Quality Assessment of Borewell and Tap Water in and Around Hyderabad City

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ABSTRACT--- To regulate the climate and shaping the land,water is the most important compound. Water is one of the important compounds that which influences the human life. Initially, mankind used water for domestic purposes such a drinking, cooking, washing. However the present uses of water may be classified as domestic, public, commercial and industrial. Due to fast growth of industries, population and large quantity use of different chemicals, fertilizers and pesticides in producing crops are causing heavy and rapid pollution in aquatic environment leading to deterioration of water condition and depletion of aquatic biota. Due to use of polluted water, human suffers from water borne diseases. It is need and compulsion to check the water pollutants at regular interval of time. The water may consist of pollutants and toxic metals which are injurious and damage thehumanhealth. Thebelow are common characteristics of potable water pollutants and examples of each parameter:

Physicalpollutants initially impact theappearance or other physical properties of water. Examples of physical pollutants are sediment or organic material settled down in the water of lakes, rivers and streams from transportation of soil and erosion.

Chemicalcontaminants are elements or compounds. Chemical pollutants are naturally occurring or man-made. Majority of the chemical pollutants are man-made Examples of chemical contaminants include nitrogen, bleaching, salts, pesticides used in different places, metals, toxins produced by bacteria, and human or animal drugs are caused chemical contamination.

Biologicalpollutants and contaminants are organisms in water. They are also referred to as microbes or microbiological contaminants. Examples of biological or microbial contaminants include bacteria, viruses, protozoan, and parasites.

Radiologicalcontaminants are radioactive elements with an unbalanced number of protons and neutrons resulting in unstable atoms that can emit ionizing radiation. Examples of radiological contaminants include cesium, plutonium and uranium.

The condition of water compound , generally examined according to its physical, chemical and biological agents. Water samples are collected from different sources and the different required water characteristics, and required parameters that may be tested include temperature, pH, turbidity, salinity, nitrates and phosphates, generally all required parameters may be tested. An assessment of the aquatic macro invertebrates can also provide an indication of water quality. The tested samples will be checked against the standards laid by the Indian standards for potable water as per BIS specifications (IS 10500-1991) or WHO standards for potable water condition. The quality of borehole water in different sources of Hyderabad city was tested with respect to BIS standards. Areas taken into consideration also include those which are industrial where there might be chances of pollution of borehole water. Samples from Balanagar, Beeramguda, BHEL, Jeedimetla, Kondapur, JNTUH & Begumpet and other different areas were collected for the test. Each sample was tested for different characteristics, such as completely dissolved solids in water, standard name as (TDS), Conductivity of Electrical (EC), pH, Chlorides & Fluorides and for few samples, hardness was also found. The testing of underground water quality in the chosen area and its suitability for potable water is computed based on water quality index values. The data has shown that there were considerable varied results in the examined sample from different sources with respect to their chemical features.

Index Terms: Electrical Conductivity, pH, Quality assessment, Total Dissolved Solids, Toxic metals, WQI.

I. INTRODUCTION

Water is an necessary commodity required to maintain life, of all the words for water in Sanskrit, one is “Jeevanam” which means life. Water is an important biological factor that plays crucial role in determining the health of people. But almost, 70% of diseases in developing countries are caused by water due to its poor quality. According to survey done by Central Pollution Control Board, only 1.6% of the 90% water supplied to towns and cities of India is treated. Out of the 1.6% water which is treated by various municipal bodies and water plants, only half of it reaches the households with good quality as treated. It is obvious that water loses its quality at the distribution and supply networks. This happens because of buried water supply lines, microbial contamination of water in supply line, chemical contamination which leads to corrosion of lines, intrusion. Poor maintenance of overhead tanks and loft tanks also affects the quality.

In addition to this,0.63% out of 97.5% of theavailable water is represented as ground water which has also been polluted by various ways. Some of the factors that are affecting ground water are chlorine, So, it becomes a challenging task for water supply management to check the quality at various stages of water distribution.

