International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Bacteriological Water Quality in Open wells at Kotapakonda village in Guntur District Andhra Pradesh during Mahasivrathri Festival

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Abstract: ***Biological analysis of open well water samples in Kotappakonda village of Guntur District during Mahasivarathi festival in February 2015 was carried out. The biological analysis carried out as per standard methods before and after the chlorination treatment. The present study aimed to study the variations in biological qualities in water resources before and after the chlorination process and in order to evaluate the suitability of water for drinking purpose biologically. The results obtained from different sampling stations are found to be within the range of Indian standards of biological parameters.***

Keywords: EC (electrical conductivity), TDS (total dissolved solids), EPA (The Environmental Protection Agency) MPN (Most Probable Number)

1. Introduction

Water is essential for the any form of life particularly the Human beings. Drinking water intended for human consumption for drinking and cooking purposes from any source. It includes treated or untreated water by any means for Human consumption. Groundwater is one of the main sources of water in villages. The village Kotappakonda in Narasaroapet Mandal in Guntur district at Andhra Pradesh where lakes of people gathered to worship the Lord Trikoteswaraswamy on Mahasivarathri festival at Trikoteswara swami temple. At this village study was carried out to evaluate the biological standard level of drinking water in open wells before and after shock Chlorination treatment.

2. Materials and Methods

Water samples are collected from the open wells for Biological analysis before and after the disinfection with Bleaching powder. Water collected in sterilized bottles by the trained personal and they are received at the Laboratory within 48hours after the collection. In the laboratory MacConkey broth tube method is used for the culture. Broth culture tube are placed in an incubator for 48hours at 37^{o} C .The culture tubes are examined at 24hr and 48hrs and the Most Probable number of organisms per 100ml is calculated. .The culture tubes were removed after 48hr from the incubator and the numbers of coliform bacteria are counted.

3. Results and Discussion

Table 1: The physical-Chemical parameters of the open well water are

O.W .1 open well at Arya Vysya Satram
O.W.2.open well at Yadava Sathram
O.W.3.Nayabramhanasathram
O.W.4 Padmasali sathram
O.W.5.ViswaBrahmana Anadana satrham
O.W.6 Cheruvu temple scheme.

Sno	*Source*	*PH*	*E.C. in micromho/cm*	*TDS in mg/L*	*Nitrate as N in mg/L*	*Ammonical Nitrogen*
1.	O.W.1	7.8	1600	1056	Light traces	Nil
2	O.W.2	7.6	1000	660	0.02	Nil
3	O.W.3	7.9	2050	1353	0.03	
4	O.W.4	7.4	1285	848	Nil	Nil
5	O.W.5	7.7	1860	1227	0.02	Nil
6	O.W.6	7.8	680	449	Nil	Nil

In the above samples the PH, E.C, TDS are in maximum permissible range and they can be permitted if there is no other alternate source. As the water sample indicate high nitrate, it indicates human or livestock waste is suspected.

Table 2: Biological Analysis of water before Chlorination

Sno	*Source*	*Residual Chlorine mg/Lt*	*MPN count of Coliform Bacteria per 100ml*	*Nature of Coli form bacteria isolated*	*MPN of Esch.coli*
1	O.W.1	Nil	1609	E.Coli	5
2	O.W.2	Nil	1609	E.Coli	5
3	O.W.3	Nil	1609	E.Coli	5
4	O.W.4	Nil	1100	E.Coli	nil
5	O.W.5	Nil	1100	E.Coli	5
6	O.W.6	Nil	1100	E.Coli	5

The above samples are considered "Unsatisfactory", and unsafe for drinking as the fecal coli form E.Coli present.
An unsatisfactory result indicates fecal contamination of the well.

