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RESEARCH ARTICLE

ANALYSIS OF WATER QUALITY STATUS & MICROBIAL FLORA OF RAAMJHARA TALAV-TULJAPUR (MAHARASHTRA)

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Abstract

In given research project, we investigate the physiochemical, biochemical and microbial aspect of Raamjhara Talav (Tuljapur), which is situated in national highway No. 211 near tuljapur bypass. We collect sample No, 1 to 5 from different location of Raamjhara Talav in sterilized container. The BOD and DO of present water sample No (1 to 5) is in between (-1 to 2) we also analyze the other parameter such as Total Dissolved Solid (TDS), Chemical Oxygen Demand (COD), Nitrate, Acidity, Alkalinity, Temperature, odor, color etc. For all sample No. 1 to 5 all above parameters were achieve the standard value that showing the quality of water is good for survival of all living things. For the purpose of microbial flora identification we send the water sample No. 1 to 5 to Jagtap Patil laboratory at Barshi, they done the identification by performing biochemical test of cultured water sample using Biomerious Vitck – 2 compact.

Introduction:-

Water is one of the most important and abundant compound of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is planet having about 70% of water. But due to increased human population, industrialization use of fertilizer in the agriculture and man – made activity it is highly polluted with different harmful contaminants. Therefore it is necessary that quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from several of water borne diseases. It is difficult to understand the biological phenomenon fully because the chemistry of water revels much about the metabolism of the ecosystem and explore the general hydro-biological relationship.[1] The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. It is necessary to know detail about different physico-chemical parameter such as color, temperature, acidity, hardness, P^H, sulphate chloride, DO, BOD, COD, alkalinity used for testing of water quality. Heavy metal such as Pb, Cr, Fe, Hg, etc. are of special concern because they produce water or chronic poisoning in aquatic animal. Some water analysis reports with physico-chemical parameters have been given for exploring parameter study guidelines & also have been given for comparing the value of real water sample.[1],[2]

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Materials and Methods:-

Physicochemical & biochemical Parameter:

It is most important to study the Physicochemical & biochemical property of water for safely drinking of water. The Physicochemical parameter like as temperature, color, odor, pH, turbidity, TDS also the biochemical property like Dissolved Oxygen (Do), Biochemical Oxygen Demand (Bod), Chemical Oxygen Demand (Cod), Chloride, Nitrate & Nitrite of collected water sample from Raamjhara talav at different five corners. [1] The Physicochemical & biochemical property of water sample is examined with the help of various tools which are listed in table No.1 [1].

Temperature:

For to analysis of water sample the temperature is very important factor, determine by dipping the thermometer into water sample and note down the reading.[4]

Color:

Determination of the color by visualization.

Odor:

Odor determination by physiological sense (nose).

pH:

P^H is the measurement of free hydrogen & hydroxyl ion in water**,** it can be determine by P^H paper by dipping in water & mach the color to standard.[1]

Total Hardness:

Can be determining by using complaxometric titration. Pipette out 20 ml of water sample and transfer into clean 250 ml conical flask. Add to it 20 ml of ammonium buffer solution to the water sample then the pH will be maintained between 9 and 10. Add few drops of EBT indicator to the conical flask and the sample turns to wine red in color. Before starting the titration rinse the burette with few ml of EDTA. Fill the burette with 0.02 M EDTA solution and adjust to zero, then fix it in burette stand. Titrate the sample with few ml of EDTA solution in the burette till all calcium and magnesium ions present in the sample reacts with EDTA.The appearance of blue color indicates that all calcium and magnesium ions are complexes with EDTA and forms a metal EDTA complex [3,2] That is the end point of titration. Note down the burette reading.

