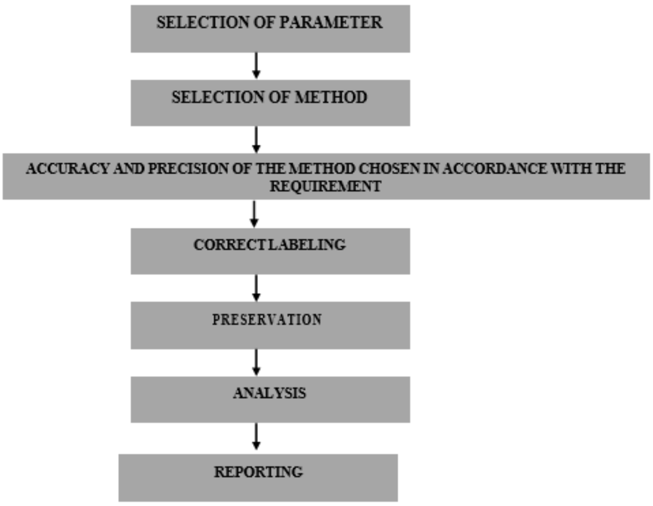

Fig 1. Steps for Water Quality Analysis

IV. EXPERIMENTAL METHOD

The water samples have been collected from 18 different places in Chandigarh area IMTECH, Sector- 39A, Sector-14, Punjab Engineering College (PEC), (PGIMER), Sukhna (Lake), Sukhna (Tap), ISKCON, Bus Stand, Tagore Theatre, NITTTR, CGA, Sector-51 (Petrol Pump), CSIO, Industrial Area Phase 1, Railway Colony, Industrial Area Phase-2, Chandigarh International Airport, Dhakoli. Further, the data have been taken of different parameters like Turbidity, Temperature, Total Dissolved Solids, pH, and Electrical Conductivity. I create the dashboard for visualizing the graph for different parameters

4.1 WATER SAMPLING PROCEDURE AND SAMPLING

In the laboratory of the CSIR- Central Scientific Instruments Organization (CSIO), Sector-30, Chandigarh, water samples were examined for a number of parameters. For the tap water of various sites, a number of physical and chemical characteristics including temperature, pH, total dissolved solids, turbidity, and electrical conductivity have been studied.

For sample collection, plastic bottles with a 1 litre capacity were employed. Deionized (DI) water was used to wash each bottle three times. The bottle was then kept in a spotless location. Each bottle was completely filled, leaving no room for air, and then sealed to stop any leaks. The sample number and site name were prominently displayed on each container as shown fig. 1

Fig.2 Samples

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4.1.1 SAMPLING POINT

The following samples were taken in Chandigarh City from the 18 sampling locations indicated in fig. 3.:

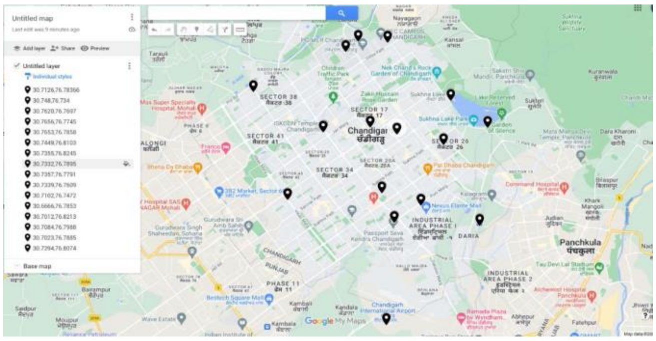

Fig.3 Collecting of Samples from Chandigarh City

1. Institute Of Microbial Technology (IMTECH), Sector-39A
2. Sector-14, Chandigarh
3. Punjab Engineering College (PEC), Sector-12
4. Sukhna (Lake)
5. Sukhna (Tap)
6. National Institute of Technical Teachers Training & Research (NITTTR)
7. ISKCON Temple
8. Bus Stand
9. Tagore Theatre
10. The Chandigarh Golf Club (CGA)
11. Post Graduate Institute of Medical Education &Research, (PGIMER)
12. Sector-51 (Petrol Pump)
13. CSIR – Central Scientific Instruments Organisation (CSIO)
14. Industrial Area Phase 1
15. Railway Colony
16. Industrial Area Phase 2
17. Chandigarh International Airport
18. Dhakoli

