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Evaluation of Physico-Chemical and Bacteriological Parameters in Drinking Water of Chitrakoot Nagar Panchayat Area (M.P) India

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Abstract: The bacteriological and physicochemical analyses were carried out of river Mandakini, dug wells, hand pump and PHE, Chitrakoot Nagar Panchayat, Satna M.P... The mean of the result obtained were compared with WHO standards for drinking water. The physicochemical analyses (pH, temp, turbidity, EC, total dissolved solids, DO, BOD, and COD) were in compliance with the WHO standards. The pH of the water samples ranged from 7.0 to 7.9 while the turbidity of water samples also ranged from 2.8 – 4.0 NTU for all the water samples. Conductivity were ranged from 372 to 788(um/cm). The bacteria isolated from water samples in this work included *Escherichia coli*, *Salmonella spp* and *Vibrio cholera*. It was found that treatment of these water was for use.

Keyword: Physico-Chemical, Bacteriological, Water Analysis

I. INTRODUCTION

The ensuring of good quality drinking water is a basic factor in guaranteeing public health, the protection of the environment and sustainable development¹. Water of good drinking quality is of basic importance to human physiology and man's continued existence depends very much on its availability². The provision of portable water to rural and urban population is necessary to prevent health hazards associated with poor drinking water. A significant proportion of the world's population use potable water for drinking, cooking, personal and home hygiene³. Before water can be described as potable, it has to comply with certain physical, chemical and microbiological standards, which are designed to ensure that the water is potable and safe for drinking. Potable water is defined as water that is free from disease producing microorganisms and chemical substances deleterious to health⁴. Water is the most common solvent for many substances and it rarely occurs in its pure state. Water can be obtained from a number of sources viz streams, lakes, rivers, ponds, rain, springs wells etc.⁵ The most dangerous form of water pollution occurs when fecal contaminant like *Escherichia coli* enter the water supply. Contaminants ingested into water supply cause many diseases. Examples of such pathogens are *Salmonella spp*, *Vibrio cholera*, *E. coli* etc. The bacteriological quality of drinking water is of paramount importance and monitoring must be given highest priority⁶. This is so because studies have attributed several disease outbreaks to untreated or poorly treated water containing bacterial pathogens that have been isolated from surface water in around Chitrakoot region. The main objective of this study was to determine the physico-chemical and bacteriological quality of drinking water of Chitrakoot Nagar Panchayat, Satna and M.P.

II. MATERIALS AND METHODS

A. Sample Collection

Drinking water samples were collected. The water samples were collected from PHE, hand pumps, river Mandakini and dug wells of (17) different locations of Chitrakoot Nagar Panchayat, Satna, M.P into sterile bottles and transported to the laboratory for analysis

B. Physico-chemical Analysis

The physico-chemical tests i.e pH, temperature, turbidity, EC, total dissolved solid, DO, BOD, COD etc were carried out using the methods APHA⁸.

C. Bacteriological Analysis

Bacteriological characteristics were determined as described by Bezuidenhout et al. (2002). The Most Probable Number- multiple tube technique was used for *E. coli*, Nutrient agar (NA), Salmonella-Shigella agar, thiosulphate citrate bile salt sucrose agar were used to determine, *E. coli*, Salmonella and *Vibrio cholera* respectively. All plates were incubated at 35°C for 24hrs. Presumptive colonies were confirmed by gram staining and biochemical reactions and each plate was given a positive or negative score. Isolates were confirmed by some conventional biochemical tests.

D. Characterization and Identification of Bacterial Isolates

Bacteria isolates were identified and characterized according to Bergey's manual of systemic determinative bacteriology.

III. RESULTS AND DISCUSSION

The result of the physico-chemical and microbial characteristics of drinking water were in given Tables-1 and 2.

A. pH

The pH is the measure of acidity or alkalinity. The pH value of water sample was found between 7.0-7.9 (Tables 1-2). Minimum pH of water was observed 7.0 at Sirsavan in post monsoon 2016, while maximum 7.9 at Purani Lanka in post monsoon 2016. pH observed at different stations is shown in Tables 1-2 and Figure.1.