Table 3: Biological Analysis of water(Post –Chlorination)

Sno	Source	Residual Chlorine mg/Lt	MPN count of Coliform Bacteria per 100ml	Nature of Coli form bacteria isolated	MPN of Esch.coli
1	O.W.1	1.0	Nil	Nil	Nil
2	O.W.2	1.0	Nil	Nil	Nil
3	O.W.3	1.0	Nil	Nil	Nil
4	O.W.4	1.0	Nil	Nil	Nil
5	O.W.5	1.0	Nil	Nil	Nil
6	O.W.6	1.5	Nil	Nil	Nil

The above samples in Post chlorination of water are considered "Satisfactory "as the total coliforms don't exceed 10 and the fecal coli form E.Coli absent.

Table 4: Bacteriological Quality of Drinking water as per Indian Standard.[7]

Sno.	Organisms	Requirements
i.	All water intended for drinking	
a)	**E.Coli or thermotolerant coliform bacteria**	**shall not be detectable in any 100 ml Sample.**
ii.	**Treated water entering the distribution system**	
a)	**E.Coli or thermotolerant coliform bacteria**	**shall not be detectable in any 100 ml Sample.**
b)	**Total coliform bacteria**	**shall not be detectable in any 100 ml Sample.**
iii.	**Treated water in the distribution system**	
a)	**E.Coli or thermotolerant coliform bacteria**	**shall not be detectable in any 100 ml Sample.**
b)	**Total coliform bacteria**	**shall not be detectable in any 100 ml Sample.**

PH

The PH value of the water changes due to the biological activity and industrial contamination. The PH values of the Present investigation is varying between 7.0 to 8.5. The Indian standard of drinking water is 6.5 to 8.5 is the Acceptable limit.

Electrical Conductivity

Conductivity is the ability of water to conduct an electrical current, and the dissolved ions are the conductors. EC is an index to represent the total concentration of soluble salts in water (Purandara et al..2003) [7] .The values obtained in the study range from 680 to 1860 uomhos/cm.

TDS (Total Dissolved Solids)

Dissolved solids refer to any minerals, salts, metals, cations or anions dissolved in water. TDS in drinking Water originates from natural sources; TDS is used as an indicator test to determine the general quality of the water. Water containing more than 500 mg/l of TDS is not considered desirable for drinking water supplies, though more highly mineralized water upto 2000mg/l may be used where better quality water is not available(Jain ,2002) [8] . In the study the TDS values range from 449 to 1353 mg/l.

Nitrates

Nitrate (NO_3) is a naturally occurring from of nitrogen found in soil. Nitrogen is essential for life. Due to high mobility nitrate also can leach into groundwater. If people or animals drink water high in nitrate. It may cause Methemoglobinemia, an illness found especially in infants.Methemoglobinemia has not been reported where water contain less than 10mg/l of NO3-N. Nitrate can be expressed as either NO_3 (nitrate) or NO_3-N (nitrate-nitrogen). Nitrate levels above the EPA Maximum Contaminant Level of 10mg/l NO_3- N or 45 mg/l NO_3 may cause Methemoglobinemia in infants.[8]

4. Bacteriological Analysis of water

Bacteriological contamination cannot be detected by sight, smell or taste. Drinking water can get contaminated by

i) Bacteria from the Human and animal wastes can enter wells that are either open at the land surface, or don't have water tight casings or caps.
ii) Insects, rodents or animals entering the well are other sources of contamination
iii) Older water systems especially, dug wells, spring-fed systems and cistern type systems are most vulnerable to bacterial contamination.
iv) Bacteria can enter a water supply is through inundation or infiltration by flood waters or by surface run off.

The Environmental Protection Agency (EPA) requires that all public water suppliers regularly test for coli form bacteria and deliver water that meats the EPA standards.

