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ANALYSIS OF GROUND WATER QUALITY

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Abstract - Water could be a basal resource for sustain atmosphere & life however in previous couple of decades the water quality is deterioration because of its overutilization. The aim of the study is to protect and maintain and spread the safe quality of water. Groundwater is becoming an important source of water supply in many regions since there has been a tremendous increase in the demand for fresh water due to population growth. The rapid growth of urban areas has adversely affected the groundwater quality due to overexploitation of resources and improper waste disposal practices. Since various blends can break down in water and others can be suspended in water, there is a potential for pollution with harmful mixes including significant particles like pH, Turbidity, Alkalinity, Cl, and Total Hardness. In this paper the assessment of groundwater is done of 10 villages of Samudarpur tehsil in wardha district. Samples were collected and tested on various physio chemical parameters to check the quality of the water.

Key Words: Groundwater, Pollution, Overutilization, Population growth

1. INTRODUCTION

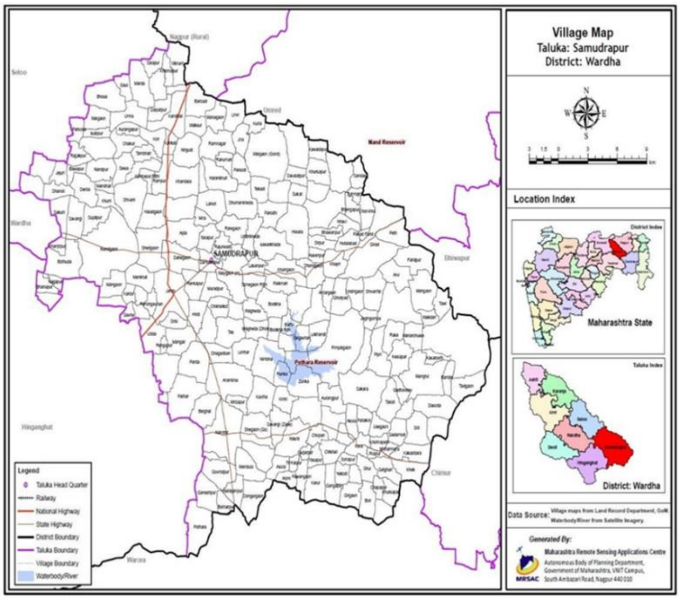
Water is one of the most important compounds of the ecosystem. Ground water is generally 30% of fresh water. Water is an essential commodity to all life, without water there is no life that's why, it is important to know about all things about water. Water is major abiotic factor in the environment. The suitability of water for different purpose is determined by its quality parameters. As per WHO about 80% diseases are caused by water. Due to increase in industrialization the water pollution is also increased, so various chemicals are mixed with water and it is harmful for health. Acid rain is also one of the major factors of water pollution. Groundwater is the water present beneath Earth's surface in rock and soil pore spaces and in the fractures of rock formations. About 30 percent of all readily available freshwater in the world is groundwater.

The depth at that soil pore areas or fractures and voids in rock become utterly saturated with water is named the formation. Groundwater is recharged from the surface; it's going to discharge from the surface naturally at springs and seeps, and might type oases or wetlands. Groundwater is additionally typically withdrawn for agricultural, municipal, and industrial use by constructing and in operation extraction wells. The study of the distribution and movement of groundwater is hydrogeology, additionally referred to as groundwater geophysics.

Typically, groundwater is believed of as water flowing through shallow aquifers, but, within the technical sense, it also can contain soil wetness, land (frozen soil), immobile water in terribly low permeableness bedrock, and deep geothermic or oil formation water. Groundwater is hypothesized to provide lubrication that can possibly influence the movement of faults. It is likely that much of Earth's subsurface contains some water, which may be mixed with other fluids in some instances.

