International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

ISSN:2347-6567

IJAMSCR | Volume 6 | Issue 3 | Jul - Sep - 2018
www.ijamscr.com

Research article *Medical research*

A Qualitative Analysis of Borewell Drinking Water in the Area of Cuddalore District, Tamil Nadu

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ABSTRACT

The water plays the vital role in the life of the earth. Water contamination is a significant effluence for the future age. This paper plans to research the qualitative analysis and some physicochemical parameters of ground water at Cuddalore locale of Tamil Nadu. A definite physical and chemical analysis was done by taking borewell water samples from Bhuvangiri, Keerapalayam and Annamalai Nagar. The parameters such as p^H, turbidity, Total dissolved solids (TDS), electrical conductivity, color, odour, alkalinitywere analyzed in each water sample. Hence, the study was intended to assess the parameters significant for portability purpose and the concentration in the water was compared with the standards prescribed by World Health Organization (WHO) and Bureau of Indian Standards (BIS).

Keywords: Borewell, Turbidity, Total Dissolved Solids, Neutrophilation, Portability

INTRODUCTION

Water plays a significant role in keeping up the human health and welfare[1]. Clean drinking water is now recognized as a fundamental right of human beings. Around 780 million individuals don't approach spotless and safe water and around 2.5 billion individuals don't have appropriate sanitation. Thus, around 6–8 million individuals bite the dust every year because of water related illnesses and debacles. Thusly, water quality control is a top-need strategy plan in numerous pieces of the world[2]. In the today world, groundwater is a significant source of water supply it is the only source of drinking water in many rural and small communities. Water pollution is a major problem for the new generation. Water quality and appropriateness for use are determined by its taste, odour, color, and concentration of organic and inorganic matters[3,4]. The problems like growing population, sewage disposal, industrial waste, radioactive waste, etc. have polluted the water resources so much[5,6,7].
These contaminants are additionally arranged as microorganisms, inorganic, organics, radio-nuclides, and disinfectants. A number of scientific procedures and tools have been developed to assess the water contaminants. These techniques incorporate the examination of various parameters such as pH, Turbidity, conductivity, Total Suspended Solids (TSS), TDS, Total Organic Carbon (TOC), and heavy metals. These parameters can influence the drinking water quality, if their qualities are in higher fixations than as far as possible set by WHO and other administrative[8,9]. In this manner, the examination of the drinking water quality by scientists and legislative divisions has been performed normally all through the world[10]. The present examination is attempted to explore the qualitative investigation and some physicochemical parameters of ground water at Cuddalore locale of Tamil Nadu.

Conductivity
Procedure for sample measurement

Rinse probe with High Purity Deionized water. Dip sufficiently in the sample. Stir and tap it gently to expel any air bubbles. Wait for the perusing to stabilize.[14]

Procedure for calibration

Calibrate Conductivity meter with e.g., 147.0 µS/cm. Immerse the cathode adequately into typical solution. Mix tenderly and trust that perusing will balance out (approximately30 sec). Tap the electrode daintily on the base of the container to evacuate any air bubbles.

Reagent

Standard Chloroplatinate solution – dissolve 1.246 g Potassium Chloroplatinate (K_2PtCl_6) and 1.0g Crystalline Cobaltous Chloride ($CoCl_2xH_2O$) in purified water containing 100 ml conc. Hcl acid. Dilute to 1000ml[12]. This solution – 500 color units.

Preparation of standards

Colour Unit	5	10	15	20	25	30	35	40	45	50	60	70
ml of stand to 50ml H_2O	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0

Procedure

Put 50ml of sample in Nessler cylinder – 50ml. and compare with the standards. Turbidity can be removed by centrifugation or with help of Buchner funnels N5. Do not use filter paper. If the turbidity has not been indifferent report color as – "apparent color".

Odour
Reagent

Standard Chloroplatinate solution – dissolve 1.246 g Potassium Chloroplatinate (K_2PtCl_6) and 1.0 g Crystalline Cobaltous Chloride ($CoCl_2xH_2O$) in distilled water containing 100ml conc. HCl acid. Dilute to 1000ml [10]. This solution – 500 color units.

Preparation of standards

Colour Unit	5	10	15	20	25	30	35	40	45	50	60	70
ml of stand to 50 ml H_2O	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0

Procedure

Put 50 ml of sample in Nessler cylinder – 50ml and compare with the standards. Turbidity can be removed by centrifugation or with help of Buchner funnels N5. Do not use filter paper. If the turbidity has not been removed report color will be taken as "apparent colour".

