

Monitoring of Water Quality the Need of Present Day House Hold Water Management

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Abstract

WHO 2019 report on drinking water says that In 2017, 71% of the global population (5.3 billion people) used a safely managed drinking-water service – that is, one located on premises, available when needed, and free from contamination.. Most countries, the proportions of piped and other-improved water supplies are faecally contaminated sources due to lack of basic sanitary protection against contamination. Contaminated water is an important contributor to water borne disease including hepatitis A, cholera, typhoid, and poliomyelitis.¹ For people with enough water supply can treat their water at home after testing water quality to ensure microbiological quality. Treating water at the household level or other point of use also reduces the risk of waterborne disease arising from recontamination during collection, transport, and use in the home. This article mainly focuses on need for water quality monitoring, water quality, types of water quality testing the importance of water quality monitoring and reviews related to water quality testing.

Keywords: Water quality, drinking water, tests in monitoring water quality, water quality standards.

Introduction

Water is a vital environmental factor to all forms of life. It has a major role to play in the social and economic life of an individual. Water is used for domestic, agricultural, industrial and electrical purposes. Water used for drinking purpose must be safe and whole some. It must be free of microbiological, physical and chemical contamination.

Unsafe drinking water along with poor sanitation and hygiene accounts for nearly 10% of the total burden of the disease worldwide .Today 2.2 billion people around the world lack safe drinking water.² It includes estimated 4 billion cases of diarrhea disease annually causing 1.8 million deaths mostly among children under 5 years of age. Around 884 million people lack access to good water supplies drawing their water from lakes and rivers unprotected wells and springs and other

sources that are highly contaminated with water borne pathogens.^{3,1} Globally at least 2 billion people use a drinking water source contaminated with faeces. People rely on improved water sources that are nevertheless subjected to frequent and extensive microbial contamination.⁴ Tap water supplied to urban dwellers in major cities in the developing countries is of uncertain microbiological quality because of inadequate treatment or may be due to microbial contamination due to failures in the distribution system. Providing disinfected piped water to each house hold is the best solution to water borne diseases; due to resources constraints which is not available in most of the developing world .⁵

The provision of safe drinking water was one of the eight essential component of primary health care at Alma Atta Declaration 1978.⁶ Millennium Development Goals focus on halving the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015. The proposed sustainable Development Goals declared in 2015 is to achieve universal and equitable access to safe and affordable drinking water for all by 2030.⁷ As per Gov. of India annual report of department of water and sanitation 2018 -2019, the Ministry had launched the National Water Quality Sub-Mission on 22nd March, 2017 under

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NRDWP to provide safe drinking water to about 28,000 arsenic/fluoride affected habitations over a span of 4 years, subject to availability of funds.⁸

In India as per the statistics 85% of the rural households have access to drinking water within or near to their premises. 70% of India's improved household water sources were polluted with sewage effluents.⁹

Water borne disease account for 10% of total burden of disease and at affect about 50 million people every year in India and claim about 5million lives, of which 1.5 million are children.¹⁰

Previously considered key factors for the prevention of water borne disease are sanitation, personal hygiene and availability of good quality drinking water. Recently quality of water also got equal or greater importance with attributable risk reduction of 39%.^{11, 12}

According to a survey by CWRDM, there are 67lakh opens wells in Kerala. 80% of population in Kerala is estimated to depend on ground water for different uses.¹³ A study conducted by CWRDM indicate that 70% of drinking water wells in Kerala have facial contamination.¹⁴

Contamination of wells can happen from both above and below the surface. It can be from failing septic tank system, manure and fertilizer applications mining and other land uses. Sources of microbial contamination of ground water include agricultural runoff, effluents from septic tank, sewage discharges and infiltration of dissolved wild animal fecal matter. Poor well maintenance and construction can increase the risk of bacteria and other microorganisms. The contamination source depend on the type of settlement, population density sanitation arrangements and sanitation behavior^{15, 16}

Water Quality: In today's world analysis of water is becoming increasingly important in order to monitor the water and waste water quality. Physical chemical biological and microbiological analysis of water is essential to assess the quality of to provide pure water to the public for drinking and other domestic purpose

Different tests in monitoring water quality:

Sensory Examination: This is the basic test for water it includes testing of clarity, odour, taste and color. Taste water for any abnormal taste and colour. Taste water for any abnormal taste. Color can be tested by usual comparison of the sample with known

concentration of coloured solution. Colour is expressed in Hazaenunit. Temperature is recorded in Celsius scale. Warm waterholds less oxygen than cold water

Dissolved oxygen: Healthy water have high levels of dissolved oxygen

pH: Water pH is usually between 6.50 and 8.50

Turbidity: Turbidity measure the clarity of water. It is measured by Nephelo Turbidity meter

Hardness: The amount of dissolved calcium and magnesium in water determine its hardness.0-50mg/L: soft water.