B. Temperature

The temperature of water which is an ideal for the biological activities of microorganism is 20-25°C. During study, temperature of all stations range 26-29°C (Tables 1-2). Minimum temperatures 26°C were recorded at Sirsavan post monsoon 2016 while maximum temperature was recorded 29°C at Rajoul post monsoon 2016. The ground and surface water temperature recorded in the range of 26°C-29°C as it depends on atmospheric temperature. Temperature observed at different stations are shown in Tables 1-2 and Figure. 2.

C. Turbidity

High turbidity is often associated with higher levels of disease causing microorganism such as bacteria and other parasites. Underground water may get contaminated from soil runoff, which thereby increases its turbidity, which is a measure of cloudiness of water. Fewer number of disease causing microorganisms may be an indication of lower turbidity value experienced with well samples. Turbidity of water sample was ranged 2.8-4.0 NTU (Tables 1-2). Lowest value was 2.8 mg/l at Tulsi Marg in post monsoon 2016 while highest value was 4.0 mg/l at Ramghat in post monsoon 2016. Turbidity observed at different stations are shown in Tables 1-2 and Figure.3.

D. Electrical Conductivity (EC)

EC is a measure of water capacity to convey electric current. It signifies the amount of total dissolved salts. EC is a direct function of its total concentration of soluble salts in water. The EC value of water sample was ranged from 374-788 µm/cm (Tables 1-2). Minimum value of EC 372 µm/cm was observed, at Hanuman Dhara in post monsoon 2016, while maximum 788 µm/cm at Pilikothi in post monsoon 2016. The average E.C. observed at different station is shown in Tables 1- 2 and Figure.4.

E. Total dissolved solids (TDS)

TDS may affect the aesthetic quality of water, interfered with washing clothes and corroding plumbing fixtures. Total dissolved solids of drinking water was ranged from 233-636 mg/l. Minimum value of TDS was observed 233 mg/l at Sirsavan in post monsoon 2016., while 636 mg/l maximum at Rajoula in post monsoon 2016. The average TDS. Observed at different stations is shown in Tables 1- 2 and Figure.5.

F. Dissolved Oxygen (DO)

In water sample dissolved oxygen (DO) was ranged from 4.7-5.5 mg/l (Tables 1-2). The minimum value of DO 4.7 mg/l was found at Ramghat in post monsoon 2016, while maximum 5.2 mg/l at Sirsavan in post monsoon 2016. Both values were below the permissible limit 5 mg/l. indicating that it has higher organic matter. The average DO. observed at different stations is shown in Tables 1- 2 and Figure.6.

G. Biochemical Oxygen Demand (BOD)

Biological oxygen demand (BOD) measures the amount of oxygen used by microorganisms in this case bacterium, to oxidize organic matter present within the samples (Nielson, 2004). Water samples with the BOD less than 4.0mg/L are considered clean. In water sample BOD was ranged from 4-5.2 mg/l. Lowest value was 4.0 mg/l at Sirsavan in post monsoon 2016 while highest value was 5.2 mg/l at Ramghat in post monsoon 2016. The average DO and BOD recorded at different stations are shown in Tables 1-2. The average value of DO and BOD observed at different stations are shown in Table 1-2 and Figure.7.

H. Chemical Oxygen Demand (COD)

According to Rajiniet al (2010), the WHO standard for COD of good quality water is < 10mg/l. If the COD is higher it will contain greater number of microorganisms. COD is a measure of the capacity of water to consume oxygen during the decomposition of inorganic chemicals such as nitrate and ammonia. COD of water sample was ranged 22-39 mg/l tables-1-2. Lowest value was 22 mg/l at Sirsavan while highest value was 39 mg/l at Rajoula in post monsoon. COD observed at different stations are shown in Tables 1-2 and Figure.8.

Results of the bacteriological analysis of the water sample were presented in Tables 1- 2. Presence of E.coli in drinking water can affect the flavour of water. It can also promote the many bacterial borne diseases and cause headache, stomach infection and eye irritation etc. E.coli were present in different sites i.e. Kamta, Hanuman dhara, Raghav Prayag, Arogyadham, Ram ghat and PiliKothi. So these water sample are contaminated and not potable for drinking purpose.