A. Microbial aspects

The highest risk from microbials in water is connected with consumption of potable -water that is polluted with, waste landfills, human and animal excreta, although other sources and routes of exposure may also be significant.The use of the water from these source may have the danger of

Revised Manuscript Received on April 15, 2019.

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causing Gastro intestinal ailment, it might contain other dangerous microscopic organisms, for example, deadly bacteria (for example, Shigella, Escherichia coli, Vibrio and Salmonella), Viruses, (for example, Norwalk and rota infections), Furthermore, protozoans, for example, (Entamoeba, Giardia and Cryptosporidium) might be found in water. These microorganisms can cause manifestations, for example, sickness, regurgitating, the runs, and stomach issues. In sound grown-up creatures, these diseases are generally mellow and don't keep going long. In babies and youngsters, the old and people with debilitated safe frameworks, these diseases can be deadly.

B. Total Dissolved Solids(TDS)

A total dissolved solids (TDS) is the term used to explain the inorganic salts and less amounts of organic matter present in solution in water. The main constituents are usually calcium, Mg, Na, potassium cations and carbonate, hydrogen carbonate, Chloride, sulphates, and nitrate anions.

C. pH

pH is a reference symbol of the acid or alkaline condition of water. 0-14is the pH scale range of values; 7 indicates neutral point, the scale value < 7 refers acidity and water tends to be corrosive, while water with a value > 7 refers alkalinity.

D. Electrical Conductivity (EC)

Electrical conductivity (EC) of water is its capability to conduct an electric current. Salts which are in water or other chemical materials that dissolve in water can break down into positively and negatively charged ions. These free ions in the water conduct electricity. Purity of water indicated by EC.

E. Chlorides

Chloride occurs naturally in ground. Due to Chloride's high corrosive, plumbing materials, appliances, and water heaters will be damage, causingheavy metals to leach into water.

F. Fluorides

Fluorine is a compound with another element or group, especially salt of the anion F^-. Thevariation of fluoride is due to many factors such as sources of water, the geological formation of the ground, the intensity of rain fall and the quantity of water lost due to evaporation.

The present study was undertaken to enumerate water condition with respect to pH, EC, Chlorides, TDS and Fluorides from the various places of Hyderabad city using water quality index (WQI) as reference of the environmental conditions and to classify based on the Indian standards.

Table I shows the standard values of parameters

Table I: Standard values of chemical parameters

Parameters	Standard values
TDS	300-500PPM
Electrical conductivity	0-1,500uS/cm
Power of Hydrogen ion concentration	6.5-8.5
Chloride	<250 mg/L
Fluoride	0.05-0.4 mg/L

The results obtained are compared with respect to the standard values above and discussed.

II. RESEARCH SIGNIFICANCE

To find the Quality Assessment of Bore well and Tap Water in and around Hyderabad city.

III. LITERATURE REVIEW

P. J. Puri, et.al. have contemplated water quality list (WQI), which has been estimated for various surface water assets specifically water stored in lakes, in Nagpur city, Maharashtra (India), for the session calendar year starting month to last month of 2008; including 3 seasons in the year, i.e., normally hot, cold and wet seasons . Examining focuses were chosen based on their significance. Water quality list was calculated by utilizing water quality record number cruncher given by National Sanitation Foundation (NSF) data framework. The calculated (WQI) for different contemplated lakes demonstrated reasonable water condition in rainstorm season which at that point changed to medium in winter and poor for summer season. Gorewada lake indicated medium water condition rating in all season aside from rainstorm season. Futala, Ambazari and Gandhisagar Lake has likewise declined in tasteful condition over past decade following attack of amphibian weeds, for example, hydrilla and water primrose, so the motivations to import water quality change and measures to be taken up as far as surface water (lakes) quality administration are required.

