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Research Article

Quality And Purity Test Of Water

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ABSTRACT

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water. But due to increased human population, pesticides, the use of fertilizers in the agriculture and man-made activity, it is highly polluted with different harmful contaminants. The results of WQI analysis indicate that the water of Chulbandh dam achieved the standard for irrigation purposes in both the dry season and rainy season. However, further study on bearing capacity of the dam will be needed for water supply purposes. Water quality is the chemical physical and biological characteristics of water usually in respect to its suitability for a designated use. The surface water sample collected from the study area shows the conductivity, temperature, pH, alkalinity, chloride, chlorine, hardness, turbidity, suspended solid, residual solid values. The pH and Turbidity of values obtained wasn't under the standard values.

INTRODUCTION

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water. But due to increased human population, pesticides, the use of fertilizers in the agriculture and man-made activity, it is highly polluted with different harmful contaminants. Therefore, it is necessary that the quality of water should be checked at regular time interval, because due to use of contaminated water, human population suffers from varying of water borne diseases. Water pollution is a serious problem in India as almost 70% of its surface water resources and a growing percentage of its groundwater reserves are contaminated by biological, toxic, organic, and inorganic pollutants. In many cases, these sources have been rendered unsafe for human consumption as well as for other activities, such as irrigation and industrial needs. This shows that degraded water quality can contribute to water

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scarcity as it limits its availability for both human use and for the ecosystem. Due to growth of population, agriculture, and industries, demand for domestic water has increased many times during the last few years. Improper waste disposal and over exploitation of resources has affected the quality, not only of tap water, but also of ground water.[1]

Figure 1: Chulbandh Dam

PHYSICOCHEMICAL PARAMETERS OF WATER

pH

pH, one of the most common analyses in soil and water testing, it is the standard of measure of how acidic or alkaline a solution is. It is a measured a scale from 0-14. pH of 7 is neutral, less than 7 is acidic and pH greater than 7 is basic. Aquatic organism needs the pH of their water body to be a certain range optimal growth and survival. The presence of acid rain can lower the pH in dam making them more acidic. [2]

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. Temperature affects water chemistry and the functions of aquatic organisms.

It influences the:

a Amount of oxygen that can be dissolved in water.

b Rate of photosynthesis by algae and other aquatic plants.

c Metabolic rates of organisms.

Total 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. [3]

Chloride Ions

Chloride, the ionized form of chlorine, is one of the most abundant inorganic ions in natural water and wastewater. Chloride ions in water may present as salt of sodium, magnesium or calcium.

Total Solids

The total solids in water comprises of both suspended solids and dissolved solids. Solids suspended in water may consist of inorganic and organic particles or of immiscible liquids. Dissolved substances may be organic or inorganic in nature. The total solids present in water can be determined by evaporating the water sample at 105℃ and weighing the dry residue left. The suspended solids can be found by filtering the water sample and weighing the residue left on the filter paper. The difference between the total solids and the suspended solids will represent the dissolved solids. [4]

Residual Chlorine

Residual chlorine is the chlorine left in the water after the required contact period. Residual chlorine ensures complete killing of bacteria and oxidation organic matters. When filtered water is chlorinated, it is consumed initially for killing microorganisms and then for oxidizing organic

matter. When oxidation is complete and break point is reached, whatever chlorine is added appears as residual chlorine .For satisfactory care of future contamination of water usually free chlorine residual of 0.2 to 0.3mg/L is sufficient for a contact period of 10- 20 minutes.

Total Hardness

Hardness is predominantly caused by divalent cations such as calcium, magnesium, alkaline earth metal such as iron, manganese, strontium, etc. The total hardness is defined as the sum of calcium and magnesium concentrations, both expressed as CaCO3 in mg/L. Carbonates and bicarbonates of calcium and magnesium cause temporary hardness. Sulphates and chlorides cause permanent hardness. Total hardness is defined as the sum of calcium and magnesium hardness in mg/L as CaCO3.

Following are the two types of Total Water Hardness –

- Temporary hardness - also called 'Carbonate hardness.
- Permanent hardness- also referred to as 'non-carbonate hardness; is the hardness due to the presence of calcium or magnesium sulphates, chlorides and nitrates.

Turbidity

The turbidity of the sample is the reduction of transparency due to the presence of particular matter such as day or silk, finely divided organic matter, plankton or other microscopic organisms. these particular manner cause light to be scattered and absorbed rather than being transmitted in straight lines thought sample. Prescribes nephelometric method for the measurement of turbidity of water. this is applicable to all types of water .it is based on the comparison of the intensity of light scattered by the sample under defined condition with the intensity of light scattered by a standard reference suspension under the same condition.