TABLE I
Physicochemical And Microbial Analysis Of Water Samples Of Different Sites

Sites Parameters	Purani Lanka	Pathara	Sirsa Van	Kamtan area	Hanuman Dhara	RaghavP rayag	Rajoula	Pramod van	WHO
pH	7.9	7.5	7.0	7.5	7.3	7.1	7.5	7.7	8.5
Temp.(°C)	27	28	26	27	28	27	29	28	30
Turbidity (NTU)	3.2	3.1	3.0	3.5	3.2	3.3	2.9	3.1	6
EC (µm/cm)	414	411	398	386	372	726	756	724	300
TDS (mg/l)	280	272	233	243	276	615	636	613	200
DO (mg/l)	5.4	5.2	5.5	5.4	5.3	5.1	5.2	5.1	>5
BOD (mg/l)	5.0	4.9	4.0	5.0	4.8	4.6	4.5	4.8	<4
COD (mg/l)	28	27	22	24	26	30	39	29	<10
E.Coli (ml)	-ve	-ve	-ve	+ve	+ve	+ve	-ve	-ve	0/100
Salmo- nella (ml)	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	0/100
Vibrio Cholerae (ml)	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	0/100

Table ii
physicochemical and microbial analysis of water samples of different SITES

Sites Parameters	NayaGao n	TulsiMa rg	Arogya dham	JankiKun d	Ram ghat	Ksheer purwa	Adarsh Nagar	Pili Kothi	Nayag aon	WHO
pH	7.2	7.5	7.1	7.2	7.1	7.6	7.3	7.2	7.2	8.5
Temp.(⁰ C)	27	28	27	27	28	28	27	28	27	30
Turbidity (NTU)	2.8	3.0	3.6	3.5	4.0	3.4	3.2	3.1	3.4	6
EC (µm/cm)	750	755	376	389	391	698	676	788	699	300
TDS (mg/l)	554	555	312	310	315	376	370	500	499	200
DO (mg/l)	5.0	5.3	4.8	4.9	4.7	5.3	5.1	5.2	5.3	>5
BOD (mg/l)	4.9	5.0	5.1	5.1	5.2	5.0	4.9	4.8	5.1	<4
COD (mg/l)	30	31	26	25	26	28	26	30	29	<10
E.Coli (ml)	-ve	-ve	+ve	-ve	+ve	-ve	-ve	+ve	-ve	0/100
Salmo- nella (ml)	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	0/100
Vibrio Cholerae (ml)	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	0/100