B. N. Tandel, Dr. J. Macwan, C. K. Soni: have studied, the water quality index is a single number that expresses the quality of water by integrating the water condition variables. Its purpose is to provide a simple and concise method for expressing the water condition for bodies. The record enhances the understanding of general water condition issues, conveys water condition status and outlines the requirement for and the viability of defensive practices. It is discovered that in all cases the change in WQIvalue follow a similar trend throughout the study period. The lake water is found of good quality (WQI - 67.7 to 78.5) amid the two seasons. In any case, it is discovered that water state of lake break down somewhat from winter to summer season by virtue of the expansion in microbial movement just as increment in contaminations fixation because of water evaporation.

V. Pradhan, M. Mohsin, B. H. Gaikwad: have examined, water nature of Chilika Lake, this was resolved amid the long stretch of January 2012. It was seen that every one of the parameters are above passable limit with the exception of at the example site S2. The outcomes are examined in the light of discoveries of different specialists.

S. Hussain, et al. have observed, In their workwork, it was accounted for the Physio chemical characteristics like power of hydrogen ion concentration, conductivity electrical, Turbidity, Total dissolved solids, Dissolved Oxygen, fluoride, chloride, Sodium, Sulphate, and so on and the qualities are looked at for treated and untreated water tests. The samples were collected from treatment plant of

Ahmedpur, Dist. Latur. The conditions change evidently after the treatment of water.

M. Pejaver and M. Gurav: have identified, the 2 lakes in Thane city, to be specific Kalwa and Jail pool of Thane city are eutrophicated and consequently the examinations were done to locate the nature of water for the time of a half year for different physio-synthetic parameters to think about the contamination condition of the lakes. The Jail lake is observed to be moderately more naturally contaminated and more prominent level of eutrophication the Kalwa lake. Among water quality parameters, a positive connection was found among chlorophyll and temperature, suspended solids, pH, broke down oxygen (not with chlorophyll c), CO2 (just with chlorophyll C). A negative relationship was seen among Chlorophyll and light entrance. The Chlorophyll a and b indicated negative relationship with CO2 silicates and Phosphates.

IV. METHODOLOGY

Hyderabad tropical region which consists of wet and dry climate. The annual mean temperature is 28°C; monthly mean temperatures is 22–35°C. The underground water level in and around the city shows reasonable variations during the year. Samples mentioned in the above location were collected without adding any preservatives. Physical parameters of water , like Power of hydrogen ion concentration(pH), Total Dissolved Solids (TDS), and Electrical Conductivity (EC) were determined with the help of digital portable analyser.

A. Test for pH

First, the water sample was stirred well, using a glass stirring rod.

About 50 mL sample was poured into the glass beaker. And the sample was kept still restfor 20 minutes to pass the temperature to neutralize,mixing it time to time while waiting. The sample temperaturecan be readandadjusted to that of the pH meter. This adjustment was done just prior to testing. The pH meter was standardized by means of the standard solutions. The electrode was then immersed into the water sample and it was made sure that a good contact between the water and the electrodes was obtained, the electrode must be immersed to a minimum of 30 seconds in the sample before reading, to allow the meter to stabilize. The readings of the pH meter were then recorded. The electrode was taken out of the beaker & washed well with distilled water, then dabbed slightly with tissues to remove any film formed on the electrode. As avoiding it may result in polarization of the electrode and consequent slow response.

B. Test for TDS

The only true method of measuring TDS is toevaporate a watersample and weigh the remains with a precision analytical balance. Though is the most reliable and accurate method, it is costly. So, inexpensive tools like TDS meters were developed to measure TDS in water.

Ironically, a TDS meter does not initially measure TDS. TDS meters, also known as TDS testers or indicators, are digital or analog meters that measure the electrical conductivity of water. Based on that conductivity, the meters estimate what the true TDS level might be an elevated TDS results in the concentration of the dissolved ions which cause the water to be corrosive or salty & results in scale formation. Many contain elevated levels of ions that are above the Primary or Secondary Drinking Water Standards, such as an elevated level of nitrate, aluminium, copper,lead,etc.