2. STUDY AREA

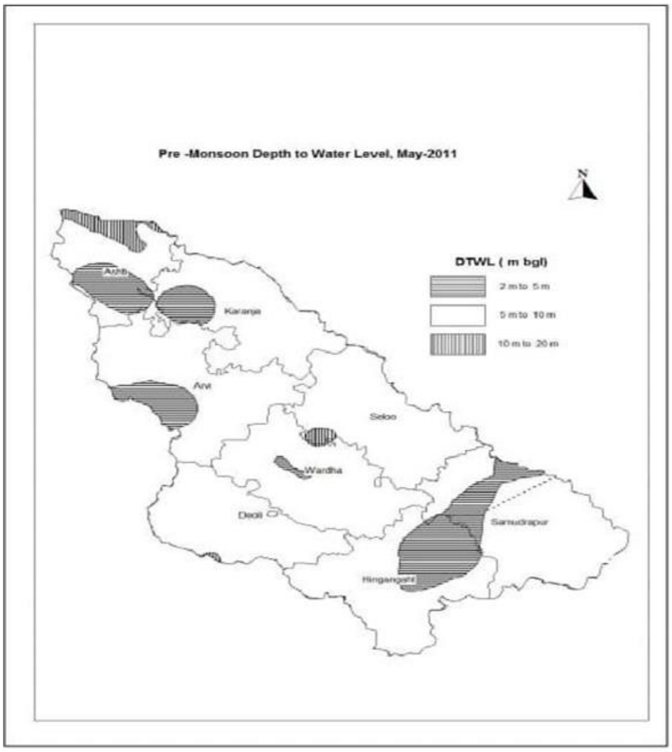
2.1 Site description



The study area is selected for this study in Wardha district Samudrpur. Wardha District is located in the Vidarbha region of Maharashtra state and is named after its most important river, the Wardha. It is located between 20.63 latitude and 78.96 longitude. The district is bounded on the west and north by Amravati District, on the south by Yavatmal District, on the southeast by Chandrapur District and on the east by Nagpur District. The boundaries with Amravati and Yavatmal districts are identified by the river Wardha. The district covers 6,310 sqkm Wardha District Administrative head quarter is Wardha. It is is Located 738 KM west towards State capital Mumbai . Wardha District population is 1296157. It is 29th Largest District in the State by population.

2.2 Depth to Water Level

Post monsoon (Nov.-2011) The depth to water level during postmonsoon ranges between 1.6 (Ashti) and 11.7 mbgl (Sukli). Spatial variation in postmonsoon depth to level is shown in Figure- 4. Deeper water levels in the range of 10-20 are observed in small patch in southern part of Seloo taluka. The water in the range of 5-10 mbgl are observed in parts of Asti. Karanja, Samud Hinganghat, Deoli, Wardha and in Major part of Deoli. The with water range of 2-5 m bgl being the most dominant occupying entire stretch north to south.



3. METHODOLOGY

3.1. Data Collection

Data collection include water quality sampling that have been collected from various 10 villages of Samudrapur tehsil.

3.2 Sampling Method: -

Collection of water samples was done according to the standard methods for the examination of water. Ground water samples data were collected from ten station (villages) of Samudrapur tehsil. Ground water samples were collected from hand pumps borewell including tap water. Water samples were taken in 1000 ml pre-washed plastic bottles. Bottles were rinsed with sample water prior to collection. Firstly, we fill 500ml of water in bottle then we add 2drops of HCL (hydrochloric acid) after that we add another 500ml of water sample. Bottles were filled to brink with water samples, tightly closed and labelled as per station number.

3.3 Physio-chemical analysis: -

Following physio-chemical properties were analyzed:
pH, Electrical conductivity (EC), Total hardness, chloride (Cl-), Total Alkalinity (TA), Dissolved oxygen (DO), Turbidity

1. PH Apparatus:

1. pH Meter with glass and reference electrode (saturated calomel) preferably with temperature compensation.
2. Magnetic stirrer with polytetrafluoroethylene coated stirring bar.
3. Thermometer with least count of 0.5°C.

Sample handling: Samples should be analyzed as soon as possible preferably in the field at the time of sampling.

High purity waters and waters not at equilibrium with the atmosphere (ground waters or lake waters collected at depth) are subject to changes when exposed to the atmosphere. Therefore the sample containers should be filled completely and kept sealed prior to analysis.

2. Chloride

The amount of chloride in water can be simply determined by titrating the collected water sample with silver nitrate solution by using potassium chromate indicator. The reaction is quantitative. The $AgNO_3$ reacts with chloride ion in a 1:1 ratio. The result is expressed as ppm.

When silver nitrate solution is gradually added into the flask, then silver ions react with chloride ions and forms silver chloride. It is precipitated in bottom of the flask. The precipitation is white in colour.

$Ag^{+}(aq) + Cl^{-}(aq) \rightarrow AgCl(s)$

The end point of the titration takes place when all the chloride ions reacts and precipitated. Then slightly extra silver ions react with the chromate ions and form a brownish-red precipitate of silver chromate. The solubility product of silver chromate exceeded in the presence of additional silver ions, and then the precipitation occurs.

