ASSESSMENT OF QUALITY OF DRINKING WATER FROM DIFFERENT WARDS OF CHANDRAPUR (M. S.)

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Abstract
Water is the essential source of life. The environmental quality is greatly focused on water because of their importance in maintaining the human health and ecosystem. Water performs unique and indispensable activities in earth ecosystem and biosphere. Thus, water is needed for recreation, transportation, hydroelectric power generation and domestic uses etc. Water quality can be determined by quantifying the physical and chemical parameters.
Keywords: Freshwater, COD, DO, hardness, alkalinity

Introduction

Water is the one of the essential sources of life on earth. It also performs unique and indispensable activities in earth ecosystem, biosphere and biogeochemical cycles. High-quality water is always a necessity for living organisms. It is the most important component among the natural resources and is crucial for the existing of all living beings and has many uses, including domestic recreation, transportation, and hydroelectric power, industrial and commercial uses.

Water covers 70.9% of the Earth's surface ("CIA-The world factbook" Central Intelligence Agency), and is vital for all known forms of life (United Nations Un. Org. 2005-03-22). On earth, it is found mostly in oceans and other large water bodies, with 1.6 % of water below ground in aquifers and 0.001% in the air as vapor, clouds (formed of solid and liquid water particles suspended in air)and precipitation (water vapors in the climate system, Special Report, [AGU], December 1995).

Water is also present in the atmosphere in solid, liquid and vapor states. It also exists as ground water in aquifers. Water plays an important role in the world economy, as it functions as a solvent for a wide variety of chemical substances and facilitates industrial cooling and transpiration. Approximately 70% of freshwater is consumed by agriculture. Fresh water is a finite resource, essential for agriculture, industry and even human existence, without fresh water of adequate quantity and quality, sustainable development will not be possible. The parameters like PH, dissolved oxygen (DO), Chemical oxygen demand (COD), Total hardness are used for analysis using standard procedures. Our study deals with the physicochemical analysis of well water samples collected from Chandrapur city and checking the quality of water, whether it is safe for drinking purpose or not by the comparative physicochemical analysis using standard methods.

Material and Method

Collection of Samples

Water samples were collected from following wards of Chandrapur city

1. Bapat Nagar
2. Nanaji Nagar
3. CSTPS Industry

Physicochemical Parameters for Water Quality Analysis

Colour

Colour identification of water sample by visualization.

Odour

Odour ofwater sample was determined by taking a smell of water.

Conductivity

Conductivity was measured with conductivity meter.

Total Solids

The solid materials present in water may be organic or inorganic and may be present in the

dissolved form or undissolved form. It was estimated by evaporating about 50 ml unfiltered water sample in a pre-weighed porcelain dish. The porcelain dish after evaporation was cooled and weighed again. The difference between the two weights gives the value of total solids present in well water sample.

Total Dissolved Solid

Dissolved solid usually consist of nonvolatile compounds and inorganic salts in the solution. It is estimated by filtering the well water sample. 100 ml of filtered water sample was evaporated onearlier weighed porcelain dish. After evaporation of water sampleporcelain dishwas cooled and weighed again. The difference between the two weights gives the amount of total dissolved solid present in well water sample.

pH

PH is defined as the logarithm to the base 10 of the inverse of the hydrogen ion concentration. It can be the negative logarithm to the base 10 of H^+ ion activity. It is measured by pH meter.

Acidity of water

Acidity in water not only makes it unsuitable for the growth of aquatic plants, fish and other useful mix-organisms but also for domestic consumption and irrigation. It is determined by adopting following procedure

Determination of free carbondioxide

In a 250 ml conical flask place 100 ml water sample add few drops of phenolphthalein indicator. If it turns pink then CO_2 is absent but if solution remains colourless then titrate against N/20 Standard NaOH solution until pink colour produced for few seconds.

Determination of acidity in water

In 250 ml conical flask place 100 ml water sample add 1-2 drops N/10 Na2S2O3 solution then add few drops of methyl orange indicator to it. If the solution turns yellow then methyl orange acidity is absent but solution turns pink then titrate against N/20 Standard NaOH solution until the pink colourchanges to yellow. Note the volume of NaOH then add few drops of phenolphthalein indicator to yellow solution then titrate with N/20 NaOH Solution until the pink colour produced for few seconds. Note the volume of NaOH.

Alkalinity

Alkalinity water is due to the presence of various ions which causes alkalinity. Highly alkaline water containing carbonates and bicarbonates of calcium and magnesium, when heated coats the inner surface of vessels there by reducing heating efficiency. It is estimated as follows:

In 250 ml conical flask place 100 ml well water sample add 3-4 drops of phenolphthalein indicator it turns pink then titrate with N/50 sulphuric acid till pink colour disappears. Recorded the volume of sulphuric acid. Now add 2-3 drops methyl orange indicator if turns yellow then titrated with N/50 sulphuric acid. The yellow colour to the solution will first change to orange and the finally red. Note the end point.