4.1.2 WATER QUALITY PARAMETER

Turbidity, Temperature, Total Dissolved Solids, pH, and Electrical Conductivity of the tap water from IMTECH, Sector- 39A, Sector-14, Punjab Engineering College (PEC), (PGIMER), Sukhna (Lake), Sukhna (Tap), ISKCON, Bus Stand, Tagore Theatre, NITTTR, CGA, Sector-51 (Petrol Pump), CSIO, Industrial Area Phase 1, Railway Colony, Industrial Area Phase-2, Chandigarh International Airport, Dhakoli.

Outcome of the parameter analysis of tap water in various Chandigarh City areas are compared to relevant requirements for water used for drinking set by the WHO. Table No. 2 contains the drinking water standard information.

Table 2. Drinking water standard recommended by WHO

S. No	Parameter	Permissible value	Unit
1.	Temperature	15 - 25	°C
2.	pH	6.5 – 8.5	-
3.	Turbidity	10	NTU
4.	Total Dissolved	500	mg/l
5.	Electrical Conductivity	< 400	µS/cm

V. METHODOLOGY FOR THE MEASUREMENT OF TEMPERATURE PROCEDURE

i. In fig 4.1 (a) The DS18B20 is a 1-wire programmable temperature sensor from Maxim Integrated. The temperature had a range between -55 °C to +125 °C along with accuracy of 5 °C.

ii. After filling the water bottle, I used the DS18B20 temperature sensor to measure the water's temperature, as shown in Fig. 4.1(b). Obtaining a measurement after enough time has passed for the temperature sensor to reach the precise temperature of the water

Fig.4.1 (a) DS18B20 Temperature sensor

Fig.4.1 (b)Temperature sensor in Water Sample Source: (https://www.deltakit.net/product/ds18b20-temperature-sensor/

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VI. METHODOLOGY FOR THE MEASUREMENT OF pH VALUE

The pH value is calculated using the logarithm of the reciprocal of hydrogen ion activity in moles per liter. pH variations in aqueous solutions are caused by the hydrolysis of strong bases and weak acids into salts. Dissolved gases such as hydrogen sulfide, ammonia, and carbon dioxide can affect water's pH. Unless otherwise specified, the pH of most natural water ranges from 6 to 8. If you're looking for an acidic or alkaline thermal spring, you'll have to settle with one with a pH of 4 or less. Temperature and pH measurements are taken, recorded, and noted by a pH meter seen in Figure 5. If the pH value continues to move, take another reading with a fresh sample of material and record it again.

Fig.5: pH Meter Taking Reading of sample

VII. METHODOLOGY FOR THE MEASUREMENT OF TURBIDITY

Turbidity in a variety of samples may be measured using a nephelometer, also called a turbidity metre. A light and photo detector is used by turbidity meters to measure light scatter, and the findings are shown in turbidity units like nephelometric turbidity units (NTU). Turbidity meters measure turbidity by using a light source, a lens, and a detector positioned 90 degrees from the light source. Some of the particles in the sample scatter the light such that it travels along a path from the light source to the detector at an angle of 90 degrees. This happens when a sample is put in the path between the light source and the detector. The detector determines the amount of light scattering and contrasts it with standards using a calibration curve. In Fig.6 Turbidimeter measured the turbidity of the Water Samples

Fig. 6 Turbidimeter

VIII. METHODOLOGY FOR THE MEASUREMENT OF ELECTRICAL CONDUCTIVITY

Conductivity may be measured using a meter and a probe. Two electrodes in a probe that is submerged in a water sample are subjected to voltage. The conductivity per centimeter is calculated using the voltagedrop caused by water resistance. In Fig.7 Electrical Conductivity measured the Conductivity of the water Samples.