3. Electrical conductivity:

Apparatus required: Electrical conductivity meter
Procedure:
1. Know the EC meter
2. Calibrate the EC meter
3. Measure conductance of samples
4. Calculate EC Know the EC meter

4. Alkalinity:

Alkalinity is a measure of the capacity of a solution to neutralize a strong acid. We can calculate the amount of alkalinity in water by titrating the sample water with an acid, using an indicator to determine when the sample water's pH has dropped to a certain level - the endpoint.

Titration does not tell us the actual types of alkalinities present in the water (though we can make an educated guess, as discussed below.) So, we cannot report our results as ppm of carbonate, bicarbonate, etc. Instead, we report the amount of alkalinity as calcium carbonate equivalent, which is the amount of alkalinity in terms of its equivalent value of calcium carbonate. This is the same unit of measurement we will use to measure hardness, as you will learn in a later lab.

Equipment 25- or 50-mL burette, graduated in 0.1 mL burette support 100 mL graduated cylinder rubber-tipped stirring rod, or magnetic stirrer and stir bar white porcelain evaporating dish, 4.5 inches in diameter reagents

The reagents needed include the indicator and the acid used for the titration. The acid is N/50 sulfuric acid, which is the same as 0.02 N sulfuric acid. The indicator for the total alkalinity test will be:

Methyl orange or methyl purple indicator, in a 50 to 100 mL dropping bottle. Store the solution in a dark place. And for the phenolphthalein alkalinity test, you will need the following indicator: phenolphthalein indicator, in a 50 to 100 ml dropping bottle.

In either test, a pH meter can be used instead of an indicator, if so desired. If using a pH meter, do not add the indicator in step 3 of the procedure below. In step 4, the acid is added not until a colour change occurs but until the pH reaches the desired endpoint - 4.5 for the total alkalinity test or 8.3 for the phenolphthalein alkalinity test.

5. Dissolved oxygen

METHOD 1: Titrating the Water

1. Gather your materials. For this measurement, you need 2 flasks with stoppers, a calibrated pipette, a graduated pipette, manganese sulfate, water, alkali-iodide-azide, sulfuric acid, sodium thiosulfate, and a starch solution.

2. Collect a sample. Take a 300 mL sample of water. This can be from a tap, a stream, a pond, or any other water source. Collect the sample in a flask with a stoppered top.

3. Mix manganese sulphate with the water. Use a calibrated pipette to add 2 millilitres (0.068 fl oz) of manganese sulphate into the sample. Put the tip of the pipette just beneath the surface of the water before releasing the contents. Stopper your bottle and mix the manganese sulphate by inverting the bottle several times slowly.

- If you drop the contents into the water they will come in contact with the air and this will introduce oxygen into the sample and alter results.
- If any air bubbles occur, then the sample is contaminated and you will need to start over.

4. Add alkali-iodide-azide to the sample. Next, add 2 millilitres (0.068 fl oz) of alkali-iodide- azide to the sample using a calibrated pipette. The tip of the pipette should be just below the surface of the water before ejecting the contents. Stopper the bottle and mix the alkali-iodide- azide by inverting the bottle slowly several times.

- If oxygen is present, you will observe the formation of floc. This is an orange-ish solid that will settle in the bottom of the flask.

5. Fix with sulfuric acid. Use a pipette to measure 2 millilitres (0.068 fl oz) of concentrated sulfuric acid. Drop the sulfuric acid into the solution. Do not place the tip of the pipette into the water. Mix the acid by inverting the flask several times. The floc should redissolve.

- ear gloves and goggles for safety when working with sulphuring acid. Avoid contact with skin and eyes. Do not ingest. Do not inhale

6. Titrate 201 mL of sample. Measure exactly 201 mL of sample into a new flask. Place this sample beneath a graduated pipet filled with sodium thiosulfate. Add sodium thiosulfate until the sample turns a pale yellow color.

Write down the initial amount of sodium thiosulfate in the pipet.

Stir the solution continually as you titrate.

7. Introduce starch solution. A starch solution will react with the iodine present in the sample to form a blue color. You only need to add 2 milliliters (0.068 fl oz) of starch solution. Stir or swirl the solution well.