Testing for coliform Bacteria: Coliform bacteria live in the gastro intestinal tract of animals, soil or vegetation, coliforms enter water supplies from the direct disposal of waste water into streams or lakes or from runoff from wooded areas, septic tanks and sewage plants in to streams or ground water. Coliforms are not a single type of bacteria that includes many strains such as E.Coli. Measurements of total coliform gives an overall picture of microbial contamination. Presence of E.Coli in water indicate fecal contamination of water. As per report on WHO/UNICEF joint monitoring programme for water supply, sanitation and hygiene no E. coli (or alternatively thermotolerant coliforms) detected in a 100 mL sample.¹⁷

Drinking water standard gives the recommended level of constituents that are acceptable in drinking water. According BIS standards the desirable limit of the drinking.¹⁸

Water Quality Standards:

Parameters	Desirable limits
Colour (Hazen unit)	5.00
Turbidity (NTU)	5.00
pH	6.50-8.50
Total Hardness	300meq/l
Iron mg/L	.30
Chloride	250mg/l
Total dissolvat solids	500.00
Sulphate (mg/L)	200
Nitrate(mg/ml)	45.00
Calcium(mg/ml)	75.00
Total coliform (MPN/100ml)	10.00
EColi	Absent

An investigation was done on bacteriological contamination of ground water and its causative factors in selected areas of Kozhikode district in Kerala state. Multiple tube fermentation technique was used to find out the total coliforms, faecal coliforms and E.coli. 55% of water sample was contaminated due to unscientific construction of latrines 11.1% by an animal source and 33.3% had a mixed source. One of the identified organism was *Bacillus cereus* from human faeces. Results showed that there was a significant influence between the distance of the latrine from the well and the presence of E.coli.¹³

Study on Sanitation mapping of groundwater contamination in a rural village of India found that poor planning, design of the wells and improper siting of wells from latrines which were found to be the possible reasons of groundwater contamination. A moderate negative correlation ($r = -0.593$, $r = -0.470$) was ensued between the distance from latrine and coliform count.¹⁶

A study conducted on relation of sanitary condition of water source and water borne diseases in rural households of South India. In order to assess the sanitary condition of the household drinking water sources and hygienic practices of the community and incidence of waterborne diseases. During the 12 months study period 72 episodes of water borne diseases was reported with an incidence rate of 49/1000 persons/year. Major source of household water supply were dug wells and 30% water source had E.coli and more than 60% of water source contain faecal coliforms more than 10 MPN/100ml in all seasons. Stagnant water in the premises was found to be associated with waterborne diseases.¹⁹

In a study conducted to assess the microbial quality of drinking water and prevalence of water-related diseases in Kenya, samples of drinking water were collected from water sources (boreholes, rivers, and wells) and at the point of use (households) and analyzed for *Escherichia coli* and total coliform (TC) bacteria using the most probable number method. The prevalence rates of some of the water-related diseases assessed using clinical health records. Findings showed that Typhoid was the most prevalent water-related disease during the dry season (10%), whereas diarrhea (3%) was the most prevalent during the wet season. All drinking water at abstraction and point of use were microbiologically contaminated and therefore pose serious health risks to consumers of such water. Thus, there is need for public health awareness campaigns

on household water management to curb incidences of water-related diseases.²⁰

In a study to assess the sanitary condition and water quality of household wells and to depict it spatially, using Geographic Information System (GIS) in an urban area of, Kerala, community-based cross-sectional census-type study was conducted among households ($n = 449$) residing in a 1.05 km² area. Structured questionnaire and Differential Global Positioning System (DGPS) device were used for data collection. Water samples taken were analyzed in an accredited laboratory. Most of the wells were in an intermediate-high contamination risk state, with more than 77% of wells having a septic tank within 7.5 m radius. Coliform contamination was prevalent in 73% of wells, and the groundwater was predominantly acidic with a mean of 5.4, rendering it unfit for drinking. The well chlorination and cleaning practices were inadequate, which were significantly associated with coliform contamination apart from a closely located septic tank. However, water purification practices like boiling were practiced widely in the area.²¹

In a review to investigate the prevalence of *E. coli* O157:H7 in water sources especially used for drinking and to develop the diagnostic method for its early detection, describes traditional cultural method, immunological techniques, and polymerase chain reaction (PCR)-based method for detection of this bacterium in water sources. The current PCR-based techniques such as real-time PCR are more specific and sensitive and require less detection time (<3 hours). These can be applied for regular water monitoring and proper management of water sources to prevent waterborne diseases due to *E. coli* O157:H7.²²

In a study among 400 households at Salyan district, Nepal Household survey, Spot observations, Physical parameters, and Microbial contamination (*E. coli*), of PoU drinking water were assessed. Physical parameters were within the limit value of National Drinking Water Quality Standards (NDWQS), 2005. Microbial contamination (*E. coli*) was laboratory confirmed in 191 PoU samples. Uncovered storage vessels possessed twice much as odds risk (OR=2.24; CI=1.208-4.166) of contamination than that of covered ones. Households with water in the dwelling had of greater risk of contamination. Technical and Behavioral factors were evidenced to be associated with microbial contamination in study sample. The study indicates that, if water is from safe distribution point and stored in a covered vessel

which is easily cleanable, PoU drinking water shall be microbiologically safe.²³

The supporting literature high lights the importance of regular testing of water quality.

Regular testing is important:

- To identify existing problems.
- Ensure water is suitable for the intended use especially if used for drinking by humans
- Track changes overtime.
- Determine the effectiveness of a treatment system.

Conclusion

Water whether for a public municipality, water facility or business/home must be tested regularly to keep the source safe and free of potential health/environmental hazards. The house hold wells needs to be tested and treated to safe guard water against harmful contaminants that may present in the well certain chemical contaminants that are sometimes found in a water source can cause long term health problem that take years to develop. Frequent water testing will identify unsafe water and ensure that the treatment system is treating the water to a satisfactory level. Private well water should be tested minimum of once per year. Drinking water supplies obtained from shallow wells and surface water source should be tested more frequently (ie seasonally) as they are more susceptible to contamination.

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