Fig.7 Electrical Conductivity meter

IX. RESULT AND DISCUSSION

AtoolcalledaDashboardDesignerisusedtovisualisecomplexdat aandturnitintoinformationthat is easy to understand and visually appealing. A dashboard design programme assists you in identifying trends and displays analytical findings with lovely graphs to transform data into insights that can be put in to practise

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9.1 Dashboard of Different Samples of Chandigarh Areas

In this study area, Data pines of tw are used as a dashboard. Here we visualise the graph of different samples of the tap water of Chandigarh areas from IMTECH, Sector- 39A, Sector-14, Punjab Engineering College (PEC), (PGIMER), Sukhna(Lake), Sukhna(Tap), ISKCON, BusStand, TagoreTheatre, NITTTR, CGA, Sector- 51(PetrolPump), CSIO, Industrial Area Phase 1, Railway Colony, Industrial Area Phase-2, Chandigarh International Airport, Dhakoli of different parameters.

In Fig.8 shows the graph of the water collected from different are of the Chandigarh with the different parameters.

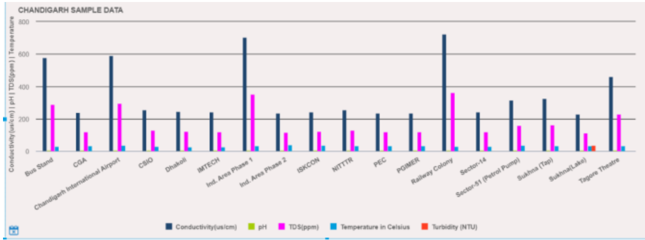

Fig.8: Dashboard of Different Samples of Chandigarh Areas.

9.1.1 TEMPERATURE

It is found that the temperature of the water supplied to the Chandigarh City are within thepermissible limit 25- 50°C as per World Health Organization (WHO).Fig.9 showsthe temperature of the tap water collected from IMTECH, Sector- 39A, Sector-14, PunjabEngineering College (PEC), (PGIMER), Sukhna (Lake), Sukhna (Tap), ISKCON, Bus Stand,Tagore Theatre, NITTTR, CGA, Sector-51 (Petrol Pump), CSIO, Industrial Area Phase 1,RailwayColony,IndustrialAreaPhase-2,ChandigarhInternationalAirport,Dhakoli.

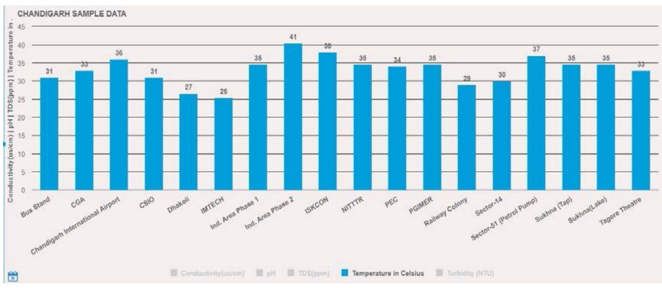

Fig.9 Temperature of Tap Water from Different Chandigarh Areas.

9.1.2 pH VALUE

The quantity of hydrogen ions in water is measured by the pH, which also expresses how acidic or alkaline the water is. However, a low number, below 4.0, will create a sour taste, while a higher value, over 8.5, exhibits an alkaline flavour. It doesn't have any direct negative effects on health. According to the recommendations made by the WHO, a pH range of 6.5 to 8.5 is often suitable. The samples' pH fluctuates between 6.8 and 7.4 in Fig. 10.

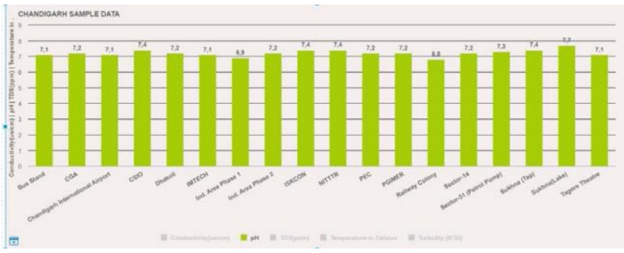

Fig.10pH of Tap Water from Different Chandigarh Areas.