Dissolved oxygen (DO)

DO is a very important parameter of water quality and an index of physical and biological process going on in water. It is an indicator of physical and biological process going on in water. It isalso present in drinking water imparts taste and it is highly fluctuating factor in water. The divalent manganese salt in solution is precipitated by strong alkali to divalent manganese hydroxide. It is rapidly oxidized by dissolved oxygen present in the sample to form trivalent or higher valency hydroxide. Iodide ions are added and acidified, which reduce tetravalent hydroxides back to their stable divalent state thereby liberating equivalent amount of iodine. This iodine is equivalent to dissolved oxygen present in the sample. The reactions involved in DO determination are as follows:

$MnSO_4 + 2\ KOH \rightarrow Mn(OH)_2 + K_2SO_4$

$2Mn(OH) + O_2 \rightarrow 2\ MnO(OH)_2$

$Mn(OH)_2 + 2KI + H_2OMn(OH) + 4I_2 + 2KOH \rightarrow$

$I_2 + 2S_2O_3^{-2} S_4O_6^{-3} + 2I^- \rightarrow$

It is determined as follows**:**

To the water sample 2ml of $MnSo_4$ solution and 2ml of alkaline potassium iodide solution were added one by one.The solution was shake thoroughly and add 2 ml. of conc. H_2SO_4 slowly. Again, the mixture was shake thoroughly to dissolve the precipitate. From the above solution 100 ml was transferred to a conical flask.Few drops of starch indicator were added drop by drop, then titrated against the

sodium thiosulphate, till the blue colour turns into violet.

Chemical Oxygen Demand (COD)

Carbonaceous organic matter present in well water has adverse effect on aquatic plants and animals, as they tend to deplete the concentration of oxygen in water. All organic matter present in water can be oxidized to carbon dioxide and water by treatment with a strong chemical oxidizing agent. Following procedure is used to determine COD.

In a 500 ml round bottom flask with a reflux condenser place 50 ml of well water sample and then add 1gm of mercuric sulphate to it. Shake the mixture and add 25ml of sulphuric acid and reflux for 2 hrs. Cool and wash inside portion of condenser with 10-15 ml distilled water. Dilute the reaction mixture by adding 150ml of distilled water to it. Pipette out 20 ml of 50 ml and titrate against ferrous ammonium sulphate using 2-3 drops of ferrous in indicator.At the end point the colour of solution changes from blue green to reddish brown.

Chloride Ion Concentration

The chlorides are present in varying proportion in all natural water bodies. chloride reach natural water through water soluble chloride salts from the surface of soil, through human excrete through industrial wasteand through artificial spray. Chlorides present in reasonable concentration (75-200 mg/liter) in water are safe for human consumption. Following procedure is followed to determine chloride concentration.

Filter the water sample. Pipette out 50 ml of filtered sample in large porcelain dish add 3-4 drops phenolphthalein indicator. If pink color develops then add dill. sulphuric acid until pink color just disappears. If pink color is not obtained then add 3-4 drops methyl orange indicator to get red color solution. Add N/50 sodium carbonate until colour of solution changes to orange. If yellow color is obtained by adding methyl orange indicator, then do not add sodium carbonate. Transfer the resultant solution in 250 ml conical flask add 1 ml potassium chromate indicator. Titrate against N/150 silver nitrate solution, white precipitate of silver chloride is obtained. Continue the addition till red color appears which disappears on shaking. Now add silver nitrate drop by drop until permanent reddish-brown colour obtained.

Hardness

Temporary hardness of water is due to the presence of bicarbonate of calcium and magnesium. Hardness of water is always expressed in terms of equivalent amount of calcium of equivalent amount of calcium carbonate ($CaCO_3$)in parts per million (ppm).

Total Hardness

Take 100 ml water sample in 250 ml conical flask.Add 10 ml buffer solution and 5-6 drops of ferrochrome black T indicator. Titrate the solution against EDTA solution until the color changes from wine red to blue.

Temporary and Permanent Hardness

Take 250 ml hard water in 500 ml beaker and boil an hour. Then cool the water sample and filter. Measure the 100 ml of filtered hard water sample in conical flask. Add 10 ml of buffer solution and 5-6 drops of Ferrochrome black T indicator. Then titrate against EDTA solution until color changes from wine red to blue.

Result and Discussion

Quality of water is characterized by various physical and chemical studies. Various observations obtained during experimental work is tabulated in following table.

Sr.No.	Parameter	Limit	Bapat Nagar	Nanaji Nagar	CSTPS Chandrapur
1.	Colour		Colourless	Colourless	Colourless
2.	Odour		Odourless	Odourless	Odourless
3.	Conductivity	<800	20 um/cm	1380um/cm	572um/cm
4.	Total Solid	< 20	1.04 ppm	7.66 ppm	178ppm
5.	TDS	< 500	130.6ppm	897 ppm	372ppm

6.	pH	6.5-8.5	8.2 eV	7.7 eV	5.75
7.	Free CO2	<50	6.16ppm	22 ppm	23.8ppm
8.	Alkalinity	<200	86 ppm	440 ppm	38ppm
9.	D.O		4.6%	7.6 %	2.5%
10.	COD		54 ppm	128 ppm	68ppm
11.	Chloride	<250	14.18 ppm	141.8 ppm	79.4ppm
12.	Total Hardness	<300	80 ppm	600 ppm	200ppm
13.	Ca. Hardness	<75	60 ppm	440 ppm	154ppm
14.	Mg. Hardness	<30	20 ppm	160 ppm	46ppm

Conclusion

Parameters of water samples taken from Chandrapur area have been presented. All physical properties such as color and odor are found to be colorless and odorless. The chemical parameters like pH, DO, COD, total solid, total dissolved solid had higher value than permissible range. The Nanaji Nagar and CSTPS area samples are not useful for drinking, but Bapat Nagar sample are potable for drinking.

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