Phosphorus [PO4] reagents

Ammonium Molybdate reagent: 25 gr. $(NH_4)_6Mo_7O_{24}$-$4H_2O$ in 175ml H_2O. Add 280ml conc. H_2SO_4 to 400 ml H_2O. Cool, add the Molybdate solution, and dilute to 1liter. Stannous chloride reagent: 2.5 g $SnCl_2$-$2H_2O$ in 100ml glycerol. Heat in the water bath and stir to hasten dissolution.This reagent is stable.

Phosphorus standard

Dissolve 109.8 mg angydrous KH_2PO_4 and dilute to 500 ml. 1.00 ml = 50.0 µg P or 150 µg PO_4 – stock solution, take 10 ml of stock solution and dilute to 100 ml. When 1ml = 5 µg P or 15 µg PO_4. –µg.

Procedure

To a 50ml sample free from color and turbidity add 1 drop phenolphthaleinIf the sample turns pink, add strong-acid sol. Dropwise, to discharge the color. Add, with mixing 2.0 ml molybdate reagent 5 drops stannous chloride reagent. The intensity of color depends on the temp., each 1^0C increase producing about 1 per cent increase in color. In-between 10 mins-12 mins to be measured. A blank must always be run on the reagent and H_2O.

Persulfate digestion method for total phosphorus reagents

Ammonium persulfate, $(NH_4)\ S_2O_8$, or Potassium persulfate, $K_2S_2O_8$, solid.
Sulfuric acid solution 100ml conc. H_2SO_4 to 200 ml of H2O, dilute to 330 ml with water [11,12].

Procedure

To 50 ml of sample add 1 drop phenolphthalein indicator. If a red color develops, add H_2SO_4 to just discharge the color. Then add 1ml H_2SO_4 sol and either 0.4 g solid $(NH_4)\ S_2O_8$. Boil gently on the hot plate 30-40 min or until final volume of 10 ml is reached. Cool, dilute to 30 ml with water, add 1 drop phenolphthalein indicator. And neutralize to a faint pink color with NaOH. Make up to 100ml.

Sulphate [SO4] reagents

Buffer solution

Dissolve 30 g Magnesium chloride, MgCl2.6H2O, 5 g Sodium acetate, CH3COONa.3H2O, 1.0 g Potassium Nitrate, KNO3, and 20 ml Acetic acid, CH3COOH (99%), in 500 ml distilled water and make up to 1000ml. Barium chloride, crystals, 20-30 mesh. Standard sulfate solution: Dilute 10.41ml of the H2SO4 0.02 N to 100 ml. (1ml= 0.1mg SO4).

Procedure

Measure 50 ml of sample into a 100ml Erlenmeyer flask. Add exactly 10ml of buffer solution and mix in the stirring apparatus. While the solution is being mixed, include a spoonful of barium chloride and start the planning right away. Mix for precisely 1min at a steady speed. Magnet ought to be of indistinguishable shape and size. Immediately after the stirring period has ended, pour some of the solution into the cell of photometer and measure immediately. Find the concentration of SO_4^2 on calibration curve[13].

Preparation of stock standards (stable 6-8 weeks)

Take 1.25 g Hydrazine Sulphate and dissolve in 100mlH_2O, take 12.56g HexamethyleneTetramine (Hexamine) in 100 ml ofH_2O, mix both solutions and make it up to 250 ml with H_2O and allow this mixture to settle for 48hours, shake this stock solution well before dilution, take 25 ml stock sol. and dilute to200 ml500NTU, take 5 ml stock sol. and dilute to200 ml100NTU.

Turbidity reagents

Take 5 g Hydrazine Sulphate and dissolved in 400ml of water. This is solution “A”50 g of HexamethyleneTetramine in 400ml of water. This is solution “B”. Mix solution “A” and “B” and dilute to 1L. Let it settle for 48 hours. This stock solution has 4000 NTU strength [14].

Working standards

- Take stock sol. 31,25 ml and dilute to 250ml – 500NTU
- Take stock sol 6,25 and dilute to 250ml – 100 NTU
- Take 5 ml of 500 NTU sol. and dilute to 250ml – 10NTU.