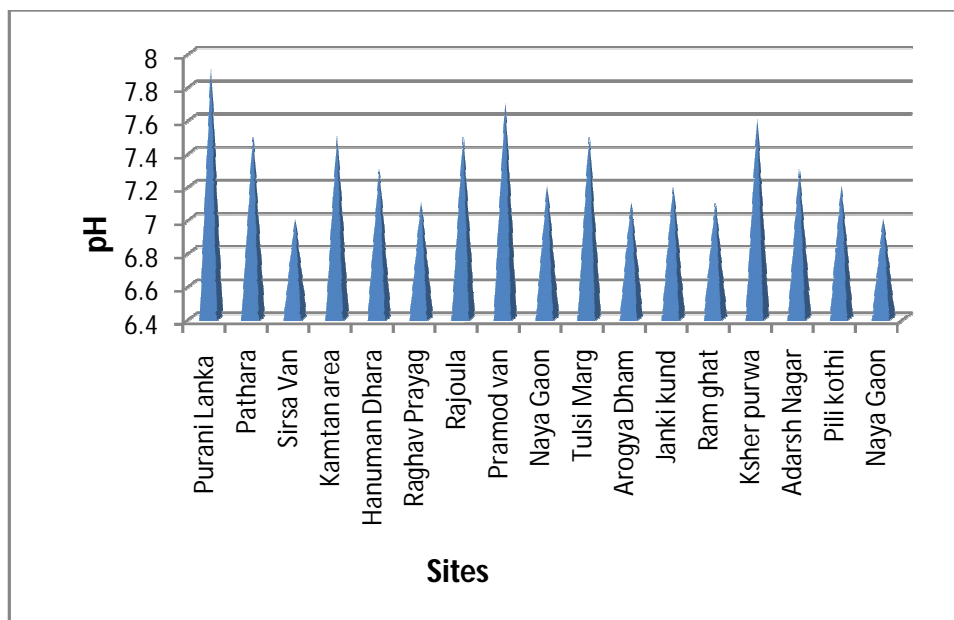


Fig-1 shows that pH of the water samples of different sites

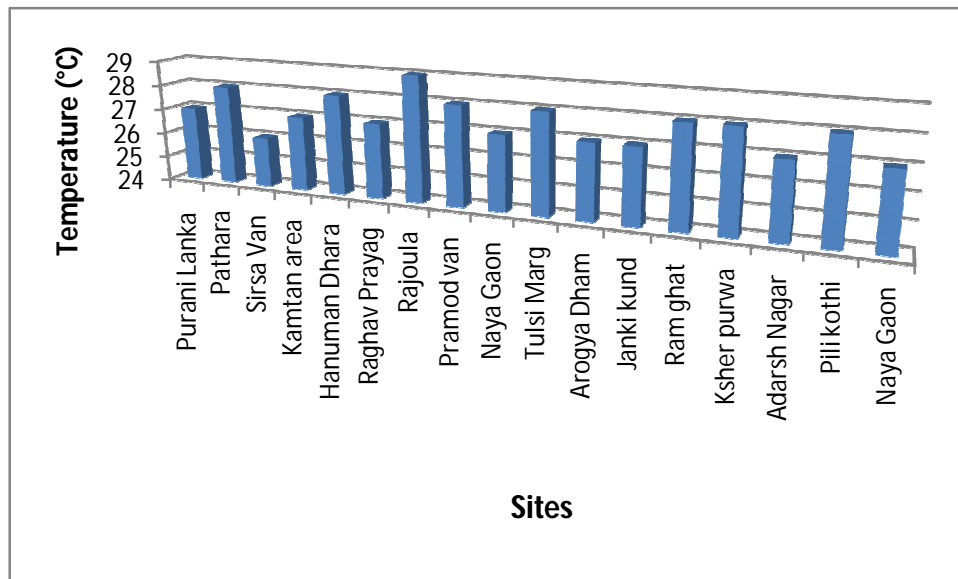


Fig-2 shows that Temperature of the water samples of different sites.

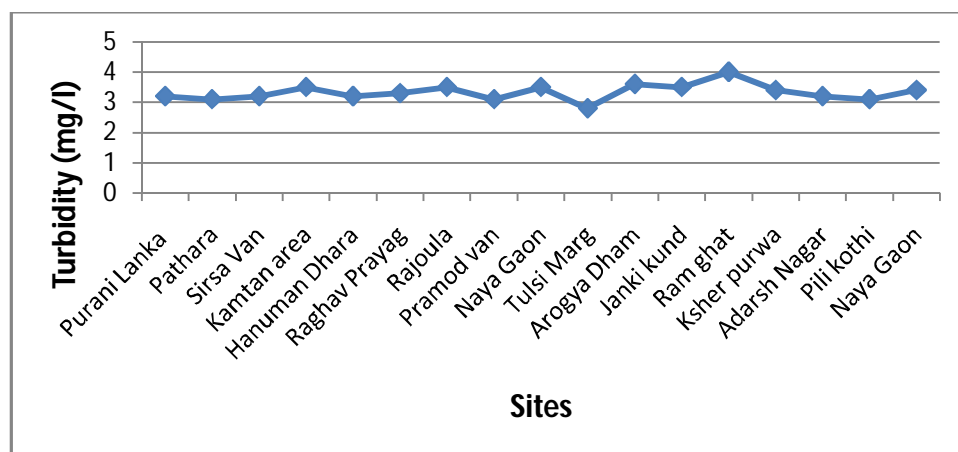


Fig-3 shows that Turbidity of the water samples of different sites.

