March 2009 Volume 4 Issue 4

Trade Science Inc.

Environmental Science
An Indian Journal
Current Research Papers

ESAIJ, 4(4), 2009 [153-156]

# Bacteriological status of drinking water available in salinity affected villages of Akola and Buldhana district of Vidharbha (Maharashtra state)

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*Received: 31st December, 2008 ; Accepted: 5th January, 2009*

## ABSTRACT

Water borne diseases continue to be a dominant cause of water borne morbidities and mortality all over the world. In present study, a total of 260 water samples were analyzed for water quality from surface water (13) shallow ground water (42), deep ground water (129) and public water supply (76) and thermotolerant coliform (*E.coli*) were isolated and detected from different localities of salinity affected villages of Akola and Buldhana district of Purna River basin of Vidharbha. The investigation showed water from these villages was not free from fecal contamination. Moreover, in villages, open defecation may be the one of the cause for water pollution in surface water along with improper management of sewage water from household, industrial influent. The contamination in hand pump and tube well which was occurred may be due to percolation of sewage and wastewater and construction of latrines near the tube well. Hence open defecation should be avoided in villages along with proper management of sewage from household, industrial effluent, water hygiene which can reduces the water pollution and water borne diseases.


## KEYWORDS

Water quality;
Akola;
Buldhana;
MTFT;
Rapid $H_2S$ test.

## INTRODUCTION

Water borne diseases continue to be a dominant cause of water borne morbidities and mortality all over the world. According to WHO about 600 million episodes of diarrhea and 40,00,000 childhood deaths are reported per year due to contaminated water and lack of sanitation. An estimated 80% of all diseases and one third deaths in developing countries are caused by consumption of contaminated water and on an average, one tenth of each person's productive time is sacrificed to water related diseases. Interventions in hygiene, sanitation, and water supply make proven contributors to controlling this disease burden. In last couple of years more attention has been given by State Government to provide drinking water through various schemes to rural population and more and more new water supply schemes are coming up in the country. To avoid the spread of water borne diseases in the community and to ensure the safety of drinking water, the regular water quality monitoring is essential[9,12].

The most important aspect of water quality is its freedom from contamination with faecal matter. The primary objective of bacteriological examination of drinking water is thus the detection of faecal pollution indicated by the presence of bacteria of faecal origin. The

common sources of water are wells (open/ tube wells) and various routes may contaminate these natural sources of water. These routes include, effluents from different industries, discharge of drainage system in natural water reservoirs from different human activities such as washing, bathing, domestic and municipal waste etc. The tube well water is almost soil filtered and should be free from bacterial pathogens. But some studies showed the fecal contamination in the tube well water. The contamination could be sewage, which could have been washed off or trickled off into the drinking water body[3,8,10] studied the water problems in Mayyanad Panchayat of Kerala and showed that 44% of household had their latrine pits at a distance of 3-6 meters from the wells, which influenced the water quality of the open wells. Ground water can be polluted from septic tank and drains[4]. The ground water quality in Bhavnagar, Gujarat, showed the presence of coliform such as *Escherichia coli* and *Enterobacter aerogenes* in drinking water[7]. The bacteriological quality of drinking water also affected by seasonal variation and low coliforms count detected in rainy season[5]. Bahador et al.[2], showed the seasonal variation of microbial pollution in surface water of Pune city and reported maximum coliform count in monsoon than the winter and summer.

The 228 villages of Akola and Buldhana districts of Vidharbha are severely salinity affected and water from these villages declared unsafe for drinking purpose by Maharashtra State. Thus attempt was made evaluate the bacteriological quality and fecal *E.coli* contamination in water from various sources in these villages.

## MATERIAL AND METHODS

A total of 260 drinking water samples were collected from surface water (13) shallow ground water (42), deep ground water (129) and public water supply (76) to study water quality and contamination of thermotolerant coliform (*E.coli*) from different salinity affected villages of Akola and Buldhana district of Vidharbha between June 2007 to December 2007 by using sterilized sample collection bottles. The bacteriological examination was performed within the 24 h of collection using standard Multiple Tube Fermentation Technique (MTFT) for determination of Most Probable number (MPN) index, nine multiple tube dilution technique using double and single strength Bromo-Cresol Purple MacConkey medium and Membrane filter techniques (MFT) by using M-EC test agar (Hi-media Lab. Mumbai), which detect only *E.coli* (Thermoto lerant coliform (TTC) with production of yellow colour colonies on membrane filter at 44.5$^0$C and Manja's Rapid $H_2S$ test for detection of fecal contaminations in drinking water. The MPN Index was calculated from MPN table and index of water more than 10 coliforms/ dl is designated as polluted or unhealthy for drinking purpose or non-potable[1].