Alkalinity:

It is nothing but, the capacity of neutralizing acid present in water sample [16]. Rinse the burette with 0.02N sulphuric acid and discard the solution. Fill the burette with 0.02N sulphuric acid and adjust it to zero. Fix the burette in the stand. Using a measuring cylinder exactly measure 100 ml of sample and pour it into 250 ml of conical flask. Add a few drops of phenolphthalein indicator to the content of conical flask, the color of the solution will turn to pink, this color change is due to alkalinity of hydroxyl ions in the water sample. Titrate it against 0.02 N sulphuric acid till the pink color disappears. This indicates that all the hydroxyl ions are removed from the water sample. To the same solution in the conical flask add a few drops of mixed indicator. The indicator of the solution turns blue. This color change is due to CO_3^{2-} and HCO_3 ions in water sample. Continue the titration from the point where stopped for phenolphthalein alkalinity. Titrating the solution becomes red the entire volume.

Acidity:

Rinse the burette with 0.02 N NaOH and then discard the solution. Fill the burette with 0.02 N NaOH and adjust the burette. Fix the burette to the stand a sample size is chosen as the titrate value does not exceed 20 ml of the titrate for highly concentrated samples dilute the usually take 100 ml of given sample in a conical flask. Add few drop of methyl orange indicator in the flask. The color change, now the titrate sample against the 0.02N NAOH solution until color faints. Note down the volume (V_1) consumed for titration 0.4 ml, this volume is used for calculating the mineral acidity. To the same solution in the conical flask add few drop of phenolphthalein indicator. Continue the titration until the color changes to faint pink color.

Note down the total volume (V_2) consumed for titration 2.3 ml this volume is used for calculating the total acidity. Repeat the titration for concordant values [3,5]

Total Dissolved Solids (TDS):
Take the weight of evaporating dish. Filter the sample of suitable quantity through filter paper. Transfer the sample to the evaporating dish. Evaporate on a water bath. Note the weight of the dish along with the contents after cooling in desiccator. Calculate total dissolved solid (TDS) and express in mg/liter [2,4]

Dissolved Oxygen (DO):
Take 50 ml of water sample in burette (reagent bottle).Add 1ml of magnesium sulphate solution, 1 ml KOH solution and 1 ml KI solution. Replace the stopper immediately. Mix the contents in the bottle. Add 2 ml of conc.H_2SO_4 and mix the contents. Transfer the contents with standard sodium thiosuphate solution till the straw yellow colors appears .Add few drop of starch solution and titrate (if blue color appears) again with sodium thiosulphate solution until blue color disappears completely.[2,5]

Biochemical Oxygen Demands (BOD):
Take a two BOD bottles for each sample. Take 50 ml of water sample in each bottles. Add a 1 ml of magnesium sulphate solution, 1 ml KOH Solution and 1 ml KI solution in each bottles. Replace the stopper immediately. Mix the content of bottles. Add a 2 ml of concentreated H_2SO_4 and mix the content in each bottle. Then from sample of the 2 bottle take 1 bottle of each sample for to incubate sample for 3 days and for remaining BOD bottle apply some procedure as DO i.e.,transfer the material in conical flask titrate the content with standard sodium thiosulphate solution till the straw yellow color appears. Add a few drop of Starch solution and titrate (if blue color appears) again with sodium thiosulphate solution until blue color disappears completely. After 3 days remove remaining BOD bottle of each sample and determine the DO from above procedure [2, 12 and 11]

Chemical Oxygen Demands (COD):
Take a two 100 ml conical flask and pour 50 ml water sample in each (duplicate). Add a 5 ml of $K_2Cr_2O_7$ solution in each of flask. Keep the flask in water bath at 100^oc (boiling temperature) for 1 hrs. Allow the sample to cool for 10 min. Add 5 ml KOH in each flask. Add 10 ml of H_2SO_4 in each flask. Titrate the content of each flask with 0.1 M sodium thiosulphate until the appearance of pale yellow color. Add 1 ml of starch to each flask. Titrate again with sodium thiosulphate until the blue color disappear completely [7]

Choride:
Pipette out 20 ml of water sample in conical flask. Add 2 drops of potassium chromate (indicator) so yellow color is appearing. Fill the burette with silver nitrate ($AgNO_3$) up to the zero mark (no bubble inside). Titrate the contain in conical flask against silver nitrate solution till color changes from yellow to Brick red. Calculate chloride concentration using formula.[5]

Nitrate:
Calibrate the UV spectrophotometer. Take standard sample of sodium nitrate. Clean the quate place the sodium nitrate solution in both tube (quate) clear the base line adjust λ at 250 µm and note the reading. Repeat same procedure for each sample.