9.1.3 TURBIDITY

Turbidity measurements show how transparent the water is. The compounds found in water in suspension are to blame for it. It is brought on by organic materials like clay, silt, and other minute creatures in natural water. Figure 11 displays a range of 0.08 NTU to 37 NTU. However, 5 NTU is the recommended upper limit for turbidity in drinking water (WHO). In every water sample, turbidity levels were higher than allowed. The turbidity of Sukhna Lake is 37 NTU. Sukhna Lake has greater turbidity than is allowed as a result of the catchment collecting silt and dissolved minerals.

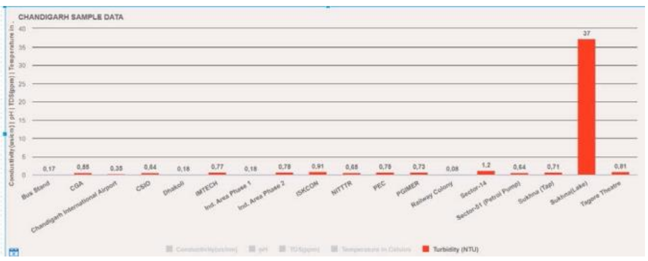

Fig.11 Turbidity of The Water Samples from Different Chandigarh Areas.

TOTALDISSOLVEDSOLIDS

The calcium, magnesium, sodium, potassium, bicarbonate, chloride, and sulphate are what cause the TDS in groundwater. TDS ranged in the study region from 114 to 363 mg/l. Since the TDS limit for drinking water is 500 mg/l, all of the water samples in Figure 12 had TDS

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concentrations that were far lower than the standard.

9.1.4

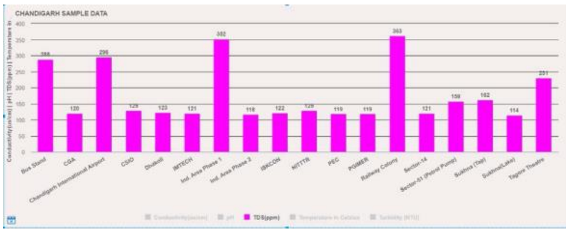

Fig12. TDS of the Water Samples from Different Chandigarh Areas.

9.1.5 ELECTRICALCONDUCTIVITY

Ameasure of water's electrical conductivity is called conductivity. The number of ions present in the water has a direct impact on this capacity. These conductive ions are produced by inorganic substances such as alkalis, chlorides, sulphides, carbonate compounds, and dissolved salts. Area Electrical Conductivity in every sample of water tested ranged from 228 S/cm to 725 S/cm. Since the recommended range for EC in drinking water is 200– 800 S/cm, all of the water samples in Figure 13 exhibit EC concentrations that are much lower than the recommended range.

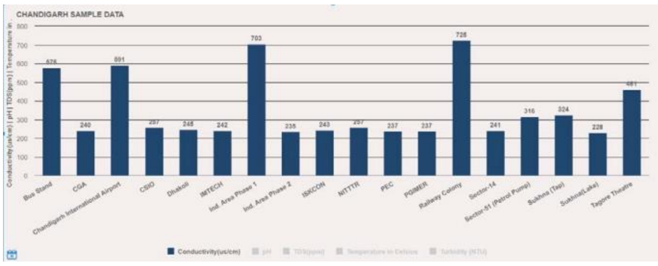

Fig.13 Electrical Conductivity of the Water Samples from Different Chandigarh areas.

X. CONCLUSION

Water samples were taken for this investigation from 18 different locations in the Chandigarh region. Then measurements were made for a variety of parameters, including temperature, pH, turbidity, total dissolved solids, and electrical conductivity. Additional measurements included B.O.D, nitrate, total coliform, and faecal coliform. One of India's most developed cities is Chandigarh, sometimes known as the "city of beauty." It may be found in Shivalik Foothills at latitudes of 300-40' and longitudes of 760-51'. A water quality standard is a regulation or legislation that specifies the uses of a body of water or water segment as well as the water quality requirements required to safeguard those uses. Here, I also discussed the methodology and principle of the measurement of each parameter.Data visualization on the datapine Dashboard shown as the graph.

XI. ACKNOWLEDGEMENT

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