The isolation and identification of *E.coli* was made based on MFT incubated at 44.5$^0$C and standard bacteriological tests such as morphological, cultural, biochemical and special tests by subculturing the MFT positive (yellow color colonies on membrane filter in M-EC test agar) colonies in respective medium. The modified $H_2S$ test medium[6] was used to detect potability of water. One mL of the modified $H_2S$ medium was added in each 30mL screw cap bottle and sterilized at 121$^0$C at for 15min. To each 30mL, 20mL drinking water was inoculated for testing its bacteriological quality in duplicate. The bottles were then incubated at room temperature for 48h of incubation. The positive $H_2S$ test or feacal contamination or pollution in drinking water indicated by change in colour of the medium to black. The statistical analysis was performed with the Statistical Package for Social Sciences 15 for Windows (SPSS Inc.; Chicago, IL, USA) software.

## RESULTS AND DISCUSSION

In present study, a total of 260 water samples were analyzed for water quality from surface water (13) shallow ground water (42), deep ground water (129) and public water supply (76) and thermotolerant coliform (*E.coli*) were isolated and detected by various methods from different localities of salinity affected villages of Akola and Buldhana district of Purna River basin of Vidharbha. All water samples were analysed by MTFT test, Manja's $H_2S$ test, and MFT and 243 (93%) water samples were found contaminated by MTFT method, 211 (81%) by $H_2S$ test and 75 (29%) by MFT. Out of 13 surface water samples, all (100%) were detected contaminated by MTFT method, 12 (92%) by $H_2S$ test

**TABLE 1: Q uality of drinking water in Akola and Buldhana district of Vidharbha (in %)**

| Type of test | Taluka wise samples | Akola district | | | | Buldhana District | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Akola (70) | Akot (55) | Balapur (3) | Murtijapur (4) | J.Jamod ((35) | Malkapur (11) | Nandura (29) | Sangrampur (14) | Shegaon (31) | Telhara (8) | |
| | Water quality | % | % | % | % | % | % | % | % | % | % | % |
| MTFT.24 | Safe | 4 | 9 | 67 | 0 | 0 | 9 | 0 | 0 | 19 | 0 | 7 |
| | Polluted | 96 | 91 | 33 | 100 | 100 | 91 | 100 | 100 | 81 | 100 | 93 |
| MTFT.48 | Safe | 4 | 5 | 67 | 0 | 0 | 9 | 0 | 0 | 13 | 0 | 5 |
| | Polluted | 96 | 95 | 33 | 100 | 100 | 91 | 100 | 100 | 87 | 100 | 95 |
| Rapid $H_2S$ test. | Safe | 14 | 38 | 33 | 0 | 14 | 18 | 17 | 14 | 10 | 0 | 19 |
| | Polluted | 86 | 62 | 67 | 100 | 86 | 82 | 83 | 86 | 90 | 100 | 81 |
| MFT | Safe | 69 | 69 | 33 | 0 | 69 | 36 | 14 | 0 | 16 | 25 | 71 |
| | Polluted | 31 | 31 | 67 | 100 | 31 | 64 | 86 | 100 | 84 | 75 | 29 |

**TABLE 2: Source wise water quality**

| Type of test | Source | Public water supply | Deep ground water | Shallow ground water | Surface water | Total |
|---|---|---|---|---|---|---|
| MTFT.24 | Safe | 8% | 6% | 7% | 0% | 7% |
| | Polluted | 92% | 94% | 93% | 100% | 93% |
| MTFT.48 | Safe | 7% | 4% | 7% | 0% | 5% |
| | Polluted | 93% | 96% | 93% | 100% | 95% |
| Rapid $H_2S$ test. | Safe | 24% | 22% | 5% | 8% | 19% |
| | Polluted | 76% | 78% | 95% | 92% | 81% |
| MFT | Safe | 72% | 71% | 76% | 46% | 71% |
| | Polluted | 28% | 29% | 24% | 54% | 29% |