C. Test for EC

EC is a measure of the capacity of water to conduct electrical current, it is directly related to the concentration of salts dissolved in water, and therefore to the TDS. EC of the water depends on the water's temperature: the higher the temperature, the higher the electrical conductivity. Theelectrical conductivityof water increases 2 to 3% for every 34°F increase in water temperature. Portable EC meters are usually used to measure the electrical conductivity of water. Various types of electrical conductivity meters may be used.Like ds/m or µs/cm.

The test procedure that was followed given below:

The EC meter was immersed in the water sample, only up to the level indicated in the instructions. Never immerse the EC meter totally. The sample water was stirred with the EC meter until the reading stabilizes and was noted.

EC meters is also said to measure the salinity of water. The high salinity may be affect plants in the following ways:

Specific toxicity of a particular ion (such as sodium).

The more osmotic pressure around the plant roots reduces the efficient water absorption by the plant root.

D. Test for microbial contamination:

H_2S strip microbial water testing kit was used to detect microbial contamination, faecal contamination in potable water. DRDO has developed a low cost, rapid field test is for removal of faecal contamination. The vial is filled with water which is to be tested, till the arrow mark indication present on the vial. The bottle is kept in a warm place(preferably at 30°-37°) 24 hours. Observe for the blackening of contents in the bottle. If water turns black-water is not fit for drinking. The blackening of water indicated the positive test after incubation period.

E. Test for chlorides:

To test the chlorides present in water, the standard test procedure was done as follows:

Initially a 0.075M known AgNO3 solution by adding 3.0g of AgNO3and 250ml of distilled water in an Erlenmeyer flask was made, and was set aside.

To find the chlorideconcentration, one(first) pipet ten ml of water passed through the filter paper, sample into a two fifty ml Erlenmeyer glass flask and titrated by mixingsixty five ml ofdistilled water. And test the power of hydrogen ion concentration of the diluted water sample pH test paper. Then add one ml of 0.25M potassium chromate to the flask. Rinse or shake it, and fill a burette with the standard AgNO3 solution. Titrate the environmental water sample by adding the AgNO3 solution slowly while stirring the sample using a magnetic bar and stir plate. The last point will be

represented by the persistence of a red-brown colour through the yellow solution for about thirty seconds.The same procedure should be repeated , the titration two to three times and average the amount of AgNO3 used to reach the endpoint.

Then titrate a blank solution using the similar procedure as mentioned above. For the blank solution use distilled water in place of the environmental water sample. Deduct the volume of AgNO3 for the blank from the average used for the sample. This volume will be the one used to find the concentration of Chloride in the water sample. The silver and chloride react in a one-to-one ratio. However, portable meters were only used to test the chloride concentration of both tap & bore water samples in order to carry out both accuracy & ease of work.

F. Test for fluorides:

Fluoride in the water sample was tested by using simple fluoride meter. Though various test methods are available such as titration, spectrophotometry. The electrode of the fluoride meter was inserted in the test sample until it was fully immersed, & the arrangement was kept still until a stable reading was obtained on the display. It was then taken out & wiped slightly by tissues & was made ready to be immersed in another test sample.

V. RESULTS AND DISCUSSIONS

Under phreatic conditions ground water occurs in shallow weathered mantle and under half confined conditions in the fault zones. Groundwater in basaltic and lateritic formations of Deccan traps occurs under water table and half-confined conditions. The transmissivity values of these formations range between 100 and 1100 m^2/day and the specific capacity varies from 0.22 to 1.2 m^3/m draw down. Water has become a scarce resource here not only due to deficient rainfall but also due to over exploitation of groundwater. Some of the places in Hyderabad have shown trace of faecal contamination added to the other abnormalities. Water Quality Index (WQI): To examine the underground water condition in the given area and its suitability for potable water is computed based on water quality index values. The data gives that there were considerable variations in the tested sample from different sources with respect to their chemical features and characteristics. From table 3,The water samples contain high amount of total hardness and not suitable for drinking.