Nitrite:
Calibrate the UV spectrophotometer. Take standard sample of potassium nitrite. Clean the quate place the potassium nitrite solution in both tube (quate) clear the base line adjust λ at 250 µm and note the reading. Repeat same procedure for each sample.

Microbiological Method:-

For the study of microbial flora of water samples, collect five different samples on Raamjhara talav (4 corners and 1 middle). The sample were collected in well sterilized glass bottles and transported to the laboratory where they are subjected to different micro-biological test. The micro-biological testing of water samples can be performed by following manner [16].

Preparation of Nutrient Agar Plates:
Take,clean,dry conical flask in that add 3 gm of agar in 100 ml of distilled water boil this mixture at 100^o C, along with take Petridish (five) clean and sterilize in autoclave both media and Petridish at 121^o C for around 15-20 minutes. Transfer this media to petriplate in laminar air flow and wait for solidification.[2]

Production of Bacterial Growth:
Take 0.5 ml of collected water samples No. 1 to 5 and add in five respective solidified agar plate in laminar air flow, incubate at 37^{o} C for 24 hrs.

Formation of Single Colony (Pure culture formation:
By using four strik method the pure culture of respective sample were prepared and preserved the growth at 4^{O}C in referigerator.[2,4]

Preparation of Nutrient Broth:
The well develop growth (pure culture of respective sample) was introduced in nutrient broth.[2,5] and incubate at 37^{0}C for 24 hrs.

Gram Staning:
Take a small drop of bacterial culture; make thin smears on separate glass slide. Let the smears air dry, heat and fix the smears. Add each smear with crystal violet for 30 sec. followed by washing, cover each smear with gram iodine solution for 3 seconds wash off iodine solution and add the diluents as 95% ethyl alcohol and quickly wash the slide again with distilled water for few seconds. Now apply counter stain saffranine to each smear for 30 seconds and again follow washing with distilled water and blot dry with absorbent paper. Examine the slide microscopically using 40 X objective. Identify the bacteria present ether gram –ve or +ve. [2]

Preparation of Agar Slant:
The respective pure culture of sample No 1 to 5 were transfer to Jagtap - Patil laboratory at Barshi (Dr. D. D. Karad Sir, well known microbiologist), they done biochemical test of cultured water sample using Biomerious Vitck – 2 compact, for identification of specific strain of bacteria.

Result and Discussion:-

Physicochemical & biochemical property of water sample from Raamjhara talav are presented in table no.2 & 3.

Physicochemical & biochemical Parameter :

1. Temperature: It determine by thermometer & from sample 1 to 5 is between 28 to 29^{o}C which is normal temperature and suitable for drinking purpose.
2. Color : color is identified by visualization and sample 1 to 5 are clear, no turbid & suitable for drinking, according to Standard.
3. Odour : Odor is identified by Physiological sense & found that sample 1 to 5 have no odor or odorless so it is good for living being.
4. P^{H} : pH of water sample is determine by pH paper & pH meter & value are in between 6.4 to 7.0 which is neutral and as per standard it is good for drinking to humans.
5. Total Hardness: By using Complexometric titration the amount of calcium & magnesium present in water are also in normal range. The values reflect near to standard value so it is good water for drinking to humans.
6. Alkalinity: Alkalinity of water samples no 1 to 5 which is comparable to standard value and result is good for use in daily drinking water.
7. Acidity: By using acid-base titration determine acidity & the values are validable for drinking purpose.
8. Total Dissolved Solids (TDS) : It is nothing but the residue left after evaporation of filter sample. The TDS value of sample 1 to 5 samples are good for drinking to humans.