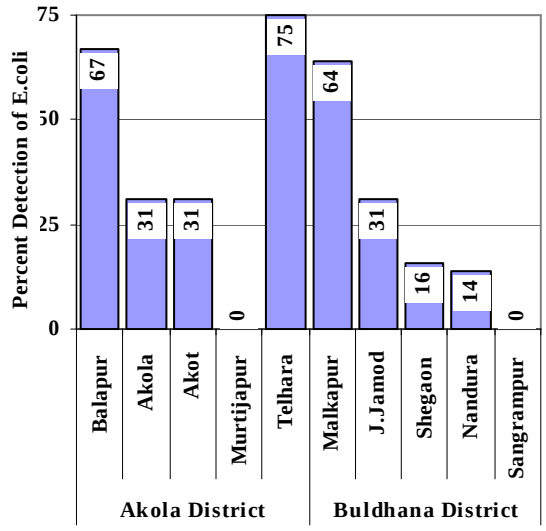


**Figure 1: Detection of *E.coli* in Akola and Buldhana district**

and 7 (54%) by MFT. Out of 10 taluka's, the water in five were 100% polluted, while in four was polluted in the range of 81-96%, except in Balapur where it was 33% by MTFT test while water in 2 taluka's (Murtizapur and Telhara) was 100% polluted, and in other 6 it was 62-86% by $H_2S$ test (TABLE 1). It may be due to contamination in water by fecal matter or due to the percolation of contaminated water in the resources. The bacteriological quality of drinking water also affected by seasonal variation and high coliforms count detected in rainy season. Lomate and Samant[5], Bahador et al.[2], showed the seasonal variation of microbial pollution in surface water of Pune city and reported maximum coliform count in monsoon than the winter and summer.

In present study a total of 260 drinking water samples were analysed from Akola district (140) and Buldhana district (120) of saline belt of Purna River basin and these were, 76 samples from public water supply scheme, 129 from deep ground water (Tube well and Hand pump) 42 from shallow ground water (open well) and 13 from surface water (River and Lakes). Out of these 39 (93%) in shallow ground water, 124 (96%) in deep ground water and 71 (93%) treated water and 13% (100%) in surface water were found to be contaminated by MTFT method, 40 (95%) in shallow ground water, 101 (76%) in deep ground water and 58(76%) treated water and 12(92%) in surface water by Rapid $H_2S$ test field test, 10(24%) in shallow ground water, 37(29%) in deep ground water and 21 (28%) treated water and 7(54%) in surface water by MFT, the results confirmed contamination were of fecal origins. Analysis of different water sources demonstrated that increasing rate of pollution from Public Water supply (PWS) treated water to surface water sources (TABLE 2). Similarly Tambekar et al.,[11], also observed 81% pollution in water in Amravati and recorded unfit for drinking. The study clearly indicated that water is heavily contaminated during monsoon as compare to pre-monsoon and post monsoon.

The detection of thermotolerant fecal *E.coli* analysis of water gives the proper status of drinking water sources and results showed that 67% fecal *E.coli* in Balapur taluka, 31% each in Akola and Akot taluka and no fecal *E.coli* in Murtijapur taluka water in Akola district while 75% in Telhara, 64% in Malkapur, 31% in J.Jamod, 16% in Shegaon, 14% in Nandura and 0% in Sangrampur taluka's of Buldhana districts (Figure 1). Analysis of drinking water from different sources demonstrated, 54% of fecal *E.coli* pollution in surface wa-

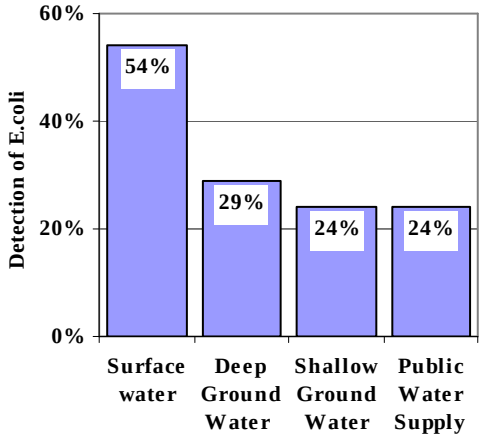


**Figure 2 : Detection of *E.coli* in water from various sources**

ter while 24%, 29%, and 28% in shallow ground water, deep ground water, and public water supply respectively (Figure 2). Highest fecal *E.coli* was recorded in surface water sources indicating entrance of fecal matter from ground (open defecation) or due to open drainage or sewage water from household. The deep ground water (hand pump and tube well) was not free from fecal contamination and it may be due to percolation of sewage and wastewater and construction of latrines near the tube wells. The public distribution system (Maharashtra Jeevan Pradhikaran) water was not free from fecal contamination regardless of degree to which the water is treated.

## CONCLUSION

Thus present investigation showed that water from salinity affected villages of Purna River Basin in Akola and Buldhana district were not free from fecal contamination. The investigation showed water from these villages was not free from fecal contamination. Moreover, in villages, open defecation may be the one of the cause for water pollution in surface water along with improper management of sewage water from household, industrial influent. The contamination in hand pump and tube well which was occurred may be due to percolation of sewage and wastewater and construction of latrines near the tube well. Hence open defecation should be avoided in villages along with proper management of sewage from household, industrial effluent, water hygiene which can reduces the water pollution and water borne diseases.

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