Based on the above test result(s), according to table 3 a portion of the water tests gathered from the regions in and around Hyderabad are recognized to have unreasonable fluorides, more than the recommended qualities, the hardness of water likewise was observed to be significantly high might be because of the land pollutions, the mechanical squanders. Specific regions, for example, BHEL have demonstrated high EC esteems which would indicate centralization of salts in water might be because of the nearness of modern movement, septic framework, risky landfills. The a portion of the examples have likewise appeared of faecal sullying of water which might be because of the ill-advised administration, security of the drag wells Water is an open decent and everybody has a directly to request drinking water. It is to be seen that essential prerequisites satisfy least water quality guidelines and be promptly and helpfully available consistently and in all circumstance. Wellbeing based targets should be built up by the experts for utilizing ground water, surface water, rain water and reused water. For each, the utilization instead of the source ought to decide the nature of water provided. For ground and surface drinking water sources, it is of most extreme significance to ensure the catchment to keep its contamination from human and creature excreta and different wellsprings of bacteriological sullying. All around structured bunds, channels, bed security and union with Nirmal Bharat Abhiyan (Total Sanitation Campaign) and MNREGS for minimal effort squander water the board through adjustment lakes, zone an essentials for Ground and Surface drinking water.Table II shows the Samples collected from tap water.Table III shows the Samples collected from bore water. Table IV shows the Samples were taken from different places in Hyderabad.

Table II : Samples collected from tap water

Areas of samples collected	pH	EC (in micro siemens)	TDS (ppm)	Chlorides (mg/L)	Fluorides (mg/L)
Balanagar	7.36	530	335	212	0.14
Beerumguda	7.1	487	262	193	0.12
BHEL	7.24	449	213	177	0.2
Begumpet	7.64	375	199	165	0.19
Jeedimetla	7.22	664	347	189	0.18
Kondapur	7.51	773	295	155	0.11
JNTU	7.2	884	413	180	0.13

Table III : Samples collected from bore water

Areas of samples collected	pH	EC (in micro siemens)	TDS (ppm)	Chlorides (mg/L)	Fluorides (mg/L)
Balanagar	7.48	1351	525	218	0.37
Beeramguda	7.14	1080	594	197	0.32
BHEL	7.36	1816	874	189	0.27
Begumpet	7.73	1180	530	175	0.24
Jeedimetla	7.31	1248	591	194	0.31
Kondapur	7.83	1157	585	165	0.26
JNTU	7.34	1055	545	186	0.23

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

Table IV : Samples were taken from different places in Hyderabad

Sample No.	pH	Chlorides (mg/l)	Fluorides (mg/l)	Conductivity (µs)	TDS(ppm)	Turbidity (NTU)	Hardness as CaCO3 (mg/l)
1	7.7	22.8	0.6	513	226	3.4	2040
2	7.8	23	0.65	520	230	3.5	2100
3	7.8	22.7	0.7	522	231	3.4	2070
4	7.7	22.8	0.7	518	227	3.6	2060
5	7.7	22.9	0.7	517	226	3.5	2059
6	7.8	23.1	0.6	516	228	3.6	2067
7	7.8	23	0.75	514	229	3.7	2098
8	7.8	22.5	0.7	520	231	3.8	2084
9	7.7	22.6	0.74	521	231	3.8	2085
10	7.7	22.8	0.79	518	227	3.7	2049
11	7.8	22.7	0.74	517	227	3.6	2081
12	7.7	22.8	0.72	514	225	3.5	2075
13	7.7	22.7	0.68	512	224	3.5	2073
14	7.8	22.8	0.74	520	231	3.4	2079
15	7.8	22.9	0.76	518	227	3.4	2078
16	7.8	23.1	0.78	514	225	3.4	2084
17	7.8	22.8	0.74	516	226	3.5	2086

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