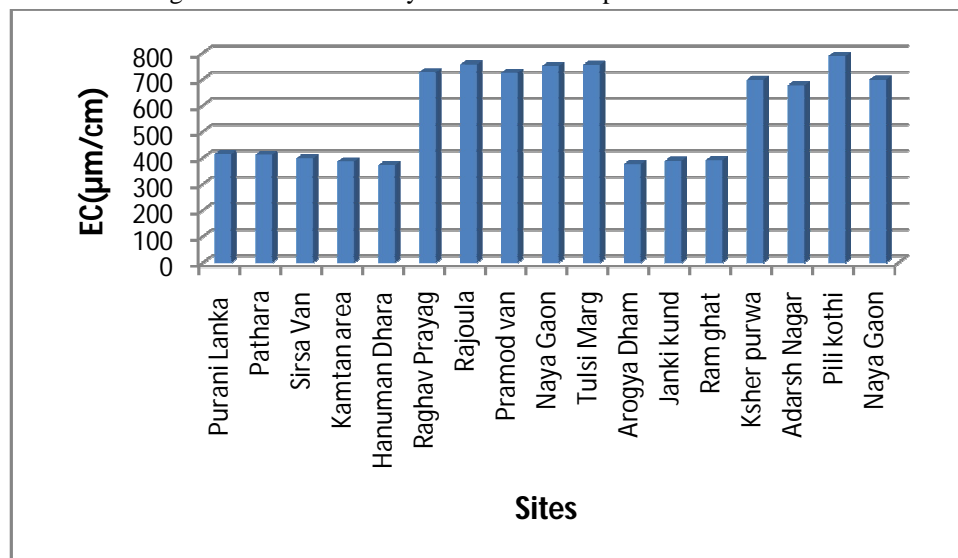


Fig-4 shows that EC of the water samples of different sites.

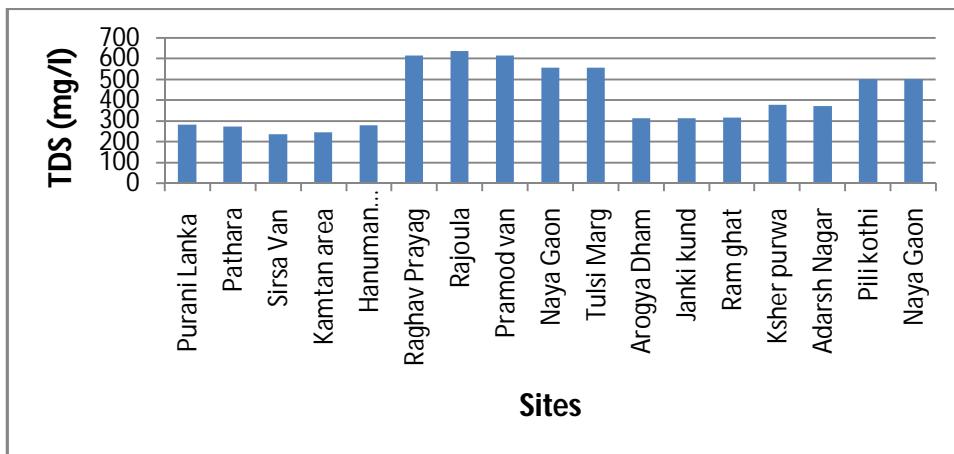


Fig-5 shows that TDS of the water samples of different sites

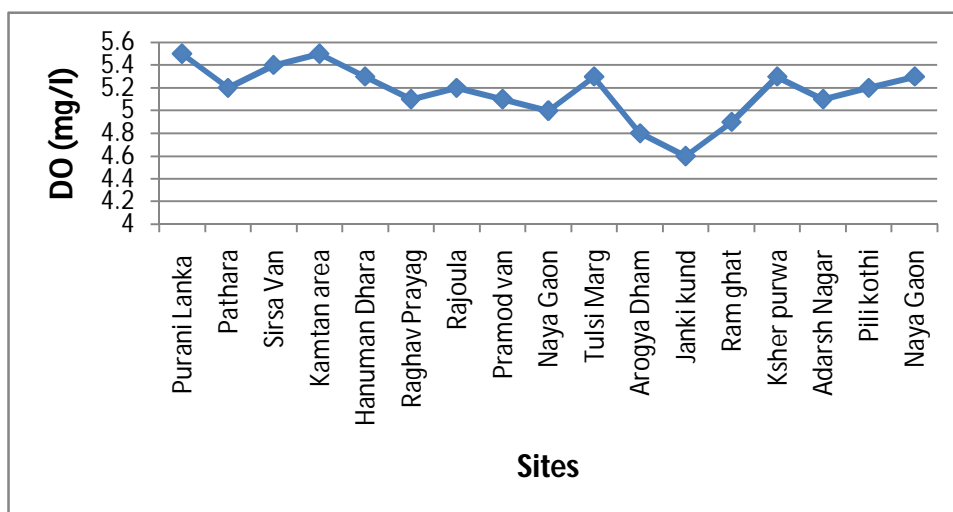


Fig-6 shows that DO of the water samples of different sites.