Biochemical Methods:

1. Dissolved Oxygen (DO) : Determine by redox titration & values of sample 1 to 5 are achieved good quality of water for drinking.
2. Biochemical Oxygen Demand (BOD) **:** BOD investigated by incubation, followed by titration, the BOD of water sample No 1 to 5 are the suitable amount of oxygen which is needed for drinking purpose.
3. COD: COD of collected water sample No 1 to 5 is by comparing test values with std.values, we can say the quality of water is good for drinking.
4. Chloride value found is in std. levels indicates that quality of water is good.
5. Nitrate & Nitrite : Both this parameter is investigated by U.V spectrophotometer & value of both parameters are in normal range.

6. Nitrite: By comparing the standard value the quality of water sample is good and we can use the water for drinking purpose.

Micro-biological method:

Jagtap - Patil laboratory at Barshi, they found the following microbial strain by using Biomerious Vitck – 2 compact.The microbial strain isolated from sample No 1 to 5 are shown below.

1. Staphylococcus humunies
2. Staphylococcus susuri
3. Streptococcus agalactiae
4. Micrococcus lutes
5. Serriatia morcescens

Tables:

Table 1:- Parameters and their related tools for detection.

Sr.No	Parameters	Tools/Methods
1	Temperature	Thermometer
2	Color	Visualization
3	Odor	Physiological sense
4	pH	pH Paper & pH Meter
5	Total Hardness	Complexometric Titration
6	Alkalinity	Acid- Base Titration
7	Acidity	Acid- Base Titration
8	T.D.S	Evaporation
9	Dissolved Oxygen	BOD Incubator
10	BOD	BOD Incubator
11	Chemical Oxygen Demand	Argintometric Titration
12	Chloride	Argintometric Titration
13	Nitrate	U.V spectrophotometer
14	Nitrite	U.V spectrophotometer

Table 2:- Physicochemical property of water sample.

Sr.no	Parameter	Values at Sampling Site				
		S_1	S_2	S_3	S_4	S_5
1	Temperature C^0	28	29	2 29	29	29
2	Color	less	less	less	less	less
3	Odour	No	No	No	No	No
4	pH[Paper]	7	7	7	7	7
	pH[Meter]	6.58	6.58	6.49	6.44	6.46
5	Total Hardness	22.5	20.5	22.5	17.5	18.5
6	Alkalinity	0.08	0.09	0.09	0.10	0.08
7	Acidity	0.11	0.101	0.106	0.100	0.107
8	T.D.S	0.040	0.03	0.02	0.02	0.00

Table 3:- Biochemical property of water sample.

Sr.no	Parameter	Values at Sampling Site				
		S_1	S_2	S_3	S_4	S_5
1	D.O (mg/lit)	6.4	5.6	5.6	7.2	4.8
2	B.O.D(mg/lit)	1.6	0.8	0.8	0.8	0.0
3	C.O.D(mg/lit)	0.072	-0.984	-0.96	-0.984	-0.656
4	Chloride(mg/lit)	-8.86	-8.86	-7 .09	-8.86	-8.86
5	Nitrate(mg/lit)	-1.02	-1.11	-1.12	-1.11	-1.11
6	Nitrite(mg/lit)	-2.07	-2.12	-2.12	-2.11	-2.12

Fig. No. 1:- A view of Raamjhara Talav,Tuljapur (Maharashtra).

Fig No. 2: A map of Raamjhara Talav , Tuljapur (Maharashtra)

Fig No 3:- Microbial flora identification from five different collected water sample of Raamjhara Talav, Tuljapur (Maharashtra).

Conclusion:-

So according to the physicochemical, biochemical & microbiological investigation the grade of water is good in case of Physicochemical & Biochemical parameter & safe for drinking, but by examine microbiological method we say that quality of water is not good for drinking but water is too good for other activities of human being & also safe for survival of all other living things.

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