Procedure

Warm up the instrument 12 -15 min. select the range 10 or 100.Turn CALIB to max clockwise position. Insert tube with H_2O.Adjust SET ZERO to get zero. Replace tube with standard solution. Adjust CALIB CONTROL accordingly. Check again calibration with water for ZERO and standard for 10 or 100.For clear drinking water use 10 NTU standard. For higher accuracy compare transparency of the tube with distilled water and tube for 10 NTU standard filled with distilled water. Difference must be less than 0.1 NTU. Otherwise, clean both tubes with detergent. Analyzed sample must be placed to 10 NTU calibration tube. For turbid sample use 100 NTU standard. If sample turbidity more 40 NTU units dilute the sample with distilled water to bring the

value within the range.

Nitrate reagents

1. Wash 25 g 20-to 100-mesh Cd granules with 6 N HCl (30 ml acid 20water).
2. Swirl Cd with 100ml 2% $CuSO_4$ 5 min until blue color partly fades.
3. Decant and repeat with fresh solution CuSO4 until brown colloidal precipitate begins to develop.
4. Gently flash with water to remove all precipitatedCu.
5. Ammonium chloride/EDTA sol. Dissolved 13 g NH_4Cl and 1.7 g EDTA in 900ml of water adjust to pH 8.5 with NH_4OH and dilute to 1L.
6. Dilute NH_4OH/EDTA sol.: Dilute stock sol. 300ml to 500ml withwater.
7. Stock standard: 163 mg KNO3 in 100ml. Stock std. 1ml = 1mgNO3.
8. Working standard: Take 2 ml stock std. and dissolve in 200 ml of water. Working standard1 ml = 10 g

Procedure

Pack the column to 18.5 cm long and maintain water level above Cd-Cu granules. Wash the column with 200 ml NH_4OH/EDTA dilute Solution Activate column passing through it 7 to 10 ml /min solution. Composed 25% 1 mg/L standard and 75 % NH_4OH/EDTA solution.

Treatment of a sample

Adjust pH between 7 and 9 to 10ml of sample or portion (dilution factor) add 30ml NH_4OH/EDTA sol. and mix. Put mix on the column and collect with rate 7-10 ml/min. Discard first 20ml. Collect the rest in original sample flask. If column do not used for few or longer wash with dilute NH_4OH/EDTA 50 ml. Store column in this solution. And never let it dry. Take 2 ml of collected sample dilute to 50 ml with HPDW and analyze as NO_2 nitrogen (SOP N120).

Procedure

Calibrate pH meter with buffer solution. Put 30 – 40ml of sample in the beaker. Adjust temperature for the sample 25^0 C. Measure pH. Wash electrode with Deionized water.

Nitrite reagents

Color reagent: To 200 ml water add 25 ml 85% phosphoric acid and 2.5 g sulfanilamide. After dissolving sulfanilamide completely add 250 mg N-(1naphthyl) – Ethylenediamine dihydrochloride. Mix to dissolve, then dilute to 250 ml with water. Stable around 1 month in brown bottle in the fridge.
Standard: Dissolve 300 mg NaNO2 in 200 ml of water. Stock standard 1ml = 1.0 mgNO2.

Procedure

Adjust sample pH between 5 and 9. To 50 ml of sample or to portion diluted to 50ml add 2ml color reagent and mix. Between 10 min and 2 hours after adding color reagent measure absorbance at 543 nm.

Standard preparation

µg of NO_2 in 1L sample	µg of NO_2 in 50 ml	Working Std. add to 50 ml.
10	0.5	0.2 ml
50	2.5	1 ml
100	5.0	2 ml
300	15	6 ml
500	25	10 ml

Sample dilution factor

Sample amount, ml	Dilution factor	Range µg/L, NO2
50	1	2 – 500
5	10	20 – 5 000

Test report

CONCLUSION

The analysis of physicochemical characters of ground water reveals the water quality parameters like total dissolved solids, magnesium, cadmium, chromium and chemical oxygen demand which were above the permissible limits prescribed by BIS and WHO standards. The quality of ground water has been found varied from location to location by the complexed geological systems. The water quality index data showed that most of the sampling sites are fit for the potable purposes. The urbanization and industrialization are the main causes for the water crisis and pollution. Hence, from the assessment it is recommended to take necessary steps for the protection of environment and human beings.

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How to cite this article: K. Kathiresan. A Qualitative Analysis of Borewell Drinking Water in the Area of Cuddalore District, Tamil Nadu.Int J of Allied Med Sci and Clin Res 2018; 6(3): 550-555.

Source of Support: Nil. **Conflict of Interest:** None declared.