Suspended Solids

The residue which remains on filter paper after filtration. The dry weight of this residue is termed as total suspended solids.

Conductivity

This is a measure of the capability of a solution such as water in a stream to pass an electric current. This is an indicator of the concentration of dissolved electrolyte ions in the water. It doesn't identify the specific ions in the water. However, significant increases in conductivity may be an indicator that polluting discharges have entered the water.

MATERIALS AND METHODS

Water samples were collected from a source with different sites of chulbandh dam. Total 4 water samples were collected from different areas of chulbandh dam which covers Bhandara district. All the sampling containers were washed with distilled water and then washed again with the target water before sampling.

pH

Figure 2: pH Meter.

Perform calibration of pH meter using standard pH solutions. The calibration procedure would depend on pH range of interest. In a clean dry 100 ml beaker take the water sample and place it in a magnetic stirrer, insert the Teflon coated stirring bar and stir well.

- Now place the electrode in the beaker containing water sample and check for the reading in pH meter. Wait until you get a stable reading.
- Take the electrode from the water sample, wash it with distilled water and then wipe gently with soft tissue.[1]

Temperature

Apparatus:

Laboratory Thermometer

Thermometer was dipped in sample and level of mercury was noted.[2]

Total Alkalinity

Procedure

1. Preparation of reagents
2. Testing of water sample

Testing of water sample

Using a measuring cylinder exactly measure 100 ml of sample and pour it in a 250 ml of conical flask. Fill the burette with 0.02N sulphuric acid. Add few drops of phenolphthalein indicator to the conical flask. If the contents in the conical flask turns pink then titrate it against 0.02N sulphuric acid till the pink colour disappears. Note down the titrate value (V1). The value of titration is 0.5 ml. This value is used in calculating the phenolphthalein alkalinity. To the same solution in the conical flask add few drops of mixed indicator and the solution turns blue. Continue the titration from the point where stopped. Titrate till the solution become red. The entire volume (V2) of sulphuric acid noted down and is accountable in calculating the total alkalinity. Repeat the titration from concordant values. [5]

Burette solution:

Sulphuric acid solution

Pipette solution:

Sample

Indicator:

Phenolphthalein Indicator, Mixed Indicator[1]

Chloride ions

Apparatus:

Burette, conical flask, pipette, measuring cylinder.

Reagents:

Potassium chromate indicator solution, standard silver nitrate titrant.

Steps:

1. Take 25 ml sample in a conical flask. Measure sample pH.
2. Add 1.0ml potassium chromate indicator solution,
3. Titrate with standard silver nitrate solution to pinkish yellow end point and note down volume of titrant used. Also measure sample pH.[1]

Formula:

TA = VT x N x W x 1000 / VS (mg/lit)

Where, VT-volume of titrant H2SO4

VS-volume of sample

N-Normality of H2SO4

W-Equivalent weight of H2SO4

Total solids

Apparatus:

Beaker, measuring cylinder, Weighing machine, Heater

Procedure:-

- The beaker is properly cleaned and dried and its weight is taken.
- 100ml of water is taken in the beaker and dried in the oven such that all the water evaporated.
- After cooling, the weight of the beaker is recorded.
- Total solids are determined by subtracting the initial weight from final weight of the beaker.[2]

Residual Chlorine

Orthotolidine test

- First take 10 ml of water sample in a test tube.
- Then 0.01 gm of bleaching powder is added to the sample.
- Kept the mixture for 15 min without any disturbing.
- After that to this chlorinated water we have to add 2-3 drops of orthotolidine solution.
- The yellow colour indicates that the residual chlorine is present in the sample.
- Then note down the residual chlorine present in diff. types of samples.[2]

Total Hardness

Figure 3: wine red colour of solution changes to pale blue at the end point

Formula: TH = VT/VS x 1000 (mg/lit)

Where,

VT = volume of titrant

VS = volume of sample

Procedure:

1**. Standardization of EDTA**

a Pipette out 20 ml of standard hard water into a conical flask.

b Add 5 ml of buffer solution and few drops of Eriochrome Black-T. The indicator, which is originally blue color would acquire a wine-red color.

c Titrate with EDTA solution taken in the burette, till the wine red color changes to blue which is the end point. Let the burette reading of EDTA be V2 ml.

2. Determination of Total hardness

Repeat the above titration method for sample hard water instead of standard hard water. Let the burette reading of EDTA be V3 ml.