The EPA established standards for drinking water which fall into **Primary standards** and Secondary standards. Primary standards are based on Health considerations, and are designed to protect from 3 classes of toxic pollutants-pathogens, radioactive elements and toxic chemicals. Bacteriological examination falls under the category of **Pathogens**. Bacterial communities found in well commonly i**) Nuisance Bacteria**—Iron Bacteria and Sulphate reducing Bacteria (SRB)[6] .. These are considered not harmful, but they can form pathogen protection biofilms and interfere with water quality testing for fecal coliforms. [1,2.] Ii) Harmful Microorganisms—Pathogenic bacteria. These are Total coliforms and Escherichia Coli, Campylobacter , Salmonellosis etc.,[3]The EPA "Most probable number" (MPN) for coliform Bacteria in drinking water is Zero (or No) total coliform per 100ml of water. The samples collected are tested bacteriologic ally and their reports shown in Table 2.The MPN for coliform bacteria is not Zero. Hence the water samples are considered as "**Unsatisfactory**" and unsafe for drinking. An unsatisfactory result indicating fecal contamination of the well. When E.Coli is present, it indicates that there is potential for disease causing organisms to be present. [4]These include germs like Salmonella, Campylobacter, E.Coli 0157 and Guardia. So it needs disinfection of the wells. As the results are unsatisfactory well water given to disinfect the well water to kill the pathogenic bacteria and the source of contamination is also searched for.

Disinfection of wells should be done regularly to keep water fit for drinking and domestic purposes. Bleaching Powder is used for this purpose because it is cheap and quite effective disinfectant. During disinfection the following steps are fallowed. i. Measurement of well for its depth and measure the height of water column. Ii). Amount of water in the well is calculated by using the formula $V=nr^2h$ x1000 liters where V= volume of water n= 22/7 r= radius (meters) h= height (meters) .The figure 1000 indicates that the volume is multiplied with 1000 to convert cubic meters into liters. iii) Amount of bleaching powder required is 10gm is sufficient to disinfect 1500 liters of water. iv) Mixing of bleaching powder is done by taking required quantity of the powder in a bucket and to this add small amount of water so as to make a paste. Then add more water with continuous stirring till the

bucket is ¾ full. Then allow it to stand for 5-10minits so as to settle the lime. Then transfer the supernatant clear liquid (chlorine solution) into another bucket and discard the lime sediment. (the lime should not be poured into the well as it increases the hardness of the well water) v) the bucket containing the chlorine solution is lowered into the well and agitate the water by lowering and drawing up the bucket several times and at the same time going round the well so as to mix the chlorine solution thoroughly with the well water. Then allow the chlorine solution to remain with well water for at least one hour (contact time) and during this period no water should be withdrawn from the well. This allows the chlorine water to kill the pathogenic micro organisms. vi) After that chlorination water has been tested for free residual chlorine. If it is less than 0.5mg per liter(0.5ppm) then additional quantity of bleaching powder is added.

Then after more than 48hrs, the water samples are collected for bacteriological testing. The bacteriological results after chlorination of the wells (Table 3) showing "**Satisfactory**" result as the total coliform doesn't exceed 10 and the fecal coli form E.coli is absent. The Table 4 showing the Indian standard for bacteriological analysis of drinking water. Post –chlorination testing of the well water should be tested several times a year for microbiological indicators given that the groundwater quality can change rapidly, with sporadic contamination throughout the year[5]. The limitations for Chlorination are, its effect is temporary , if the source of contamination is not addressed before treatment.[9] Chlorination does not reliably eradicate all microbial populations ex. Cryptosporidium oocysts show remarkable free chlorine tolerance.[10] The bioforms may further hinder disinfection [2] and facilitate rapid resurgence [11].

5. Conclusion

The analysis of the water quality of drinking water from the open wells of Kotappakonda village , Guntur district in comparison with the Indian standards of bacteriolocal quality of drinking water are considered as " satisfactory" after the post chlorination and the water is acceptable for human consumption bacteriologically . Chlorination has to be performed on an as needed basis (e.g. after a flood, suspicious G.I. illness, or positive test for E.coli and during fairs and festivals) .It is recommended to go for the disinfection measures for all the wells in a village before the fairs and festivals particularly. It is recommended at least once in a year as parts of well maintenance program me to control nuisance bacteria.

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