- Starch solution can be made by mixing water with corn or potato starch, or you can buy one premade.

8. Continue to titrate. Once the sample turns blue, continue titrating with sodium thiosulfate.

Add the titrant slowly, as one drop will make a difference at the end of the titration. You should stop titrating when the blue color is gone from the sample.

Hold the sample up against a white background in order to look for blue color.

9. Understand the results. When the titration is complete, write down the amount of sodium thiosulfate left in the pipet. Subtract this amount from the initial amount of sodium thiosulfate to find how many mL of sodium thiosulfate you used to titrate the sample. The amount of sodium thiosulfate in mL is equal to the dissolved oxygen content in mg/L.

For example, if you used 8 mL of sodium thiosulfate, that would correspond to a dissolved oxygen content of 8 mg/L.

6. Turbidity

Apparatus: Turbidity meter

Procedure:

Direct Turbidity Grab Sample Bottle Measurement

1. Turn meter on by pressing the Menu/On button.
2. Press and hold the Menu/On button for 3 seconds to confirm that the correct range is selected. “Ch50” should be displayed in the bottom right corner indicating a 0-50 NTU range setting. If the range is not correct.
3. Rinse the sensor with distilled water. Dry and clean the lenses with alcohol.
4. Insert the sensor into the wastewater sample bottle. Make sure that the stainless-steel portion of the sensor is in contact with the water and that the sensor tip is at least 3” from the bottom of the vessel. If necessary, use a lint free cotton swab bent at 90° angle to remove any air bubbles on the tip of the sensor; these bubbles will cause large errors. Wait for the sensor to stabilize. Once reading is stable, record the reading in NTUs in the field logbook.
5. Clean the sensor using distilled water.
6. At the end of data collection, verify the instrument’s calibration, place the sensor in its calibration environment and check to see that the meter is reading its calibration value. Enter this verification in the Field Data Log.
7. Clean the sensor with distilled water. 8. For storage >30 days, remove the batteries from the instrument

7. Total dissolved solids, mg/l, Max

Procedure: Hardness, scaly deposits, sediments, cloudy coloured water, salty or bitter taste, corrosion of pipes and fittings

Sources: Salts, heavy metals and organic compounds found in agricultural and urban runoff. Waste water from households, industries. Sewage from urban and rural areas, hazardous wastes from landfills. Total Dissolved Solids mainly refers to any kind of organic or inorganic matter that is found in water. Firstly, take a 50ml of water sample in a beaker, pour it into a porcelain dish, measure the weight of the porcelain dish before taking a water sample in it. Keep the porcelain dish on a burner and start to heat it. After some time take the porcelain dish in an electric oven for 30 minutes.

Take a porcelain dish out of the Electric oven keep it in a desiccator to cool it down.

Treatment: Reverse Osmosis, Distillation, deionization by Ion Exchange

3. CONCLUSIONS

1. The pH of study area is 6.91 to 8.02. All sample stations are within limit according to BIS the range is 6.5 to 8.5.
2. Dissolved oxygen of study area were obtaining after analysis of water samples is 4.7 to 7.5 and further compared with BIS Standards is 6 5 to 8 mg/L. The Sample Station (SS- is not within the limit.
3. The electric conductivity of study area is 0.04 to 0.8 all sample stations are within limit and according to BIS Standards the given acceptable limit is less than 0.8.
4. The chloride of Study area obtained 46.08 to 322.5 mg/L in ground water sample, further compared with BIS Standards acceptable limit is 250 mg/L and permissible limit is 1000mg/L. And during the testing SS (Sample Station) SS-1, SS-5, SS-7 is not within the limit.
5. The Turbidity of Study area we found during the test ranges from 0.5 to 1.6 and according to BIS Standards the acceptable limit of the Turbidity is 1 NTU and during the testing SS-2 , SS-7, SS -8 are not within the acceptable limit and Permissible limit of Turbidity is 5 NTU.
6. The Alkalinity of study area we found during the test ranges from 80 to 107mg/L and according to BIS Standards the acceptable limit is 200mg/L, all sample stations are within the acceptable limit.
7. The acceptable limit of Total Dissolved Solids according to BIS Standards is 500ppm and Permissible limit is 2000 mg /L and results found during the testing in the range of 224.1 ppm to 905.8 ppm. During the testing the SS-1 SS-3 ,SS-5, SS-6, SS-8, SS -9, not in the acceptable limit

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