3. Determination of Permanent hardness

Take 100 ml of sample hard water in 250 ml beaker. Boil it to remove temporary hardness to about half of this volume and cool to room temperature. Filter through filter paper to remove insoluble CaCO3 and MgCO3. Make up the volume to the original 100 ml by adding distilled water. Now pipette out 20 ml of this solution into a clean conical flask. Then repeat the process of titration steps as mentioned above. Let the burette reading of EDTA be V4 ml.[6]

Formula

TH=VT/Vs x 1000 (mg/lit)

where ,

VT = volume of titrant

VS= volume of sample

Turbidity:-

Apparatus:- Nephelometer

Figure 4: Nephelometer

Preparation of reagents

Stock turbidity suspension

1. Solution1-1g hydrazine sulphate in 100ml of D.W.
2. Solution2-10g hexamethylene tetramine in 100ml D.W.
3. 5ml of each solution 1 and 2 are mixed in volumetric flask and kept at 25℃ for 24 hrs.
4. Standard turbidity suspension10ml of stock solution diluted to 100ml with D.W.to give std solution of 400NTU

Procedure:

Nephelometer was calibrated using D.W.at 0 NTU and Standard turbidity solution at 400 NTU. Sample shaken and take in nephelometric tube and reading is recorded. 72]

Suspended Solids

Figure 5: Whatman filter paper no. 44

Procedure

a. Take a tripod stand and put it on the table to which funnel is placed.
b. Take initial weight of Whatman filter paper as (W1)
c. Now place the Whatman filter paper three folded on the funnel.
d. Pour the well mixed sample on the Whatman filter paper.
e. Wait for some time so as to drain out the water sample completely.
f. Now remove the Whatman filter paper and keep it in the oven. Care should be taken to see that the filter paper should not be scratched.

Now take the final weight of the filter paper along with residue as (W2). [8]

Conductivity

Figure 6: Digital Conductivity meter

Procedure

Calibrate Instrument using std KCL solution. Electrodes of conductivity meter are dipped into sample and readings are noted for stable values.[9]

RESULTS AND DISCUSSIONS

pH

Sample No	A	B	C
pH	8.5	8.1	8.7

Standard acceptable limit for pH is 6.5 to 8.5 From the above observation, sample no B and sample no C was found to be the highest and lowest pH value.

Temperature

Sample No	A	B	C
Temperature (ºC)	23	22	24

Standard acceptable limit for Temperature is 39°C. From the above observation, sample no B and sample no D was found to be the lowest and highest temperature value.

Total Alkalinity

Sample No.	A	B	C	D
Total Alkalinity	65	67	61	63

Standard acceptable limit for Total Alkalinity is 220.From the above observation, sample no B and sample no C was found to be the highest and lowest Total Alkalinity value

Chloride ions

Sample No	A	B	C	D
Chloride Ions (mg/L)	199	205	200	207

Standard acceptable limit for Chloride Ions is 250 mg/lit. From the above observation, sample no A and sample no D was found to be the Lowest and Highest chloride ions value.

Total solid

Sample No	A	B	C	D
Total Solid (mg/L)	375	378	372	374

Standard acceptable limit for Total solid is 500 mg/lit. From the above observation, sample no B and sample no C was found to be the highest and lowest chloride ions value.

Residual Chlorine

Sr. No	Name of the sample	Source of the sample	Residual Chlorine
1.	A	Dam	It complies the test
2.	B	Dam	It complies the test
3.	C	Dam	It complies the test
4.	D	Dam	It complies the test

Total Hardness

Sample No	A	B	C	D
Total Hardness	12.10	10.06	14.25	15.12

Standard acceptable limit for Total Hardness is 150 mg/lit. From the above observation, sample no

B and sample no D was found to be the lowest and highest Hardness value.

Turbidity

Standard acceptable limit for Turbidity is 1 to 5 NTU. From the above observation, sample no C and sample no D was found to be the lowest and highest Turbidity value.

Suspended Solids

Sample No	A	B	C	D
Suspended Solids (mg/L)	1300	1290	1330	1330

From the above observation, sample no B and sample no C&D was found to be the lowest and highest Turbidity value.

Conductivity

Sample No	A	B	C	D
Conductivity	0.125	0.160	0.158	0.455

Standard acceptable limit for Conductivity is 220. From the above observation, sample no A and sample no D was found to be the lowest and highest Conductivity value.

CONCLUSION

This study has suggested a possible combination of quality and pollution indices based on monitoring environmental parameters for dam quality assessment.The results of WQI analysis indicate that the water of Chulbandh dam achieved the standard for irrigation purposes in both the dry season and rainy season. However, further study on bearing capacity of the dam will be needed for water supply purposes.Water quality is the chemical physical and biological characteristics of water usually in respect to its suitability for a designated use. The surface water sample collected from the study area shows the conductivity, temperature, pH, alkalinity, chloride, chlorine, hardness, turbidity, suspended solid, residual solid values. The pH and Turbidity of values obtained wasn't under the standard values.

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