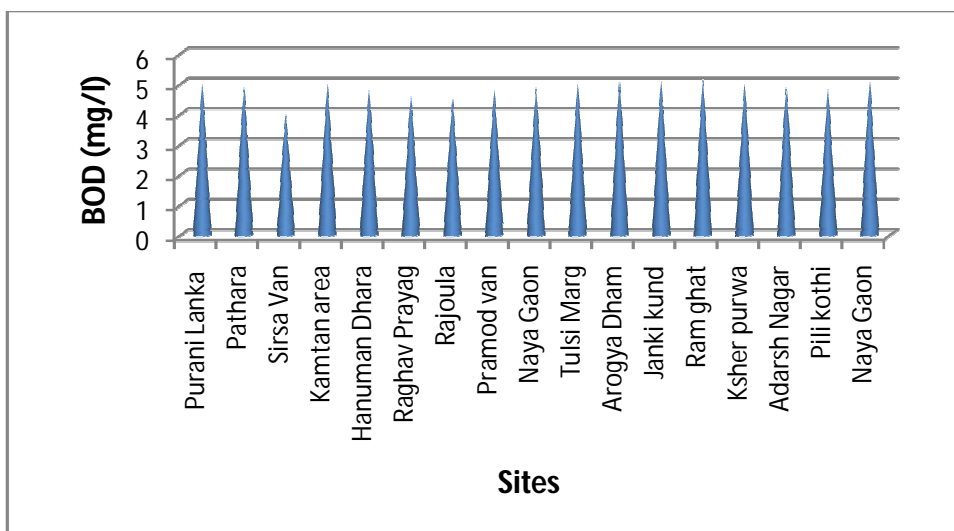


Fig-7 shows that BOD of the water samples of different sites.

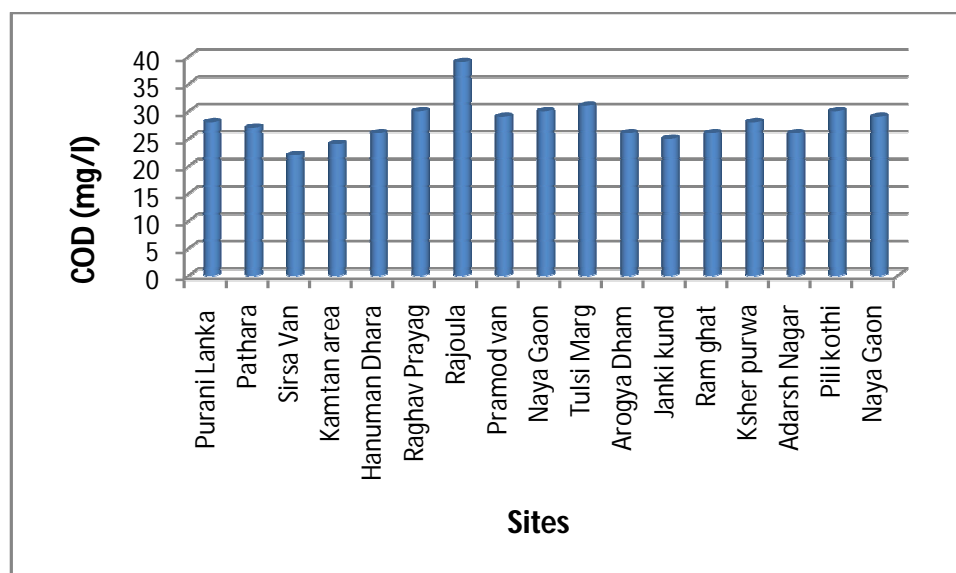


Fig-8 shows that COD of the water samples of different sites.

IV. CONCLUSION AND RECOMMENDATIONS

This study concluded that water quality distributed at Chitrakoot Nagar Panchayat need more effort in limiting the numbers of microbial organisms released into distribution systems. The use of contaminated water can in drinking expose human body to various water borne diseases hence water treatment and improving quality of water before drinking is required. It is recommended that effective management and maintenance are required in order to minimize acute problem of water related diseases, which are endemic to the health of man. This research also demonstrated the importance of education for the consumers who use individual supplies for their drinking water. Much needs to be done to increase awareness of the hazard of drinking contaminated water and of ways to prevent contamination.

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